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Analysis of Rainfall induced landslides susceptibility along 50-110k section of the Southern Cross Island Highway in Taiwan

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Landslide located at the Southern Cross Island Highway, Taiwan damaged the natural environment and caused economic losses, damaged basic facilities, and resulted in human casualties in recent years. In order to reduce the reconstruction cost of broken roads, the study areas were chosen from mileage ranging from 50 to 110 kilometers and buffer range of 1,400 meters of the highway. The landslide susceptibilities along the highway were established.

Two steps, the selection procedure and the model development procedure, have been used to establish landslide susceptibility model. The landslide inventories of the study area triggered by typhoon Mindulle, Morakot, and 0719 rainfall event, produced by the Central Geological Survey, were used for analyzing and modeling. In the selection procedure, the potential environmental factors, including the elevation, slope, slope aspect, slope high, lithology, terrain roughness, slope roughness, plan curvature, profile curvature, total curvature, distance of road, and distance of river, were selected as landslide causative factors. In order to select the factors efficiently, each factor was normalized from 0 to 1 to reduce the difference between the range of various factors. In the model development procedure, the Logistic regression method was used to establish the landslide susceptibility model. The classification error matrix and ROC-curve were used to evaluate the accuracy of landslide predicted by the developed model. The rainfall intensities of different rainfall durations were used as a landslide triggering factor in different rainfall events. The present model could predict landslide effectively. The overall accuracy of the three rainfall events was up to 70% or above. However, the predictions of Mindulle and 0719 rainfall event did not improve obviously by using landslide triggering factors, while the overall accuracy of Morakot event increased from 66.82% to 71.34%. The result suggests that if the rainfall event is long-duration and high-intensity, such as Morakot event, the model with the rainfall factor will increase the landslide predictive capability. The other two events remain similar landslide predictive capability with and without the landslide causative factor in the model.

Moreover, the maps of potential landslide were delineated to discuss the influence of rainfall on the landslide susceptibility analysis. The landslide susceptibilities were separated into four levels, including high, medium, low, and steady. The results can support planning of the surrounding area along the highway and be a reference for disaster warning