Assessment model for rainfall induced landslides in central Taiwan

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A number of methodologies concerning landslide susceptibility assessment have been devised in an attempt to mitigate the disaster. The aims of the present study are to explore the potential with a preexisting landslide dataset to develop a methodology for landslide susceptibility zoning. Slope instability is governed by a complex set of interrelated terrain parameters. Selection of instability factors in the study is in accordance with subjective expert opinion by Analytic Hierarchy Process and prior studies in the study area. The instability factors that were selected in this study are: slope, geology, vegetation, soil moisture, road development, landslide reoccurrence and rainfall.

The study assumes the LTV (landslide threshold value) and the slope becomes instable when LPV (landslide potential values) of the slope excesses LTV. The weighting and assessment value of the instability factors are obtained by Analytic Hierarchy Process and the landslide cases which was induced by Typhoon Toraji except rainfall factor. Rainfall factor contains antecedent rainfall (ARI) and accumulated rainfall (R) during the rainfall event. The combination of the instability factors uses the following expressions:

$LPV_{afterrainfall}$=Rainfall factor X $LPV_{beforerainfall}$

$LPV_{beforerainfall}$=0.179 slope factor + 0.250 geology factor + 0.089 vegetation factor

+0.153 soil moisture factor + 0.144 road development

+0.186 landslide reoccurrence factor

Rainfall factor= $\log(ARI + R) = \log\left[\sum_{n=1}^{10} 0.85^n \times (0.8 \times R_n) + R\right]$

R_N indicates the daily rainfall of the Nth day before rainfall event. According to the methodology, the study uses 175 landslide cases from the 7th, 8th, 14th and 20th Province Highway in Taiwan as the training cases to estimate the LTV (landslide threshold value).

The study uses 9149 landslide cases which was induced by Typhoon Toraji in Central Taiwan in 2001 to validate the landslide potential model. The study selects the serious damaged area, including 1 city and 15 townships and occupies a total area of 7662.4 km^2, as the study area. The validation of the landslide potential model is about 85%.