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Assessment of Rainfall-induced Landslide Potential and Spatial Distribution

Yie-Ruey Chen (1), Kuang-Jung Tsai (2), Jing-Wen Chen (3), Jie-Lun Chiang (4), Shun-Chieh Hsieh (5), and Yung-Sheng Chue (6)

(1) Dept. of Land Management and Development, Chang Jung Christian University, Tainan, Taiwan. (yrchen@mail.cjcu.edu.tw), (2) Dept. of Land Management and Development, Chang Jung Christian University, Tainan, Taiwan. , (3) Dept. of Civil Engineering, National Cheng Kung University, Tainan, Taiwan., (4) Dept. of Soil and Water Conservation, National Pingtung University of Science and Technology, Pingtung, Taiwan., (5) Dept. of Land Management and Development, Chang Jung Christian University, Tainan, Taiwan. , (6) Dept. of Civil Engineering, National Cheng Kung University, Tainan, Taiwan.

Recently, due to the global climate change, most of the time the rainfall in Taiwan is of short duration but with high intensity. Due to Taiwan's steep terrain, rainfall-induced landslides often occur and lead to human causalities and properties loss. Taiwan's government has invested huge reconstruction funds to the affected areas. However, after rehabilitation they still face the risk of secondary sediment disasters. Therefore, this study assesses rainfall-induced (secondary) landslide potential and spatial distribution in watershed of Southern Taiwan under extreme climate change.

The study areas in this research are Baolai and Jianshan villages in the watershed of the Laonongxi River Basin in the Southern Taiwan. This study focused on the 3 years after Typhoon Morakot (2009 to 2011). During this period, the study area experienced six heavy rainfall events including five typhoons and one heavy rainfall. The genetic adaptive neural network, texture analysis and GIS were implemented in the analysis techniques for the interpretation of satellite images and to obtain surface information and hazard log data and to analyze land use change. A multivariate hazards evaluation method was applied to quantitatively analyze the weights of various natural environmental and slope development hazard factors. Furthermore, this study established a slope landslide potential assessment model and depicted a slope landslide potential diagram by using the GIS platform. The interaction between (secondary) landslide mechanism, scale, and location was analyzed using association analysis of landslide historical data and regional environmental characteristics.

The results of image classification before and after six heavy rainfall events show that the values of coefficient of agreement are at medium-high level. By multivariate hazards evaluation method, geology and the effective accumulative rainfall (EAR) are the most important factors. Slope, distance from fault, aspect, land disturbance, and elevation are the secondary important factors. Under the different rainfall, the greater the average of EAR, the more the landslide occurrence and area increments. The determination coefficients of trend lines on the charts of the average of EAR versus number and area of landslide increment are 0.83 and 0.92, respectively. The relations between landslide potential level, degree of land disturbance, and the ratio of number and area of landslide increment corresponding six heavy rainfall events are positive and the determination coefficients of trend lines are 0.82 and 0.72, respectively. The relation between the average of EAR and the area of landslide increment corresponding five heavy rainfall events (excluding Morakot) is positive and the determination coefficient of trend line is 0.98. Furthermore, the relation between the area increment of secondary landslide, average of EAR or the slope disturbance is positive. Under the same slope disturbance, the greater the EAR, the more the area increment of secondary landslide. Contrarily, under the same EAR, the greater the slope disturbance, the more the area increment of secondary landslide.

The results of the analysis of this study can be a reference for the government for subsequent countermeasures for slope sediment disaster sensitive area to reduce the number of casualties and significantly reduce the social cost of post-disaster.