Assessments on landslide susceptibility in the Tseng-wen reservoir watershed, Taiwan

Yu-Chin Chen, Yung-Chau Chen, and Wen-Fu Chen

Dept. of Soil and Water Conservation, Nation Chung Hsing University, Taichung, Taiwan (berry02kimo@hotmail.com)

Typhoon Morakot under the strong influence of southwestern monsoon wind struck Taiwan on 8 August 2009, and dumped record-breaking rains in southern Taiwan. It triggered enormous landslides in mountains and severe flooding in low-lying areas. In addition, it destroyed or damaged houses, agricultural fields, roads, bridges, and other infrastructure facilities, causing massive economic loss and, more tragically, human casualties. In order to evaluate landslide hazard and risk assessment, it is important to understand the potential sites of landslide and their spatial distribution. Multi-temporal satellite images and geo-spatial data are used to build landslide susceptibility map for the post-disaster in the Tseng-wen reservoir watershed in this research.

Elevation, slope, aspect, NDVI (normalized differential vegetation index), relief, roughness, distance to river, and distance to road are the considered factors for estimating landslide susceptibility. Maximum hourly rainfall and total rainfall, accompanied with typhoon event, are selected as the trigger factors of landslide events. Logistic regression analysis is adopted as the statistical method to model landslide susceptibility. The assessed susceptibility is represented in 4 levels which are high, high-intermediate, intermediate, and low level, respectively. Landslide spatial distribution can be depicted as a landslide susceptibility map with respect to each considered influence factors for a specified susceptible level.

The landslide areas are about 358 ha and 1,485 ha before and after typhoon Morakot. The new landslide area, induced by typhoon Morakot, is as almost 4 times as the landslide area before typhoon Morakot. In addition, there is about 44.56% landslide area elevation ranging from 500m to 1000m and about 57.22% average slope ranging from 30° to 45° of landslide area. Furthermore, the devastating landslides were happened at those sites close to rivers, exposed area, and area with big land cover change (high human development). Among considered factors, slope, distance to river, NDVI, and maximum hourly rainfall are the major influence factors for landslide susceptibility. The results show that the accuracy of predicted landslide area is 74.74% and AUC is 0.82 corresponding to typhoon Morakot. Comparing model predicted with actual landslide areas, it shows that the predicted accuracy is 93% for high or high-intermediate level landslide area. It suggests that a landslide susceptibility map, depicted by this assessment model, is applicable on landslide prediction.