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Comprehensively identifying above- and under-ground effects of vegetation on slope stability- results of a preliminary analysis

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It is widely recognized that vegetation can significantly reduce rainfall-induced shallow landslides. Although vegetation can influence slope stability through effects of its root and above-ground systems, most previous studies focused on roots. The ultimate goal of the present study is to identify vegetation properties influential to slope stability in a more comprehensive way. This study site is located in the 25-ha Lienhuachih Forest dynamics Plot (23°54'49"N, 120°52'43"E), central Taiwan. Diameter at breast height (DBH) and species for 203,640 trees in this plot were recorded in 2007. Typhoons Kalmaegi and Sinlaku caused landslides with total area of 1.22 ha and removed 4,236 trees in 2008. Using regression models established by studies overseas, 6 attributes (root collar diameter, tree height, tree crown size, above-ground biomass, root biomass, radius of root network) for each tree were inferred from DBHs. The 25-ha plot was divided into 625 20m by 20m quadrats. Quadrats with or without landslides were identified. Nine vegetation properties (3 root and 6 above-ground properties) for each quadrat were further inferred from tree attributes. When conducting logistic regressions, vegetation properties and landslide occurrence were treated as independent and dependent variables respectively. Results showed that none of the 6 above-ground properties were influential to landslide occurrence, including stem density, mean height of 30 % tallest trees, area without projected tree crown cover, summed-up length of root collar diameter, summed-up area of tree crowns and total above ground biomass. The likelihood of landslide occurrence increased significantly with area without root network cover, which was consistent with most previous studies. However, logistic regressions also showed that root biomass was not influential to landslide occurrence and higher summed-up area of root networks promoted more landslide occurrence. These two results at odd with previous studies were attributed to that non-locally-developed regression models were used to infer tree attributes from DBHs. The preliminary results highlighted that our current approaches can provide clues for identifying vegetation properties influential to landslide occurrence. It is expected that effects of these vegetation properties will be identified more precisely once we establish site- and species-specific regression models.