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Title
An enlarging landslide scar and evolution of the surrounding forested hillslope: Results from a dendrogeomorphic and multi-temporal LiDAR DTM survey

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Abstract

Landslide sediment hazard assessments performed in Taiwan commonly rely on the area of landslide scars clearly visible in aerial photos or satellite images to gauge sediment hazard. Although studies in Taiwan have shown that erosion rates associated with an exposed landslide scar can be more than two times as high as pre-landslide levels, it has also been shown that a significant amount of sediment is derived from further retrogressive enlargement of the scar. Hillslope surface features such as tension cracks and secondary scarps located outside of the scar may be indicative of future landslide activity, however, because temporal relationships between those features and the landslide scar are unknown, confidence in future scar enlargement area estimates can be limited. The goal of this study is to investigate how a hillslope both spatially and temporally evolves around an enlarging landslide scar and how that evolution may have been related to the final area of the scar.

The hillslope is the north face of a low elevation(800m to 1200m) spur located in the northern Xueshan mountains of Taiwan. Prior to formation of the landslide scar, the hillslope was defined by a forested, nearly planar surface incised by several shallow, parallel draining hollows. During a period of strong typhoons between 1997 and 2008, the landslide scar initiated at the foot of the slope and intermittently enlarged along one of the hollows until reaching the ridgeline. Presently, numerous tension cracks, debris flow channels and smaller landslide scarps cut across the hillslope on all sides of the scar.

Evolution of the scar is reconstructed using aerial photo and satellite images. The location of landslide features hidden by the forest outside of the scar are surveyed in the field and an attempt is made to identify the timing of sub-canopy movement using a dendrogeomorphic survey on primarily alder and all available conifer trees. Multiple AirLIDAR DTM data sets, recorded throughout the later half of landslide scar development, are used to analyze changes in hillslope topography. Inferences regarding rainfall characteristics and hillslope scale landslide processes that include both the visible scar and landslide features obscured by the forest are presented and implications for landslide sediment hazard assessments discussed.

Keywords
Hillslope evolution, Landslide scar, Dendrogeomorphology, Landslide activity

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