

Rapid post-fire decay of root reinforcement in subtropical Taiwan

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Climate change-induced increases in drought frequency have elevated the risk of forest fires, consequently reducing slope stability and increasing landslide susceptibility in mountainous forested areas. This study aimed to quantify the post-fire decay of tree root systems and their contribution to slope stabilization. The study was conducted in Huisun Experimental Forest, central Taiwan, managed by National Chung Hsing University, where a forest fire occurred in May 2021. Two dominant tree species, *Pinus taiwanensis* (a conifer) and *Castanopsis indica* (a broadleaf species), were selected to measure root area ratio (RAR) and root reinforcement in both living trees and trees that had died following the fire. By integrating data from living and dead trees and applying decay models, the decay rates of RAR and root reinforcement after fire were estimated.

The results indicated that the half-lives of RAR for dead *P. taiwanensis* and *C. indica* were 2.25 and 1.59 years, respectively, with RAR declining to 10% of living-tree values at 9.14 and 5.27 years after the fire. Root reinforcement decreased to 50% of living-tree values at 1.90 and 1.45 years for *P. taiwanensis* and *C. indica*, respectively, and further declined to 10% at 3.01 and 4.83 years after the fire. Compared with previous studies conducted in temperate regions, the decay of RAR and root reinforcement observed in this study occurred over a substantially shorter timescale. This accelerated decay may be associated with Taiwan's warm and humid climate, which likely enhances post-fire root decomposition and the degradation of mechanical properties. These findings highlight the rapid loss of slope-stabilizing functions following forest fires and underscore the importance of prompt post-fire reforestation and vegetation restoration to mitigate landslide risk.

Keywords: Forest fire, Landslide, Reforestation, Root area ratio