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Root reinforcement and its implications in shallow landsliding susceptibility on a small alpine catchment

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Roots shear resistance offers a considerable contribution to hill-slope stability on vegetated terrains. Through the pseudo-cohesion of shrubs, trees and turf's roots, the geomechanical properties of soils can be drastically increased, exerting a positive influence on the hillslope stability.
We analysed the shallow landsliding susceptibility of a small alpine catchment (Duron valley, Central Dolomites, Italy) that we consider representative of a wide altitude belt of the Dolomites (1800 - 2400 m a.s.l). The catchment is mostly mantled by grass (Nardetum strictae s.l.), with clustered shrubs (Rhododendron hirsutum and Juniperus nana), and trees (Pinus cembra, Larix decidua and Picea abies). The soil depth, investigated with direct and indirect methods, ranges from 0 to 180 cm, with its peak at the hollow axes. Locally, the bedrock, made of Triassic volcanic rocks, is deeply incised by the Holocene drainage network. Intensive grazing of cows and horses pervades the catchment area and cattle-trails occupy ca 20% of the grass cover. We used laboratory and field tests to characterize the geotechnical properties of these alpine soils; moreover we designed and tested an experimental device that measures, in situ, the shear strengths of the grass mantle. In the study area we mapped 18 shallow landslides, mostly related to road cuts and periodically reactivated as retrogressive landslides. The triggering mechanisms of these shallow landslides were qualitatively analysed at large scale and modelled at smaller scale. We used SHALSTAB to model the shallow landsliding susceptibility of the catchment at the basin scale and SLIDE (RocScience) to compute the Safety Factor at the versant scale.
Qualitative management solutions are provided, in order to reduce the shallow landsliding susceptibility risk in this alpine context.