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Modeling the mechanical and hydrological controls of vegetation in shallow landslides

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Coupled hydrological-stability models are widely used to evaluate rain triggered shallow landslide hazards at basin. Vegetation influences landslides in several ways. Plants directly interact with many of the hydrological processes (e.g. foliage interception, evapotranspiration, root water uptaking), and lead to a reduction of the amount of water available for infiltration which can cause instability. From a mechanical point of view, the root system increases the resistance of soil through its tensile strength and frictional or adhesive properties (apparent root cohesion); however, such an effect is rarely explicitly considered in the spatially distributed applications.

This study proposes a methodology for modeling the mechanical control of vegetation within an existing physically-based, eco-hydrological and stability model. The approach is based on the estimation of the apparent root cohesion term as a function of the spatial distribution of the roots in soil expressed in terms of Root Area Ratio (RAR). A synthetic case study is presented to assess the consistency and the capability of the methodology, by investigating both the hydrological and mechanical controls.