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Investigating the relationships among vegetation characters, saturated hydraulic conductivity and surface morphology at catchment scale by integrating new field data and morphometric analysis

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Shallow landslides susceptibility assessment by physically based methods relies on the parametrization of both hydraulic and geotechnical properties of soils, which in turn depend on the conditions of root structures and vegetation cover. Vegetation roots contribute to the shear strength of soils, but their quantitative contribution is currently uncertain. Saturated hydraulic conductivity (*Ks*) is also relevant for slope stability as it influences infiltration rates and runoff. While the literature clearly shows the dependence of *Ks* on soil texture, there is a general understatement of the role of root structures on this parameter. Moreover, the distribution patterns of vegetation follow relations with surface morphologies which are not fully understood and therefore, are worthy of further investigations. For these reasons, this work focuses on the quantitative assessment of the influence of vegetation on shear strength for shallow landsliding and the investigation of the relationships between vegetation characters, saturated hydraulic conductivity and topographic parameters. Study areas affected by shallow landslides are chosen in the Garfagnana and Alpi Apuane regions (Northern Apennines, Italy), as well as in the Mt. Amiata volcano area (Southern Tuscany, Italy), where field measurements of below-ground vegetation (Root Area Ratio - RAR), above-ground vegetation (Leaf Area Index - LAI and vegetation load) and *Ks* are acquired inside, in the neighbour and far from shallow landslide sites. To this aim, a multi-temporal landslide inventory is already available for the study area. Below-ground data are collected in trench profiles, while above-ground data are acquired by using a digital relascope as well as implementing vegetation cover photography methods. Measurements of *Ks* are carried out by means of both constant and falling head approaches. The morphometric analysis is performed by using some morphometric variables (eg. slope and hillslope curvatures) derived from a digital elevation model with cell size of 10 m. Morphometric clustering of these variables allows us to extract a set of land units where the distribution of vegetation characters and *Ks* are assessed. First results show that: a) root reinforcement to soil in terms of root-related cohesion plays a relevant role within the soil depths involved in shallow landslides; b) the weight of above-ground vegetation plays a “mild” negative role on slope stability; c) *Ks* is correlated with both RAR and soil

depth, suggesting possible criteria for the straightforward parametrization of input parameters.