Modeling vegetation effects on hydrological and mechanical mechanisms of shallow landslides

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Effects of vegetation in improving slope stability can be recognized on both hydrological and mechanical mechanisms. With regard to the hydrological effect, vegetation leads to lower porewater pressure and soil moisture due to interception by foliage of rainfall, which reduces the amount of water available for infiltration, or uptake by root system of soil moisture. With regard to the mechanical aspects, root system, due to their tensile strength and frictional or adhesive properties, reinforce the soil and thus increase the resistance of soil. This mechanical effect is at times the most significant and in slope stability analysis is taken into account by means of the apparent root cohesion. Some root reinforcement models existing in literature are capable to estimate the apparent root cohesion as a function of vegetation properties and spatial distribution of the roots in soil in term of root area ratio.
In the present study the effects of vegetation on slope stability by modeling both the hydrological mechanisms and the root tensile strength are investigated. The model used is the landslide component of the eco-hydrological model, tRIBS-VEGGIE (Triangulated Irregular Network (TIN)-based Real-time Integrated Basin Simulator with VEGetation Generator for Interactive Evolution) capable to evaluate vegetation dynamics and predict shallow landslides. The selected study area is the Mameyes basin, located in the Luquillo Experimental Forest (Puerto Rico), where other slope stability analysis were carried out with the same model.