



Modeling vegetation landslides - An extension to the infinite slope model to accommodate thick organic layers

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Roots of trees in tropical montane forests tend to grow mainly in an organic layer covering the mineral soil and do not reach deep into the ground. Thus they do not necessarily stabilize a slope by increasing soil shear resistance or cohesion to the extent that is widely assumed within state-of-the-art slope stability models. For tropical montane forests, roots can be seen as a carpet-like structure that sometimes is sparsely connected to the underlying mineral soil.

Regarding this mechanical setup, we introduce an extension to the classical infinite slope concept for slope stability modeling by formulating two distinct factors of safety. Parametrized with measurements from an undisturbed rain forest of the Andes of Southern Ecuador, the model allows to reproduce our observation of pure vegetation slides. Based on our measurements, we use a Monte-Carlo simulation for all model parameters to estimate the fraction of the research area, that is either susceptible to sliding events of a classical shallow translational type or to pure vegetation slides. We found at least 1.3% of the area being potentially unstable in a classical way. Regarding the observation of 1% up to 2.8% of the area being permanently covered by visible landslide scars, our simulation results illustrate that pure vegetation slides can be held responsible for up to 56% of all landslides in the area.