Modeling the additional root cohesion of four sub-tropical shrub and tree species

Elisa Arnone[1], Quintilio Napoleoni[2], and Leonardo Noto[3]

[1]Università degli Studi di Udine, DPIA, Udine, Italy

[2]Università di Roma Sapienza, DICEA, Roma, Italy

[3]Università degli Studi di Palermo, DI, Palermo, Italy

The effect of plant roots on hillslope stabilization against rainfall-induced shallow landslides depends on the mutual interaction between biotechnical characteristics of the root system (i.e., root length, root tensile strength, root area, root diameter profile) with the soil root-zone and the hydrological processes therein. Describing adequately the root architecture of a plant species is useful when root strength models, such as the Root Bundle Model (RBM), are applied to assess the ultimate root reinforcement.

This study describes the preliminary results of the calibration of an existing Root Topological Model (RTM) combined with a RBM model to estimate the additional roots shear resistance of vegetation typical of a subtropical climate.

Specifically, the dataset of the root system of four Hong Kong native species of shrubs (Rhodomyrtus tomentosa and Melastoma sanguineum) and trees (Schefflera heptaphylla and Reevesia thyrsoidea) has been used. The dataset includes the measurements relative to both the root architecture, i.e., root diameter classes and number of roots as function of depth, and the root resistance, i.e. root tensile strengths for each diameter classes, which were obtained from laboratory test.

The present application allows for calibrating and exploiting the potentiality of the framework RTM-RBM in a climatic environment different from the Mediterranean one analyzed so far for its development, thus testing the response and the flexibility of the modeling framework. The availability of such a tool could enhance, for example, the assessment of the most suitable plant species to be adopted for the slope stabilization in different soil and/or climatic conditions.