Geophysical Research Abstracts
Vol. 16, EGU2014-4339, 2014
EGU General Assembly 2014

Root strength evaluation on vineyards in an area susceptible to shallow landslides: preliminary results

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The role played by plant roots in reinforcing mechanically the soil is widely recognized and numerous studies were carried out in the last years for the quantification of the effect of vegetation on slope stability, especially in terms of root reinforcement. Vegetation can represent an effective instrument to decrease landslides susceptibility, in particular towards shallow landslides, which usually develop in the first 2 meters from the ground level where the majority of plant roots develop.
In this work preliminary results of root reinforcement on vineyards located in an area susceptible to shallow landslides are presented. Vineyards have been chosen because there are no studies about the role played by vineyards roots on soil cohesion and because they represent the most common species in the studied area. The objectives of the study were i) to estimate the root strength through laboratory tests on sampled roots of living vine plants, ii) to analyze the distribution pattern of roots of living plants in the soil profile, iii) to assess the root contribution to soil cohesion on the basis of the measured root strength and the distribution pattern of the roots evaluated trough in-situ surveys.
The sample study area is in the north-eastern part of Oltrepo Pavese, in northern Italy. In this area, hilly slopes are extensively cultivated with vineyards for the production of wine. In April 2009, this sector of Oltrepo Pavese experienced a great rainfall event, which triggered more than 1600 shallow landslides in an area of about 250 km2. In particular, a great number of these phenomena affected slopes cultivated with vineyards that were completely or partially destroyed with consequent serious economic losses.
Roots for mechanical properties evaluation were collected from pits in different test-site slopes characterized by vineyards of the same installation age (about 10-20 years). In correspondence of these pits the distribution pattern of the living roots with depth was analyzed through the evaluation the number of the roots per diameter class and the Root Area Ratio (RAR). On the same pits, pedological profiles were accurately determined and soil samples for geotechnical characterization were collected at different depths. Different soil levels were characterized in terms of grain size distribution, Atterberg limits, carbonate content, soil shear strength and soil hydrological parameters. Root mechanical properties evaluation was performed trough laboratory tensile tests in terms of tensile force, which is dependent on diameter following a power law. Root cohesion was then estimated for each depth of soil for the different excavated profiles applying the Fiber Boundle Model (FBM). The estimated root cohesion at test site slopes will have been compared with values of this parameter obtained through back-analysis on some slopes cultivated with vineyards affected in the past by shallow landslides.