Geophysical Research Abstracts
Vol. 15, EGU2013-2806, 2013
EGU General Assembly 2013

Quantifying the effects of root reinforcing on slope stability: results of the first tests with an new shearing device

Christian Rickli (1) and Frank Graf (2)

(1) Swiss Federal Institute for Forest, Snow and Landscape Research, CH-8903 Birmensdorf, Switzerland, (2) WSL Institute for Snow and Avalanche Research SLF, CH-7260 Davos Dorf, Switzerland

The role of vegetation in preventing shallow soil mass movements such as shallow landslides and soil erosion is generally well recognized and, correspondingly, soil bioengineering on steep slopes has been widely used in practice. However, the precise effectiveness of vegetation regarding slope stabilityis still difficult to determine. A recently designed inclinable shearing device for large scale vegetated soil samples allows quantitative evaluation of the additional shear strength provided by roots of specific plant species. In the following we describe the results of a first series of shear strength experiments with this apparatus focusing on root reinforcement of White Alder (Alnus incana) and Silver Birch (Betula pendula) in large soil block samples (500 x 500 x 400 mm). The specimen with partly saturated soil of a maximum grain size of 10 mm were slowly sheared at an inclination of 35° with low normal stresses of 3.2 kPa accounting for natural conditions on a typical slope prone to mass movements. Measurements during the experiments involved shear stress, shear displacement and normal displacement, all recorded with high accuracy. In addition, dry weights of sprout and roots were measured to quantify plant growth of the planted specimen. The results with the new apparatus indicate a considerable reinforcement of the soil due to plant roots, i.e. maximum shear stress of the vegetated specimen were substantially higher compared to non-vegetated soil and the additional strength was a function of species and growth. Soil samples with seedlings planted five months prior to the test yielded an important increase in maximum shear stress of 250% for White Alder and 240% for Silver Birch compared to non-vegetated soil. The results of a second test series with 12 month old plants showed even clearer enhancements in maximum shear stress (390% for Alder and 230% for Birch). Overall the results of this first series of shear strength experiments with the new apparatus using planted and unplanted soil specimen confirm the importance of plants in soil stabilisation. Furthermore, they demonstrate the suitability of the apparatus to quantify the additional strength of specific vegetation as a function of species and growth under clearly defined conditions in the laboratory.