Geophysical Research Abstracts
Vol. 14, EGU2012-11476, 2012
EGU General Assembly 2012

Evaluation of Mechanical Effect of Vegetation on Slope Stability in Terms of Root Evolution

W. Meng and T.A. Bogaard
Delft University of Technology, Water resources Section, Delft, Netherlands (w.meng@tudelft.nl, t.a.bogaard@tudelft.nl)

Vegetation is planted to reduce probability of slope failure for its hydrological and mechanical effects. Root reinforcement provides additional cohesion to soil to protect slope from mass movement. The interaction between roots and soil in terms of root morphology was understood and quantified well with in situ and ex situ experiments and numerical models, especially for soil core samples. However, root morphology such as root density, root depth, root tensile strength and root orientation, which are the basis of the additional cohesion for soil, varies gradually during the life of vegetation. Furthermore, entire stand structure also changes because of individual growing that would affect root morphology within a stand. As a consequence, the mechanical effect of vegetation on slope stability should be investigated at different life stages at stand scale.
The objective of this research is to understand and quantify the dynamic stabilizing mechanical effect of forest on potentially unstable slopes. To achieve this, we focus on the changes of slope stability with regard to variation in root morphology over the life cycle of stand. First, root evolutes as a result of stand density decrease with competition of bigger individual tree. Second, gaps get larger between them which could not protect soil loss. Root density, root depth and root tensile strength varies to meet the physiological demands of various growth stage of a forest stand.
A spatially distributed, physical-based, dynamical model is employed to calculate the safety factor and probability of failure in a catchment on a daily time scale with root system dynamic evolution as a parameter. The results of the quantification of the mechanical effect of vegetation show there is a significantly influence by temporal and spatial distribution of stand root system and this provides reference for reliable management strategies at the scale of forest stands.

Key words: slope stability, mechanical effect, root, vegetation