VEGETATION-MEDIATED GROUND-ATMOSPHERE INTERACTION

Fully-funded PhD position - University of Strathclyde

SUMMARY:
Rainfall is a major triggering factor of shallow landslides. When heavy and/or prolonged rainfall events occur, water infiltrates into the slope causing pore-water pressures build-up. This reduces soil shear strength eventually triggering slope instability. Rainfall-induced shallow landslides may evolve into debris flows. These are characterised by high velocities and long travel distance and are a main cause of property and infrastructure damage, injury, and death. An example of fast-moving rainfall-induced landslides is given by Rest and Be Thankful (A83) in Scotland, which has been subject to frequent landslide activity in recent years with two road closures per annum on average recorded over the last five years.

It is widely acknowledged that the presence of vegetation can influence landslide occurrence and, for this reason, vegetation is often regarded as potential remedial measure. In shallow landslides, the failure surface tends to develop below the rooting zone, where mechanical reinforcement is obviously not playing any role. However, stability can be enhanced by two other different mechanisms:

- Hydrological reinforcement - The soil, the plant, and the atmosphere form a continuous hydraulic system, which is referred to as Soil-Plant-Atmosphere Continuum (SPAC). Water flow from the soil through the plant up to the leaves takes place because of gradients in hydraulic head triggered by the negative water pressure (water tension) generated in the leaf stomata. Plant-mediated soil water removal generates suction below the rooting zone, which in turn increase soil shear strength along potential failure surfaces.
- Hydraulic reinforcement - The root system can promote subsurface lateral flow by creating networks of preferential flow. The rhizosphere, the upper portion of soil profile affected by root secretions and soil microorganisms, can therefore act as a lateral drainage, i.e. diverting rainwater from downward infiltration.

This dissertation will investigate these two mechanisms based on the Rest and Be Thankful case study. Transpiration mechanisms will be investigated based on measurement of xylem water potential using the high-capacity tensiometer, a technique recently developed by the University of Strathclyde. The impact of the hydraulic 'diversion' promoted by the rhizosphere on landslide occurrence will be investigated numerically and experimentally via purposely-designed field measurements.

DURATION:
3 years

START DATE:
ASAP

STIPEND:
~ £1250/month

ELIGIBILITY
Applications from **UK/EU APPLICANTS ONLY** with First Class Honours (or equivalent)

WHERE:
Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, Scotland

SUPERVISORS
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