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Optimising vegetation species selection and management regime for slope stabilisation: Experiments from column, centrifuge and field slope scales.

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Plant roots mechanically reinforce the soil due to their tensile strength, whilst extraction of water by roots for transpiration increases soil water suction in the profile and hence increases effective stress. Relatively little is known about the relative effectiveness of different plant species in their ability to mechanically and hydraulically reinforce slopes, and so decisions on species selection are seldom made with optimisation of slope reinforcement in mind. This paper will consider both species selection and vegetation management effects on slope reinforcement, considering both root mechanical and hydrologic reinforcement. The root to shoot ratio of ten deciduous and evergreen woody shrubs was strongly related to their rate of developing soil water suction: soil strength increased up to ten-fold faster for species with a large root to shoot ratio and large specific leaf area, for plants of similar size and age. Field experiments over a two-year period yielded similar rankings to glasshouse experiments in soil columns in terms of species ability to rapidly develop soil water suction and soil strength after rainfall. Ongoing experiments in which slopes vegetated with willow, grass and gorse are progressively wetted under intense rainfall events in a geotechnical centrifuge will be described, in relation to interpreting the hydro-mechanical stabilisation effect of the vegetation at field scale. Advantages and limitations of the centrifuge experimental approach will be considered.
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