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The effect of forest management on the spatial distribution of root cohesion and slope stability

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The species composition of southern Appalachian forests is changing rapidly due to fire suppression, residential expansion and introduced parasites, such as the woody adelgid. Changes in the distribution and age of tree and understory species cause changes in rooting characteristics and therefore the stability of slopes. The amount of apparent cohesion provided by roots is dependent on the tensile strength of individual roots and their distribution in the soil column, which varies with soil type, topographic position, species and plant age. We measured variability in root cohesion for fifteen individual trees and two mixed species locations in the Coweeta Hydrological Laboratory, North Carolina. The individual pits were chosen to capture variations in species (10 species total), topographic position (nose, side slope, hollow), and age (a range of DBH between 5 cm and 60 cm). Root cohesion is primarily dependent on the size, strength, and vertical distribution of roots in the soil column. Our data show that root tensile strengths from different hardwood species were very similar, but root strength increased for plants found on noses relative to hollows. Roots are concentrated close to the soil surface (at least 70% of biomass occurs within 50 cm of the surface) and variations in this pattern occur primarily as a function of age and topographic position. Fire suppression in Coweeta's forests has led to a recent expansion of *Rhododendron maximum*, a woody shrub, into hollows. *R. maximum* roots are shallower and weaker than tree roots, which when coupled with low transpiration rates, lower the total cohesive strength and make them susceptible to high pore pressure

events. We have investigated the potential for mapping *R. maximum* based on the ratio of near-infrared to red within leaf-off color infrared images. When we combine the remotely-sensed distribution of *R. maximum* with the root cohesion data from individual pits, we can produce a realistic spatial distribution of root cohesion for southern Appalachian forests.