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Understanding plant root system influences on soil strength and stability

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Plant roots modify and reinforce the soil matrix, stabilising it against erosion and shallow landslides. Roots mechanically bind the soil particles together and modify the soil hydrology via water uptake, creation of biopores, and modification of the soil water-release characteristic. Key to understanding the mechanical reinforcement of soil by roots is the relation between root strength and root diameter measured for roots in any given soil horizon. Thin roots have frequently been measured to have a greater tensile strength than thick roots, but their strength is also often much more variable. We consider the factors influencing this strength-diameter relationship, considering relations between root tensile strength and root dry density, root water content, root age, and root turnover in several woody and non-woody species. The role of possible experimental artefacts and measurement techniques will be considered. Tensile strength increased generally with root age and decreased with thermal time after excision as a result of root decomposition. Single factors alone do not appear to explain the strength-diameter relationship, and both strength/stiffness and dry density may vary between different layers of tissue within a single root. Results will be discussed to consider how we can achieve a more comprehensive understanding of the variation in root biomechanical properties, and its consequences for soil reinforcement.

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