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Root diversity in alpine plants: root length, tensile strength and plant age

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A high diversity of plant species and functional groups is hypothesised to increase the diversity of root types and their subsequent effects for soil stability. However, even basic data on root characteristics of alpine plants are very scarce. Therefore, we determined important root characteristics of 13 plant species from different functional groups, i.e. grasses, herbs and shrubs. We excavated the whole root systems of 62 plants from a machine-graded ski slope at 2625 m a.s.l. and analysed the rooting depth, the horizontal root extension, root length and diameter. Single roots of plant species were tested for tensile strength. The age of herbs and shrubs was determined by growth-ring analysis. Root characteristics varied considerably between both plant species and functional groups.

The rooting depth of different species ranged from 7.2 $\pm$ 0.97 cm to 20.5 $\pm$ 2.33 cm, but was significantly larger in the herb *Geum reptans* (70.8 $\pm$ 10.75 cm). The woody species *Salix breviserrata* reached the highest horizontal root extensions (96.8 $\pm$ 25.5 cm). Most plants had their longest roots in fine diameter classes ($0.5 < d \leq 2.0$ mm), and only herbs with tap roots (*Arabis caerulea* and *Geum reptans*) had longer roots in higher diameter classes ($2 < d \leq 5$ mm). Large differences in root tensile strength indicate a different potential to stabilise soil.

This work underlines the importance of high plant diversity, increasing the diversity of root types and root functions which are probably important for the stability of alpine soils.