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The concurrent kinetics of N uptake by soil microbes and western hemlock (Tsuga heterophylla) seedlings: a microcosm study

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There is disagreement over the relative ability of microbes and plants to compete for soil N. Empirical data are needed, therefore, to develop models that can be applied for specific plant species across different soil conditions. We grew western hemlock (Tsuga heterophylla (Raf.) Sarg) seedlings in humus collected from old-growth forest plots (high available C) and from adjacent clearcut plots (low available C). We injected the rhizospheres with either 15N-labelled NH4+ or 15N-labelled amino acid solutions, over a wide range of N concentrations. The uptake of these N compounds by soil microbes and seedlings was assessed 4 h after injection. Microbial uptake rates of NH4+-N were best described by a linear models, whereas microbial uptake of amino acid-N as well as seedling N uptake were best described by asymptotic models. Microbial uptake rates were several orders of magnitude greater than seedling uptake rates, except at low concentrations that are typical under field situations. The provenance of the humus also had significant effects on N uptake kinetics by microbes and seedlings, which were consistent with the available C status of each humus type. Results suggest that differences in N uptake kinetics between plants and microbes are complementary functions that may confer resistance and resilience to forest ecosystems.