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Waldernährungsstrategien und deren Wechselwirkung mit bodenchemischen und bodenbiologischen Eigenschaften

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Titel
Himalayan treeline soil and foliar C:N:P stoichiometry indicate nutrient shortage with elevation

Abstract
Only a few studies have addressed the soil and foliar carbon:nitrogen:phosphorus (C:N:P) stoichiometry in alpine treeline ecotones. Moreover, information on the soil nutrient availability (primarily N, P) in such ecosystems is rare. To fill these gaps, we performed a multiple data sampling in a near-natural alpine treeline ecotone in Rolwaling Himal, Nepal. Our results show strongly varying soil C:N:P ratios and nutrient availabilitywith soil depth. Caused by high monsoon precipitation and coarse-grained soils with low water-holding capacities, a vertical transport of nutrients and potentially mineralizable soil organic matter (SOM) in soils occurs, which is a general problem in the study area impeding growing conditions for trees. Soil N and P availability, and soil C:P and N:P ratios decrease significantly as elevation increases, especially at the transition from krummholz (dominated by rhododendron campanulatum) to the alpine tundra (dwarf scrub heath). Soil C:N ratios increase significantly with elevation, most notably from the subalpine forest to krummholz and the alpine tundra. These altitudinal trends indicate increasing nutrient (N, P) shortage especially in the alpine tundra. LowNand P availability in alpine tundra soils are likely caused by a lower litter input from dwarf shrub vegetation, and a decline in litter mineralization in this altitudinal zone resulting in small accumulation of SOM. Nutrient availability in the entire study area is generally limited by low soil pH (from 2.5 to 4). In total six investigated tree species show diverse relationships between foliar and soil stoichiometric ratios, and soil nutrient availability. Significantly increasing foliar C:N and C:P ratios with elevation due to significantly decreasing foliar N and P concentrations suggest a limitation in N and P. Foliar N:P ratios indicate N rather than P limitation. Contrary to previous studies from different alpine treeline ecotones, we do not consider the Rolwaling treeline ecotone as an area of nutrient accumulation. We conclude that altitudinal variations in stand structures themselves govern nutrient cycling through the input of C, N, and P into soils by differences in leaf fall.