Sustainable supply of base cations in boreal forests – the role of ectomycorrhizal fungi

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In boreal forests symbiotic ectomycorrhizal fungi play important roles in mobilising nutrients and sequestering carbon belowground. The fungal mycelia increase the nutrient absorbing surface area of their host plant root systems and provide a direct pathway for translocation of photosynthetically derived C to microsites in the soil that are inaccessible to plant roots. This provision of energy-rich compounds powers mobilisation and uptake of nutrients from both organic and inorganic substrates. It is well established that the fungal symbionts are able to mobilise N and P from organic polymers with different degrees of recalcitrance. Renewed focus on the role of ectomycorrhizal fungi in weathering of minerals suggests that they are the dominant drivers of silicate weathering and may even buffer global CO_2 levels over geological time scales. Sustainable forest production requires efficient recycling of N, P and base cations from organic residues as well as the release of P and base cations from mineral substrates through weathering to replace those lost through leaching and biomass harvesting. The relative long-term importance of these two pathways under different harvesting scenarios, patterns of carbon allocation and identity and functioning of the different mycorrhizal species involved are still the subject of intensive research - using field and laboratory microcosm experiments, profiling of fungal and bacterial communities with high-throughput DNA and RNA sequencing, and measurements of stable and radioactive isotopes. Our studies indicate increased abundance of different ectomycorrhizal fungi in E-horizon material and superficial granite rock outcrops, and ^{13}C stable isotope probing is currently being used to identify the dominant fungal taxa allocating C to mineral substrates. The mycelium itself may constitute a significant pool of base cations and new tools based on fractionation patterns of stable isotopes of Mg are being developed to distinguish between *de novo* supply of base cations via mineral weathering and recycling of mycelial pools.