



Conference Abstract

Seasonal dynamics of C and N along the soil-mycorrhiza-plant continuum in a *Pinus sylvestris* boreal forest

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Received: 12 Feb 2025 | Published: 28 May 2025

Citation: Guidoni I, Sbrana C, Scartazza A, D'Andrea E, Tunno I, Schiestl-Aalto P, Rezaie N (2025) Seasonal dynamics of C and N along the soil-mycorrhiza-plant continuum in a *Pinus sylvestris* boreal forest. ARPHA Conference Abstracts 8: e149501. <https://doi.org/10.3897/aca.8.e149501>

Abstract

Boreal forests represent one of the most important carbon (C) sinks globally. Current climate change could have unpredictable effects on the processes that regulate the dynamics of C allocation in boreal forests and, consequently, on the terrestrial C balance. In these extremely nutrient-poor ecosystems, symbioses between plant roots and ectomycorrhizal fungi play a crucial role in enhancing nutrient uptake by plants. It was therefore hypothesised that, in a mature *Pinus sylvestris* boreal forest, there is a phenological and environmental control on C and N exchange. For this reason, at the Hyytiälä Forest Research Station (SMEAR II), equipped with an Eddy-covariance tower for measuring net fluxes of C between the atmosphere and the ecosystem, the seasonal dynamics of C and N allocation along the soil-ectomycorrhiza-host-plant continuum were studied, and the possibility of using the natural abundances of the stable isotopes of C ($\delta^{13}\text{C}$) and N ($\delta^{15}\text{N}$) as tracers to investigate these processes was evaluated. On the basis of NEE (Net Ecosystem Exchange) and GPP (Gross Primary Productivity) data, three sampling dates from June to October were selected and chemical-isotopic analyses were

performed on soil, rhizosphere, mycorrhizal root tips (ECM), roots and leaves. The collected data show a synchronised C allocation towards ECM and xylogenesis, driven by the strong increase of NEE during the spring-summer period. Furthermore, seasonal variations in C and N concentrations along the soil-ECM-plant continuum suggest a close interaction between the cycles of these nutrients. These results agree with the model that, under nutrient-limited conditions, an increased allocation of C to symbiotic fungi would favour an immobilisation of N by the fungi to support their development and metabolism. Conversely, a decrease in C supply to the mycorrhizal fungi would lead to an increase in the amount of N released to the host plant. This hypothesis is supported by $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analyses that show an isotopic fractionation associated with the exchange of C and N between symbiont fungus and host plant. The results obtained may therefore have significant implications for understanding nutrient exchange within a boreal forest.

Keywords

stable isotopes; ectomycorrhizal fungi;xylogenesis; eddy covariance

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Presented at

POSTER

Conflicts of interest

The authors have declared that no competing interests exist.