EGU22-10476
https://doi.org/10.5194/egusphere-egu22-10476
EGU General Assembly 2022

The Spatial Extent of Carbohydrate Sharing in the Wood-Wide Web Varies with Climate and with Taxonomy of Ectomycorrhizal Fungi : Insights from the Swiss Forest FACE

Erik Hobbie[1], Sonja Keel[2,6], Katharina Steinmann[3], Markus Wilhelm[4], Matthias Saurer[3,5], Rolf Siegwolf[3], and Christian Körner[2]

[1]University of New Hampshire, Earth Systems Research Center, Durham, United States of America (erik.hobbie@unh.edu)
[2]Institute of Botany, Department of Environmental Sciences, University of Basel, Basel, Switzerland
[3]Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland
[4]Verein für Pilzkunde Basel, Basel, Switzerland
[5]Paul Scherrer Institute, Laboratory of Atmospheric Chemistry, Villigen, Switzerland
[6]Climate and Agriculture Group, Agroecology and Environment, Agroscope, Zürich, Switzerland

To assess how belowground mycorrhizal networks may share resources, we used $\delta^{13}C$, $\delta^{15}N$, and C/N measurements to calculate spatial and temporal dynamics of carbohydrate and amino acid movement through ectomycorrhizal networks of mature trees.

Canopies of 14 deciduous trees were continuously labeled with ^{13}C-depleted CO_2 from 2001-2005 (Swiss Forest FACE) and the ^{13}C label traced into ectomycorrhizal sporocarps.

Sporocarps derived 69±5%, 30±6%, and 16±7% of their carbon from labeled trees in the elevated (beneath labeled trees), 0-6 m, and 6-12 m distances, respectively. Sporocarp $\delta^{13}C$ correlated positively with C/N under elevated CO_2 and negatively elsewhere, reflecting that high-$\delta^{13}C$ carbohydrates from surrounding trees contributed to sporocarps under elevated CO_2 and low-$\delta^{13}C$ carbohydrates from elevated CO_2 trees contributed to sporocarps elsewhere. Sporocarp $\delta^{15}N$ increased in *Cortinarius* with decreasing $\delta^{13}C$, suggesting that greater hyphal growth with elevated CO_2 sequestered ^{15}N-depleted N from sporocarp formation. Sporocarp $\log_e$ C/N decreased during the 2004 growing season and the contribution of ^{13}C-depleted carbon from elevated CO_2 plants decreased at the 0-6 m and 6-12 m distances, suggesting decreased carbohydrate availability and network transport that year. In contrast, sporocarp $\log_e$ C/N increased during the 2005 growing season and the contribution of ^{13}C-depleted carbon from elevated CO_2 plants increased at the 0-6 m distance, suggesting increased carbohydrate availability and network transport that year. Relative to other taxa, elevated CO_2 reduced C/N by 15% and ambient CO_2 increased C/N by 5% in taxa exclusively associated with deciduous trees, suggesting increased carbohydrate sharing by the deciduous-associated taxa.

These patterns indicated that 1) carbohydrates (high C/N), not amino acids (low C/N), were preferentially transferred between regions differing in source $\delta^{13}C$, 2) sporocarp C/N reflected

yearly plant productivity, 3) network transport was influenced by climate, and 4) taxonomy influenced transport dynamics belowground.