Beneath the trees: How mycorrhizal fungi shape the soil carbon cycle

Johanna Pausch

The world's soils are the largest terrestrial reservoir of organic carbon (C). Feedbacks between soil organic C and atmospheric CO_2 will determine the future trajectory of climate change. However, predictions are largely uncertain because we still lack fundamental knowledge of the complex interplay between plants and microorganisms and its influence on C turnover.
Most terrestrial plants live in symbiosis with mycorrhizal fungi. Plants supply substantial amounts of recent assimilates to their fungal partners in exchange for nutrients. This makes mycorrhizal fungi an important C sink in soils. Furthermore, unlike most other soil organisms, mycorrhizal fungi are exempt from C limitation. Thus, they are key players in the decomposition of soil organic matter, either directly or indirectly through interactions with saprotrophic microorganisms. Finally, microbial necromass, including mycorrhizal fungal residues, contributes to the stabilization of C in soil via binding to minerals. These mechanisms of C cycling, including the input, turnover and stabilization of C in soil, are thought to be dependent on the type of mycorrhiza. And in fact, the distribution of plants with distinct mycorrhizal types was recently shown to be linked to terrestrial C stocks on a global scale. To date, however, it is not clear whether there is a causal relationship between mycorrhizal type and soil C storage. Answering this key question requires novel concepts that consider the mechanistic link between short-term C fluxes from plants to soil via mycorrhizal fungi and C stabilization as an emerging ecosystem property. In this presentation, I will provide examples and discuss C input dynamics mediated by mycorrhizal fungi, their effects on C turnover and the implications for C storage in soil.

CV

Johanna Pausch is a professor for Agroecology at the University of Bayreuth and a member of the Bayreuth Center of Ecology and Environmental Research (BayCEER). After she earned a diploma in Geoecology (2009) and a Ph.D. in Agroecosystem Research (2012), she worked as an academic assistant at the Department of Soil Science at the Georg-August University of Goettingen. Since 2017, she is leading the Agroecology group at Bayreuth. Her research concentrates on interactions between plants, soils and microorganisms in various ecosystems with special emphasis on biogeochemical processes in the rhizosphere and the role of mycorrhizal fungi in soil C storage.

https://www.bayceer.uni-bayreuth.de/agroecology/