



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Plant carbon investment in fine roots and arbuscular mycorrhizal fungi: A cross-biome study on nutrient acquisition strategies



Svenja C. Stock^{a,b,*}, Moritz Koester^{a,c}, Jens Boy^d, Roberto Godoy^e, Francisco Nájera^f, Francisco Matus^{g,h}, Carolina Merino^{g,h}, Khaled Abdallahⁱ, Christoph Leuschner^j, Sandra Spielvogel^k, Anna A. Gorbushina^{i,l}, Yakov Kuzyakov^{b,m,n,1}, Michaela A. Dippold^{a,1}

^a Biogeochemistry of Agroecosystems, University of Goettingen, Goettingen, Germany

^b Soil Science of Temperate Ecosystems, University of Goettingen, Goettingen, Germany

^c Institute of Geography, University of Bern, Bern, Switzerland

^d Institute of Soil Science, Leibniz University Hannover, Hannover, Germany

^e Institute of Environmental and Evolutionary Science, Universidad Austral de Chile, Valdivia, Chile

^f Department of Engineering and Soils, Universidad de Chile, Santiago, Chile

^g Laboratory of Conservation and Dynamics of Volcanic Soils, Department of Chemical Sciences and Natural Resources, Universidad de La Frontera, Temuco, Chile

^h Network for Extreme Environmental Research (NEXER), Universidad de La Frontera, Temuco, Chile.

ⁱ Department Materials and Environment, Federal Institute for Material Research and Testing, Berlin, Germany

^j Plant Ecology and Ecosystem Research, University of Goettingen, Goettingen, Germany

^k Institute of Plant Nutrition and Soil Science, Christian-Albrechts University of Kiel, Kiel, Germany

^l Institute of Biology and Department of Geosciences, Freie Universität Berlin, Berlin, Germany

^m Institute of Environmental Sciences, Kazan Federal University, Kazan, Russia

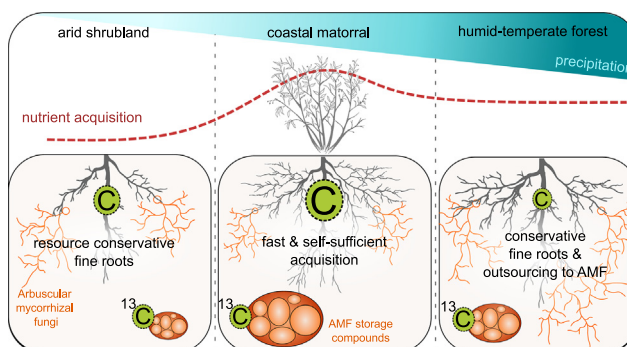
ⁿ Agro-Technology Institute, RUDN University, Moscow, Russia

HIGHLIGHTS

- ¹³C₂ pulse labeling in arid shrubland, coastal matorral, and humid forest
- Ecosystem-specific acquisition strategies and distinct mutualism with AM fungi
- Conservative resource economics in arid shrubland supported by AM fungi
- Acquisitive resource and do-it-yourself economics in coastal matorral
- Conservative and outsourcing resource economics in humid forest

GRAPHICAL ABSTRACT

Plant resource acquisition strategies were ecosystem-specific with distinct mutualism with arbuscular mycorrhizal (AM) fungi. Root traits indicated conservative resource economics in the arid shrubland, but an acquisitive and self-sufficient (“do-it-yourself”) acquisition strategy in the semiarid coastal matorral, resulting in large carbon (C) investments (green). Forest plants with conservative root traits seem to intensively outsource their acquisition to AM fungi, compensating for lower uptake capacities of conservative roots (red line). High allocations of freshly assimilated C into AM fungal storage compounds illustrated the relevance of AM fungi as C sink, especially in the semi-arid matorral.



* Corresponding author at: Institute of Geography and Geoecology, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
E-mail address: svenja.stock@kit.edu (S.C. Stock).

¹ Michaela A. Dippold and Yakov Kuzyakov should be considered joint senior author.