



TREE SPECIES INTERACTION AND SOIL DEPTH AFFECT THE RESPONSE OF ROOT EXUDATES TO DROUGHT

Melanie Brunn¹, Benjamin D. Hafner^{2,3}, Hermann F. Jungkunst¹, and Taryn L. Bauerle³

¹ iES Landau, Institute for Environmental Sciences, University of Koblenz-Landau, Landau, Germany

² Ecophysiology of Plants, Technical University of Munich, Freising Weihenstephan, Germany

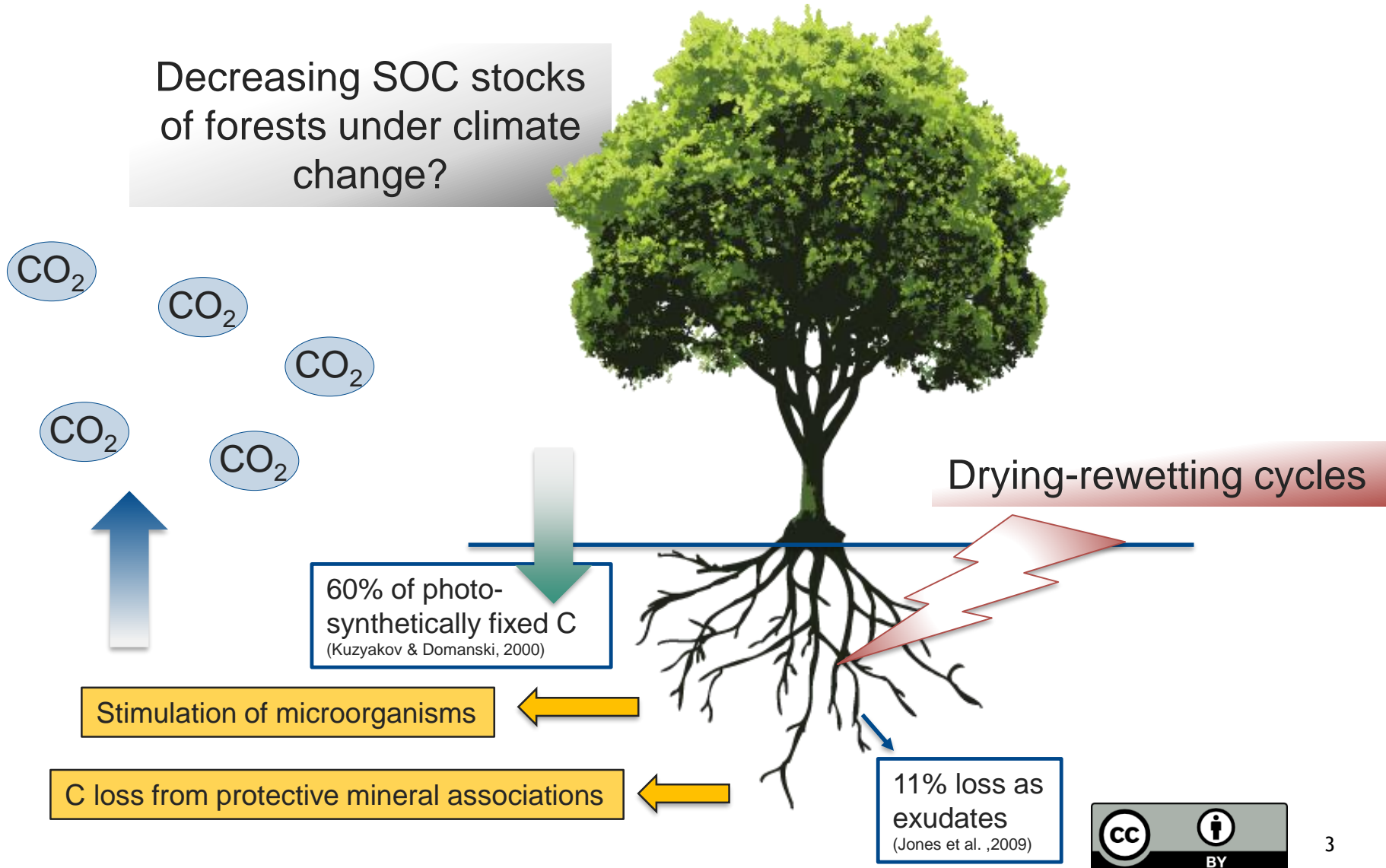
³ School of Integrative Plant Science, Cornell University, Ithaca, NY, USA

“Root exudates ... are part of a belowground, inter-species language between plants and other plants, or other types of organisms”

Coskun et al. 2017. *Trends in Plant Science*

HOW ROOTS AFFECT SOIL ORGANIC CARBON (SOC) DYNAMICS

Decreasing SOC stocks of forests under climate change?



RESEARCH QUESTIONS

1. Do trees invest in the production of root exudates under drought?
2. Do root exudation rates increase in deeper soil as a response to drought?
3. Do species growing in mixture exude more C?

METHODS

Experimental site



Five years of severe summer drought (KROOF experiment):

<https://www.kroof.wzw.tum.de/ueberblick/>

<https://www.youtube.com/watch?v=KfO88XaoNvI>

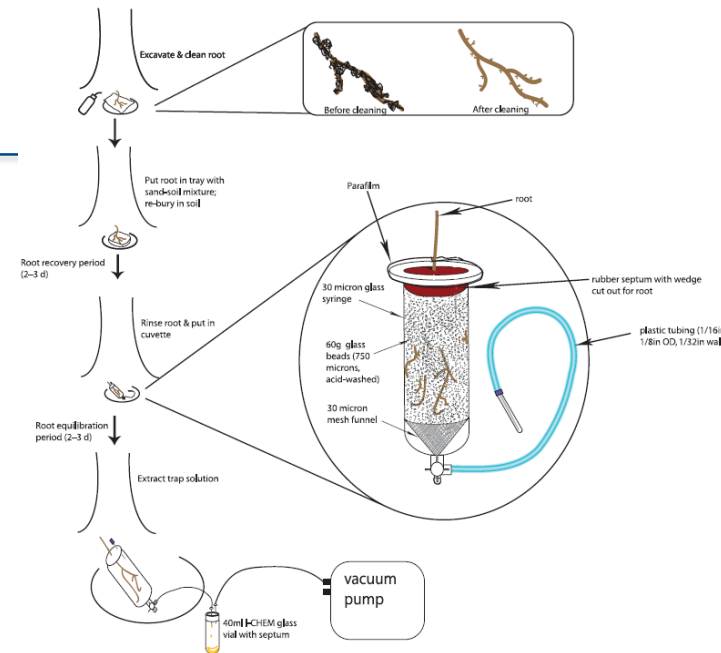
Beech (*Fagus sylvatica* L.) and Spruce (*Picea abies*) in monoculture and in mixture

Sampling

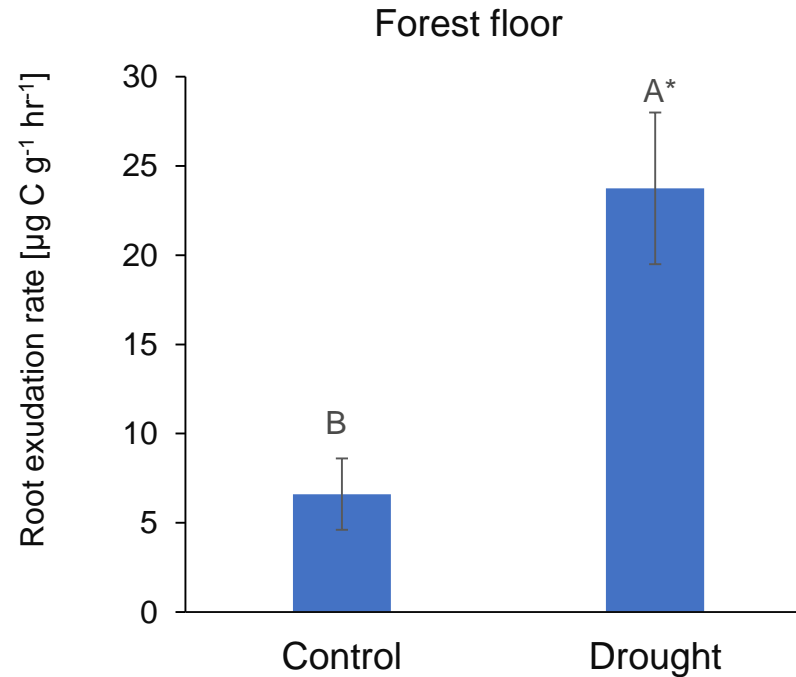


Root exudates (C concentrations) in the forest floor and the mineral soil (at 30 cm depth)

Four control plots, four plots under drought

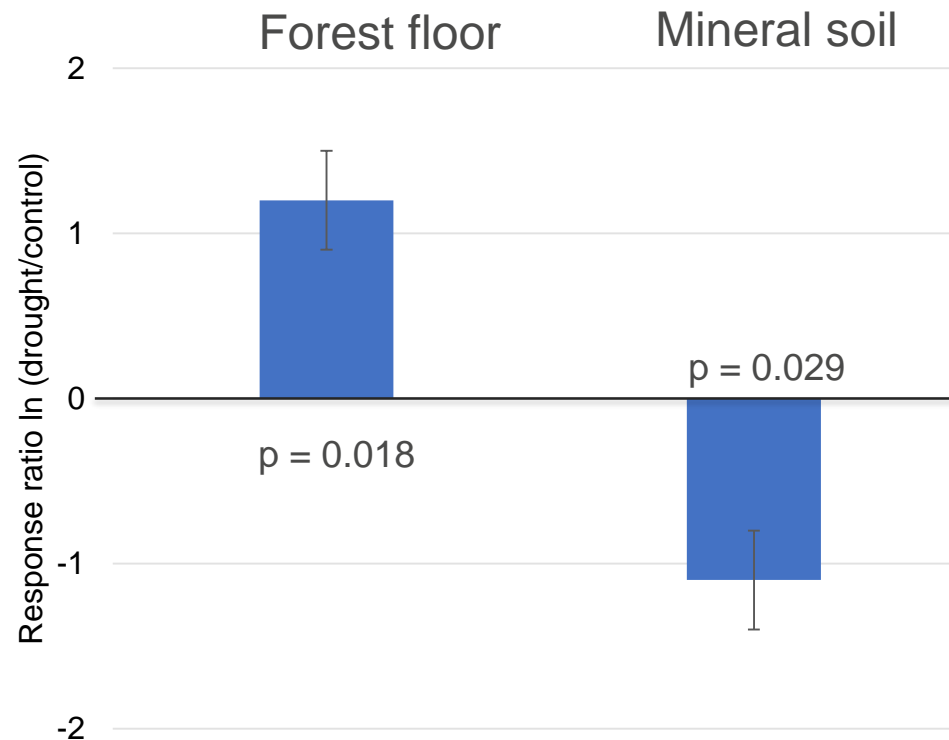


DO TREES INVEST IN THE PRODUCTION OF ROOT EXUDATES UNDER DROUGHT?



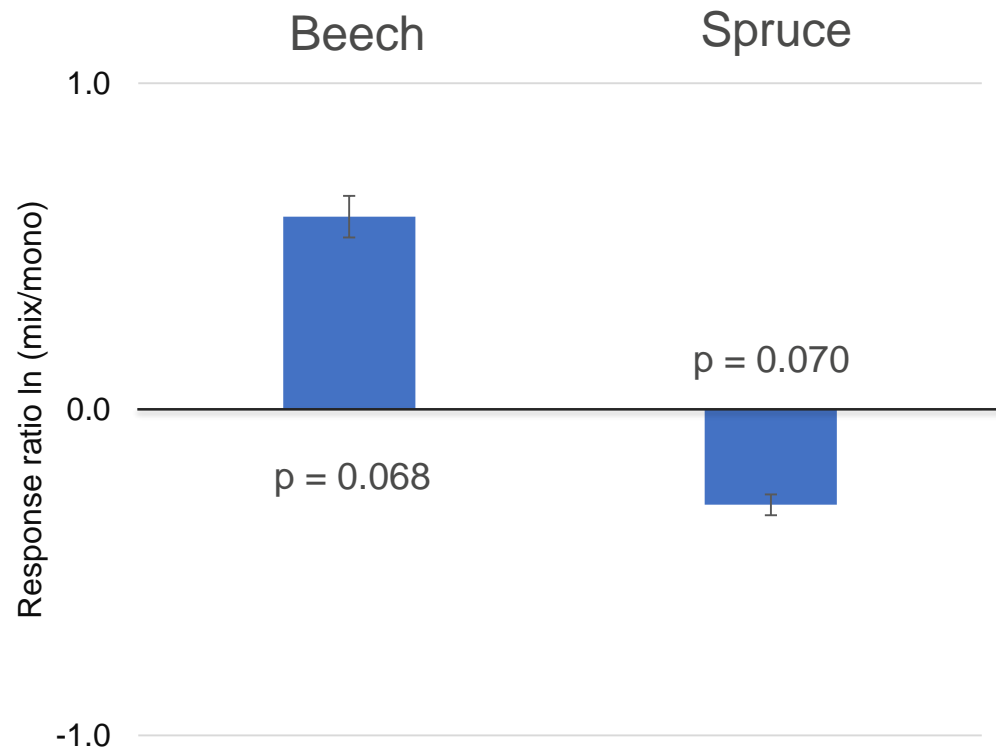
Root exudation rates increase under drought in the forest floor

DO ROOT EXUDATION RATES INCREASE IN DEEPER SOIL AS A RESPONSE TO DROUGHT?



Root exudation rates increase under drought only in the forest floor, while they decrease with drought in the mineral soil.

DO SPECIES GROWING IN MIXTURE EXUDE MORE C?



Beech tends to increase root exudation rates when growing together with spruce, while spruce shows the reverse response

CONCLUSION

- Similar to previous studies of herbaceous plants, we were able to measure an **increase of root exudation rates as a response to drought** in a mature forest.
- The response to elevate exudation rates under drought was only measured in the forest floor. **In deeper soil, exudation rates decreased** as a response to drought.
- Since root growth, sap flow and net photosynthesis decreased under drought at the site, it seems that root exudation is sustained by a few roots that may form **hotspots in the zone between the organic layer and the mineral soil**.
- There may be a potential **benefit of spruce growing together with spruce** due to a reduced belowground carbon loss

THANK YOU!



Dr. Melanie Brunn
iES Landau, Institute for Environmental Sciences
University of Koblenz-Landau
Fortstraße 7, 76829 Landau, Germany
Phone: +49 (0)6341 280-31477
Email: melanie.brunn@uni-landau.de

