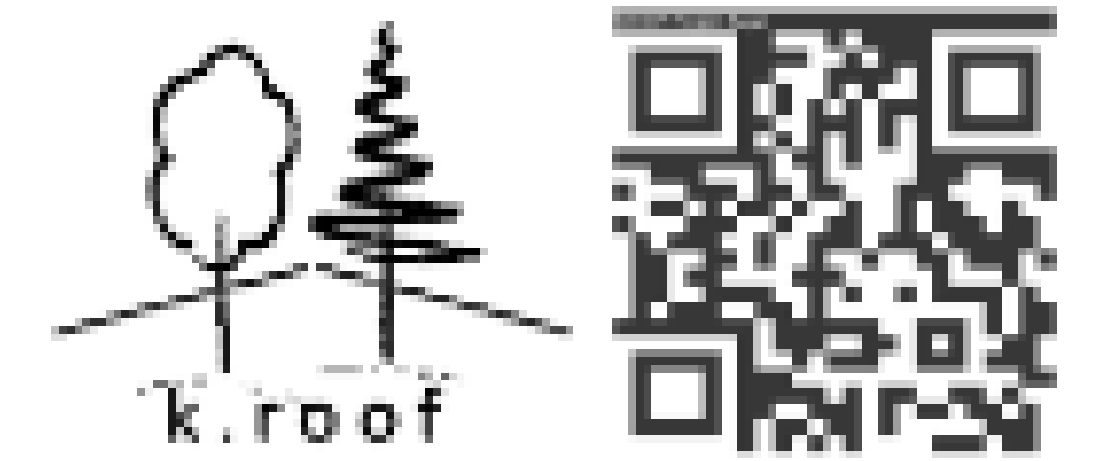


# Carbon allocation in *Picea abies* (L.) Karst roots during recovery from a five-year long drought

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## Introduction

- The Kranzberg roof (KROOF) experiment focuses on recurring summer droughts and tree recovery from drought.
- Spruce trees were exposed to a five year drought during vegetation period and rewatered by drip irrigation.
- In this work we asked, whether the trees are able to recover and how they will allocate carbon during recovery.

## Experimental setup and methods

- Mature spruce trees without (CO) or with throughfall exclusion (TE) (drought period: 2014-18)<sup>1</sup>
- Rewatering and fumigation with <sup>13</sup>C-depleted CO<sub>2</sub> in June 2019<sup>1</sup>



- Fine root growth and vitality: meshbags, picture analysis, fluorescein diacetate vital staining (FDA)



- Carbon allocation to mycorrhizal and non mycorrhizal root tips (IRMS)



Figure 1: Impressions of the Experimental setup and methods.  
a) CO and roofed TE plot at Kranzberg Forest.  
b) Spruce trees with pipes for fumigation with depleted <sup>13</sup>C<sub>2</sub>,  
c) drip irrigation system.  
d) mesh bags at harvesting day.  
e) mesh bag roots before and 28 days after watering.  
f) FDA vitality staining.  
g) taking IRMS samples.

Table 1: Proportional allocation of newly assimilated carbon in CO and TE fine roots. The star (\*) shows a significant difference.

Tissue	CO	TE
New long roots	3 ± 0 % *	29 ± 6 % *
Mycorrhized root tips	5 ± 1 %	3 ± 1 %

## Results

After rewatering:

- Fine root growth rapidly adjusts to CO level
- Most carbon is allocated into long roots whereas mycorrhized root tips don't show a difference to CO
- Root vitality increases but remains consistently lower

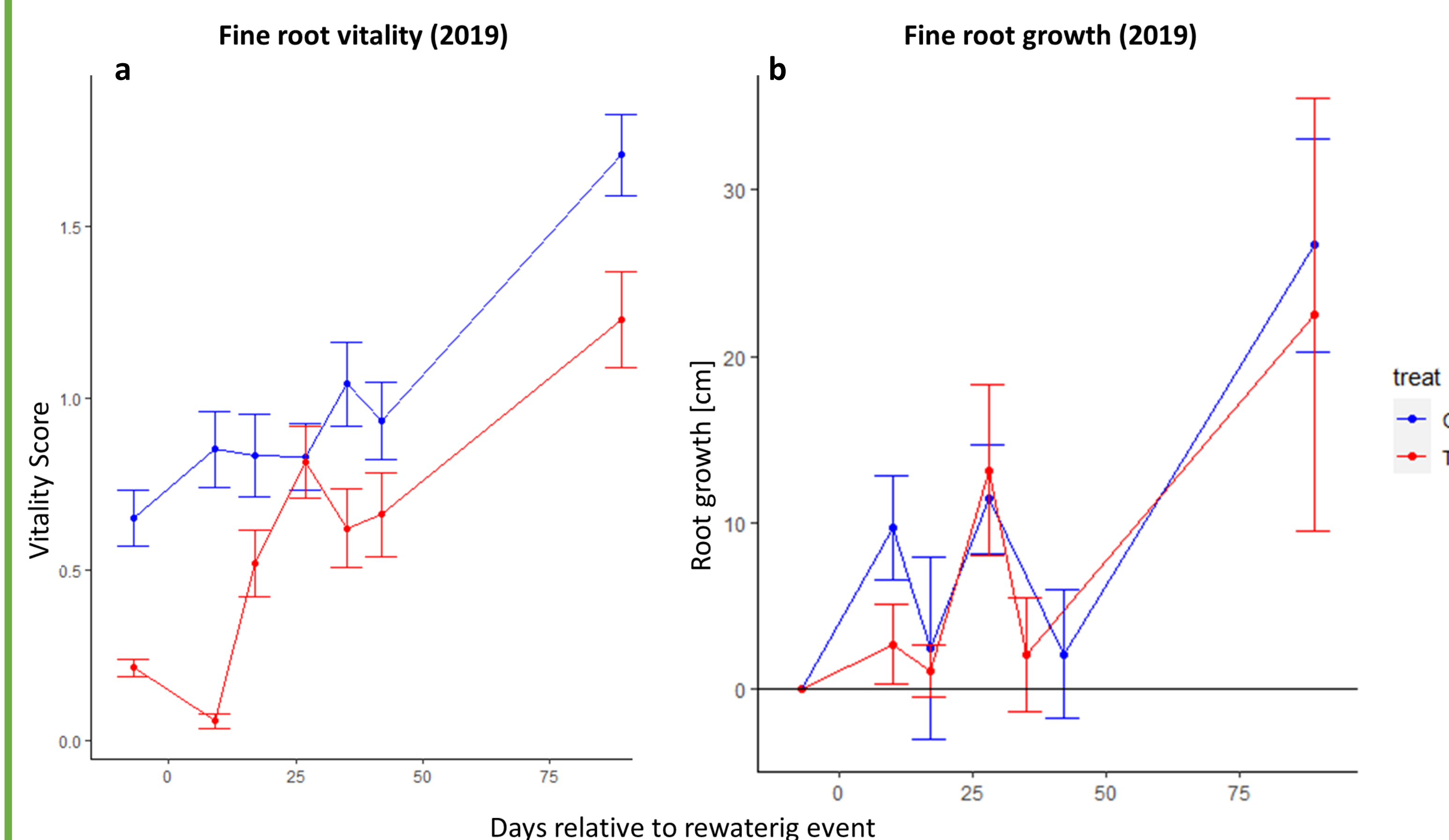


Figure 2: Development of fine root vitality during and after rewatering.  
a) Root tip vitality based on FDA staining.  
b) Root growth in meshbags based on foto analysis.

## Conclusion

- Long roots are the main carbon sink during recovery
- Fine root growth adapts fast to CO but with a shorter lifespan

### References:

<sup>1</sup> Grams et al. 2021, Ecosphere 12(3): e03399

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