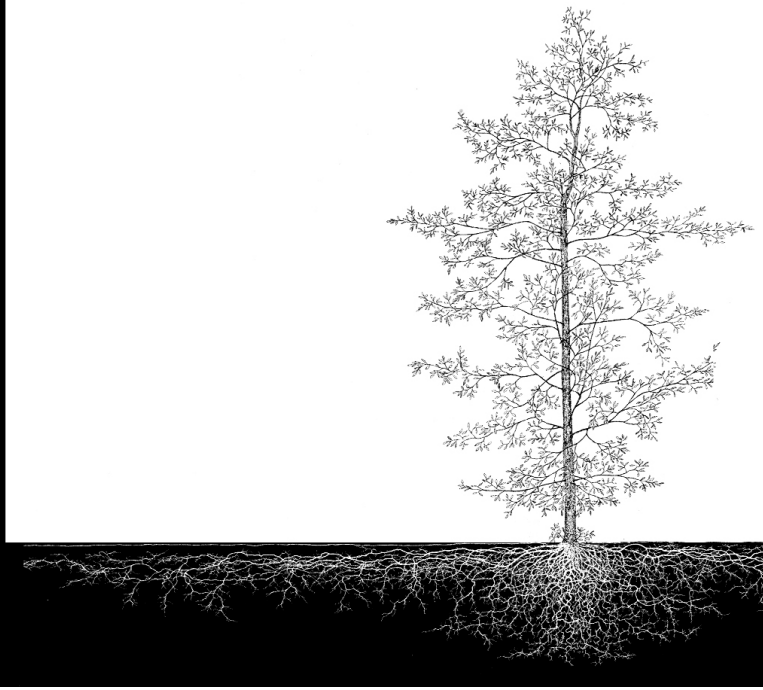
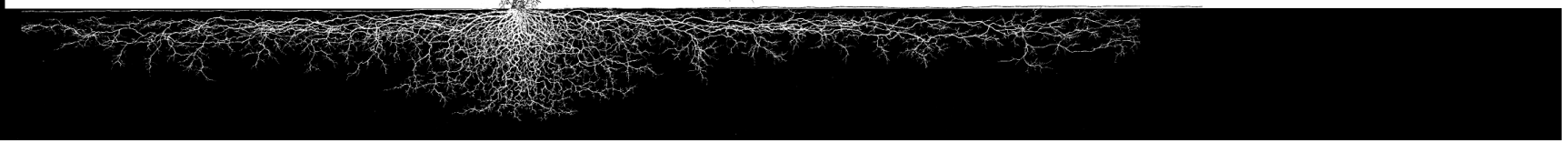
Fine root dynamics of *Fagus sylvatica*: Interacting effects of soil temperatur, drought and ozone treatment

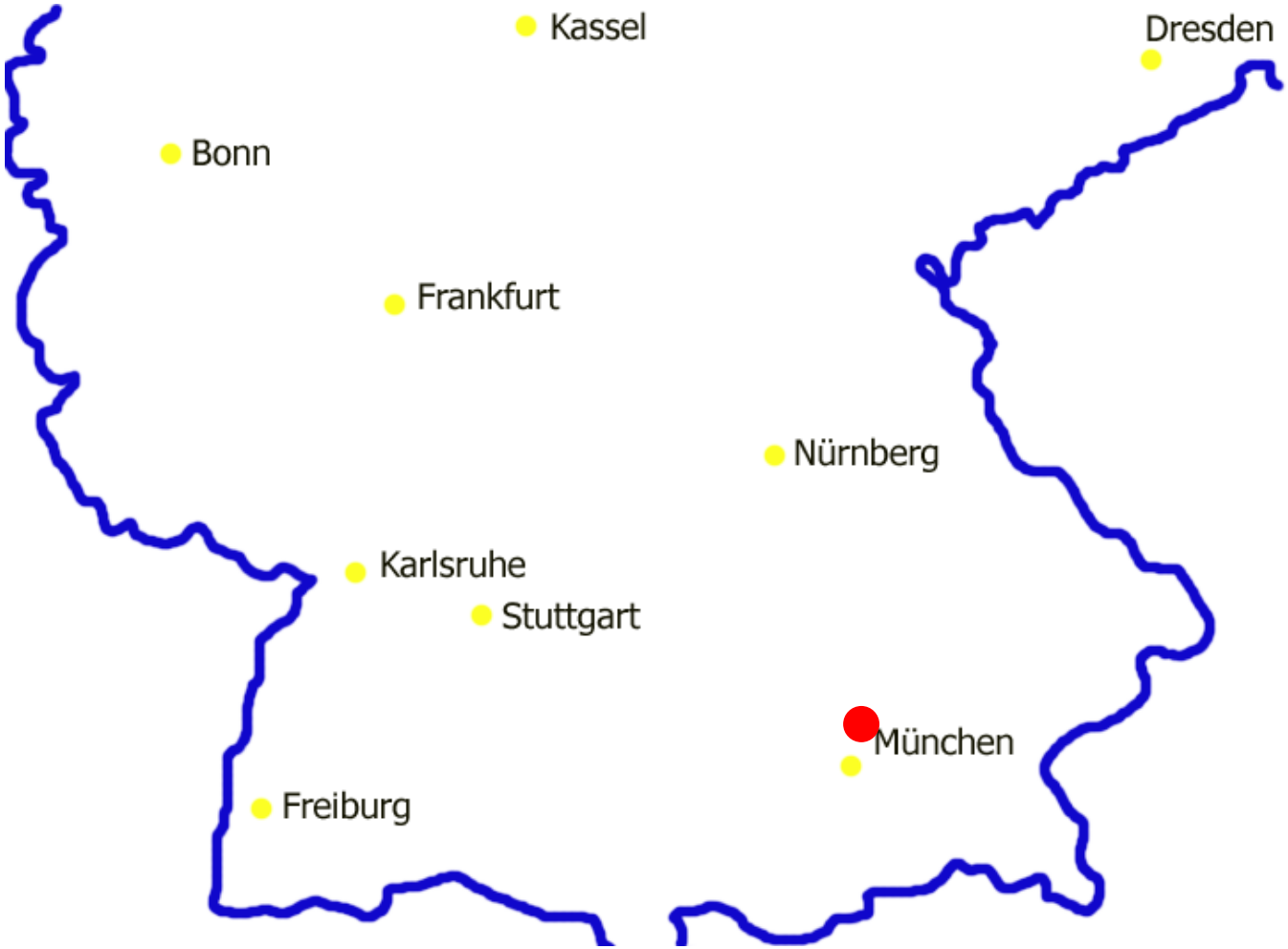
R. Mainiero, I. Schmid and M. Kazda
Department of Systematic Botany and Ecology
University of Ulm





Fine root dynamics of *F. sylvatica*

Study site and experimental setup



Fine root dynamics of *F. sylvatica*

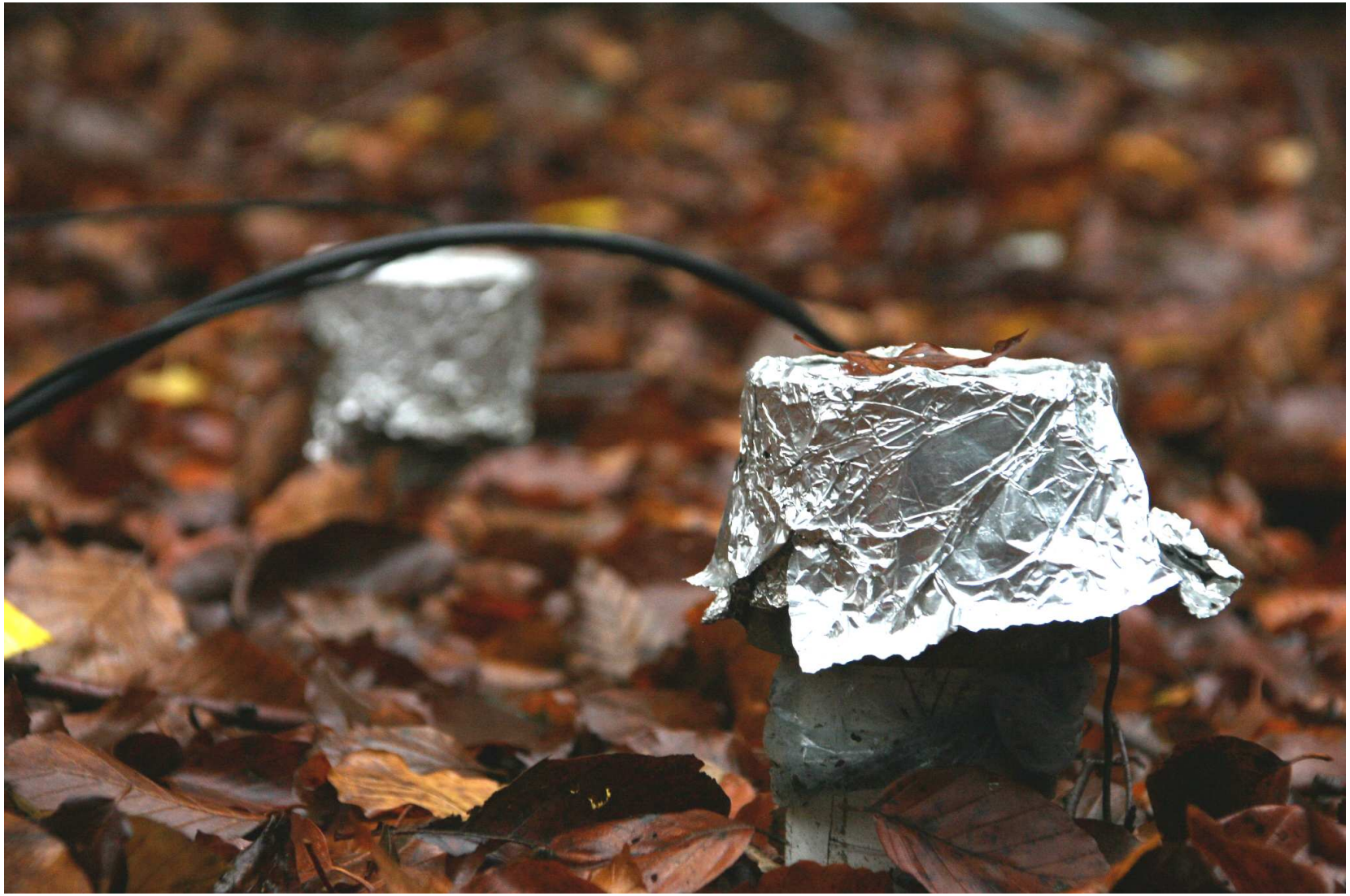
Study site and experimental setup

2x ozone level

150 ppb maximum

Fine root dynamics of *F. sylvatica*

Study site and experimental setup



Fine root dynamics of *F. sylvatica*

Study site and experimental setup

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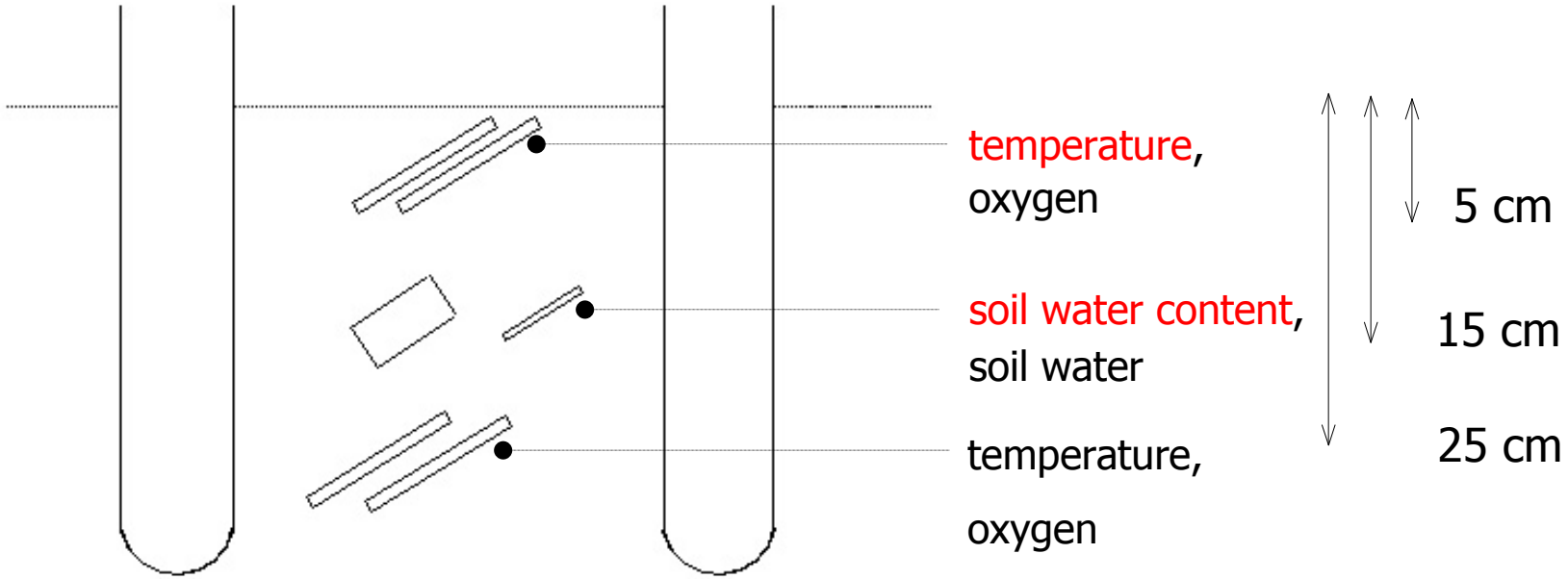


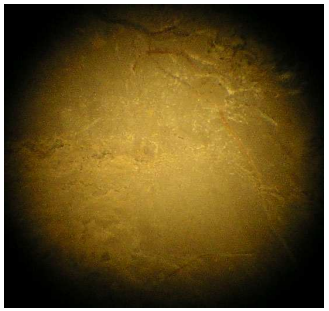
- 6 depth levels, down to 45 cm

  4 directions → 24 images tube^{-1}

- 4 pairs plot $^{-1}$ (n = 4)
- more than 7000 images

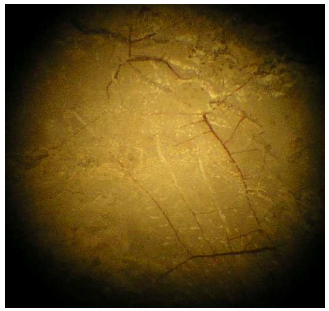
Fine root dynamics of *F. sylvatica*

Study site and experimental setup


July, 17 2003


July, 26 2003


August, 08 2003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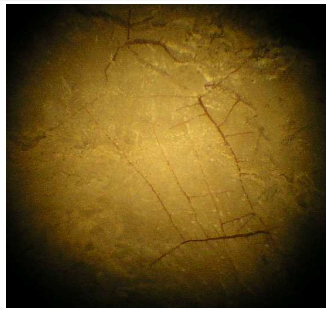
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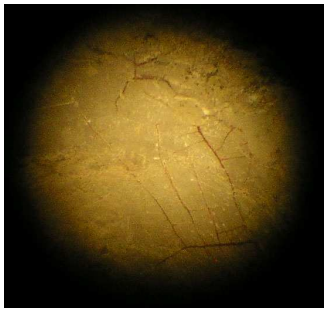
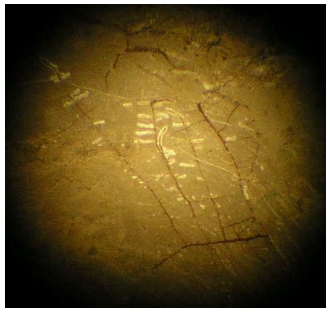
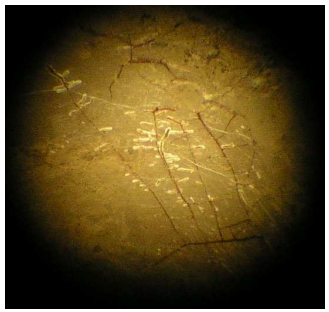
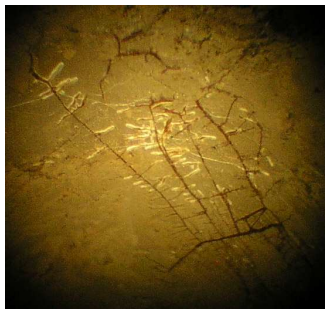

October, 09 2003


October, 23 2003


November, 27 2003


December, 28 2003


March, 17 2004


April, 09 2004


April, 28 2004


May, 11 2004


May, 26 2004


June, 15 2004

Fine root dynamics of *F. sylvatica*

Study site and experimental setup

Study site and experimental setup

- root density

  (roots dm^{-2})

- brown (suberized) / light coloured roots

- root appearance

  (roots m^{-2} d^{-1})

- root mortality

  (roots m^{-2} d^{-1})

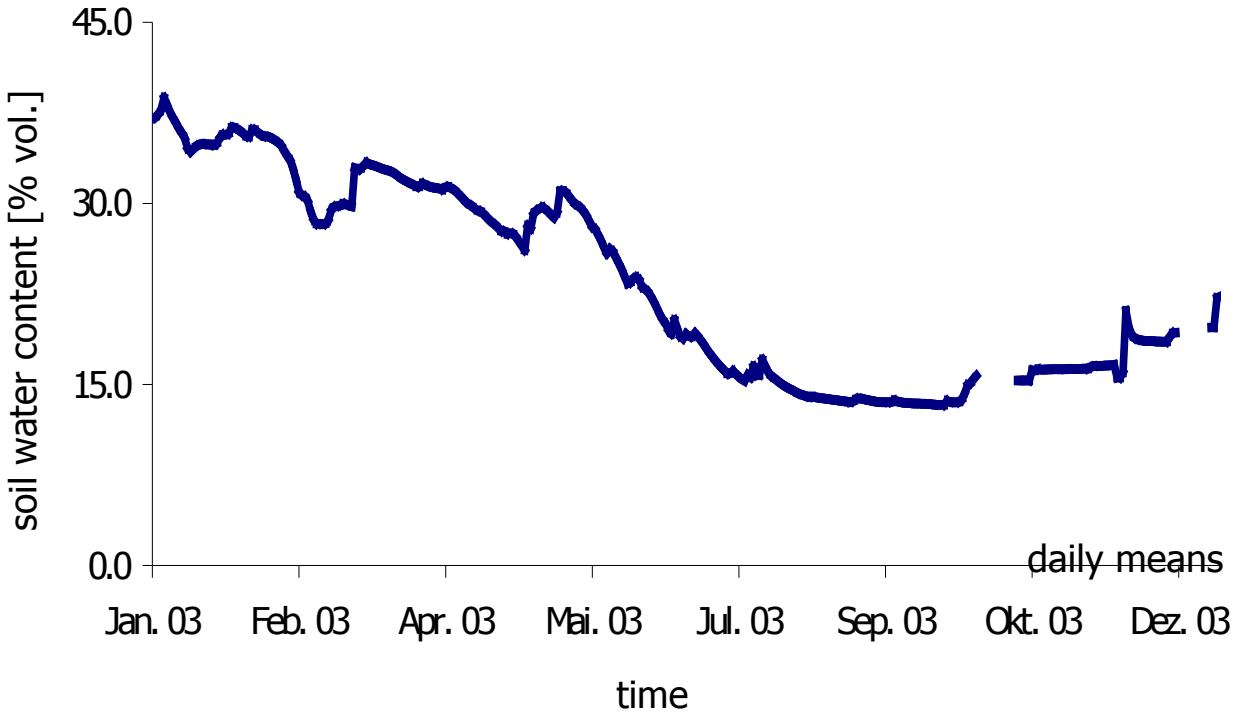
$$\Rightarrow \textbf{turnover coefficient} = \frac{\sum \text{roots appeared [roots m}^{-2}\text{ year}^{-1}]}{\text{mean root density [roots m}^{-2}\text{]}}$$

$Rl = c * N_r$ with $3.8 \geq c \geq 1$

Smit et al. (2000) Root Methods

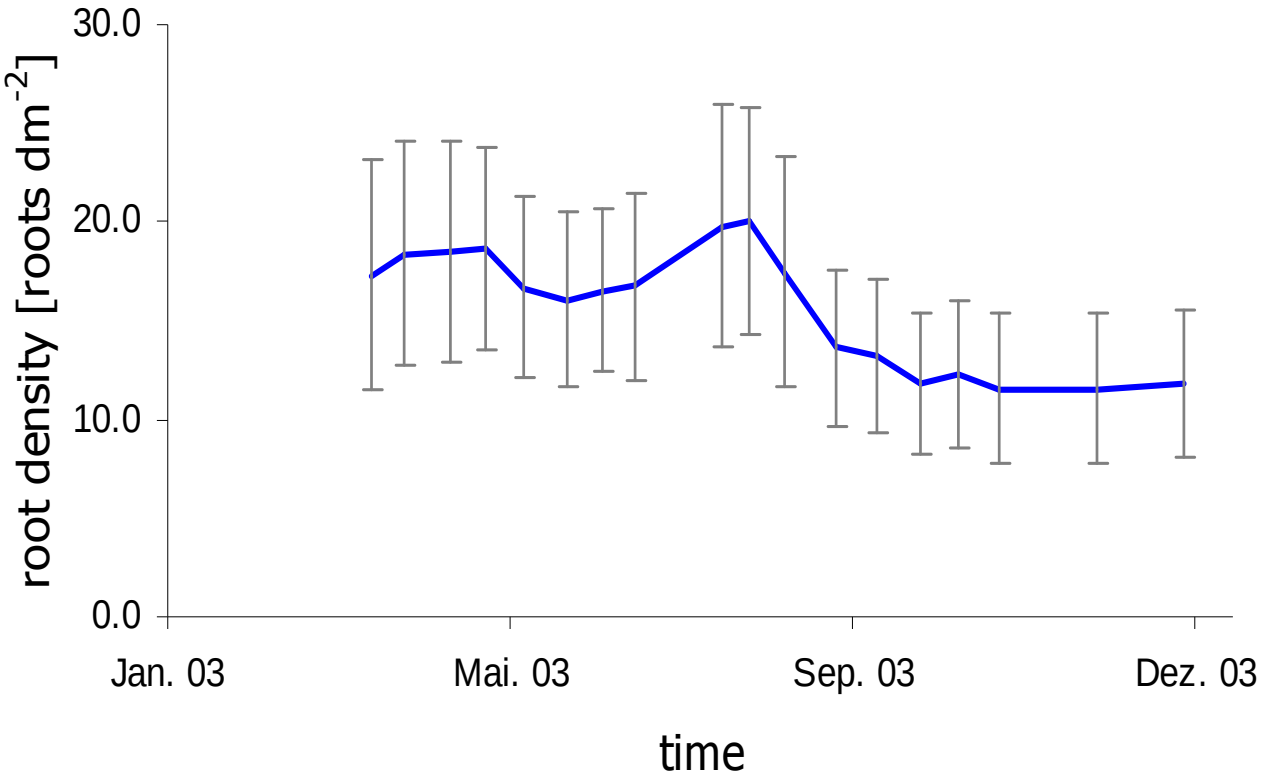
Bragg et al. (1983) Plant and Soil 73 : 435-440

⇒ carbon investments


45.0
30.0
15.0
0.0
soil water content [% vol.]
daily means
Jan. 03
Feb. 03
Apr. 03
Mai. 03
Jul. 03
Sep. 03
Okt. 03
Dez. 03
time

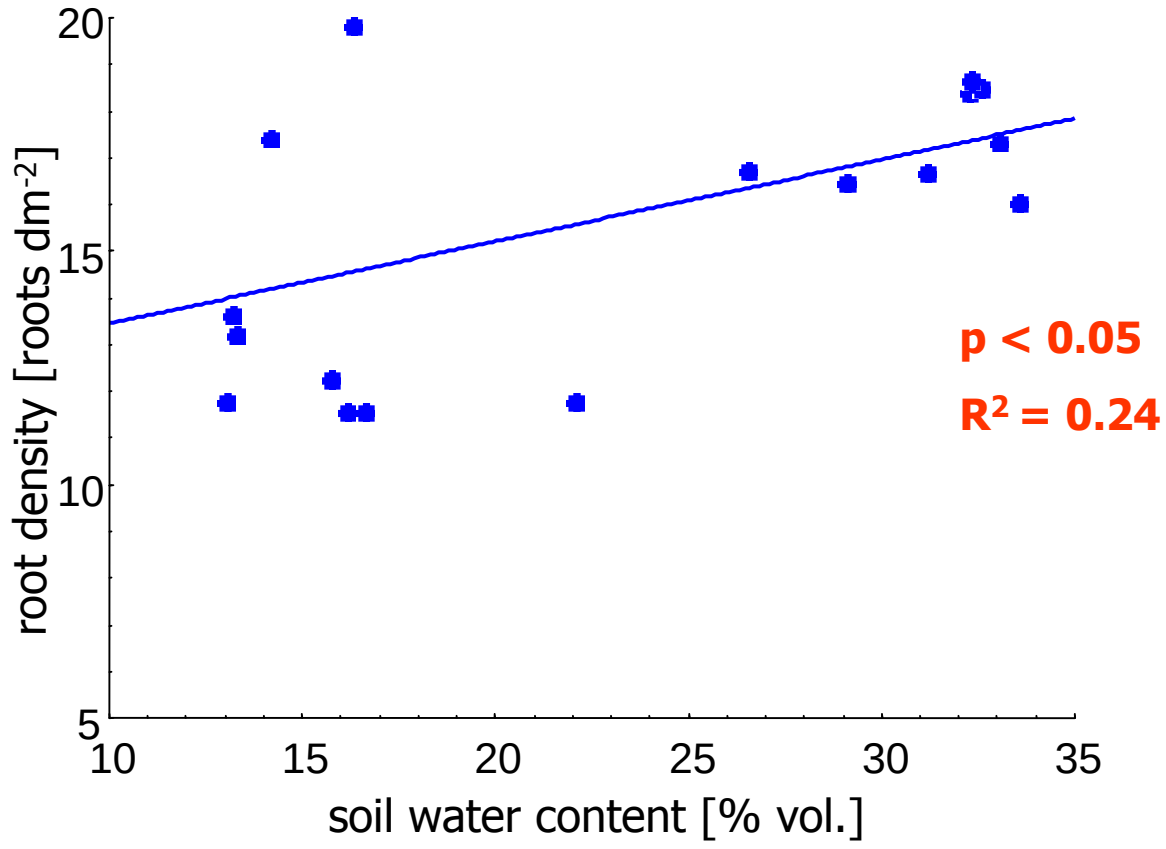
Fine root dynamics of *F. sylvatica*

Results



***F. sylvatica*, control**
mean ± 1SE

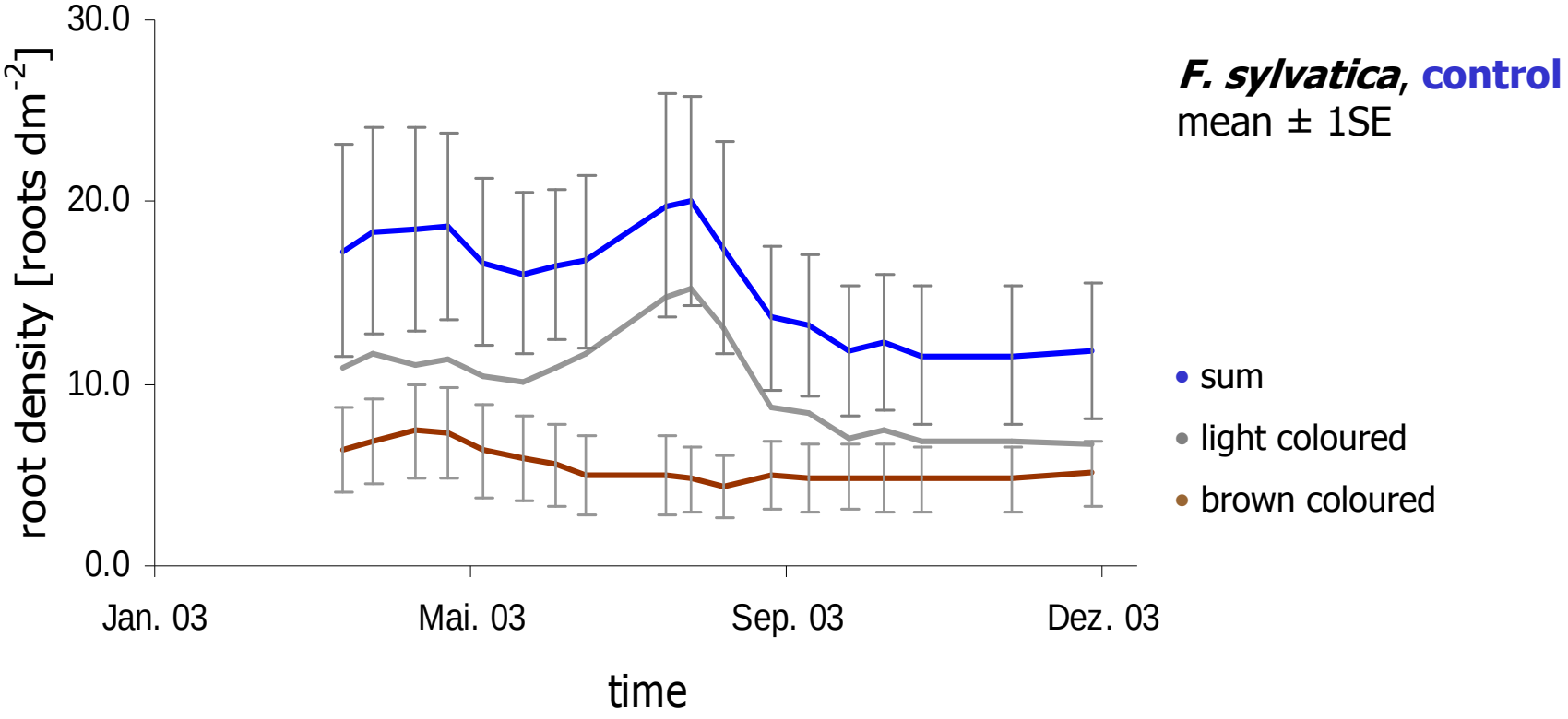
• sum



***F. sylvatica*, control**
means

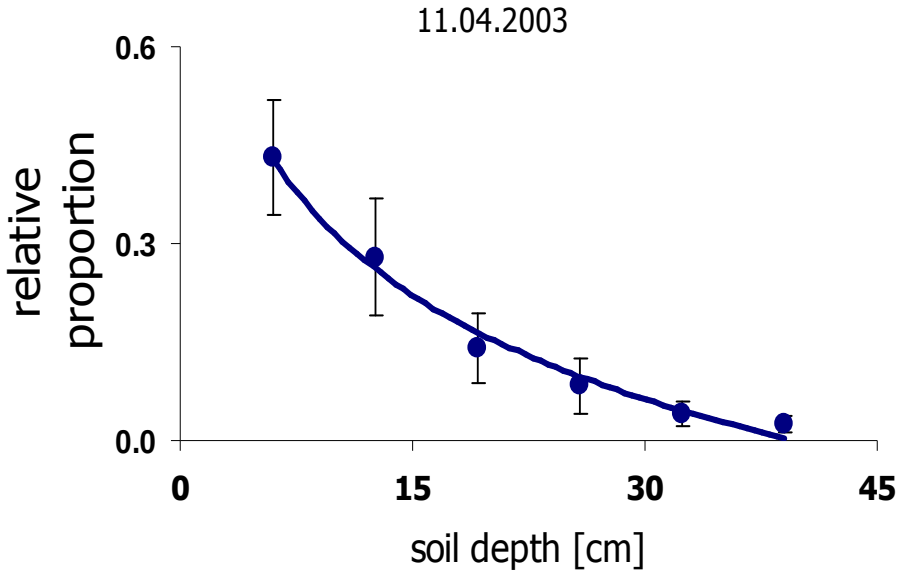
Fine root dynamics of *F. sylvatica*

Results



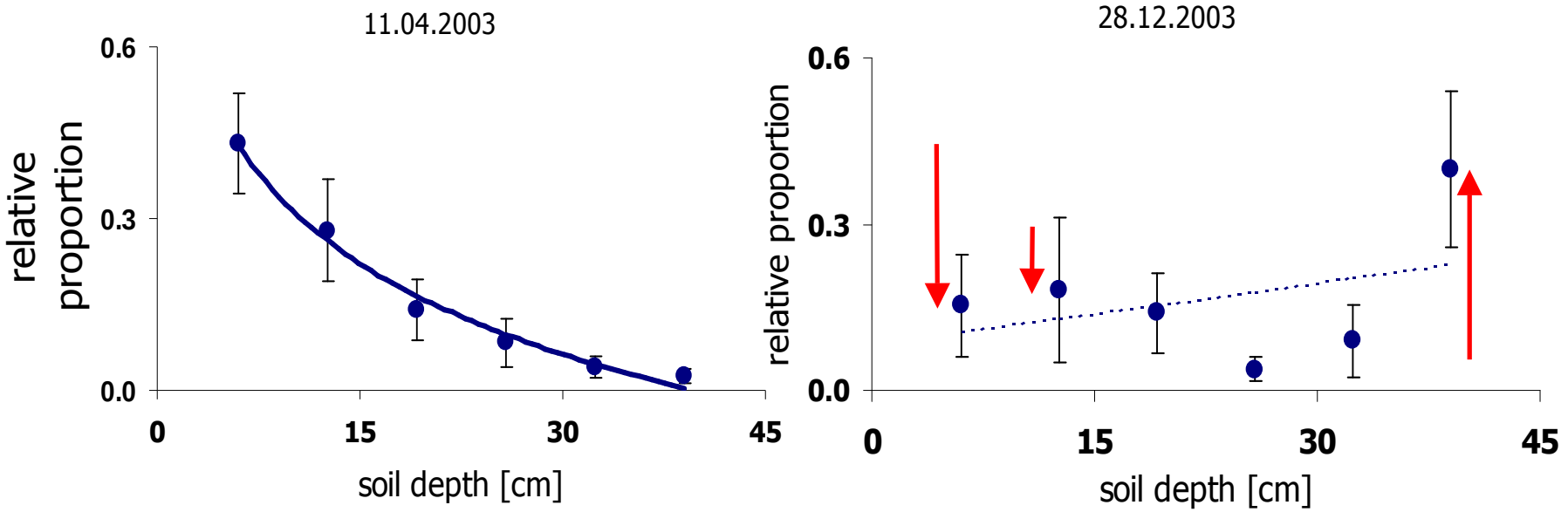
***F. sylvatica*, control**

mean ± 1SE



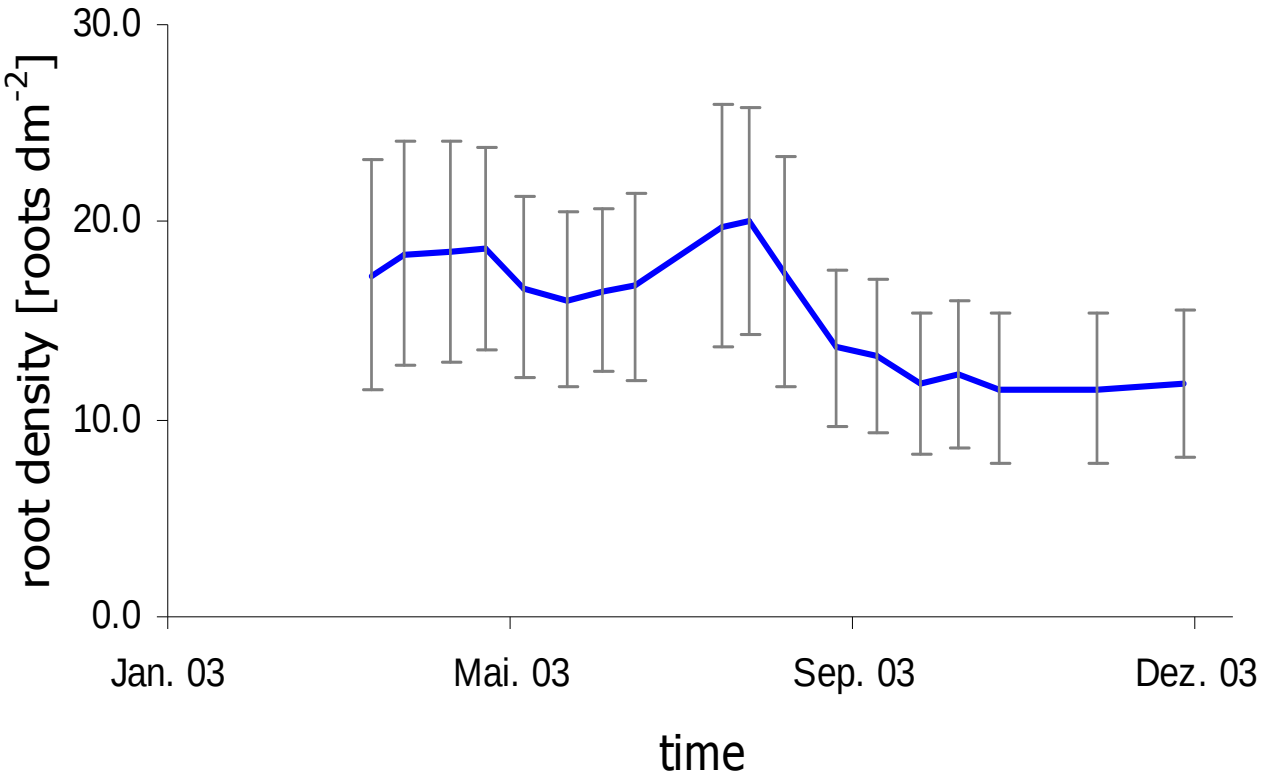
***F. sylvatica*, control**

mean ± 1SE



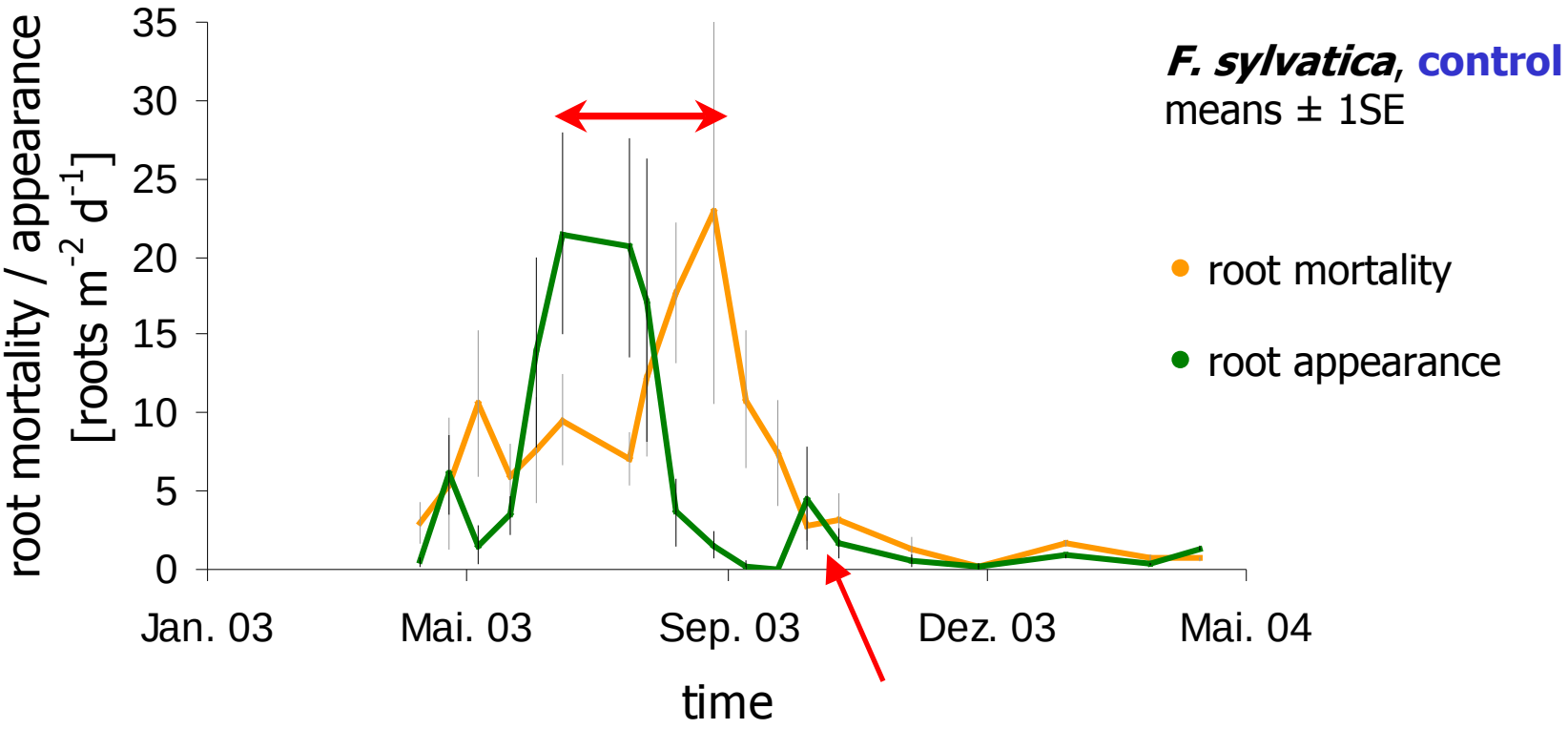
Fine root dynamics of *F. sylvatica*

Results



***F. sylvatica*, control**
means ± 1SE

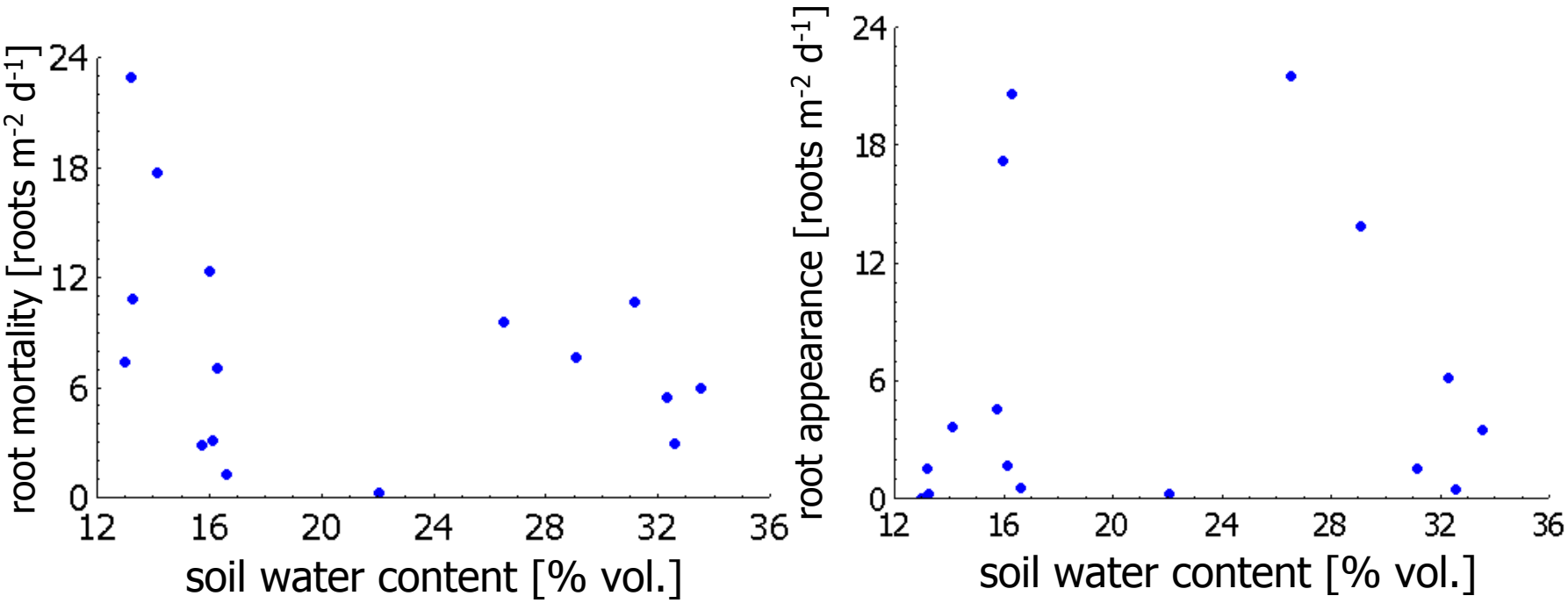
• sum



Mean turnover rate 1.3 year^{-1}

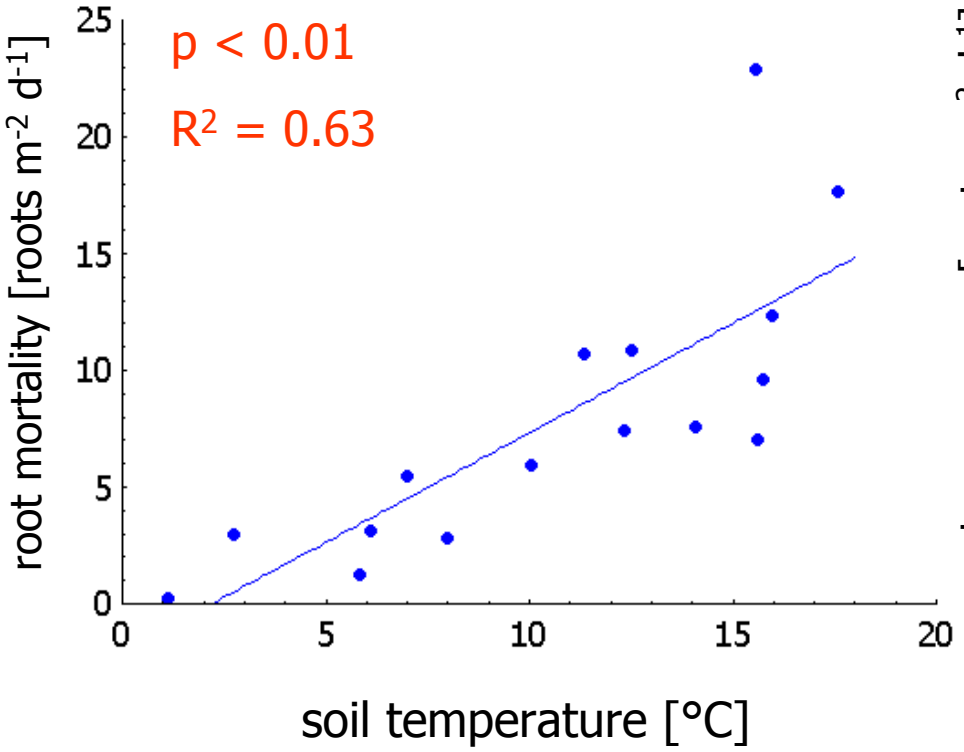
***F. sylvatica*, control**

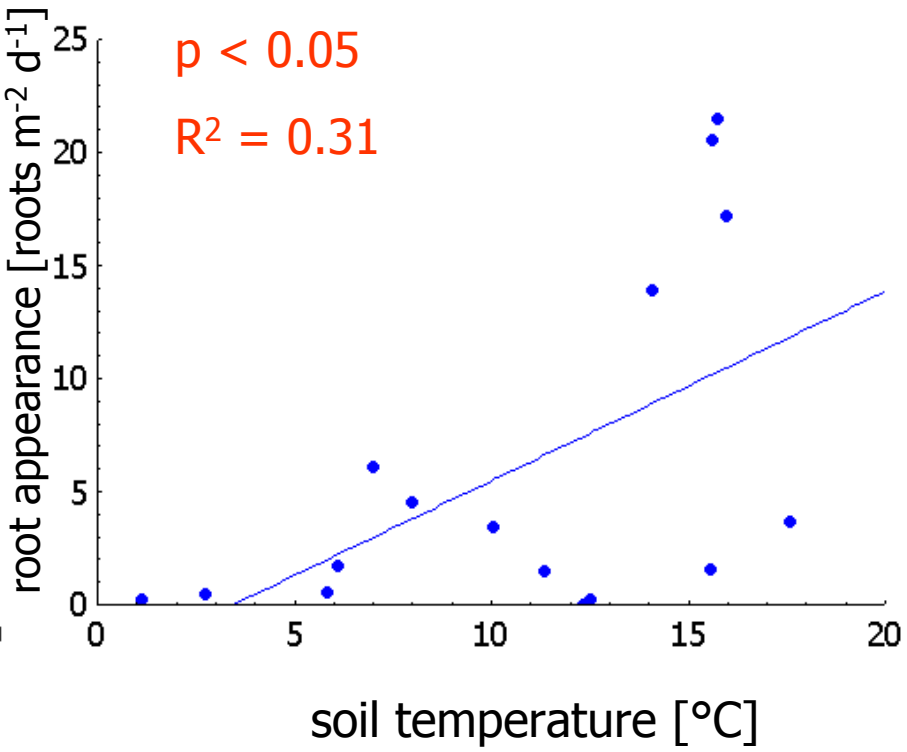
means



***F. sylvatica*, control**

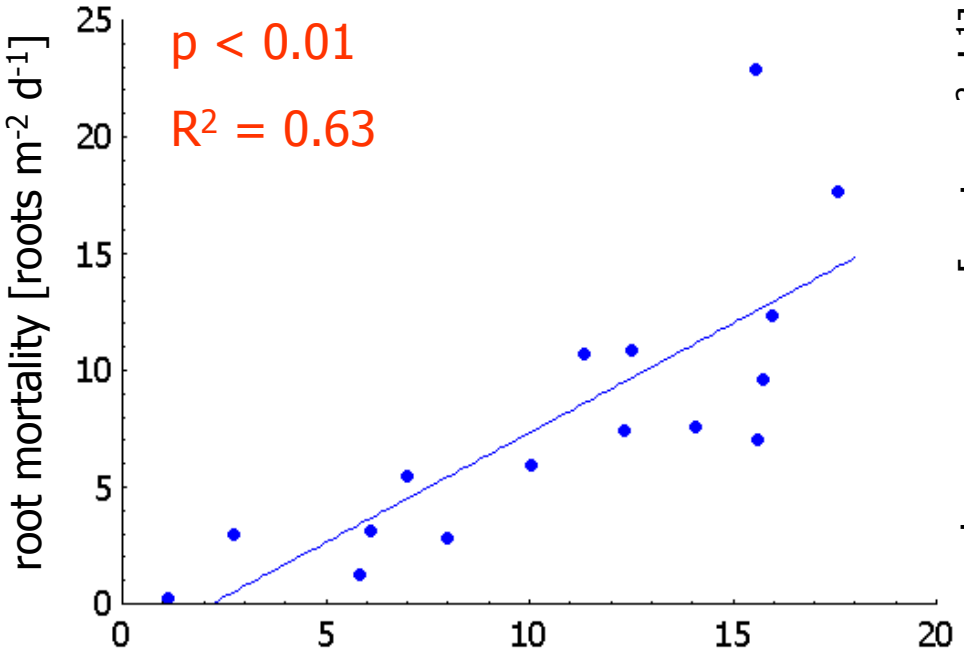
means

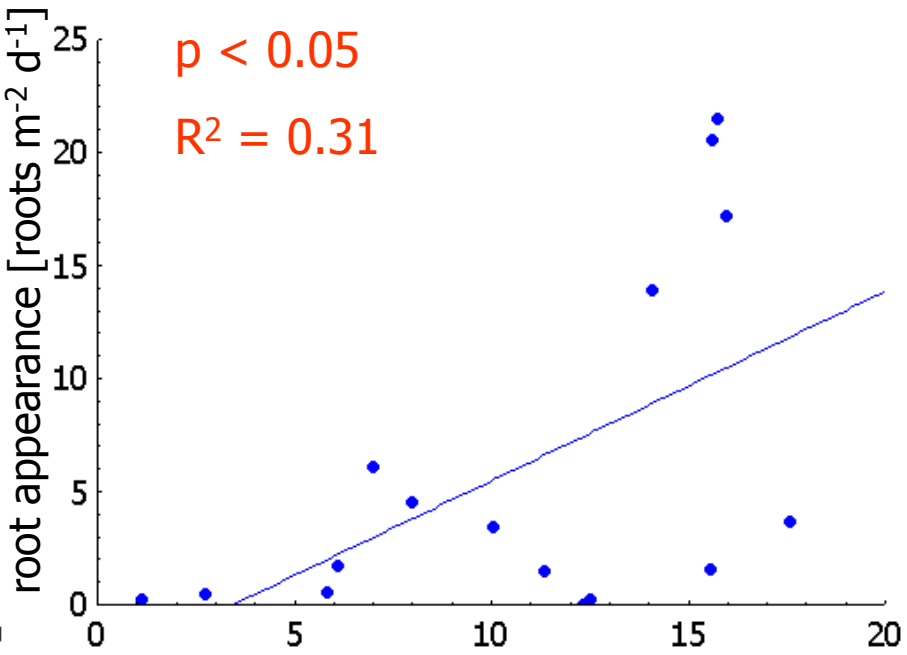




***F. sylvatica*, control**

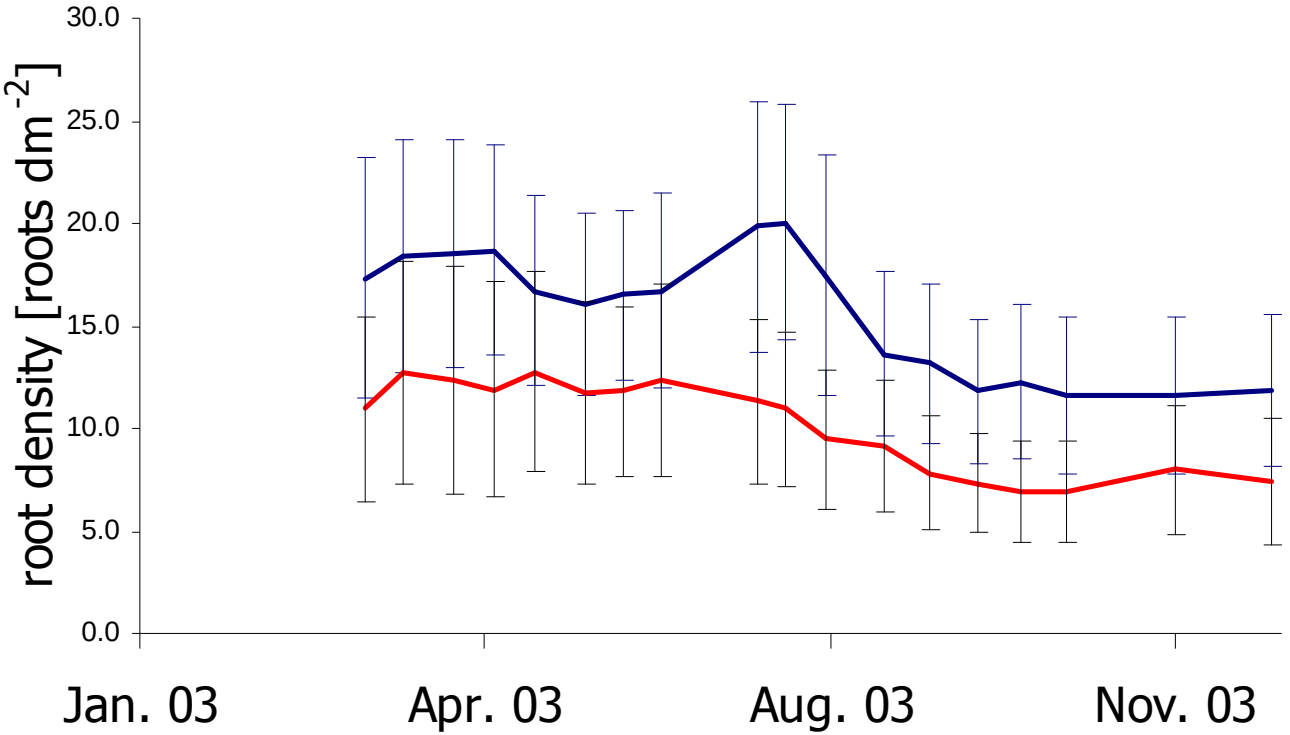
means





Fine root dynamics of *F. sylvatica*

Results



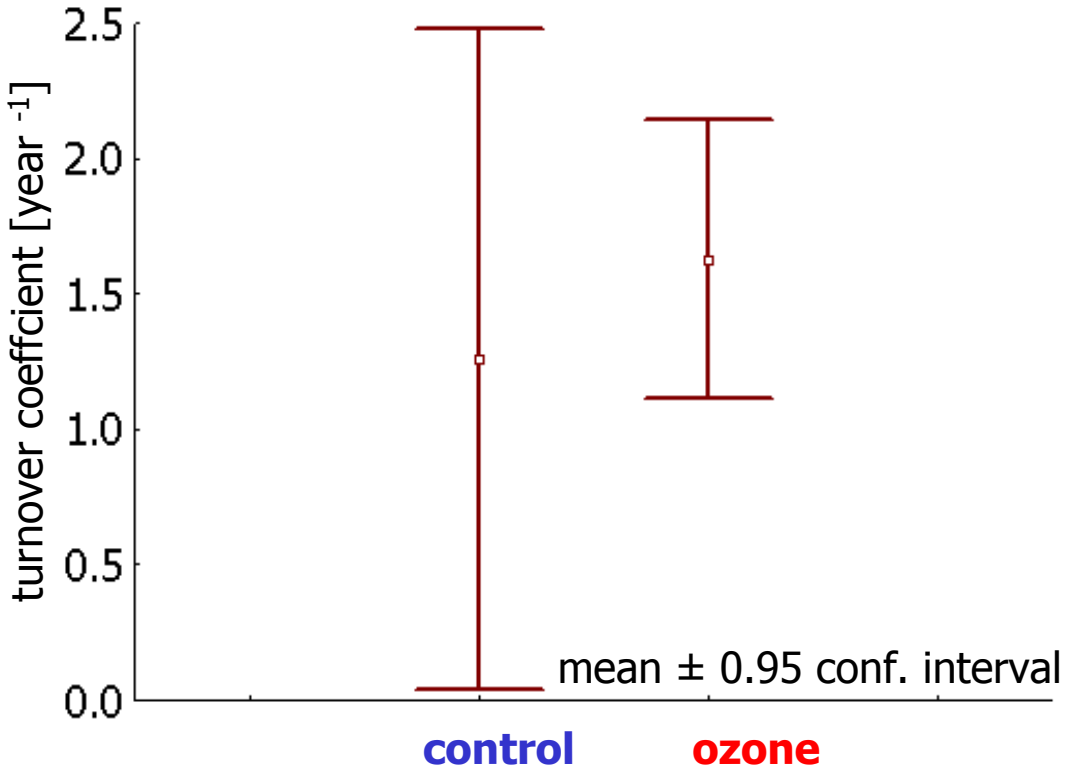
- *F. sylvatica* **ozone**
- *F. sylvatica* **control**

means ± 1SE

Repeated measurements ANOVA

$p < 0.05$

$$\text{turnover coefficient} = \frac{\sum \text{roots appeared [roots m}^{-2}\text{ year}^{-1}]}{\text{mean root density [roots m}^{-2}\text{]}}$$



Fine root dynamics of *F. sylvatica*

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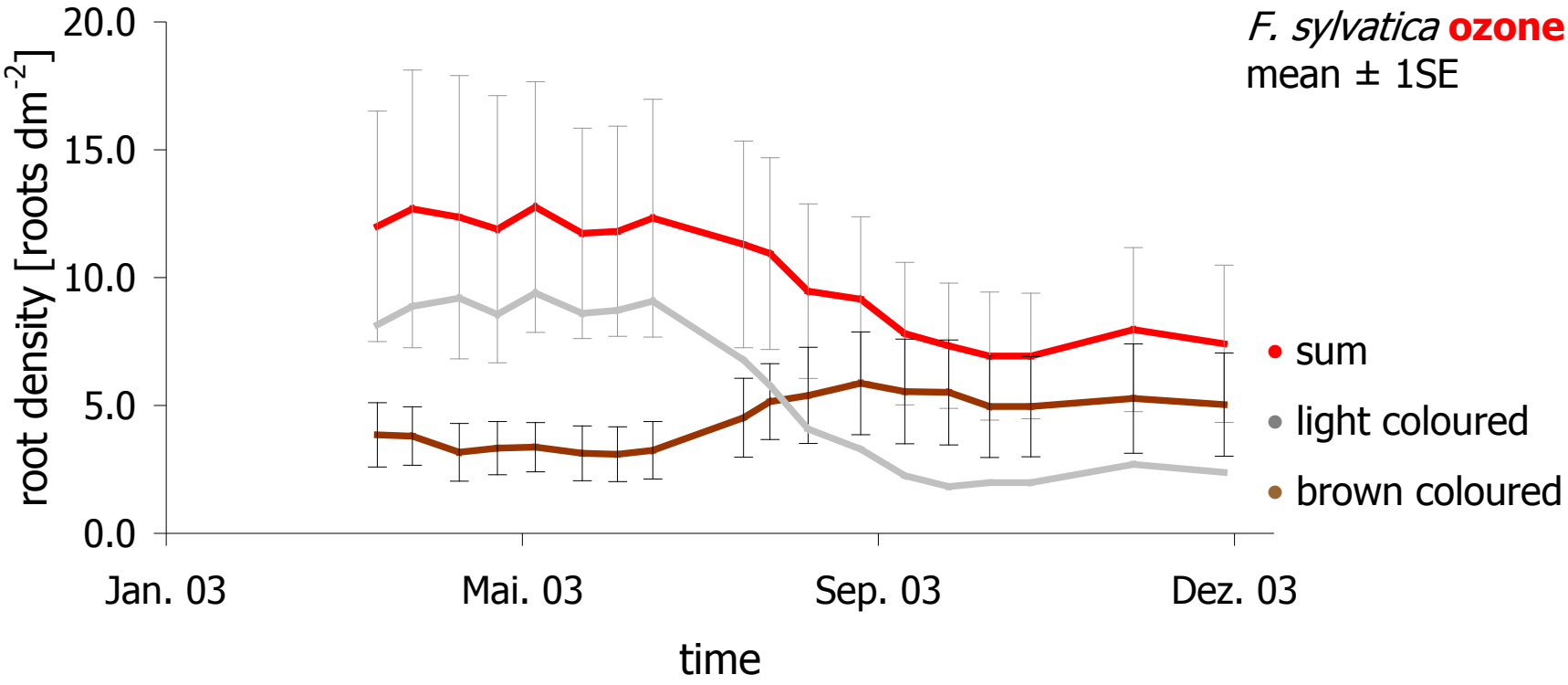
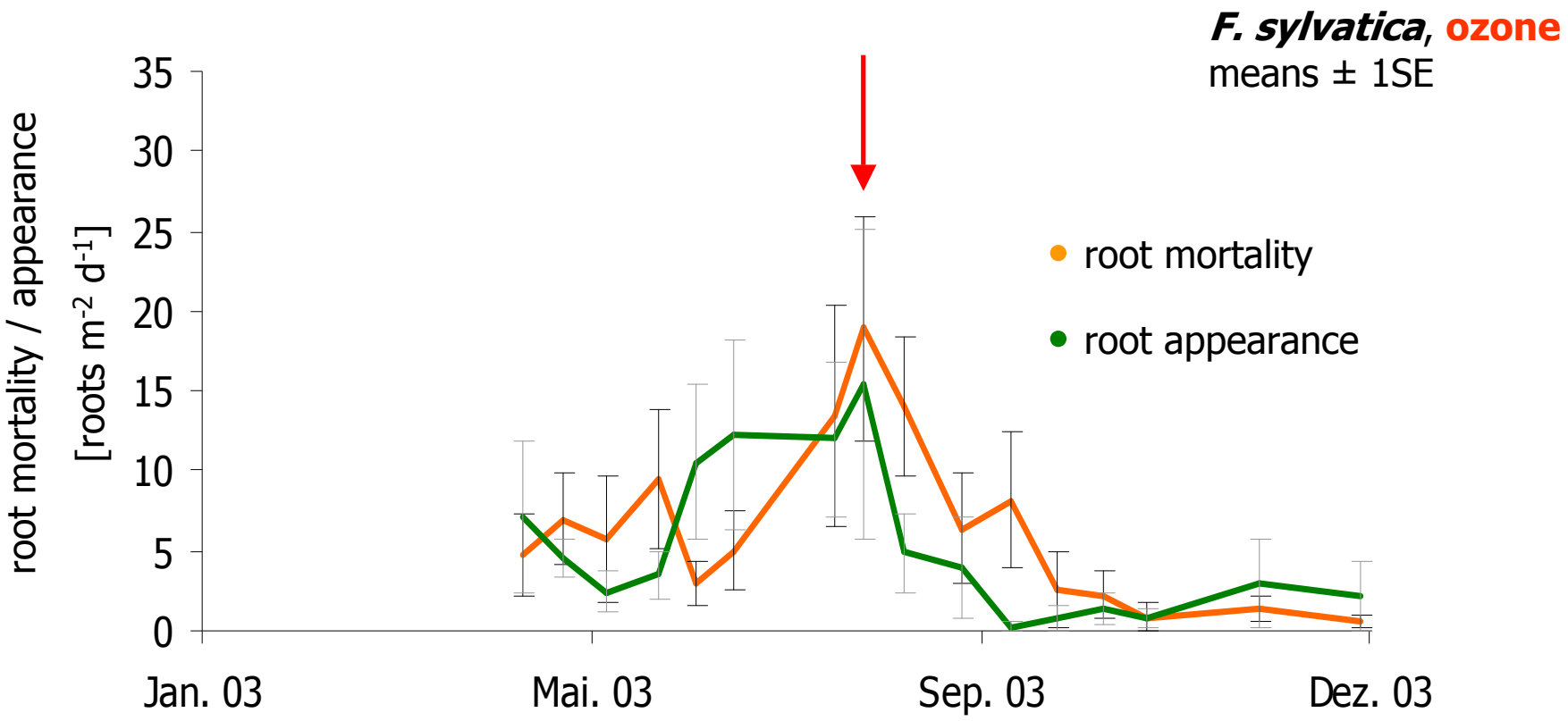


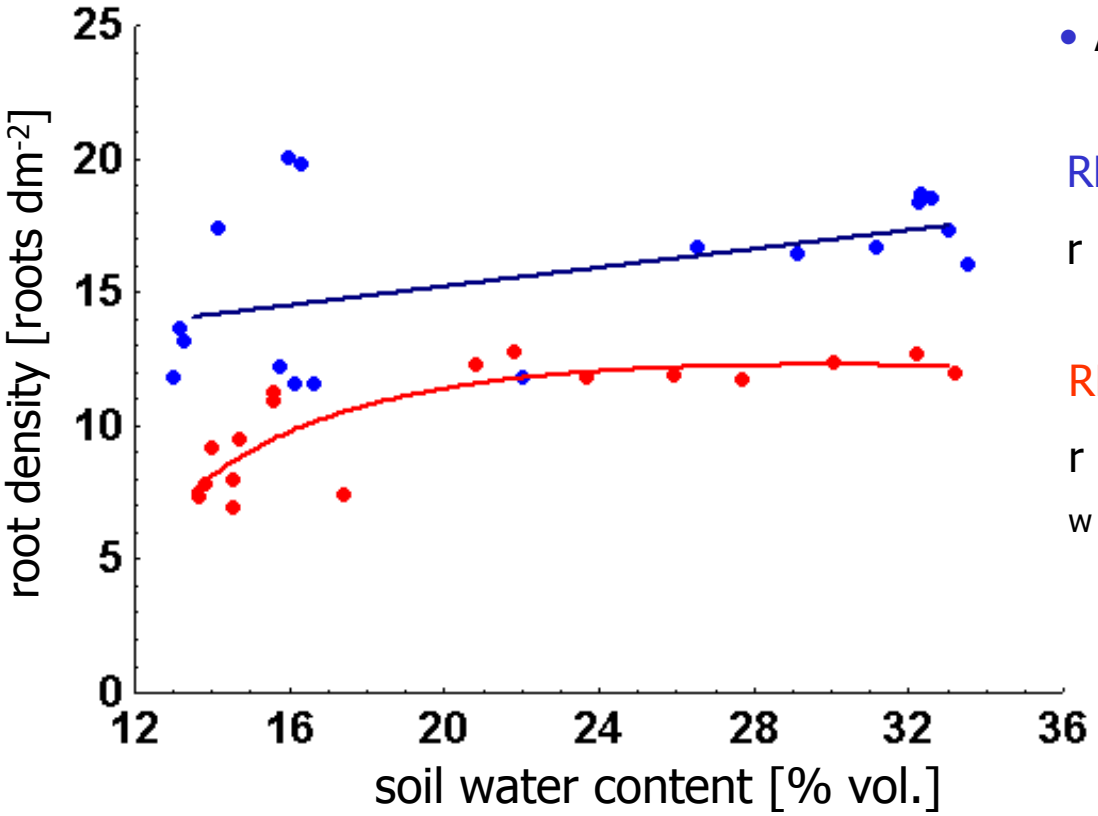
Fine root dynamics of *F. sylvatica*

Results



Fine root dynamics of *F. sylvatica*

Results



- *F. sylvatica* **ozone**, means
- *F. sylvatica* **control**, means

RD = 0.18 * w + 11.7

r = 0.49

RD = 572 * $(w+31)^{-1}$ * $\log_{10}(w-9.6)$

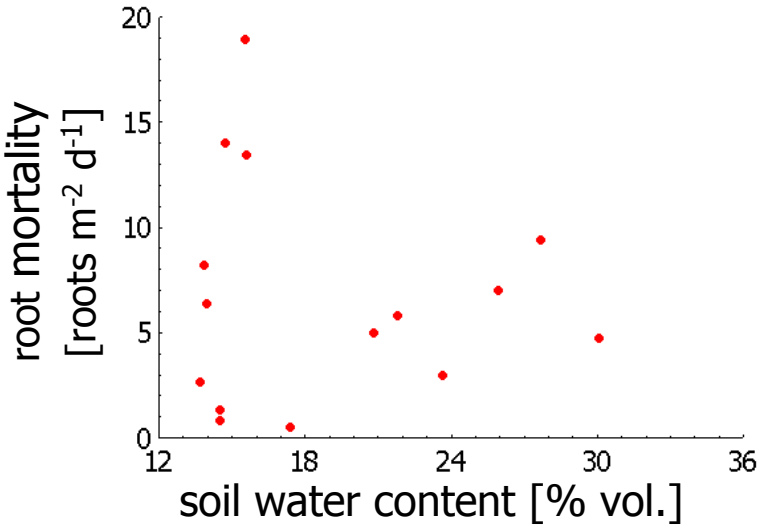
r = 0.83

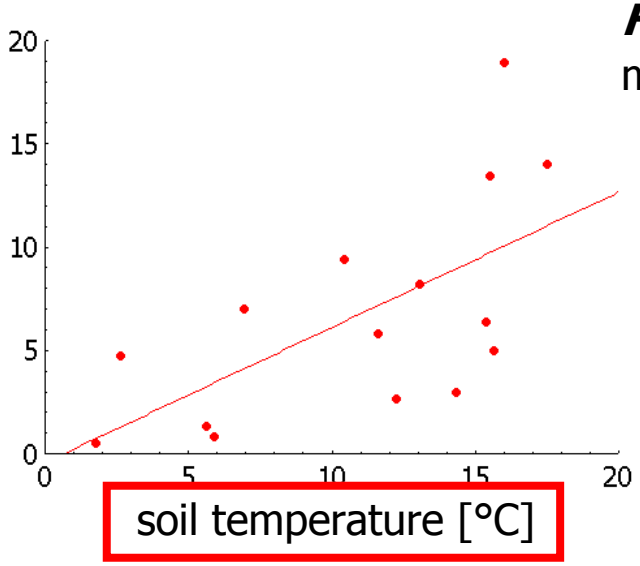
w = soil water content

Fine root dynamics of *F. sylvatica*

Results

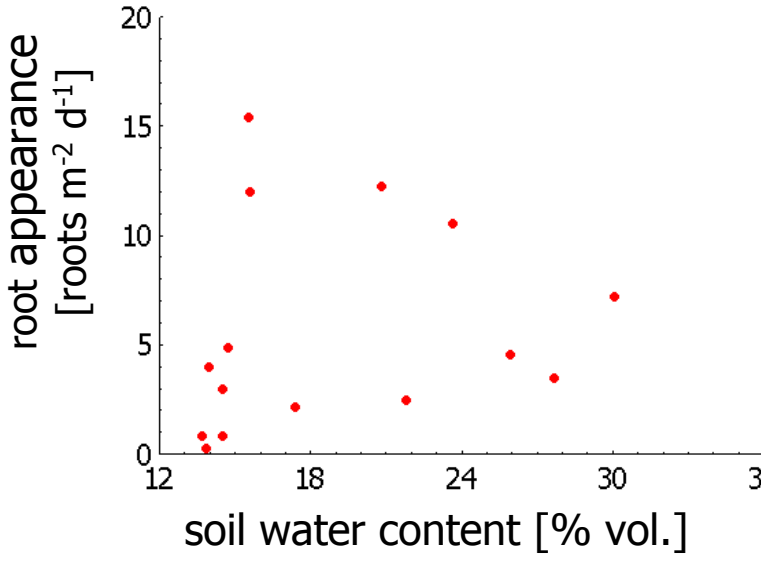
***F. sylvatica*, ozone**
means

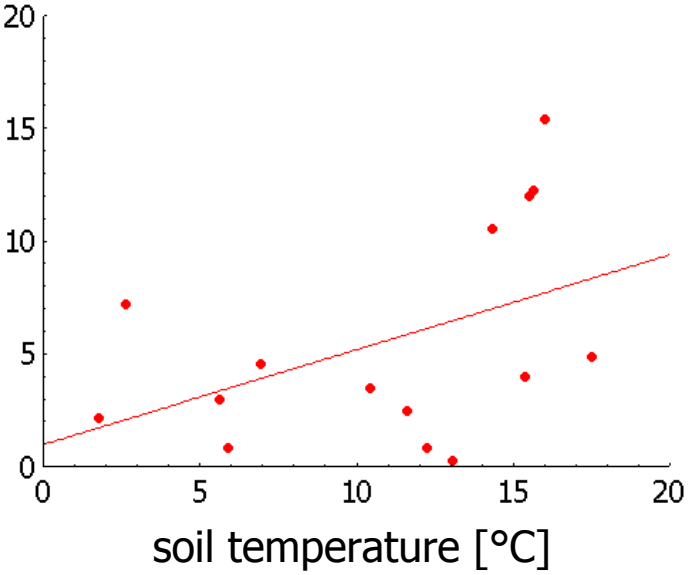




$p < 0.05$

$R^2 = 0.40$





$p = 0.09$

$R^2 = 0.21$

Conclusion

- Drought reduces fine root density
- Additional impact of ozone increases susceptibility to drought

- Turnover processes are not influenced by soil water content
- Soil temperature is the predominant factor controlling fine root dynamics
- Impact of ozone does not influence turnover rate

Anknowledgements

- German Science Foundation
  Deutsche Forschungsgesellschaft (DFG)
- Prof. Dr. R. Matyssek and staff
- Thomas Feuerbach

- The audience