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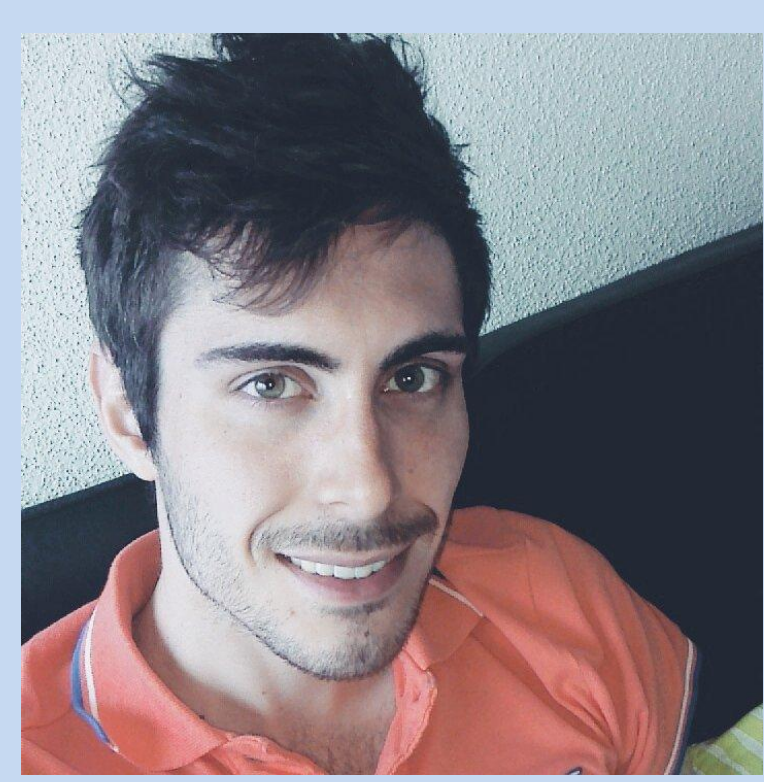
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Effects of competition and water availability on above- and belowground growth and functional traits of European beech



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Background and Aims

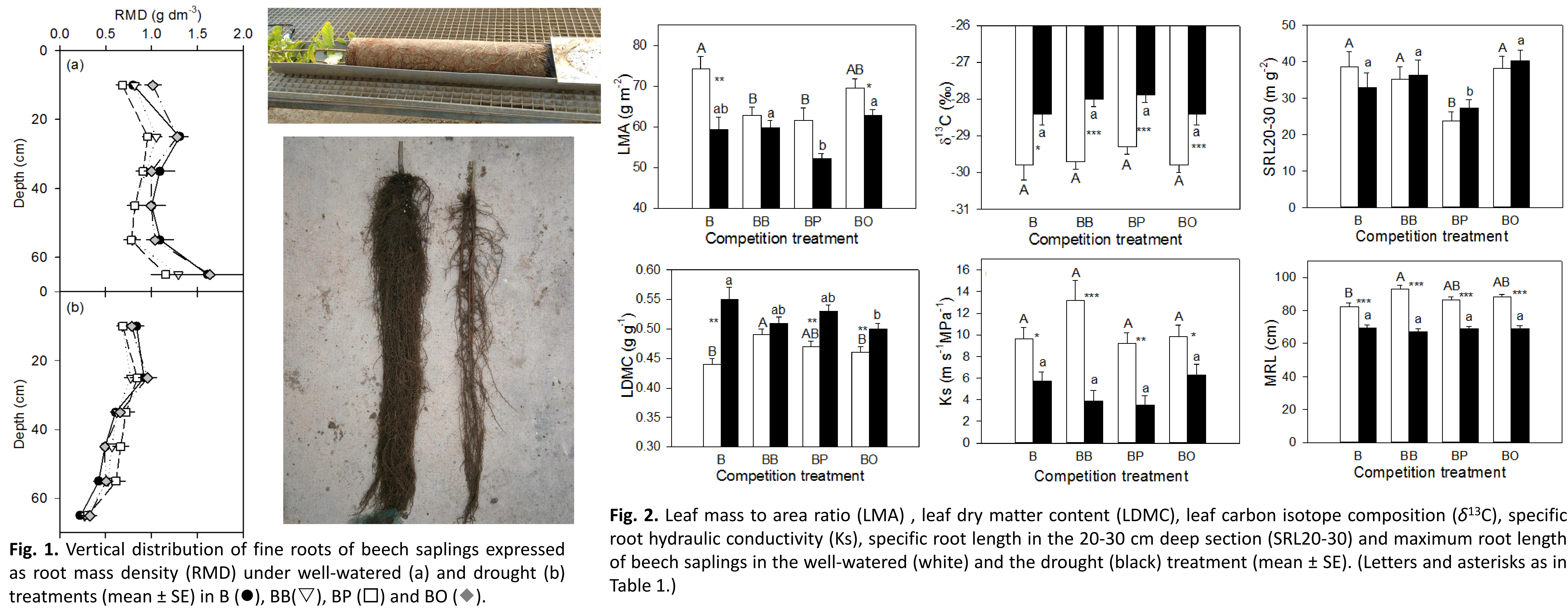
European beech (*Fagus sylvatica*) is the most abundant deciduous tree species in Europe and suffers from strong intraspecific competition and drought (Packham et al, 2012, *Journal of Ecology*). Mixing functionally different tree species has been proposed as a way to increase wood productivity and forests resistance to drought. We investigated beech performances under drought and in competition with different species and we tested the following hypothesis: **(1) Presence and identity of competitor impact performances of saplings, and (2) Water availability influences the nature and strength of interactions.**

Material and Methods

Beech saplings were grown alone (B), with a competitor, being a beech (BB), a sessile oak (BO) or a scots pine (BP). A drought treatment (20-25% of the relative extractable water) was applied on half of the pots and the other half was well-watered (55-80% of the REW). After one growing season, saplings were harvested and a range of above- and belowground growth and functional traits were measured.

	Total Biomass (g)	Fine root / Leaf ratio	RGR _H (mm m ⁻¹ d ⁻¹)	RGR _D (mm m ⁻¹ d ⁻¹)
Well-watered				
B	57.2 ± 8.0 a	2.0 ± 0.1 a	5.62 ± 0.78 a	5.45 ± 0.26 a
BB	46.4 ± 4.9 a	3.1 ± 0.2 b	1.40 ± 0.54 c	4.18 ± 0.20 bc
BP	46.6 ± 4.2 a	3.1 ± 0.2 b	2.60 ± 0.82 bc	3.80 ± 0.29 c
BO	60.5 ± 4.5 a	2.4 ± 0.1 a	4.14 ± 0.67 ab	5.00 ± 0.29 ab
Drought				
B	35.0 ± 2.0 a *	3.5 ± 0.3 ab ***	0.47 ± 0.15 a ***	2.76 ± 0.21 ab ***
BB	28.9 ± 2.3 a ***	2.9 ± 0.1 ab	0.75 ± 0.17 ab	2.40 ± 0.14 b ***
BP	29.4 ± 2.5 a **	3.8 ± 0.4 a	0.59 ± 0.14 a *	2.60 ± 0.26 ab ***
BO	33.7 ± 2.2 a ***	2.8 ± 0.2 b	1.44 ± 0.26 b **	3.05 ± 0.26 a ***

Table 1. Total biomass, fine root-to-leaf ratio, relative growth rate in height (RGR_H) and diameter (RGR_D) of beech (mean ± SE). Different letters indicate significant difference between competition treatments within the well-watered and the drought treatments ($p < 0.05$). Asterisks indicate significant differences between water treatments within a competition treatment (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$)



Conclusion and perspectives

Strong belowground competition occurred and reduced beech saplings growth. Yet, the developmental and morphological root traits showed weak responses to competition. What about about root functioning?

Mixing ecologically and functionally different species does not necessarily alleviate competition intensity even for species known to experience strong intraspecific competition.

Drought decreased the importance of negative interactions between saplings and positive interaction occurred between beech and oak saplings. Tree mixtures seem to be particularly dependent on species identity.

Under expected dryer climates, natural regeneration of European beech may be advantageous for beech sapling survival and growth in mixture with oak. In contrast, favoring regeneration or developing plantations that include beech and pine young trees may be less advantageous.