# Fine root dynamics of Fagus sylvatica: Interacting effects of soil temperature, drought and ozone treatment

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Fine root dynamics of mature Fagus sylvatica trees (European beech) was studied from March to December 2003 using minirhizotrones on the site of the SFB 607 near Freising, Germany. In this field experiment ozone levels in the canopy were doubled compared to ambient levels. Experimental setup consisted of four pairs of minirhizotrones in each plot (control and ozone fumigated) with soil probes for temperature (5 cm depth) and water content (15 cm depth) placed between each pair. The vegetation period in 2003 was characterized by high temperatures, partial high ozone concentrations and drought. Daily mean soil water content (volumetric percentage) steadily decreased from 30.8 –32.0 % in April to 13.2 - 13.9 % to the end of September.

Fine root density in the control plot increased from 17.3 in mid March to 20.0 roots dm-2 to the end of July and decreased rapidly afterwards to 11.6 roots dm-2 at the end of October. This course was the result of the interaction of high rates of root formation in the first half of the vegetation period and high rates of root die off in the second. There was only a weak correlation between fine root density and soil water content and no correlation with soil temperature. Turnover rate (i.e. the sum of appeared and disappeared roots dm-2 d-1) correlated significantly with soil temperature ($R2 = 0.79$, $p < 0.001$) but was not effected by soil water content ($p = 0.76$).

In the ozone-fumigated beech plot fine root density remained constant at about 12.1 roots dm-2 from March until end of July and then decreased to 6.9 roots dm-2 by end of October. Root density decreased exponentially below 20 % soil water content. In comparison with the control plot, maximum die off of fine roots under ozone influence occurred much earlier and peaked concurrently with root formation. Root turnover of ozone treated trees ceased already in October whereas there was still root activity in the control. The correlation to soil temperature was slightly weaker than in the control plot ($R2 = 0.55$, $p < 0.01$) and again no relationship was found to soil water content. Thus, although beech trees were faced with severe drought, the current data suggest that soil temperature is the predominant factor in determining fine root turnover. Impact of ozone additionally increased the sensitivity of beech fine roots to drought.