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Effects of drought on monocultures and mixtures of British deciduous tree species

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In plots of six year old stands of Alnus glutinosa, Betula pendula, Fagus sylvatica and a mixture of the three species, subcanopy roofs were constructed. The roofs covered 70% of the total area and were made of transparent plastic. Using the roofs rain water was excluded from the plots from June to beginning of November 2010 and mid April to mid September 2011. Leaf biomass was negatively affected by the drought. Alnus decreased most in above ground biomass whereas Fagus was unaffected by the drought. Fine root production, as measured by ingrowth nets, was lower in the drought treatment than in the controls for all species. This was reflected in the standing fine root biomass, which was after 2 years lower in the top 10 cm in the drought than in the control. Soil respiration decreased during drought. Alnus had the highest soil respiration and Fagus the lowest in both the treatment and control stands during the time the roofs were on, but differences between species did not persist during the winter. No significant flush of CO_2 due to a rewetting effect could be detected. The measured cumulative soil CO_2 efflux after the experiment was significantly lower in the drought than in the control except for the birch plots. Our results indicate that there is no large rewetting effect compensating for the lower respiration during the growth season due to drought and differences between species in carbon turnover during the growth season disappears after the growth season.