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Tree species diversity improves beech growth and alters its physiological response to drought in Belgium

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The predicted increase in drought frequency and severity is expected to affect forest growth. Common beech, a widespread and economically important tree species in Europe, is known to be drought sensitive. It is thus important to increase our understanding about the effect of drought on the growth of beech in interaction with management. Diversifying forests has been proposed as a useful management strategy to mitigate the effects of increasing drought on forest growth. In order to study if beech trees growing in more diverse forest patches are more resistant and resilient to drought compared to those growing in monoculture patches, a unique observational platform was set up in Belgium. Beeches growing along a tree diversity gradient (from monocultures to forest patches with up to three species) were selected. Combining dendrochronological and stable carbon and oxygen isotope data allowed for studying the effect of tree species diversity on beech growth and its reaction to drought regarding stem radial growth and isotope proxies for physiological performance. Enhanced stem radial growth and higher resistance to drought was observed for beech trees growing in diverse patches. During drought years the increase in δ13C compared to the years prior to drought in more diverse stands was less pronounced compared to beech trees growing in monocultures, indicating enhanced stomatal conductance and growth continuation of trees growing in mixtures. Until now the positive effect of diversity on beech growth and resistance seems to still outperform negative effects induced by drought; though increasing drought frequency and severity might override this in the future