
Choosing drought-tolerant tree species will be a better option than diversifying stands to reduce the risk of drought-induced mortality.

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Résumé

Increasing tree diversity is considered a key management option to adapt forests to climate change. However, whether species diversity can alleviate tree water stress during extreme drought remains unclear. In this study, we assessed drought tolerance (xylem vulnerability to cavitation) and water stress (water potential), and combined them into a metric of drought-mortality risk (hydraulic safety margins) during extreme 2021 or 2022 summer droughts in five European tree diversity experiments. Overall, we found that drought-mortality risk was primarily driven by species identity (56% of the total variability), while tree diversity had a much lower effect (9.9% of the total variability). Tree diversity effect on drought-mortality risk was mediated by changes in water stress intensity, not by changes in xylem vulnerability to cavitation. Significant diversity effects were observed in all experiments, but those effects often varied from positive to negative across mixtures for a given species. Indeed, we found that the composition of the mixtures (i.e., the identities of the species mixed), but not the species richness of the mixture *per se*, is a driver of tree drought-mortality risk. This calls for a better understanding of the underlying mechanisms before tree diversity can be considered an operational adaptation tool to extreme drought. Forest diversification should be considered jointly with management strategies focused on favouring drought-tolerant species.

Mots-Clés: water stress, forest adaptation, forest management, species richness, tree diversity, species interactions, hydraulic traits, xylem embolism, hydraulic safety margin

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