DIV4DROUGHT

Tree diversity effects on forest drought resilience: A mechanistic approach to reconcile divergent observations

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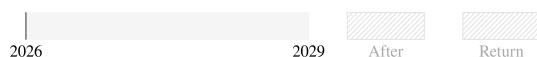
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Widespread global reports of drought and heat-induced tree mortality have raised questions about the long-term persistence of forests and associated ecosystem services. [...] A better understanding of the ecological and biological mechanisms at play is necessary to reconcile these divergent observations. In the Div4Drought project, we will 1) conduct a meta-analysis of existing evidence for tree diversity effects on forest drought resilience and its components, resistance, and recovery; 2) coordinate current efforts to build a globally harmonized and open-source tree species hydraulic trait database. Hydraulic traits will be used as predictors in the meta-analysis; 3) use three process-based forest dynamics models informed by the trait database to evaluate the mechanisms responsible for diversity effects. Our main hypotheses are as follows: 1) Complementarity effects can foster drought resilience in species mixture because a combination of hydraulic strategies allows water-use to be optimized through niche partitioning in time or in space. 2) Increasing stand structural diversity enhances microclimate buffering (facilitation), and thus increases drought resilience. 3) The higher mortality of drought-sensitive species during extreme drought improves the water status of the remaining species. This "fuse (selection) effect" implies a rapid decline of positive diversity effects on drought resilience under repeated severe drought. [...] Transdisciplinarity will allow the innovative exploration of a long-standing blind spot of tree diversity effects on forests, with important implications for forest management and conservation under climate change.