



TRAPEZE

Effect of intra-population functional diversity on the population resilience to drought

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Summary

Context — Most scenarios for future climate predict an increase in intensity and frequency of drought events. Intense or recurrent droughts have long been identified as a major contributing factor of tree decline and mortality. To avoid widespread forest declines, forest management practices have to adapt the modern forest to the ongoing environmental changes. Identifying the best-adapted populations is challenging because of the tremendous complexity of the relationships between plant functioning and multiple environmental constraints. Moreover, between-tree functional diversity within population is usually much higher than across-population variation and current knowledge failed to provide a general understanding of the origin of the intra-population variations in mortality and drought resilience.

Objectives — Our main objective is to evaluate the effect of the intra-population functional diversity on the population resilience to drought. Because of its ecological and economical importance, as well as for the acquired ecophysiological and genetic knowledge, sessile oak was selected as species model.

Approaches — A retrospective approach, based on the analysis of tree-ring chronologies, is used as a unique and efficient way to: 1) study the tree response to drought events over a period long enough to estimate their resilience, 2) characterize the trees phenotypic variability (each ring being considered as a phenotypic expression) in relation to their fitness (relative growth being used as a proxy), 3) analyse the trees functional trajectory with aging. The retrospective assessment of the functional diversity is based on wood traits expressed annually in tree rings: WUE (estimated from $\delta^{13}\text{C}$), investment in reserves component (estimated from δD vs. δO^{18}) and hydraulic impairment (estimated from quantitative anatomy).

Expected results and impacts — This project will help understanding how the functional diversity among trees impacts the ecosystem resilience in terms of survival, biomass production and water consumption, providing eventually insights to improve forest management with respect to the changing climate.