
From population to community: can local competitors composition influence the demographic vulnerability of tree species in their climatic niche?

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Résumé

Variations in demographic rates of tree species - recruitment, growth, and survival - within their climatic niche, shape their distributions. Intraspecific and interspecific competition drive the dynamics of these vital rates at the population and community level, hence the demographic performance of species and their maintenance over time.

To date, most demographic studies have assessed performance in a non density-dependent context, using mean population growth rate. Demographic performance was proved to vary at the margins of a species' climatic niche, with strong differences between species. Interaction with competing individuals or species is expected to further complicate species' demographic response in their distribution. Although much is known about the effects of competition on specific vital rates (growth, survival), anticipating its effects at the community scale remains a challenge, especially as the composition of competing species shifts along climatic gradients. The aim of our study was to evaluate the demographic performance of tree species throughout their climatic niches and assess the effect of local competitive species on these patterns.

To achieve this, we used a density-dependent integral projection model to simulate population and community dynamics of 23 European tree species across their climatic niche. For each species and climatic condition, we ran simulations for both mono-specific stands and for the 10 most frequently observed species assemblages based on National Forest Inventory data. From these simulations, we computed three metrics capturing different facets of demographic performance: invasion rate, stochastic extinction rate and resilience to perturbation.

Using these simulations, we tested if the demographic performance of all species populations decreases in hotter areas, while performances at the cold edge are more variable. We further tested whether competition reduces the variability of demographic performance in species' climatic niches, in particular their resilience.

We also explored the sensitivity of demographic performances to each vital rate. We tested the relative importance of variation in climatic conditions and the variation in the composition of competitors on the change of each vital rate accounting for their effects on demographic performance.

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Mots-Clés: forests dynamics, competition, resilience, demographic stochasticity, community