

Age-structured plant invasion dynamics across spatially explicit landscapes

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Abstract

We present a spatially explicit age-structured model to investigate the invasion dynamics of plant species, with a focus on how habitat quality, demographic structure, and seed dispersal interact. The model incorporates a continuous age structure and leads to the explicit derivation of an invasion threshold, $\mathcal{T}_0(q)$, which depends on habitat quality. This threshold predicts whether a species can successfully establish ($\mathcal{T}_0(q) > 1$) or is likely to go extinct ($\mathcal{T}_0(q) \leq 1$). It captures the combined influence of biotic interactions, abiotic environmental conditions, and dispersal capacity. We illustrate the relevance of this framework by simulating the spatio-temporal spread of black cherry (*Prunus serotina*) in France, based on empirical data.

Key words: Age-structured model, habitat suitability, seed dispersal, invasion threshold, black cherry (*Prunus serotina*), spatial dynamics, invasive species