Memories of trees past: coexistence implications of legacy conspecific density dependence

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Abstract

The Janzen-Connell Hypothesis posits that plant species diversity is maintained by a reduction in seedling survival near living conspecific trees relative to heterospecifics –known as negative conspecific density dependence (CDD). CDD facilitates coexistence if stronger than heterospecific density dependence (HDD). However, whether and how long CDD persists after trees die is unknown. In a three-year study across three forests, we monitored seedling survival near living and dead trees, both conspecific and heterospecific, across a seven-year chrono-sequence since tree death. CDD persisted for at least five years after tree death ('legacy CDD'), and most species showed increasingly stronger CDD relative to HDD through time. We used our empirical findings to parametrize a theoretical community dynamics model. Our model suggests that both stabilizing niche differences and fitness differences persist after tree death. While legacy CDD can facilitate coexistence, fitness differences often overwhelmed niche differences, making competitive exclusion the most likely outcome.

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