FORECASTING CHANGES IN OAK FORESTS FOLLOWING SPONGY MOTH (*LYMANTRIA DISPAR*) INVASION WITH A LANDSCAPE SIMULATION MODEL

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PURPOSE AND SCOPE

Invasive spongy moth (*Lymantria dispar*) was introduced to the Northeastern United States in 1869, and then spread and caused novel defoliation outbreaks in oak-dominated forests. Once the moth establishes, population fluctuations cause periodic defoliation events that reduce growth and increase mortality among host tree species. Spongy moth larvae are generalists with a broad diet, but *Quercus* species are among their favorite hosts and suffer heavy defoliation, leading to predictions that oak abundance should decline following invasion. Yet oak species also have adaptations that allow them to withstand defoliation, including traits related to ring-porous wood anatomy and nonstructural carbohydrate storage.

METHODS AND APPROACH

We developed a model to simulate realistic defoliation outbreaks within the landscape forest succession and disturbance model, LANDIS-II. We used the model to forecast potential changes in species composition and carbon storage that occur following spongy moth outbreaks across a latitudinal range of oak-dominated sites monitored through the National Ecological Observatory Network (NEON). We initialized the model with NEON data (NEON 2023, Weinstein et al. 2024) and tested how sensitive measures of forest change were to the initial abundance of oak species, as well as to the extent, duration, and frequency of spongy moth outbreaks, and other disturbances (harvests, wind, insects, disease).

FINDINGS AND IMPLICATIONS

We found that shifts in forest composition to favor nonhost species took decades or centuries, depending on the disturbance scenario and site and that more severe outbreaks and compounding disturbances could facilitate oak persistence

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due to spillover on less-preferred hosts and increases in light availability for new cohort establishment. Spatial predictions of individual canopy tree species from NEON data (Weinstein et al. 2024) provided a novel input for initialization of the LANDIS-II model and could streamline workflows to create test landscapes for model development using data from intensively monitored ecological sites.

LITERATURE CITED

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