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Dynamic anthropogenic edge effects on the distribution and diversity of fungi in fragmented old-growth forests

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Abstract

Diversity patterns and dynamics at forest edges are not well understood. We disentangle the relative importance of edge-effect variables on spatio-temporal patterns in species richness and occupancy of deadwood-dwelling fungi in fragmented old-growth forests. We related richness and log occupancy by 10 old-growth forest indicator fungi and by two common fungi to log conditions in natural and anthropogenic edge habitats of 31 old-growth *Picea abies* forest stands in central Sweden. We compared edge-to-interior gradients (100 m) to the forest interior (beyond 100 m), and we analyzed stand-level changes after 10 yr. Both richness and occupancy of logs by indicator species was negatively related to adjacent young clear-cut edges, but this effect decreased with increasing clear-cut age. The occupancy of logs by indicator species also increased with increasing distance to the natural edges. In contrast, the occupancy of logs by common species was positively related or unrelated to distance to clear-cut edges regardless of the edge age, and this was partly explained by fungal specificity to substrate quality. Stand-level mean richness and mean occupancy of logs did not change for indicator or common species over a decade. By illustrating the importance of spatial and temporal dimensions of edge effects, we extend the general understanding of the distribution and diversity of substrate-confined fungi in fragmented old-growth forests. Our results highlight the importance of longer forest rotation times adjacent to small protected areas and forest set-asides, where it may take more than 50 yr for indicator species richness levels to recover to occupancy levels observed in the forest interior. Also, non-simultaneous clear-cutting of surrounding productive forests in a way that reduces the edge effect over time (i.e., dynamic buffers) may increase the effective core area of small forest set-asides and improve their performance on protecting species of special concern for conservation.

Keywords

Boreal forest; Deadwood; Edge dynamics; Edge effects; Hierarchical Bayesian model; Indicator species