A Bayesian network approach to trophic metacommunities shows habitat loss accelerates top species extinctions

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Abstract

We develop a novel approach to trophic metacommunities which allows us to explore how progressive habitat loss affects food webs. Our method combines classic metapopulation models on fragmented landscapes with a Bayesian network representation of trophic interactions for calculating local extinction rates. This means we can repurpose known results from classic metapopulation theory for trophic metacommunities, such as ranking the habitat patches of the landscape with respect to their importance to the persistence of the metacommunity as a whole. We use this to study the effects of habitat loss, both on model communities and the plant-mammal Serengeti food web dataset as a case study. Combining straightforward parameterizability with computational efficiency, our method permits the analysis of species-rich food webs over large landscapes, with hundreds or even thousands of species and habitat patches, while still retaining much of the flexibility of explicit dynamical models.

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