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# The empty and unstable forest: habitat loss effects on multitrophic communities

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## Abstract

Changes in habitat are a key factor behind the current biodiversity crisis. With habitat loss it is not only species what ecosystems are loosing, but also their inter-specific interactions. Further, interaction loss has the potential to significantly alter fundamental structural and stability properties of biological communities. However, little is known about how habitat destruction impacts diversity, structure and stability in communities with multiple interaction types. In this study, we present a synthetic theoretical analysis of community responses to habitat loss, which includes diversity and network properties, as well as several spatial and stability metrics. We use spatially-explicit, individual-based models to simulate the dynamics of multi-trophic communities, with both antagonistic and mutualistic interactions, under two habitat loss scenarios. We address three questions: (i) how do communities with multiple interaction types respond to habitat loss?, (ii) does the proportion of mutualism to antagonistic interactions influences these responses?, and (iii) do communities respond differently to different habitat loss patterns? Our results suggest that habitat destruction affects the temporal stability of biological communities by shifting the distribution of interaction strength within the community and altering its trophic structure and spatial variability. These findings are not sensitive to the proportion of interaction types within a community, but they do strongly depend on the spatial pattern of habitat destruction. Given that landscape disturbances, including habitat destruction, are seldom randomly distributed (rather, they operate in a self-organised manner or are subjected to multi-scaled randomness), these results provide important insights into how communities respond to global change.

**Keywords:** species interactions, habitat loss, stability, space

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