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Size-dependent species removal impairs ecosystem functioning in a large-scale tropical field experiment

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Abstract

A major challenge of ecological research is to assess the functional consequences of species richness loss over time and space in global biodiversity hotspots, where extinctions are happening at an unprecedented rate. To address this issue, greater realism needs to be incorporated into both conceptual and experimental approaches. Here we propose a conceptual model that incorporates body size as a critical aspect of community responses to environmental change, which we tested in the Western Amazonian rain forest, one of the most speciose ecosystems on the planet. We employed an exclosure removal experiment (replicated under 10 microhabitats and four climatic conditions) in which we manipulated access to two types of resource by the whole community of dung and carrion beetles (>60 species), depending on their size. Our 400 independent measurements revealed that changes in the number of species and functional groups, and temporal patterns in community composition, all affected resource burial rates, a key ecosystem process. Further, the functional contribution of species diversity in each size class was tightly dependent on beetle abundance, and while the role of large species could be performed by abundant smaller ones, and other naturally occurring decomposers, this was not the case when environmental conditions were harsher. These results demonstrate, for the first

time in an animal assemblage in a tropical ecosystem, that although species may appear functionally redundant under one set of environmental conditions, many species would be needed to maintain ecosystem functioning at multiple temporal and spatial scales. This highlights the potential fragility of these systems to the ongoing global "Sixth Great Extinction," whose effects are likely to be especially pronounced in the Tropics.

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