Species losses, gains, and changes in persistent species are associated with distinct effects on ecosystem functioning in global grasslands

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Abstract

Global change drivers such as anthropogenic nutrient inputs simultaneously alter biodiversity, species composition, and ecosystem functions such as aboveground biomass. These changes are interconnected by complex feedbacks among extinction, colonization, and shifting relative abundance. Here, we use a novel temporal application of the Price equation to quantify the functional contributions of species that are lost, gained, and persist under ambient and experimental nutrient addition in 59 global grasslands. Under ambient conditions, compositional and biomass turnover was high, but species losses (i.e., local extinctions) were balanced by gains (i.e. colonization). There was biomass loss associated with species loss under fertilization. Few species were gained in fertilized conditions over time but those that were, and species that persisted, contributed to net biomass gains, outweighing biomass loss. These components of community change are key to understanding the relationship between change in composition, diversity and functioning.

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