

Letter

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Diversity and dispersal interactively affect predictability of ecosystem function

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Theory and small-scale experiments predict that biodiversity losses can decrease the magnitude and stability of ecosystem services such as production and nutrient cycling^{1,2}. Most of this research, however, has been isolated from the immigration and emigration (dispersal) processes that create and maintain diversity in nature^{3,4,5}. As common anthropogenic drivers of biodiversity change—such as habitat fragmentation, species introductions and climate change—are mediated by these understudied processes^{5,6,7}, it is unclear how environmental degradation will affect ecosystem services^{3,4}. Here we tested the interactive effects of mobile grazer diversity and dispersal on the magnitude and stability of ecosystem properties in experimental seagrass communities that were either isolated or connected by dispersal corridors. We show that, contrary to theoretical predictions^{2,8,9,10,11}, increasing the number of mobile grazer species in these metacommunities increased the spatial and temporal variability of primary and secondary production. Moreover, allowing grazers to move among and select patches reduced diversity effects on production. Finally, effects of diversity on stability differed qualitatively between patch and metacommunity scales. Our results indicate that declining biodiversity and habitat fragmentation synergistically influence the predictability of ecosystem functioning.

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