



2004 EPA STAR Graduate Fellowship Conference Next Generation Scientists—Next Opportunities

TESTING THE EFFECTS OF REGIONAL SPECIES POOL DYNAMICS ON BIODIVERSITY AND ECOSYSTEM FUNCTION

ABSTRACT

Regional species pools -- the set of species occurring in a region that is capable of reaching and surviving in a given location -- are incredibly dynamic due to anthropogenic disturbances like habitat fragmentation, climate change, and species introductions. Despite the long-recognized importance of regional species pools to diversity patterns at multiple scales, however, most research on the relationship between biodiversity and ecosystem function has been conducted at fine scales in isolation from processes that link regional species pools to local communities. Consequently, we still know very little about how anthropogenic disturbances will affect ecosystem function in either local communities or across landscapes. I conducted a seagrass mesocosm experiment that tested how regional species pool size and dispersal affect diversity patterns and ecosystem functions in local communities and regions. Preliminary results suggest that both regional species pool size and dispersal can significantly affect both the magnitude and temporal and spatial variability of ecosystem function. This project is the first experimental demonstration of the effects of biodiversity on ecosystem function at more than one scale. It is also the first test of the effects of dynamic biodiversity (derived from regional species pool size and dispersal among local communities rather than static, imposed richness levels) on ecosystem function. This information is critical for conserving diversity and managing essential ecosystem services in light of the likely changes to regional species pools caused by anthropogenic disturbance.

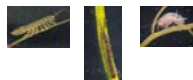
OBJECTIVES

Determine the effects of regional species pool size and landscape connectivity (dispersal) on:

- patterns of diversity at multiple spatial scales
- ecosystem functions (such as net ecosystem productivity)
- spatial and temporal variability of ecosystem functions

EXPERIMENTAL DESIGN

Small Regional Species Pool



Non-Connected Regions



Connected Regions



Large Regional Species Pool



Mesocosm Set-Up



STUDY AREA:

York River, Chesapeake Bay



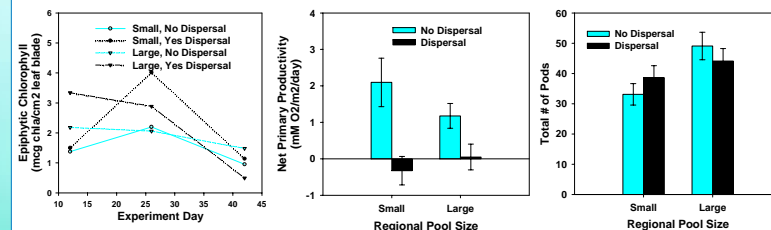
SIGNIFICANCE

Three major anthropogenic influences on the environment, habitat fragmentation, non-native species introductions, and climate change, are changing regional biodiversity. We have a very limited understanding of how regional biodiversity affects local diversity and ecosystem function because most research has been conducted at fine scales, cut off from regional processes, like dispersal, that maintain diversity.

Understanding the relationships between biodiversity and ecosystem function at multiple scales and the role of dispersal in mediating those relationships is critical for managing ecosystem services in an increasingly fragmented environment.

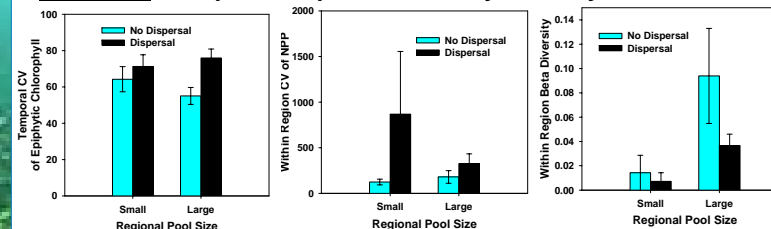
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RESULTS: Effects on ecosystem function



- Connecting local communities switches the ecosystem from net autotrophy to net heterotrophy ($p < 0.001$, $df = 1$)
- Increasing regional pool size increases the total number of grazers in local communities ($p = 0.018$, $df = 1$)

RESULTS: Temporal & spatial variability of ecosystem function



- Connecting local communities increases the temporal variability of epiphyte load ($p = 0.007$, $df = 1$) and the spatial variability of net primary productivity (NS)
- Beta diversity is increased by increasing regional species pool size ($p = 0.023$, $df = 1$) and decreased by connecting local communities (NS)

PRELIMINARY CONCLUSIONS

- Both regional species pool size and landscape connectivity affect ecosystem function within local communities, but landscape connectivity may play a more important role.
- Although dispersal reduces the variability of species composition among local communities (beta diversity), it increases the temporal and spatial variability of ecosystem functions.
- Regional processes, such as dispersal, can have significant effects on ecosystem function within local communities.