Abstract

The system-wide attributes of ecological communities - such as community-level abundance, biomass, and metabolic flux, and how these are distributed among species and organisms - emerge from a web of shifting environmental constraints, diverse species interactions, and ubiquitous mathematical rules. While this apparent complexity can present a challenge to synthesis in community ecology, a macroecological perspective embraces ecological complexity as a path towards general understanding. In this dissertation, I use a telescoping macroecological perspective to explore how these factors shape community properties and determine how they change over time, building from a granular focus on species interactions in a well-studied experimental system, to successively broader spatial and conceptual scales in pursuit of general insights. In chapter 1 (the introduction), I offer an overview of the macroecological approach as it applies to community ecology and the specific vignettes in this dissertation. In chapter 2, I use a long-term experiment on desert rodents to disentangle how shifting environmental conditions and species interactions modulate the impact of species loss on community function. In chapter 3, I leverage modern computational approaches to show how changes in community structure modulate nuanced relationships between the long-term trends in size- and individuals- based currencies of community function. In chapter 4, I borrow tools and conceptual frameworks from statistical mechanics to explore what common ecological patterns stand to teach us about ecological, as opposed to statistical, processes. Finally, in chapter 5 (the conclusion), I offer concluding reflections on the current landscape of prospects and challenges associated with a macroecological lens on community structure and function.