The spatial scaling of food web structure

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Abstract

Species-area relationships (SAR) have been fundamental in the understanding of diversity patterns and a key instrument for predicting species loss in response to global environmental change. Through its recognised effect on species diversity, geographic area plays a role in determining the patterning of species interactions in multispecies communities. Here we extend the study of the spatial scaling of biodiversity by disentangling the effect of space on species richness and the organisation of trophic interactions. We use three theoretical models to show how different spatial processes shape diversity across spatial scales, which in turn affects food web structure. We show that there exists a Network-Area relationship and that it is modulated by the different processes analysed. Specifically, we show that differences in SARs across trophic levels generate Network-Area relationships, that as the area sampled increases the number of specialist species found is larger, and that dispersal, through its influence on local and beta-diversity, increases food web complexity at both local and regional spatial scales. We offer an integrative theoretical framework to better understand the spatial scaling of biodiversity (species and their interactions), which is crucial for accurate predictions and management of the potential effects of perturbations on natural communities.

Keywords: spatial scale, food web structure, spatial processes, dispersal, species area relationship, island biogeography, network area relationship

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