
Coevolution and community assembly in communities with varying niche widths

Vasco Lepori^{*1}, Nicolas Loeuille², and Rudolf Rohr³

¹Department of Biology, University of Fribourg – Switzerland

²Institute of ecology and environmental sciences iEES – Institut de Recherche pour le Développement, Sorbonne Université, Université Paris-Est Créteil Val-de-Marne - Paris 12, Centre National de la Recherche Scientifique, Institut National de Recherche pour l’Agriculture, l’Alimentation et l’Environnement – France

³Department of Biology, University of Fribourg – Switzerland

Abstract

Species and populations in nature fall along a specialist-generalist continuum whether in habitat preference, resource use, or seasonal activity. Empirical investigations have highlighted the dynamic nature of niche width in different systems. Since available niches and environmental space are limited, their occupancy patterns will be dictated by competition, leading to coexistence of either many specialist or few generalist phenotypes. However, with few exceptions, traditional studies on niche packing and diversification have focused on the position of species along an axis, assuming constant niche widths.

Here we study how the co-evolution of both niche position and width in competitive systems affects packing, assembly, and the properties of resulting communities. Notably, we observe that even under symmetric resource scenarios, evolution can lead to diversification and differentiation resulting in asymmetric configurations of coexisting generalist and specialist phenotypes. Moreover, alternative evolutionary stable states can arise, some of which are only locally uninvadable. The existence of such evolution-mediated priority effects suggests that the mode of community assembly influences the properties of the final community. This supports the need to consider both local adaptation and regional processes to understand eco-evolutionary dynamics at the community level. To this end, we contrast communities formed through coevolution and diversification with those arising from immigration and intermediate modes of assembly.

We find that evolution rates correlate negatively with richness, while communities shaped by strong immigration tend to be richer and more specialist. Yet, these effects are not strictly additive, and transient dynamics are observed. Finally, immigrants’ invasion success decreases with time and this process is accelerated by high rates of evolution, a pattern consistent with community monopolization.

Keywords: EcoEvolutionary dynamics, Generalism, Community assembly, Resource competition

*Speaker