

Effects of varying niche width on eco-evolutionary dynamics and community properties

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How species diversify to fully occupy available niches has been the object of much ecological investigation throughout the years. However, with a few exceptions, traditional works on niche packing and diversification dynamics have mostly focused on the position of species along a resource axis, while assuming constant niche widths. Yet we know that in nature species and populations fall along a specialist-generalist continuum, be it in habitat preference, resource use, or seasonal activity. How allowing for such differences affect niche packing and species coexistence is largely unknown.

We first derive a Lotka-Volterra model from an explicit resource-consumer model. We then consider coevolution in a community governed by these dynamics, under the framework of adaptive dynamics, where both niche position and niche width are evolving traits. We observe that even under perfectly symmetric resource scenarios, eco-evolutionary dynamics can lead to differentiation of niche widths so that we observe emergence of generalist and specialist phenotypes. Then we explore the effect of resource width and trade-off shape on the evolutionary outcomes, and how these impact community coexistence and structure. Finally, we discuss implications of our model when applied to phenology distributions and their variation in different growing season regimes, and whether this approach may contribute to a more mechanistic understanding of latitudinal patterns of species interactions.