
How species interactions affect species responses to climate change ?

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Abstract

Most studies aiming to predict species response to climate change consider single species in isolation, whereas in nature, species interactions may have a profound impact on a species' ability to adapt to a changing environment or track new suitable habitats. To make forecasts more realistic, we integrate species interactions into an eco-evolutionary dynamic model to predict species responses to climate change. We consider two types of interactions: 1) competition, where phenotypically similar individuals or species compete more strongly than phenotypically divergent ones, and 2) predation, where the predator trait evolves to match the mean prey trait which evolves to match the changing environmental optimum. By increasing the selective pressure on maladaptive individuals and the rate of selective events, predation and competition may speed the adaptation of species to climate change and enhance the persistence of population. Nevertheless, such phenomena are observed only when the positive effects of interactions on species adaptation overcome the reduction of population density, in part from the direct impact of competition and predation and in part from the departure of species from their phenotypic optimum due to character displacement. We discuss the mechanisms and conditions that lead to positive and negative effects of competition and predation on species responses to climate change and emphasize the implications of our results for species conservation practices and policy.

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