

# Rapid Adaptation and Diversification under Competition for Limiting Resources

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Biological diversity results from the interplay of diversification processes and mechanisms that allow for coexistence. Mutations are the ultimate source of such variation and their fate is determined by a combination of drift and selection whose effects can be both dependent on ecological factors. Although the general principles have been long understood, disentangling the eco-evolutionary dynamics in natural communities remains an open challenge. Theoretical works have integrated ecological and evolutionary processes - e.g. by assuming that the species' parameters are not constant over time - and a common result is that evolution leads to competitive exclusion and reduces the diversity that, on the contrary, ecology alone could sustain. However, such theories often assume that adaptation is slow relative to the ecological dynamics and therefore ignore possible phenomena that can emerge when the two timescales meet. In addition, an increasing amount of time resolved data of evolving populations seems to contradict such exclusion principle and also suggests that the assumption of slow adaptation is often not appropriate. Thus, integrating dynamics at different scales remains a major challenge towards a better understanding of evolution. Here we study a model of asexual populations which evolve under competition for limiting resources and where no assumption is taken on the timescales. In particular we are interested in those mechanisms through which rapid adaptation can increase trait diversification and can generate stably diverse communities that were unreachable otherwise.