



Trade-off shapes diversity in eco-evolutionary dynamics

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Abstract: Over the last decades one of the main drivers of research in biodiversity has been to explain the naturally observed coexistence of competing species. Many models have been proposed to this end but so far a simple general model capable of describing observed diversity and coexistence, even in uniform well-mixed system, has been lacking. In this project we propose a simple solutions for paradoxical question of diversity in competitive communities in a bare-bone and generic model [1]. We introduce an Interaction and Trade-off based Eco-Evolutionary Model (ITEEM), in which species are competing for resources in a well-mixed system, and their evolution in interaction trait space is subject to a life-history trade-off between replication rate and competitive ability. We demonstrate that the strength of the trade-off has a fundamental impact on eco-evolutionary dynamics, as it imposes four phases of diversity, including a sharp phase transition. Despite its minimalism, ITEEM produces without further ad hoc features a remarkable range of observed patterns of eco-evolutionary dynamics. Most notably we find self-organization towards structured communities with high and sustainable diversity, in which competing species form interaction cycles similar to rock-paper-scissors games. Our approach to study the role of trade-offs in diversity provides a general framework to study assembly process of competitive communities and investigate the mechanisms responsible for resistance and resilience of their networks.

Keywords: Diversity; Coexistence; Competition; Trade-off; Evolving interaction network; Eco-evolutionary model

References

[1] F. Farahpour, M. Saeedghalati, V. Brauer, D. Hoffmann, "Trade-off shapes diversity in eco-evolutionary dynamics," BioRxiv, DOI 10.1101/184432, Submitted.