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Discriminating the effects of spatial extent and population size in cyclic competition among species DAVID LAMOUROUX, STEPHAN EULE, THEO GEISEL, JAN NAGLER, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany — Quantifying and understanding the stability and biodiversity of ecosystems is a major task in biological physics as well as in theoretical ecology. From the perspective of game theory, this is highly relevant for questions pertaining to the emergence of cooperation or the coexistence of cyclically competing species. The latter has been recently proposed as a paradigm for biodiversity and it has been shown that the mobility of individuals can support the stability of biodiversity by the formation of spirals. In this contribution, we present a population model for species under cyclic competition that extends earlier lattice models to allow the single cells to accommodate more than one individual by introducing a per cell carrying capacity. We confirm that the emergence of spirals induce a transition from an unstable to a stable regime. This transition however does not appear to be sharp and we find a broad intermediate regime that exhibits an ambiguous behavior. The separation of the two regimes by the usual scaling analysis is thus hampered. The newly introduced carrying capacity offers an alternative way of characterizing the transition. We thus overcome the original limitations by separately analyzing the effect of spatial extent and population size.

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