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Environmental vs. demographic variability in stochastic lattice predator-prey models

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In contrast to the neutral population cycles of the deterministic mean-field Lotka-Volterra rate equations, including spatial structure and stochastic noise in models for predator-prey interactions yields complex spatio-temporal structures associated with long-lived erratic population oscillations. Environmental variability in the form of quenched spatial randomness in the predation rates results in more localized activity patches. Population fluctuations in rare favorable regions in turn cause a remarkable increase in the asymptotic densities of both predators and prey [1]. Very intriguing features are found when variable interaction rates are affixed to individual particles rather than lattice sites. Stochastic dynamics with demographic variability in conjunction with inheritable predation efficiencies generate non-trivial time evolution for the predation rate distributions, yet with overall essentially neutral optimization [2].

[1] U. Dobramysl and U.C.T., Phys. Rev. Lett. **101**, 258102 (2008);
[2] U. Dobramysl and U.C.T., Phys. Rev. Lett. **110**, 048105 (2013); J. Stat. Mech. P10001 (2013).