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Space, coexistence, and mutual invasibility

Two possible conditions that will lead to two species coexisting are: (i) there is a stable equilibrium point where both densities are nonzero; and (ii) either species can invade the other when rare. For many simple models these two conditions are equivalent, but this need not be the case. Unfortunately, a dearth of exact analytical methods hampers the exploration of this question for spatial, stochastic systems. However, asymptotically exact results can be computed in the limit where interactions take place on a large but finite length scale [1]. Here, I study a spatial, stochastic Lotka-Volterra competition model, which is selectively neutral except for the spatial kernels that describe within- and between-species interactions [2]. The equilibrium stability eigenvalue gives a wealth of (asymptotically exact) results for when coexistence is to be expected. However, the invasibility eigenvalues give different preditions. I argue that this is because exponential growth is not an appropriate description of successful invasion in spatial systems. This means that approximation methods for computing invasion eigenvalues can give misleading results in evolutionary studies of spatial systems.

References

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[2] D. J. Murrell and R. Law *Heteromyopia and the spatial coexistence of similar competitors* Ecology Letters **6** 48–19 (2003).