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Joint evolution of dispersal and cooperation in a locally stochastic metapopulation model

In this talk I will investigate a structured metapopulation model [2], consisting of small local populations. Local population dynamics (birth, death, emigration and immigration) is thus stochastic. The evolution of dispersal in this model has been earlier studied [3]: the dispersal rate evolves, because catastrophes and demographic stochasticity result in sparsely populated patches, into which immigration is beneficial. In addition, dispersal reduces kin competition.

Recently, the evolution of public goods cooperation in this model has also been studied [4]. In each habitat patch, individuals can contribute to a common resource, which benefits the reproduction of all individuals of the patch. Contribution is costly, and increases the death rate of the contributor. I assume that cooperation is altruistic, thus the direct benefits from the own action of a focal individual will never exceed their direct costs. Nevertheless cooperation can evolve, because of benefits to own kin.

It is obvious that dispersal affects the evolution of cooperation: for low dispersal rates relatedness is high, and cooperation can evolve. Increasing the dispersal rate is expected to decrease relatedness, and thus make cooperation less favorable. This is, however, not always the case, and even evolutionary suicide can be observed [4]. Cooperation will also affect the evolution of dispersal: a highly cooperating individual is expected to disperse less than an individual, which cooperates only little or not at all. These effects give motivation for the study of the joint evolution of dispersal and cooperation using the methods of adaptive dynamics [1]. In this talk I will present various evolutionary outcomes possible in the model, including evolutionary branching and evolutionary suicide. I will also discuss the effect of essential parameters.

References

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