Spatial populations with seed-bank: equilibria and finite-systems scheme

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Abstract

In this lecture we consider a system of interacting Fisher-Wright diffusions with seed-bank. Individuals carry one of two types, live in colonies, and are subject to resampling and migration as long as they are *active*. Each colony has a structured seed-bank into which individuals can retreat to become *dormant*, suspending their resampling and migration until they become active again. As geographic space labelling the colonies we consider a countable Abelian group. Our goal is to understand in what way the seed-bank *enhances genetic diversity*.

When individuals become dormant they adopt a *random colour* that determines their wake-up time. This allows us to model wake-up times with *fat tails*. The system of continuum stochastic differential equations describing the population in the large-colony-size limit has a unique strong solution, and converges to an equilibrium parametrised by the initial type densities that exhibits a dichotomy of *coexistence* (= locally multi-type equilibrium) versus *clustering* (= locally mono-type equilibrium). We identify the parameter regimes for which these two phases occur, which are qualitatively different when the mean wake-up time is finite or infinite.

We establish the *finite-systems scheme*, i.e., identify how a finite truncation of the system (both in the geographic space and in the seed-bank) behaves as both the time and the truncation level tend to infinity, properly tuned together. If the wake-up time has finite mean, then the scaling time is proportional to the volume of the system and there is a *single universality class* for the scaling limit. If the wake-up time has infinite mean, then the scaling time grows faster than the volume of the system and there are *two universality classes* depending on how fast the truncation level of the seed-bank grows compared to the truncation level of the geographic space.

Joint work with Andreas Greven (Erlangen) and Margriet Oomen (Leiden).