Stochastic Models for Structured Populations: Scaling Limits and Long Time Behavior (Mathematical Biosciences Institute Lecture Series)

Sylvie Méléard, Vincent Bansaye

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In this contribution, several probabilistic tools to study population dynamics are developed. The focus is on scaling limits of qualitatively different stochastic individual based models and the long time behavior of some classes of limiting processes.

Structured population dynamics are modeled by measure-valued processes describing the individual behaviors and taking into account the demographic and mutational parameters, and possible interactions between individuals. Many quantitative parameters appear in these models and several relevant normalizations are considered, leading to infinite-dimensional deterministic or stochastic large-population approximations. Biologically relevant questions are considered, such as extinction criteria, the effect of large birth events, the impact of environmental catastrophes, the mutation-selection trade-off, recovery criteria in parasite infections, genealogical properties of a sample of individuals.

These notes originated from a lecture series on Structured Population Dynamics at Ecole polytechnique (France).

Vincent Bansaye and Sylvie Méléard are Professors at Ecole Polytechnique (France). They are a specialists of branching processes and random particle systems in biology. Most of their research concerns the applications of probability to biodiversity, ecology and evolution.

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