

Persistence in Structured Populations

Background.

Persistence of an organism is a fundamental issue in ecology and epidemiology. In ecology (and conservation in particular) we are generally concerned with maximizing the persistence of rare species – although removal of an invading species is also important. In epidemiology, the general issue is eradication of an infection and so we wish to understand how to maximize the rate of becoming disease-free.

Objectives.

A range of simple stochastic models have been used to simulate the dynamics of populations (both ecological and epidemiological) and to assess persistence. However, far less work has focused on structured populations where risk or spatial structure is explicitly included.

The basic objective of this project is to investigate (through simple simulation) how persistence changes as one scales from a homogeneous to heterogeneous model structure (eg. from one large population to multiple interacting populations).

Techniques

The main techniques will be programming simple stochastic models and the analysis of model output. However, there is also the potential to utilize a range of other methods, from branching processes to moment closure, if the student wanted a more theoretical approach.

Deliverables

The main deliverable will be to understand the way that structure influences persistence. Depending on progress this could be achieved for one or more model systems. Any research relating the findings to theoretical/analytic results would be a bonus, but far from essential.

Downstream Users

The work has both theoretical appeal and long-term practical benefit for the control of infections and the conservation of species.

PhD project.

This work could be readily extended into a PhD project. More theory could be developed; more realistic applications considered; real-world data on persistence to be analysed and compared to model results.

Relevant Literature.

McCallum, H. and Dobson, A. 2002 Disease, habitat fragmentation and conservation. *Proc. Roy. Soc. Lond. B.* **269** 2041-2049

Keeling, M.J. 2000 Metapopulation moments: coupling, stochasticity and persistence. *J. Animal. Ecol.* **69** 725-736.