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Fully spatially structured metapopulation models for predator-prey dynamics

We use mathematical modelling to describe a fully spatially structured multi-patch metapopulation model. Within each patch we have predator-prey dynamics. The patches are embedded in a surrounding domain where the species can disperse, die, but not interact. Thus migration between the patches is via the surrounding domain. The whole model is described using coupled reaction-diffusion equations. The model has implications for many actual habitats, for example: islands in the Galapagos; groups of lakes; or patches of forest in arable land. Traditional metapopulation models are well mixed (i.e. not spatially structured), thus our model should yield new insights on the role of spatial structure in metapopulations. As the model is a coupled nonlinear system of partial differential equations defined over a complicated domain, the finite element method is employed to simulate the population dynamics. The ultimate aim is to investigate some fundamental ecological questions that are difficult to answer from field data.