Spatial simulation modelling of the interacting population dynamics of Maculinea butterflies and their host Myrmica ant colonies within heterogeneous habitat

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Maculinea are endangered species of blue butterflies. Several weeks after the adults lay their eggs on foodplants, the surviving caterpillars drop to the ground, where they are found by foraging Myrmica ants. The ants "adopt" the caterpillars and take them back into their nest where the caterpillars are either feed (under contest competition) by the workers in preference to their own brood or they predate (in scramble competition) upon the ant brood. If species-specific habitat conditions and food supply are adequate, these "parasitic" caterpillars emerge as adult butterflies 10 months later.

This talk describes a spatially explicit cellular automata type stochastic simulation model which has been developed to investigate the population dynamics and represent the interactions between the butterfly, its larval foodplant, the ant nests and species, and the underlying controlling habitat pattern. The model parameters are estimated, where possible, from a range of field observations; problems of calibration are discussed. Spatial heterogeneity or "ruggedness" of the habitat distribution within a site is shown to influence population dynamics when there is density-dependent stepping-stone dispersal of competing ant colonies. Sensitivity analysis and successful tests of the model on a range of field sites can both help identify the critical parameters.

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References

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