Horst Malchow
Institute of Environmental Systems Research
Department of Mathematics and Computer Science
University of Osnabrück, 49069 Osnabrück, Germany
e-mail: malchow@uos.de

Infection and biocontrol of an invading competitor

Biological invasions including the spread of infectious diseases have strong ecological and economical impacts. The perception of their often harmful effects has been continuously growing both in sciences and in the public. Mathematical modelling is a suitable method to investigate the dynamics of invasions, both supplementary to and initiating field studies as well as control measures.

Holling-type II and III predation as well as Lotka-Volterra competition models with possible infection of the prey or one of the competitors are introduced. The interplay of local predation, intra- and interspecific competition as well as infection and diffusive spread of the populations can cause spatial and spatiotemporal pattern formation. The environmental noise may have constructive as well as destructive effects.

A plant competition-flow model is considered for conditions of invasibility of a certain model area occupied by a native species. Short-distance invasion is assumed as diffusion whereas long-distance seed dispersal can be stratified diffusive or advective. The variability of the environment due to contingent landslides and artificial causes such as deforestation or weed control leads to the temporary extinction of one or both species at a randomly chosen time and spatial range. The spatiotemporal dimension of these extreme fragmentation events as well as a possible selected harvesting or infection of the invading weed turn out to be the crucial driving forces of the system dynamics.