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Global dynamics of populations in fragmented landscapes under monostable and bistable growth dynamics

Many biological populations reside in increasingly fragmented landscapes, where habitat quality may change abruptly in space. A reaction-diffusion model for a single species which grows and disperses in a one-dimensional heterogeneous landscape is presented. The landscape is composed of two homogeneous adjacent patches with different diffusivities and net growth functions (monostable and bistable). An interface condition connects population density and flux between the two patches. We first classify all possible positive steady states using a phase plane approach. We continue by analyzing the stability properties of certain simple possible positive steady states. Numerical simulations reveal fold bifurcations. We end by studying how the movement behaviour can affect the overall dynamics of the population.