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An integro-differential equation with spatially varying delay

We consider an integro-differential equation with spatially varying delay, motivated by the tick population dynamics with development delay influenced by spatially varying environmental conditions. We establish the threshold dynamics and show how the spatial distribution of the positive equilibrium (if exists) is impacted by the spatial heterogeneity of the development delay. Our analysis illustrates two novel phenomena for the ecological system modelled: population survival is highly sensitive to environmental change rates (slow changes cause extinction, whereas rapid changes facilitate survival through redistributing the population in space); for a given mode of spatial distribution, we can select a corresponding spatially varying development delay so that the stable positive equilibrium has the target mode. This is based on joint work with Y. Tang and B. Dai.