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Population dynamics in a habitat with a protection zone

Protecting native species or endangered species has been an important issue in ecology. We derive a reaction-diffusion model for a population in a one-dimensional bounded habitat, where the population is subjected to a strong Allee effect in its natural domain but obeys a logistic growth in a protection zone. We establish threshold conditions for population persistence and extinction via the principal eigenvalue of an associated eigenvalue problem. We then obtain the influences of the protection zone on the long-term population dynamics under different boundary conditions and propose strategies for designing the optimal location of the protection zone in order for the population to persist in the long run.