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Traveling wave solutions for a free boundary problem modeling spread of ecosystem engineers

Ecosystem engineers are species that modify their environment to make it (more) suitable for them. Beavers are a well-known engineering species. We present a novel model for the spread of ecosystem engineers as a free boundary problem: ahead of the front, the habitat is unsuitable for the species, and behind the front, the habitat is suitable. The engineering action of the population moves the boundary ahead. We derive a semilinear parabolic equation from an individual random walk model. The condition for the moving boundary is a biologically derived two-sided condition that models the movement behavior of individuals at the boundary as well as the process by which the population moves the boundary to expand their territory.

We study the model with the Allee growth function and prove the existence of traveling wave solutions of different types. Then we will determine how model parameters affect the ability of an ecosystem engineer species to invade new environments and the speed at which such an invasion occurs.