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Two-Sex Invasion Dynamics

A key descriptive statistic of an ecological invasion is the speed at which it spreads across the landscape—the invasion speed. In general, the invasion speed depends on the vital rates (growth, survival, fecundity, etc.) and dispersal rates of individuals. These rates vary from individual to individual and much of that variability can be attributed to the individual's life-history stage. Ecologists have incorporated these stage-specific differences into integrodifference matrix population models from which they can compute the invasion speed, and the sensitivity of the speed to changes in the vital and dispersal rates.

Vital rates and dispersal rates also vary according to an individual's sex, and for many animal species, fertility depends on the formation of breeding pairs, which in turn depends on the relative frequency of the sexes. We have developed an invasion model that accounts for both the age- and the sex-structure of the population, and includes the pair formation process and sex bias in the vital and dispersal rates.

We have derived, and will present, a formula for the invasion speed obtained from the model using low-population-density approximations. Our comparison of this formula with the results of numerical simulations suggests that the formula is correct for a class of reasonable nonlinear models and initial conditions as well. Using the formula, we will show that the invasion speed depends in complex ways upon the model parameters and on the nature of the pair-formation process that governs mating.