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Generational spreading speeds for integrodifference equations

Some of the most fundamental quantities in population ecology describe the growth and spread of populations. Population dynamics are often characterized by the annual rate of increase, lambda or the generational increase, R_0. Analyses involving R_0 have deepened our understanding of disease dynamics and life-history complexities beyond that afforded by analysis of annual growth alone. While range expansion is quantified by the annual spreading speed, a spatial analog of lambda, an R_0-like expression for the rate of spread is missing. Using integrodifference models, we derive the appropriate generational spreading speed for populations with complex stage-structured life histories. The resulting measure, relevant to locations near the expanding edge of a (re)colonizing population, incorporates both local population growth and explicit spatial dispersal. The calculations for generational spreading speed are often simpler than those for annual spreading speed, and analytic or partial analytic solutions can yield insight into the processes that facilitate or slow a population's spatial spread. We analyze the spatial dynamics of teasel as an example to demonstrate the flexibility of our methods and the intuitive insights that they afford. This work is joint with Andrew Bateman, Marty Krkosek and Mike Neubert.