Mathematical Biology Seminar

Monday, October 4, 2021
3 pm – Virtual

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Invasions with Fat-tailed and Long-distance Dispersal

Ecologists have recognized fat-tailed and long-distance dispersal (LDD) as critical to population spread and invasions; heavy- and fat-tailed kernels fit empirical dispersal data better than classical thin-tailed kernels, and long-distance dispersal has driven some of the most rapid invasions. Despite their importance, researchers have struggled to incorporate fat-tailed and long-distance dispersal into mathematical models of spread, and analytical techniques for fat-tailed dispersal and for LDD in spatially explicit models of spread have seen limited recent development.

In this talk, I detail new analyses and techniques to study invasions with fat-tailed and long-distance dispersal. I study invasions with two types of dispersal kernels associated with long-distance dispersal: fat-tailed (power-law decay) kernels, which have a propensity for generating extreme events, and thin-tailed mixed-dispersal kernels, which combine multiple dispersal kernels that disperse over different spatial scales. I first use regularly varying densities and tail additivity to characterize the asymptotic rate of spread for invasions with fat-tailed dispersal, and I show the rate of spread to be geometric. I next turn to the transient timescale dynamics of invasions with long-distance dispersal. I show that LDD can lead to biphasic range expansion, where the invasion has two distinct phases and rates of spread.

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