

Multiplicity of ESS in Dispersal Rate in Advective Environment

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The evolution of dispersal has a long and fascinating history. In the modeling context of reaction-diffusion equations, Hastings first showed in 1983 that unconditional dispersal is selected against in spatially heterogeneous environments. In contrast, Lou and Lutscher proved in 2014 that in an advective environment without boundary loss, fast dispersal is selected for. However, this prediction does not hold in general advective environments, as boundary loss penalizes excessive dispersal. In this talk, we analyze the role of habitat size and the loss rate at the downstream boundary in shaping the selection of diffusion rates in advective environments. We show that there are at least nine qualitatively different types of pairwise invasibility plots, and that selection can favor fast or intermediate dispersal. In addition, we rigorously demonstrate that certain environments can support up to three distinct evolutionarily stable strategies (ESSs) in dispersal rate. This is joint work with Wenrui Hao (Penn State) and Yuan Lou (Shanghai Jiao Tong University).

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