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The effect of temporal variability on persistence conditions in rivers

There has been great interest in the invasion and persistence of algal and insect populations in rivers. Recent modeling approaches assume that the flow speed of the river is constant. In reality, however, flow speeds in rivers change significantly on various temporal scales due to seasonality, weather conditions, or many human activities such as hydroelectric dams. In this talk, I study persistence conditions by looking at the upstream invasion speed in simple reaction-advection-diffusion equations with coefficients chosen to be periodic step functions. The key methodological idea to determine the spreading speed is to use the exponential transform in order to obtain a moment generating function. In a temporally periodic environment, the averages of each coefficient function determine the minimal upstream and downstream propagation speeds for a single-compartment model. For a two-compartment model, the temporal variation can enhance population persistence.

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