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Impact of Predation on Invasive Species Spread

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ABSTRACT

Biological invasions are currently regarded as a major threat to biodiversity. Apparent importance of this issue has brought to life various strategies of invasive species management. The concept of biological control is based on the assumption that the impact of certain biological or environmental factors can slow down or block the spread of exotic species. In this talk we consider how the rate of invasion and the whole pattern of spread can possibly be affected by the impact of predation.

Mathematically, the system is described by two nonlinear diffusion-reaction equations. We first study the problem analytically. Under some additional constraints we obtain its exact solution [1]. From considering the solution properties, we infer that predation normally slow down the species spread, although invasion blocking or reverse is only possible when the population growth is damped by the strong Allee effect. We then study the problem by means of extensive numerical experiments in one and two spatial dimensions and show that the impact of predation can change the whole pattern of spread: in a certain parameter range, invasion can take place not via the intuitively expected circular expanding population front but via motion and interaction of separate patches [2]. The population density appears to be on the order of carrying capacity inside the patches and it is virtually zero between the patches. We then show that this phenomenon of patchy invasion takes place 'at the edge of extinction' so that a small change of controlling parameters either brings the species to extinction or restore the travelling population fronts [3]. Moreover, we show that the regime of patchy invasion in two spatial dimensions actually takes place when the species go extinct in the corresponding 1-D system.

Key Words: biological invasion, predation, exact solution, patchy spread

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References

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