Patchy invasion of stage-structured alien species with short-distance and long-distance dispersal

Luiz Alberto Diaz Rodrigues^a , Diomar Cristina Mistro^a, Elisa Regina Cara^b Natalia Petrovskaya^c, Sergei Petrovskii^{d1}

^{a} Departamento de Matematica, Universidade Federal de Santa Maria, Santa Maria, RS, Brasil.

^{b} Departamento de Matematica, Universidade Federal de Porto Alegre, Porto Alegre, Brasil.

^{c} School of Mathematics, University of Birmingham, Birmingham B15 2TT, U.K.

^{d} Department of Mathematics, University of Leicester, University Road, Leicester LE1 7RH, U.K.

Abstract

Understanding of spatio-temporal patterns arising in invasive species spread is necessary for successful management and control of harmful species, and mathematical modeling is widely recognized as a powerful research tool to achieve this goal. The conventional view of the typical invasion pattern as a continuous population traveling front has been recently challenged by both empirical and theoretical results revealing more complicated, alternative scenarios. In particular, the so-called patchy invasion has been a focus of considerable interest; however, its theoretical study was restricted to the case where the invasive species spreads by predominantly short-distance dispersal. Meanwhile, there is considerable evidence that the long-distance dispersal is not an exotic phenomenon but a strategy that is used by many species. In this paper, we consider how the patchy invasion can be modified by the effect of the long-distance dispersal and the effect of the fat tails of the dispersal kernels.

Keywords: biological invasion, Allee effect, predator-prey system, integro-difference equation, Cauchy kernel

[1]Corresponding author. Phone/fax: +44 116 252 3916/3915, email: sp237@le.ac.uk