



## VII Escuela de Verano en Sistemas Complejos

Instituto de Sistemas Complejos de Valparaíso -ISCV-  
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Abstract  
Course  
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### "Some questions in mathematical ecology"

This series of lectures is about various models in spatial ecology dealing with biological invasions, population distributions, the effect of heterogeneous environment and the effect of a climate change on a species. The models I will discuss are partial differential equations of the reaction-diffusion type. In the first lecture, I will discuss some of the principles behind the use of these equations in the context of ecology. I will also describe some of the fundamental properties of this class of equations. Then, I will explain how they can be put to use to derive qualitative properties and ecological consequences. The questions I will address then are related to the global effect on survival of an environment consisting of mixed favorable and unfavorable regions and establish a criterion for the survival of species and the population distribution in such an environment. Next, I will derive some results concerning the invasion of a biological species in such a heterogeneous environment. A second class of models deals with the effect of climate change on a species which is, say, temperature dependent. There too, the aim is to understand the conditions under which the species survives and how this climatic change affects the population distribution and dynamics. I will also discuss some effects of geometry.

References of the works I will discuss in my lectures are the following:

H. Berestycki, F. Hamel, L. Roques: Analysis of the periodic patch model : I -- The effects of heterogeneous environment on species conservation. *J. Math. Biol.*, **51** (2005), p. 75-113.

H. Berestycki, F. Hamel, L. Roques: Analysis of the periodic patch model : II – Biological invasions and pulsating travelling fronts. *J. Math. Pures Appl.*, **84** (2005), p. 1101-1146.

L. Roques, A. Roques, H. Berestycki and A. Kretzschmar: A population facing climate change: joint influences of Allee effects and environmental boundary geometry. *Population Ecology*, **50** (2008), p. 215-225.

H. Berestycki, O. Diekmann, K. Nagelkerke, P. Zegeling: Can a species face a climate change? *Bull. Mathematical Biology*, (2008 - 2009), in press.

H. Berestycki, L. Rossi: Reaction-diffusion equations for population dynamics with forced speed, I - The case of the whole space, *Discrete and Continuous Dynamical Systems*, **21** (2008), p. 41--67.

H. Berestycki, L. Rossi: Reaction-diffusion equations for population dynamics with forced speed, II - Cylindrical type domains. *Discrete and Continuous Dynamical Systems*, (2008 - 2009), to appear.

Some of these papers (in preprint form) are available on my web page:

<http://www.ehess.fr/centres/cams/person/berestycki/>