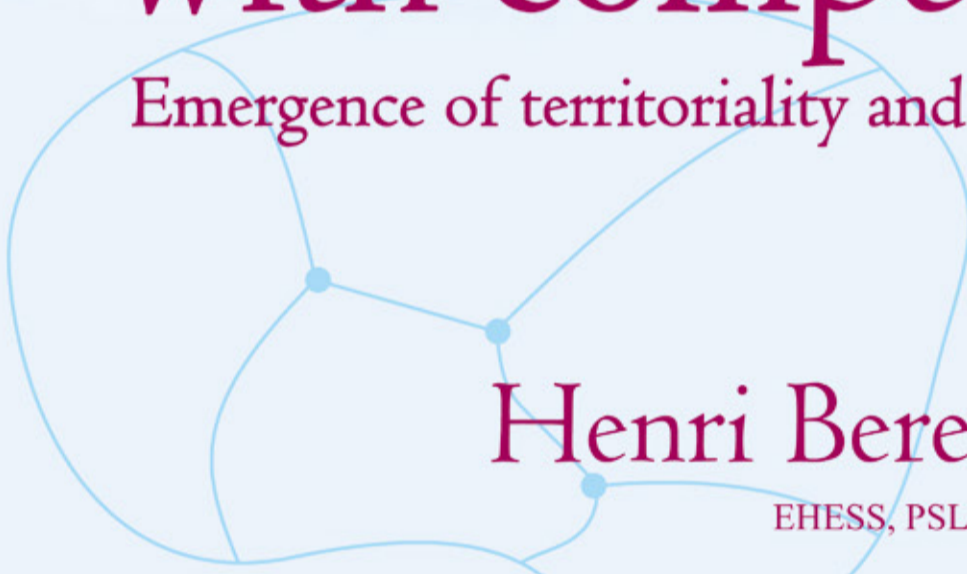# MIMS/CMMA

Meiji University
Center for Mathematical Modeling and Applications

Predators-prey model with competition

Emergence of territoriality and packs in animal behavior

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$$\begin{cases} u_t - D\Delta u = u\left(r - \frac{r}{K}u - \gamma \sum_i w_i\right) \\ w_{i,t} - d\Delta w_i = w_i\left(-\mu + \gamma u - \beta \sum_{j \neq i} w_j\right) \end{cases}$$

Lecture Series

Abstract
In these lectures, I will present a new model that aims at showing how territories and packs are formed among certain predators. This model rests on basic principles of predators – prey interaction and competition.
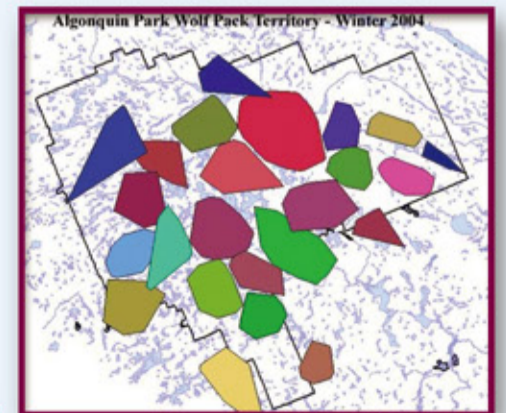
Lecture 1　: 15:00 - 16:00
I will start by introducing the classical Lotka-Volterra model, a dynamical system describing predator – prey interaction. This simple system is one of the cornerstones of mathematical ecology. Including spatial dependence and animal movement, one is led to a system of reaction-diffusion equations. In this context, I will present recent work in collaboration with Alessandro Zilio about an extension of the original Lotka-Volterra system.

Lecture 2　: 16:10 - 17:00
We analyze the situation of predators like wolves that can divide up into several hostile packs. The questions we address are to understand the conditions under which predators segregate into packs, whether there is an advantage to have such hostile packs, and to compare the various territory configurations that can arise. In mathematical terms, we focus on the analysis of stationary states, stability issues, and various asymptotic behaviors of this system, especially when the competition parameter becomes unbounded.

Discussions: 17:00 - 17:15

Algonquin Park Wolf Pack Territory - Winter 2004

MIMS