Pacific Institute *for the* Mathematical Sciences

Mathematical Models for Territorial Interaction

Thursday, March 14 2013
University of Victoria
3:30pm SCI A104 (Bob Wright Centre)
3:00pm Pre-lecture reception

SPEAKER: Mark Lewis (University of Alberta)

Mathematical models can help us understand the formation of complex spatial patterns, including the territories of wolves and coyotes. Here scent marks provide important cues regarding the use of space. In this talk I will show how biologically-based mechanistic rules can be put into a mathematical model which predicts the process of territorial formation as individuals create and respond to scent marks. The model predicts complex spatial patterns which are seen in nature, such stable `buffer zones' between territories which act as refuges for prey such as deer. The mathematical work is supported by detailed radio-tracking studies of animals. I will also employ the approach of game theory, where each pack attempts to maximize its fitness by increasing intake of prey (deer) and while decreasing interactions with hostile neighboring packs. Here the predictions are compared with radio-tracking data for wolves and coyotes. Finally I will show how a version of the territorial model has been applied to human populations in understanding spatial patterns arising from conflict between urban gangs.

MARK LEWIS is a Professor in the Department of Mathematical and Statistical Sciences at the University of Alberta. He holds a Canada Research Chair in Mathematical Biology and a Killam Research Fellowship. His research is mathematical biology, with a focus in spatial ecology and his mathematical models include nonlinear partial differential equations, integrodifference equations and related stochastic spatial processes. Biological problems include modeling the process of territorial pattern formation in wolves, predicting population spread in biological invasions, calculating optimal strategies for biocontrol and assessing the effect of habitat fragmentation on species survival. A significant part of his research involves the formulation and verification of quantitative models, in collaboration with biologists. His mathematical approaches include analytical methods for dynamical systems, perturbation theory and computational methods.

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