The University of Chicago
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MASTER'S THESIS PRESENTATION

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The *Chase-Escape* Model on 2-D Lattice: A Simulation Approach

MONDAY, November 21, 2011 at 11:00 AM
110 Eckhart Hall, 5734 S. University Avenue

ABSTRACT

The *Chase-Escape* model describes the dynamics of two species, herbivores and carnivores, competing on an infinite graph. At any time t, each site of the graph can be occupied by only one of the species. The interaction between the two species is as follows: 1) herbivores ("*Red*") colonize the nearby empty sites at exponential rate λ_R; 2) carnivores ("*Blue*") eat herbivores and take over their sites at exponential rate λ_B; 3) herbivores can not eat carnivores, and carnivores can not colonize the empty sites directly. We are interested in the coexistence of the two species, particularly on the 2-dimensional graphs. We did extensive simulations of the *Chase-Escape* model on the 2D lattice to find out the critical value p_c (if exists), such that whenever the relative growth rate $p = \lambda_R/\lambda_B > p_c$, the coexistence of two species is probable. We investigated various types of 2D lattices (squared, triangular, and hexagonal etc.) and found that the critical value is **larger** when the degree of each site on the lattice is **smaller**, with $p_c \approx 0.50$ for the squared lattice. Moreover, the growth behavior right at the critical value p_c is complex, which is characterized by scale-free behavior, such as fractal shapes and power laws.

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