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Department of Biomathematics Seminar Series:
Frontiers in Systems and Integrative Biology

Unexpected Responses of Disease to Global Change

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Thursday, November 6, 2014
4:00 PM
13-105 Center for the Health Sciences (CHS)

ABSTRACT: With the threat of changing climate, species invasions, shifts in land use, and other anthropogenic changes, ecologists are increasingly concerned about the emergence and spread of infectious diseases. The common assumption is that environmental changes will facilitate disease spread and increase the risk to humans and species of agricultural and conservation concern. Yet most ecological processes are nonlinear, and the response of infectious diseases to environmental change is no exception. In this talk, I will explore how nonlinearities in disease transmission lead to unexpected responses of disease to environmental change in two systems: (1) a fungal pathogen called Black Fingers of Death that spills over from invasive cheatgrass to native grass species in the western U.S., and (2) changes in human malaria risk in response to temperature. To understand the importance of nonlinearity in these systems, I use mathematical models fit to empirical data. In both cases the field-parameterized models show, counter-intuitively, that environmental change does not necessarily lead to negative disease-mediated outcomes. In fact, the fungal pathogen is predicted to benefit the native grass species in competition with invasive cheatgrass, and warm temperatures are expected to decrease malaria transmission in currently heavily-infected areas. These surprising results underscore the importance of integrating models and data to predict responses of disease to environmental change in nature.

Host: Van Savage, Ph.D.

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