HC 399: Section 003
Fall 2008: Honors Colloquium (2 credits)
Introduction to Mathematical Ecology

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Office Hours: 1-1:50pm R or by Appt

Class Time and Room: TR 9-9:50 am, WLKN 231
Website: http://www.math.oregonstate.edu/~bokilv/HC399F08

Textbook: There is no required text.

Prerequisites: MTH 252 or MTH/FW 268. Please contact me to discuss your background if you do not have the necessary prerequisites.

Course Description: Mathematical methods are increasingly becoming important in the study of ecological systems. This course will introduce mathematical models for applications in ecology and will be accessible for students who have completed first-year courses in differential and integral calculus (e.g. Math 251 and 252 or the equivalent).

We will study how differential and difference equations are used to model various ecological phenomenon including population growth, spread of infectious diseases, habitat fragmentation, competition between species and predator prey relationships, among others. We will also consider how uncertainty about different aspects of the process to be modeled can be incorporated into the model. The analysis of these models provides insights into the behavior of different phenomenon and suggests various strategies for conservation. We will also consider the numerical solution of different models and I will demonstrate different examples using the software MATLAB.

Students will have the opportunity to meet and hear from OSU faculty researchers in mathematical ecology, including members of the Ecosystems Informatics (EI) strategic initiative at OSU, who will introduce their research and present possibilities for further student involvement. There will be topical lectures as well as discussion of a pertinent paper each week.

Syllabus:

- **Week 1**: Introduction to Modeling and Simulation in Ecology
- **Week 2**: Single Species Population Dynamics: Continuous and Discrete Models.
- **Week 3**: Structured Population Dynamics: Leslie and Lefkovitch Matrices.
- **Week 4**: Numerical Simulation of Models: Simple numerical methods such as forward and backward Euler, Trapezoidal method.
- **Week 5**: Population Dynamics of Interacting Species: Host-Parasitoid Models.
- **Week 6**: Population Dynamics of Interacting Species: The Lotka-Volterra and Predator-Prey Models.
• **Week 7**: Modeling of Infectious diseases: SIR models

• **Week 8**: Modeling of Infectious diseases: SIR models with Vectors

• **Week 9**: Spatial Dynamics: Metapopulation models

• **Week 10**: Metapopulation Models and the Theory of Island Biogeography.

• **Finals Week**: Final papers due. Presentations of final papers.

### General Format of the Class:

- **T** class will be a lecture on the given topic for the week

- **R** class will be a discussion of a paper that uses ideas based on **T** lecture. This will involve an **EI** faculty who will participate in the discussion.

- Look at calendar posted on the website for topics to be covered and information about visiting faculty.

### Assignments and Grading:

- **Writing Assignments**: There will be three assignments involving discussion of models or issues related to modeling/simulation/analysis for a particular ecological application. Discussion of shortcomings/difficulties/open questions in the area will also be included.

- **Final Paper**: At the end of the course, students will write a 4-6 page final paper discussing the construction, analysis and simulation of mathematical models for a particular ecological application. The students could pick one of the writing assignments and expand on it. The students will give a 10 minute presentation to the class on their final paper.

### Course Grading:

- **Writing Assignments**: 66%

- **Final Paper**: 34%

**Special arrangements**: For students with disabilities, absence during exams due to extenuating circumstances, etc.: please contact the instructor and provide appropriate documentation. Course drop/add information is at http://oregonstate.edu/registrar/.

Check the class website (given above) for general information and other policies regarding the class.