Course Syllabus

Professor: Dr. Joshua Weitz
Teaching Assistant: Andrey Kislyuk

Contact information:

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Lectures: Tue, Thursday 12:05-1:25 PM in Cherry Emerson 320
Matlab recitations: Time/Location TBD

Textbooks:
    Required: Alan Hastings (abbreviated H), Population Biology: Concepts and Models. Springer 1997.
    Suggested reading: J.D. Murray (abbreviated JM-I), Mathematical Biology I. Springer 2004.
    Special readings to be posted on http://tsquare.gatech.edu

Course Topics: Current and foundational theoretical issues in ecology and evolutionary biology. Topics inlude: Mathematical foundations; Population models; Community models; Stochasticity in model formulation; Evolutionary ecology; Game theory; Spatial models; Epidemiology; Ecological networks.

Prerequisites: One year of calculus and one year of biology are required for the course. We assume you are comfortable with basic mathematical concepts of simple probability, statistics, and integration/differentiation.

Overview

This class emphasizes the application of mathematical concepts to ecology, evolution and epidemiology. The course is built around assignments that introduce students to

techniques for developing and analyzing quantitative models;

software such as MATLAB, to support a thorough understanding of stochastic and dynamic modeling using mathematics as a structural and logical tool.

Course format

Three hours each week are scheduled for the class. Class time will be divided among traditional lectures and group problem-solving exercises or discussions.. A component of the course will involve student formulating and solving problems in small cooperative groups of three to four members.

Some class days will be devoted to in-class modeling exercises. These days will be announced at least one day prior to class. You are invited and encouraged to bring laptop computers to class to work on these problems.

Software: Implementation of homework requires use of (i) mathematic analysis; and (ii) Matlab. Students are encouraged to attend weekly recitations where they will learn how to *translate mathematical ideas about biological problems into a computational model.*

Grading Scheme:
   35% homework
   25% midterm exam
   20% final presentation
   20% final paper

Midterm exam: There will be one in-class midterm exam, counting for 25% of the final grade. This exam will be closed book, i.e., no notes, no calculator, and no collaborative work. The *tentative* exam date is February 21.

Final project: Collaborative group projects will be developed over the course of the semester. Final project proposals will be handed in around March 6, and final presentations are *tentatively*, scheduled for April 22 and 24. Final papers will be due on April 25th. More information will be available later in the term.

Homework: Some homework will involve group work and some will be expected to be completed individually. The following rules apply to all group work:

1.   Everyone is responsible for making sure that all group members contribute.

2.   Assist each other in understanding the material and in developing skills such as translating scenarios to equations, using computer software, writing model reports, and designing figures and tables.

3.   Each group will prepare a joint (single) report. Each member of the group should

sign the report, thereby indicating agreement with the group's conclusions, contribution to the report, and understanding of its contents. If you use any sources other than class notes or your own original ideas, you must cite the source(s). Violation of this policy is a violation of the GT Honor Code.

4. You will work collaboratively with other members of your group, but collaboration between or among groups is not authorized, whether on the conceptualization, development, interpretation, or writeup of the homework. Violation of this policy is a violation of the GT Honor Code.

Attendance: Regular attendance in lectures is expected – most lectures will include some component of group work and problem solving. Exceptions will be accepted for valid, documented reasons only, including: (1) official representation of the Institute; and (2) medical emergencies.

Academic Integrity: Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct, available online at:
http://www.deanofstudents.gatech.edu/integrity/policies/honor_code.php
http://www.deanofstudents.gatech.edu/codeofconduct.
Any violations must be reported to directly to the Dean of Students.

Additional Resources:
*   Tsquare — http://tsquare.gatech.edu
*   Tech Tutoring — http://www.undergradstudies.gatech.edu/supportTutoring.htm

Updates: This syllabus is subject to modification. Any changes will be announced in class and posted on the course website.

Lecture Schedule:

I. Introduction to Theoretical Ecology
Readings: H 1., 2.1, 4.1-4.2
1. January 8:   (J. Weitz)   Course logistics; course overview
2. January 10:   (J. Weitz)   Single species dynamics (I)

Readings: H 3.1, 4.1-4.4
3. January 15:   (A. Kislyuk)   Introduction to Matlab
4. January 17:   (J. Weitz)   Single species dynamics (II)

Readings: H 2.2
5. January 22:   (J. Weitz)   Structured populations I
6. January 24:   (J. Weitz)   Structured populations II

II. Fundamentals of multi-species interactions
Readings: H 6, 7
7. January 29:   (J. Weitz)   Competition for a common resource (I)
8. January 31:   (J. Weitz)   Competition for a common resource (II)

Readings: H 8
9. February 5:   (J. Weitz)   Predator-prey theory (I)
10. February 7:   (J. Weitz)   Predator-prey theory (II)

Readings: TBA
11. February 12:   (J. Weitz)   Food web theory

III. Evolutionary ecology
Readings: TBA
12. February 14:   (J. Weitz)   Game theory in action (I)

Readings: TBA
13. February 19:   (J. Weitz)   Game theory in action (II)
14. February 21:   (J. Weitz)   Midterm exam

Readings: H 3.1-3.3
15. February 26:   (J. Weitz)   In-class collaborative group project lab
• *Form final project groups*
16. February 28:   (J. Weitz)   Evolution of traits (I)

Readings: H 3.4
17. March 4:   (J. Weitz)   Evolution of traits (II)
18. March 6:   (J. Weitz)   Evolutionary genetics
• *Final group project report proposals due!*

Disease and epidemiology
Readings: H 10
19. March 11:   (J. Weitz)   Epidemics I
20. March 13:   (J. Weitz)   Epidemics II

Spring break, March 17-21

Readings: TBA
21. March 25:   (J. Weitz)   Within-host dynamics of pathogens (I)
22. March 27:   (J. Weitz)   Within-host dynamics of pathogens (II)

Special topics
Readings: JM 11
23. April 1:   (J. Weitz)   Spatial models I
24. April 3:   (J. Weitz)   Spatial models II

25. April 8:   (C. Price):   Scaling in ecology
26. April 10:   (H. Wang):   Ecological stoichiometry

27. April 15:   (Y. Mileyko):   Biological data analysis
28. April 17:   (H. Weiss):   Spatial ecological models

Presentations
29. April 22   Group presentations
30. April 24   Group presentations
• *Group papers due on April 25th*