Course description, syllabus, and policies

Course overview

Credits:	4 credits + 1 credit lab (**ENVR 5131**)
Prerequisites:	MATH 1241, MATH 1251, or MATH 1341
Lectures:	Mon, Thu from 11:45 AM – 1:25 PM
Labs:	Mon, Thu in Holmes 070 (GIS lab)
Recitations:	Right after labs on Mon and Thu
Website:	http://blackboard.neu.edu/ (Ecological Dynamics; ENVR 5130)

Instructor contact information

Name:	Dr. Tarik C. Gouhier
Office:	Holmes 071 (Main campus) & Marine Science Center 61 (Nahant)
E-mail:	tarik.gouhier@gmail.com
Office hours:	Immediately following lectures

Required textbook

Gotelli, N. J. 2001. A primer of ecology. Sinauer Associates.

Recommended textbooks

1. Otto, S. P., and T. Day. 2007. A biologist's guide to mathematical modeling in ecology and evolution. Princeton University Press.
2. Bolker, B. 2008. Ecological models and data in R. Princeton University Press.

Required software

1. Download the free `R` environment for Windows, Mac, or Linux: http://www.r-project.org
2. Download the free RStudio IDE for Windows, Mac, or Linux: http://www.rstudio.com
3. Download the free LaTeX distribution that is appropriate for your computer:
   (a) For Macs, download MacTex: http://www.tug.org/mactex/
   (b) For PCs, download the MikTex Net Installer in "Other Downloads": http://miktex.org/download

Course description

This course is designed to provide students with a comprehensive overview of the mathematical and computational concepts needed to construct (meta)population, (meta)community, and (meta)ecosystem models. The lectures will describe how to mathematically derive and model processes such as growth, trophic and non-trophic species interactions, dispersal, and environmental variability to understand patterns of population abundance and species diversity in a changing world. Special emphasis will be placed on the mathematical tools required to (1) analyze the dynamical behavior of ecological models (e.g., stability, invasion, graphical, and numerical analyses) and (2) validate model predictions using empirical data (e.g., via maximum likelihood and optimization methods). The supervised lab sessions will teach students how to derive, analyze, and test models using the free `R` programming environment.

Course goals

The overall goals of the course are to (1) provide an overview of the mathematical and computational approaches used to derive and construct ecological models; (2) discuss the suitability of each approach for tackling different classes of ecological and environmental issues; (3) teach the programming and numerical skills needed to test model predictions with empirical data; (4) allow students to develop the writing and presentation skills required to successfully convey complex concepts to scientists and non-scientists alike.

How to do well in this course

Naturally, attending the lectures and labs is crucial for doing well in this course. Additionally, students are expected to do the assigned readings *prior to* the lectures. Doing so will allow students to get the most out of the lectures and ask any lingering questions regarding the material. If the concepts remain unclear after the lectures, students should seek help from the instructor *immediately* via email and/or arrange to meet during office hours.

Backboard

The syllabus, course policies, discussion boards, handouts, and all other course material will be available online at Northeastern's Blackboard site at http://blackboard.neu.edu/ (Ecological Dynamics - Spring 2015; ENVR 5130).

Grading scheme

Your course grade will be based on the following grading scheme:

Evaluation	
Assignments	20%
Project proposal	20%
Peer-review of project proposal	5%
Final project	40%
Presentation of final project	15%

Grading system

Letter grade	**Numerical equivalent**
A	93-100
A-	90-92
B+	86-89
B	83-85
B-	80-82
C+	76-79
C	73-75
C-	70-72
D+	66-69
D	63-65
D-	60-62
F	below 60

Assignments

The assignments will consist of problem sets designed to assess comprehension of the lecture material and the `R` programming environment.

Project proposal

Students will write a 2-page (single-spaced) proposal for their final project containing the following sections: "Introduction & Background", "Questions & Goals", "Methodological Approach","Expected Results & Implications". The "Introduction & Background" section should describe an open question/topic in any biological field and outline its importance. The "Questions & Goals" section should clearly delineate the questions your project will attempt to answer and your hypotheses/predictions. The "Methodological Approach" section should describe how you plan to carry out the research (e.g., what kind of model and analysis will you use?). Finally, the "Expected Results & Implications" section should describe what you expect to find and the implications of your results for scientists and the broader public.

Peer-review of project proposal

Students will review the proposals of their peers by ranking them based on criteria such as clarity, novelty, feasibility, and potential applicability to real-world issues.

Final project

For the final project, students will write a scientific manuscript based on their proposal that adheres to the format of a *Letter* for the journal *Ecology Letters*. Specifically, the manuscript will have the following structure: "Abstract", "Introduction", "Methods & Materials", "Results", "Discussion", "References", "Tables", "Figures"; all in no more than 5,000 words and 6 tables/figures. The manuscript will present a novel model that tackles the topic described in the proposal. The paper will also include an appendix describing the rationale for the model derivation and analysis, along with the `R` code used to produce the results.

Presentation of the final project

Students will prepare and deliver a 15-minute long presentation of their final project.

Calendar (tentative)

Week	Date	Lecture	Readings	Evaluation	Lab
1	Mon Jan. 12 Thu Jan. 15	Introduction Philosophy of modeling	**O**1		No Lab*
2	Mon Jan. 19 Thu Jan. 22	**MLK day: no class** Constructing models	**O**2	Assignment 1	No lab
3	Mon Jan. 26 Thu Jan. 29	Population growth (1/2) Population growth (2/2)	**G**1, **G**2		Lab 1
4	Mon Feb. 02 Thu Feb. 05	Matrix models Competition (1/2)	**G**3, **O**10		Lab 2
5	Mon Feb. 09 Thu Feb. 12	Competition (2/2) Predation (1/2)	**G**5	Assignment 2	Lab 3
6	Mon Feb. 16 Thu Feb. 19	**Presidents' day: no class** Predation (2/2)	**G**6		No lab
7	Mon Feb. 23 Thu Feb. 26	Food chains (1/2) Food chains (2/2)	**G**6		Lab 4
8	Mon Mar. 02 Thu Mar. 05	Food webs (1/2) Food webs (2/2)	Selected papers	Assignment 3	Lab 5
9	Mon Mar. 09 Thu Mar. 12	**Spring break: no class** **Spring break: no class**			
10	Mon Mar. 16 Thu Mar. 19	Epidemiological models (1/2) Epidemiological models (2/2)	**O**3	Project proposal	Lab 6
11	Mon Mar. 23 Thu Mar. 26	Spatial models (1/2) Spatial models (2/2)	**G**4	Proposal review	Lab 7
12	Mon Mar. 30 Thu Apr. 02	Environmental change (1/2) Environmental change (2/2)	Selected papers		Lab 8
13	Mon Apr. 06 Thu Apr. 09	Fitting models to data (1/2) Fitting models to data (2/2)	**B**7		Lab 9
14	Mon Apr. 07 Thu Apr. 10	Project presentations Project presentations		Presentation	No Lab
15	Mon Apr. 13 Thu Apr. 16	Project presentations Project presentations		Presentation	No Lab
16	Mon Apr. 20 Fri May 01	Project presentations **Projects due**		Project	

Note: Readings beginning with **G**, **O** and **B** respectively refer to Gotelli (2001), Otto and Day (2007) and Bolker (2008).

*You are expected to read chapter 2 of the course manual in order to be able to complete the labs and assignments.

ENVR 5130 course policies

Late assignments: All late assignments will be marked down by 5% per day (and down to zero once the solutions are posted online). In special circumstances, short extensions can be granted, but extensions must be requested at least one week in advance of the due date. Special consideration will be given in circumstances where health-related or family emergencies arise around the due date.

Class attendance and participation: You are expected to come to class on time, complete each assignment, and generally engage in all aspects of this class. This means that cell phones should be in 'airplane' or 'silent' mode during class to avoid interruptions such as texting, emailing, surfing the web, phone calls, etc... You may be dismissed from class for failing to abide by this policy.

Lab attendance: You are expected to attend the labs and complete the planned activities. The lab activities are designed to teach you the `R` programming environment and prepare you for both the assignments and the final project. Students who fail to attend the labs and complete the planned activities will receive a 1% deduction from their final course grade for each lab missed. **You should read the second chapter of the course manual and become acquainted with `R` ahead of the first lab.**

Course schedule: The tentative class calendar outlined above covers the topics that I think are most important for students seeking to pursue careers in biological disciplines. However, the topics will be adjusted based on student performance in order to ensure that the class benefits at least a majority of the students. This means that I reserve the right to modify the course by (1) adding topics if most students are absorbing the material easily or (2) cutting topics in order to spend more time explaining the material if most students are struggling. I ask that you please let me know if there are issues with the level or amount of material being presented so that we can seek an immediate resolution.

Blackboard: Questions and comments about the lecture material or labs should be posted on Blackboard's discussion forum so that the entire class may benefit from the discourse that stems from your inquiry. Any such questions posed to me via email will be posted (along with my answer) on Blackboard's discussion forum. Please do not post personal concerns, extension request, or any other information on Blackboard. All personal requests pertaining to the class should be submitted either directly to me via email or in person.

TRACE: Students are expected to complete the student survey known as TRACE (Teaching Rating and Course Evaluation), which is accessible via the MyNEU website. Students who complete the survey will receive a 1% bonus on their final course grade.

Northeastern University policies

Northeastern University is committed to the principles of academic integrity. The following is an overview of the types of activities that violate Northeastern's academic integrity policy:

Cheating: The University defines cheating as intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise. When completing any academic assignment, a student shall rely on his or her own mastery of the subject.

Fabrication: The University defines fabrication as intentional and unauthorized falsification, misrepresentation, or invention of any information, data, or citation in an academic exercise.

Plagiarism: The University defines plagiarism as intentionally representing the words, ideas, or data of another as one's own in any academic exercise without providing proper citation.

Unauthorized Collaboration: The University defines unauthorized collaboration as instances when students submit individual academic works that are substantially similar to one another. While several students may have the same source material, the analysis, interpretation, and reporting of the data must be each individual's independent work.

Participation in Academically Dishonest Activities: The University defines participation in academically dishonest activities as any action taken by a student with the intent of gaining an unfair advantage.

Facilitating Academic Dishonesty: The University defines facilitating academic dishonesty as intentionally or knowingly helping or attempting to violate any provision of this policy.

Any violation of Northeastern University's academic integrity policy will result in a grade of zero for the assignment or exam, and could result in course failure. The office of student conduct and conflict resolution will also be notified.