Syllabus

Advanced Ecology: Fundamentals of Ecological Modelling

BIO 534 & BIOL 534

Stuart R. Borrett

Fall 2016

Course Description

Scientists investigate the dynamics of complex systems with quantitative models, employing them to synthesize knowledge, to explain observations, and to forecast future system behavior. This course introduces the basic principles of ecological modeling including model conceptualization, construction, analysis, use and abuse. Students will develop knowledge and skill through a sequence of exercises and laboratories that culminate with the design, implementation, and evaluation of their own process-based simulation model. At the completion of the course, successful students will be able (1) to use modeling knowledge to construct dynamic simulation models, and (2) to comprehend and evaluate models presented in the literature.

Course Time and Location

Part	Days	Time	Location
Class Meetings:	Monday, Wednesday	1:00–2:15 pm	Friday Hall 1014
Laboratory:	Tuesday	2:00–4:50 pm	Friday Hall 2041

Contact Information

Stuart R. Borrett

Office:	Friday Hall 1057
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Email*:	borretts@uncw.edu
Office Hours:	By appointment

* I will respond to email as soon as possible, but please allow 24 hours for a response. If you require a faster response you may call my office phone.

Texts and Readings

We will read material from a variety of sources including textbooks and primary literature. The required text is N. Gotelli's (2008) **A Primer of Ecology** (4^{th} ed), Sinauer, MA, which is available in the bookstore. Other assigned readings will be available as PDFs from the course website which can be found at http://people.uncw.edu/borretts/teaching.html. I will also post lecture notes and laboratory assignments on the website.

In addition to the assigned readings, I recommend the following texts for further exploration.

Ecological Modeling

Haefner, J.W., 2005. Modeling Biological Systems: Principles and Applications. (2nd ed.). Springer. [**MBS**]

Jørgensen, S.E. and Bendoricchio, G., 2001. Fundamentals of Ecological Modelling. (3rd ed.). Elsevier, Amsterdam. [**FEM**]

Ellner, S.P. and Guckenheimer J. 2006. Dynamic Models in Biology. Princeton University Press, NJ. [**DMB**]

Otto, S.P. and Day, T. 2007. A Biologist's Guide to Mathematical Modeling in Ecology and Evolution. Princeton University Press, Oxford. [**BGM**]

Gurney, W.S.C. and Nisbet, R.M., 1998. Ecological Dynamics. Oxford University Press, NY.

Kot, M., 2001. Elements of Mathematical Ecology. Cambridge University Press, Cambridge, U.K..

Hilborn, R. and Mangel, M., 1997. The Ecological Detective: Confronting Models with Data. Princeton University Press, Princeton, N.J.

Ford, E.D., 2000. Scientific Method for Ecological Research. Cambridge University Press, Cambridge; New York. (see especially chapter 12)

Kingsland, S.E., 1995. Modeling Nature: Episodes in the History of Population Ecology. The University of Chicago Press, Chicago, Il.

Programming with R

Dalgaard, P. 2002. Introductory Statistics with R. Springer, New York, NY.

Maindonald, J. and Braun, J. 2007. Data Analysis and Graphics Using R: An Example-Based Approach. (2nd ed.) Cambridge University Press, Cambridge.

Venables, W.N., Smith, D.M., and the R Development Core Team. 2004. An Introduction to R. Network Theory Ltd., Bristol, U.K..

Stevens, M.H.H., 2009. A Primer of Ecology with R. Springer, New York, NY.

Course Goals

Course Learning Outcomes

Through your experiences in Bio534 and BIOL334 you will be able to:

- Construct and use process–based simulation models to evaluate ecological hypotheses;
- Understand the fundamental concepts in ecological modeling and their application;
- Interpret and critique primary literature that uses models; and
- Communicate modeling results to a scientific audience.

What are your personal goals for Bio534?

- What do you want to know and be able to do by the end of this course?
- Do you feel prepared to achieve these goals?
- How will you attempt to achieve these goals?

Faculty Goals

My goals for this course are best stated by Ebert–May and Tsao (2007) as follows:

- As a facilitator I will encourage and create a learning environment in which all students are actively engaged in the process of scientific thought and reasoning.
- I will guide your development toward higher-order thinking and reasoning skills so you can successfully explore and demonstrate achievement of each of the goals above.

Schedule and Assignments

The schedule and assignments for lecture and laboratory are listed on the course website
http://people.uncw.edu/borretts/teaching.html.

This is an initial plan that I expect we will adapt as the course progresses. However, I will work not to shift the dates of the exams or assignment due dates unless absolutely necessary and we all agree.

The lecture course is designed so that we first cover the core concepts. Then, the latter part of the course is comprised of case studies, driven by discussing primary literature.

About the Course

In class meetings there will be lectures, readings, story-telling, student presentations, discussions, problem–solving, and more. I expect you to work cooperatively in our meetings as well as study together outside of class. Together, we will uncover much about ecology and ecological modeling. I will strive to make the class as active and cooperative as possible.

You are expected to read assignments ahead of the class meeting scheduled to address that topic. In class, we will often discuss only parts of a chapter or advanced topics that build upon the reading. Thus, we may not review all of the reading in class, but you remain responsible for this material for quizzes and exams. If you don't read prior to class and laboratory you should not be surprised if you become lost during the discussions and activities. You are expected to accept responsibility for your own learning.

Assessment

Ecological modeling requires active engagement and inquiry to learn. Therefore, material in class meetings is integrated with the laboratory exercises. The laboratories build in complexity allowing you to develop your skills with programming, mathematics, and ecological modeling.

Lecture work will be assessed following the scheme in Table 1. Please notice that the course grade is dominated by two exams that will cover the concepts and theory we discuss in the first part of the class. Additional assessments include in class participation, homework assignments, and a reading proposal. The participation score includes attending class prepared to engage with the material as well as actively participating in class activities and discussions.

Table 1: Lecture Assessment

Activity	**Course Weight (%)**
Participation	10
Homework Assignments (10 × 2% each)	20
Reading Proposal	10
Exam I	30
Exam II	30
total	100

Laboratory will be assessed using the scheme in Table 2. The laboratory exercises will culminate in a brief summary of the activities. I encourage you to work in small teams to complete the laboratories, but everyone will write their own summaries, as this will allow me to assess your individual work and written communication skills. The final course research project will be 45% of the laboratory grade.

Table 2: Laboratory Assessment

	Laboratory	**Weight (%)**
1	Getting Started with R	2.5
2	Practical Programming with R	2.5
3	Single State Variable Models	15
4	Single State Variable Models: Ricker Model and Chaotic Dynamics	5
5	Two State Variable Models: Resource-Consumer Dynamics	15
6	Three State Variable Models: Chains and Webs	15
7	Connecting Models and Data	5
	Final Project	
	Task I: Topic Selection	5
	Task II: Report	25
	Task III: Presentation	10
	total	100

University Resources and Policies of Concern

Disabilities

If you are a person with a disability and anticipate needing accommodations of any type for this course, you must first notify Disability Services (DePaolo Hall, http://uncw.edu/disability/), provide the necessary documentation of the disability, and arrange for the appropriate authorized accommodations. Once these accommodations are approved, please identify yourself to me in order that we can implement these accommodations.

Violence and Harassment

UNCW practices a zero-tolerance policy for violence and harassment of any kind. For emergencies, contact UNCW CARE at 910.962.2273, Campus Police at 910.962.3184, or the Wilmington Police at 911.

Academic Honor Code

The Department of Biology and Marine Biology and I strongly support the Academic Honor Code as stated in the "Student Handbook and Code of Student Life," and we will not tolerate academic dishonesty of any type. The UNCW Academic Honor Pledge is

> As a student at The University of North Carolina Wilmington, I am committed to honesty and truthfulness in academic inquiry and in the pursuit of knowledge. I pledge to uphold and promote the UNCW Student Academic Honor Code.

The University Learning Center

The University Learning Centers (ULC) mission is to help students become successful, independent learners. Tutoring at the ULC is NOT remediation: the ULC offers a different type of learning opportunity for those students who want to increase the quality of their education. ULC services are free to all UNCW students and include the following:

- Learning Services (University Studies) http://www.uncw.edu/ulc/learning/index.html
- Math Services http://www.uncw.edu/ulc/math/index.html
- Study Sessions http://www.uncw.edu/ulc/includes/StudySessions.html
- Supplemental Instruction http://www.uncw.edu/ulc/si/index.html
- Writing Services http://www.uncw.edu/ulc/writing/index.html

Cornerstone Pledge

I am an **engaged learner** in constant search of knowledge.

I foster **human dignity** through acts of civility and respect.

I maintain a distinguished character based on **truth**, **honesty**, and **integrity**.

I pursue **inner peace** by recognizing the significance of **spirituality**.

I demonstrate honorable **citizenship** through acts of **civic** engagement.

I embrace community by active **involvement** and **service**.

I lead a lifestyle that advances physical **health** and **emotional** well-being.

You can learn more about the Cornerstone Pledge and the values of the UNCW community at http://uncw.edu/communitystandards/cornerstone.html.