INTRODUCTION TO ECOLOGICAL MODELING: CONCEPTS, METHODS AND APPLICATIONS
M/W/F 10:30 – 11:20
W 12:30 – 2:20

https://uw.instructure.com

Professor: Tim Essington
Office Hours:
W 2:20 – 3:15 PM 136 FISH
Th 3:20 – 4:20 PM, 318B FISH

About the Course

This is a course about modeling (the process), not models (the product). As a consequence, you will be learning by doing in this course through in-class exercise and three projects. In-class exercises will familiarize you with the process of model evaluation, while the assignments are designed to expose you to the entire model-building process. To be prepared for this course, you should have prior coursework in calculus, statistics and ecology.

Contacting Instructors

There are two ways to send questions or comments:

> If you have a question about any course content, use the Discussion Board link on the canvas site.
>
> If you have a personal question that is not appropriate for sharing with the class, send a private message to me via canvas

In both cases, please only send queries that can be answered by a short message. Questions that require more in-depth responses should be made in person during office hours (see above). The discussion board and private messages will be checked daily, M – F. Generally, expect a response within 24 hours after it is checked.

Lectures

Monday and Wednesday lecture sessions are intended to give the necessary background material to conduct the weekly exercises. You'll learn the major concepts, the people who developed this field, and specific applications of varying modeling applications

Weekly Exercises and Lab Session

Weekly exercises are due on the following Monday at 10:30 am. Lab sessions are intended to get you practice using and interpreting models. You will need access to a computer with Microsoft Excel (or R, see below) installed to complete the exercises.

Skills session

Friday mornings will focus on developing particular skills through hands-on tutorials. We'll meet in the computer room on these mornings.

Readings

I'll provide optional readings for each week's topic for those seeking a fuller treatment. All readings will be available via the canvas site. For many weeks detailed lecture notes are posted on-line.

Assigments

In addition to the weekly work, there will be 3 additional assignments that will encourage you to think critically about models and to develop your own models. Assignments are due at the beginning of lecture on the due date.

Grading

Your final grade will be based on your weekly homework and class assignments

Weekly Homework: 150 (15 pts / week; 5 pts for in class portion, 10 pts for out of class portion); Projects: 150 (50 pts each).

The following lists the minimum scores needed to achieve each grade tier. This will be curved as needed.

Total Points	Grade
291	4
275	3.5
256	3
239	2.5
223	2
206	1.5
189	1
160	0.7

Late assignments are subject to a 10% / day penalty. Assignments submitted later than 3 days from the due date will not receive credit.**Holidays and weekend days are NOT excluded from the late penalty assignment**.

How'd you do that?

Although this course is not intended to provide detailed instruction about the mechanics of models, many students become interested in modeling and seek to learn more about how the models used in class actually work. I'll include a supplementary "How'd you do that" document to lab exercises that explain what's going on "under the hood".

Spreadsheets vs. R

Spreadsheets are an extremely useful tool for developing many models. Some students may prefer to use R for weekly exercises and class assignments. We will provide R programs to accompany each spreadsheet in weekly exercises and will provide support to students that choose to use R for assignments.

Course Schedule

	Date	Notes	Topics	Lab	Skills
M	1/07		Why do we Model? What is a Model? Process of Model Building	Model Development	Mastering Microsoft Excel
W	1/09				
F	1/11				
M	1/14		Population Models	Population Models	Programming in VB and R
W	1/16				
F	1/18				
M	1/21	*Martin Luther King Jr. Day*	Myths and Misconceptions about modeling and decision making; Sensitivity Analysis	Sensitivity Analysis	Implementing Monte Carlo Routines
W	1/23				
F	1/25				
M	1/28		Multi-species models	Competition and predation	Simulating Differential Equations
W	1/30				
F	2/1				
M	2/4	**Assignment 1 due**	Stochastic population models	Population Viability Analysis	Putting the “fun” in “function”
W	2/6				
F	2/8				
M	2/11		Ecosystem models	Compartment Models	Simulation Modeling in R
W	2/13				
F	2/15				
M	2/18	*Presidents Day*	Simulation Studies and Policy Evaluation Probability part I	Simulation Studies	** extra lecture **
W	2/20				
F	2/22				
M	2/25	**Assignment 2 Due**	Likelihood	Probability and Likelihood	Numerical Optimization Methods
W	2/27				
F	3/01				
M	3/4		Parameter Estimation 101; Bayesian Parameter Estimation	Parameter Estimation	Optimization in R
W	3/6				
F	3/8				
M	3/11		Modeling Behavior and Growth	Optimal Foraging Models	Bayesian Integration Methods
W	3/13				
F	3/15				
M	3/18	**Assignment 3 due**			

Optional texts

Otto, S.P and Day T. 2007. A biologist's guide to mathematical modeling in ecology and evolution. Princeton University Press. 732 pp.
Outstanding introductory text, with plenty of background information

Gotelli, N. 1995. A primer of ecology. Sinauer Associates. 206 pp.
A great review of the "classic" models in ecology.

Mangel, M. 2006. The Theoretical Biologist's Toolbox. Cambridge University Press.
Fairly advanced, but very thorough and informative

Hilborn, R. and Mangel, M. 1997. The Ecological Detective. Princeton University Press.
This is "must reading" for any quantitative ecologist, focusing on modeling selection and parameter estimation.

Bolker, B.M. 2008. Ecological models and data in R. Princeton University Press. This is essentially a more advanced version of Hilborn and Mangel, specifically tailored to the use of "R".

Academic Conduct Statement:

Plagiarism, cheating, and other misconduct are serious violations of the student conduct code. We expect that you will know and follow the UW's policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to UW regulations. More information, including definitions and examples, can be found in the Faculty Resource for Grading and the Student Conduct Code (WAC 478-120).