EEB 5301 **Spring 2017**

POPULATION AND COMMUNITY ECOLOGY

Tuesday and Thursday 12:30-1:45
Torrey Life Sciences 301
3 credits

Instructors:
Eldridge Adams; Pharm/Bio 205A; eldridge.adams@uconn.edu
Carlos Garcia-Robledo; Pharm/Bio 400A; carlos.garcia-robledo@uconn.edu
Erin Kuprewicz; Pharm/Bio 600A; erin.kuprewicz@uconn.edu

Textbooks (available at the UConn Bookstore):

Vandermeer, J. H., and D. E. Goldberg. 2013. *Population Ecology*. Princeton University Press, Princeton, N.J.

Mittelbach, G.G. 2012. *Community Ecology*. Sinauer Associates, Sunderland, Mass.

The course's HuskyCT site is available through: https://lms.uconn.edu/

Grades will be based on:

Exams (a midterm and a final) :	120 points each
4 problem sets :	20 points each
2 paper critiques :	40 points each
Total:	400 points

You will need a scientific calculator (one that supports logarithms and exponentiation) for some problem set questions, class exercises, and exams. For the problem sets, you will also need access to a computer to which you can download software from the internet, including R.
R is a free statistics and graphing package that runs on Windows, Mac, and Linux operating systems.

You may work in groups of up to three students on the problem sets. All members of the group must sign off on the product and will receive the same score. One goal of the problem set is to provide practice for exam problems, so each person should be sure that they understand the procedures and answers. Problem sets are due by the start of class. Late problem sets will be penalized and will not be accepted once the answer key is posted. Help from the instructor is not available after 5 P.M. the evening before the problem set is due.

The first half of the course, taught by Prof. Adams, will cover population ecology. The second half of the course, taught by Profs. Garcia-Robledo and Kuprewicz, will cover community ecology, including species interactions, biodiversity, and species coexistence.

1st half details: Population Ecology (with Prof. Adams)

The first half of the course focuses on the abundance and distribution of single species. The available introductory textbooks on population ecology (or population and community ecology), including Vandermeer and Goldberg (2013), are in agreement about a core set of mathematical models and underlying concepts that are foundational in this field. These are the exponential and logistic growth equations (including versions that are deterministic, stochastic, discrete, continuous, and with time-lags), complex dynamics (oscillations and chaos), life tables and projection matrices, and models of metapopulation dynamics. Most of these textbooks also include models that were developed specifically for plants, such as the self-thinning law. By the end of this section of the course, you will be able to solve problems (by hand, calculator, or with the R statistical package) using each of these models, to apply them to new cases, and to explain their usefulness and limitations.

We will go beyond the textbook in several important ways.

First, the examples in the textbook are rather thin. Actual examples of population ecology are quite interesting because the organisms are interesting and the ways their interactions drive population dynamics are intriguing and beautiful. For each of the major quantitative approaches, we will consider case histories in which field biologists have sought to evaluate how that approach illuminates population ecology.

Second, while density-dependent regulation is centrally important in population models, some ecologists see little evidence of regulation within the populations they study and several have argued that the emphasis placed on this concept is misguided. By the end of the population biology unit, you will have developed a well-reasoned view of the meaning of the term “population regulation,” and of the importance (or lack thereof) of this concept to field biologists.

Third, we will consider species distribution modeling, which has become centrally important to population ecology but is not covered in any of the basic textbooks. You will learn about the main concepts and approaches by using the R statistical package to fit species distribution models to real data. You will also learn about some potential problems in spatial analysis and how to handle them.

Fourth, ecologists may differ in how data should be interpreted and in what conclusions should be drawn from a particular study. Ecologist read one another’s papers critically; indeed, this is part of the review process that determines which papers should be published. Beginning with a group discussion in class and continuing with two written papers (one in each half of the course), you will analyze the strengths and limitations of published studies, and you will critically assess the conclusions drawn by the authors.

Details for the first half of the course (Population Ecology)

Date:		**Topic:**	**Assignments & main readings**
January			
17	Tu	(1) Introduction to population ecology	Komdeur and Pels 2005
19	Th	(2) Population growth: basic models (**Have the R package and RStudio running**)	V&G Chapter 1
24	Tu	(3) Age- and size-structured populations	V&G pp. 30-45 & Ch. 2 Appendix **Ungraded R exercises due**
26	Th	(4) Projection matrices	V&G pages 45-50
31	Tu	(5) Population regulation: concepts and theory	V&G pages 73-80
February			
2	Th	(6) Population regulation: evidence	Anderson and Burnham 2002 Fowler et al. 2006 **Problem set 1 due**
7	Tu	(7) Group discussion	**Paper discussion in class** Paper TBA
9	Th	(8) Time-delays, oscillations, and chaos	V&G Chapter 4 Tilman and Wedin 1991
14	Tu	(9) Spatial patterns	V&G pages 126-136
16	Th	(10) Species distribution models	**Paper critique due** Elith and Leathwick 2009
21	Tu	(11) SDM issues and examples	Barker and Barker 2012
23	Th	(12) Metapopulations	V&G pages 142-151 **Problem set 2 due** Gonzalez et al. (1998)
28	Tu	(13) Spatial dynamics and climate change Group discussion	Paper TBA
March			
2	Th	**Midterm Exam (take home)**	

V&G = Vandermeer and Goldberg (2013)

Additional optional readings will be listed for particular lectures.

Papers available for free from UConn computers. Enter the title in Google Scholar, and then click on UConn links.

Anderson, D. R., and K. R. Burnham. 2002. Avoiding pitfalls when using information-theoretic methods. Journal of Wildlife Management **66**:912-918.

Barker, D. B., and T. M. Barker. 2012. A discussion of two methods of modeling suitable climate for the Burmese Python, *Python bivittatus*, with Comments on Rodda, Jarnevich and Reed (2011). Bull. Chicago Herp. Soc. **47**:69-76.

Elith, J., and J. R. Leathwick. 2009. Species distribution models: ecological explanation and prediction across space and time. Annual Review of Ecology, Evolution, and Systematics **40**:677-697.

Fowler, N. L., R. D. Overath, and C. M. Pease. 2006. Detection of density dependence requires density manipulations and calculation of λ. Ecology **87**:655-664.

Gonzalez, A., J. H. Lawton, F. S. Gilbert, T. M. Blackburn, and I. Evans-Freke. 1998. Metapopulation dynamics, abundance, and distribution in a microecosystem. Science **281**:2045-2047.

Hijmans, R. J., and J. Elith. 2017. Species distribution modeling with R.
R vignette for the dismo package; available from
https://cran.r-project.org/web/packages/dismo/index.html

Komdeur, J., and M. D. Pels. 2005. Rescue of the Seychelles warbler on Cousin Island, Seychelles: the role of habitat restoration. Biological Conservation **124**:15-26.

Tilman, D., and D. Wedin. 1991. Oscillations and chaos in the dynamics of a perennial grass. Nature **353**:653-655.