

ECOL/BOT/WILD 8310 – POPULATION ECOLOGY (4 cr hrs)

FALL 2009

SYLLABUS

Class Times: Tues/Thur 9:30-10:45 (Ecology Rm. 117), Fri 10:10-12:05 (Ecology Teaching Lab)

Instructor: Dr. John Drake (Office: 133 Ecology, email: [jdrake@uga.edu](mailto:jdrake@uga.edu))

**Course description:** Advanced study of biological populations. Mathematical and evolutionary treatment of population growth and regulation, niche theory, life history evolution, natural selection, predator-prey dynamics, competition, and transmission of infectious diseases.

**Course objectives:** (1) In course lectures, students will be introduced to the basic concepts and ideas of population and evolutionary ecology; (2) Students will critically engage the primary literature through assigned readings and discussions; (3) In lab sessions, students will develop techniques for analysis of models and data. The weekly order of classes will roughly follow a schedule with the first class period a lecture, the second class period a group discussion of readings from the primary literature, and the lab session computer exercises aimed at developing analytical skills.

**Grading policy.** Homework will be assigned at the instructor's discretion and will be scored for completeness. Labs will be scored for completeness and correct answers. The final grade will be a weighted average of the following items using the plus/minus grading system:

10% first exam  
10% second exam  
30% final exam  
10% homework problems  
20% lab reports  
20% class participation

**Late assignment policy.** Any homework (generally rare) is due at the class meeting immediately following assignment. Lab reports are due at the exam following that section of the course, e.g., Labs 1-6 are due on 10/2, Labs 7-9 are due on 11/6 and Labs 10-11 are due at the Final Exam. Unless permission is obtained in advance, the earned score will be reduced by one letter grade for each day late.

**Missed class policy.** Unless permission is obtained in advance or appropriate paperwork is received (e.g., doctor's note), the instructor reserves the right to subtract 10% from the final grade for every class missed beyond three.

**Office hours & contact policy.** Office hours are by appointment; the primary means for out-of-class contact should be e-mail ([jdrake@uga.edu](mailto:jdrake@uga.edu)).

**Reading assignments.** The main text for this course is Ted J. Case, *An Illustrated Guide to Theoretical Ecology*, Oxford UP (2000). Class discussions will focus on readings from the primary literature. Assigned readings are to be discussed in the class period listed (*i.e.*, read Chapters 1 and 5 from the textbook before class on 8/25). Reading assignments for class discussions and computer lab exercises can be downloaded from the electronic Learning Commons.

**Official University Policy:** The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary. All academic work must meet the standards contained in *A Culture of Honesty*. Students are responsible for informing themselves about those standards before performing any academic work.

CLASS SCHEDULE

<i>Wk</i>	<i>Day</i>	<i>Date</i>	<i>Topic</i>	<i>Chapter</i>
SECTION I: SINGLE-SPECIES POPULATION DYNAMICS				
1	Tu Th Fri	8/18 8/20 8/21	Lecture: Introduction to population and evolutionary ecology Discussion: Lawton (1999) plus two of the following: Ghilarov (2001), Turchin (2001), Colyvan (2003), Lange (2005), O'Hara (2005) Lab 1: Introduction to R	
2	Tu Th Fri	8/25 8/27 8/28	Lecture: Population growth and regulation Discussion: Davidson & Andrewartha (1948), Turchin (1995) Lab 2: Population dynamics in continuous time	1,5  Appx 1,5
3	Tu Th Fri	9/1 9/3 9/4	Lecture: Individual variation and demographic stochasticity Discussion: Mangel & Tier (1994), Melbourne & Hastings (2008) Lab 3: Demographic stochasticity	2
4	Tu Th Fri	9/8 9/10 9/11	Lecture: Structured populations Discussion: Werner & Caswell (1977), Morris et al. (2008) Lab 4: Matrix models of structured populations	3,4  Appx 2
5	Tu Th Fri	9/15 9/17 9/18	Lecture: Complex dynamics Discussion: Dennis et al. (2001), Henson et al. (2001) Lab 5: Complex population dynamics	6
6	Tu Th Fri	9/22 9/24 9/25	Lecture: Spatial population dynamics Discussion: Holmes (1994), Klausmeier (1999) Lab 6: Estimating spread	16
7	Tu Th Fri	9/29 10/1 10/2	Lecture: Metapopulation dynamics Discussion: Levins (1969); Pulliam (1988); Hanski (1998) Lab: FIRST EXAM	
SECTION 2: EVOLUTIONARY ECOLOGY				
8	Tu Th Fri	10/6 10/8 10/9	Lecture: Life history evolution (Guest: Dr. Rich Shefferson) Discussion: Cole (1954), Reznick (2004) Lab 7: Life history evolution	7,8
9	Tu Th Fri	10/13 10/15 10/16	Lecture: Coevolution Discussion: Dawkins & Krebs (1979), Decaestecker (2007) Lab 8: Coevolution	
10	Tu Th Fri	10/20 10/22 10/23	Lecture: Niche theories Discussion: Hutchinson (1959), Pulliam (2000) Lab 9: Testing niche differentiation	
11	Tu Th Fri	10/27 10/29 10/30	Lecture: Natural Selection (Guest: Dr. Sonia Altizer) Discussion: Auguilar et al. (2005); Grant & Grant (2006) Lab: FALL BREAK	9
SECTION 3: INTERACTING POPULATIONS				
12	Tu Th Fri	11/3 11/5 11/6	Lecture: Consumer-resource dynamics Discussion: Leigh (1968); Krebs et al (1995); Stenseth et al. (1997) Lab: SECOND EXAM	11-13  Appx 4
13	Tu Th Fri	11/10 11/12 11/17	Lecture: Competition (Guest: Dr. Drew Kramer) Discussion: Tilman (1977), Fargione et al (2007) Lab 10: Host-Parasitoid Dynamics I	14
14	Tu Th Fri	11/17 11/19 11/20	Lecture: Host-parasite dynamics (Guest: Dr. Krisztian Magori) Discussion: Bartlett (1957), Rohani et al. (2002) Lab 11: Simulating seasonal epidemics	
15	Tu Th Fri	11/24 11/26 11/27	THANKSGIVING HOLIDAY THANKSGIVING HOLIDAY THANKSGIVING HOLIDAY	
16	Tu Th Fri	12/1 12/3 12/4	Lecture: Diversity & Stability Discussion: Lewontin (1969), May (1973), McCann et al. (1998) Lab: Review session	15
17	Tu	12/8	Lab: Exam Review session	
18	Tu	12/15	FINAL EXAM (8:00-11:00)	

## GOALS OF LAB SESSIONS

This course is intended to meet learning objectives at several levels. In weeks with lab sessions, students are introduced to particular topics or models in population ecology each of which is representative of a more general concept which will be applicable to other systems, other sub-disciplines (e.g., ecosystem ecology), and even other scientific fields and, finally, which is used to teach particular analytical skills or tools. Lectures, discussions, and lab exercises have been coordinated to introduce the student to an array of topics, concepts, and analytical skills that are important for both mastering population ecology and which may be useful in your research. The following table outlines these topics/concepts/tools and how they will be studied in the semester. **Students are encouraged to work in groups on these exercises.** Students are required to submit a lab report (pdf format) for each exercise.

Lab No.	Ecological Topic	General Concept	Tool
SECTION I: SINGLE-SPECIES POPULATION DYNAMICS			
1	Orientation		R environment for scientific computing
2	Population growth	Continuous-time models	Numerical solution of differential equations
3	Individual variation	Discrete-time models; stochastic vs. deterministic models	Markov chains
4	Structured populations	Systems of equations	Matrix algebra
5	Density-dependence	Complex dynamics and chaos	Nonlinear recursions
6	Spatial pattern formation	Discrete simulation	Cellular automata
SECTION 2: EVOLUTIONARY ECOLOGY			
7	Life history evolution	Game theory	Optimization
8	Coevolution	TBA	TBA
9	Niche theory	Spatially distributed dynamics	Stochastic simulation
SECTION 3: INTERACTING POPULATIONS			
10	Host-parasitoid dynamics	Population cycles and stability	Stability analysis
11	Ecological epidemiology	Environmental forcing	Bifurcation analysis