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

FALL 2007

SYLLABUS

Class Times: Tues/Thur 9:30-10:45 (Ecology Auditorium), Fri 10:10-12:05 (Ecology Teaching Lab)
Instructor: Dr. John Drake (Office: 133 Ecology.; jdrake@uga.edu)
Teaching Assistant: Jamie Sanderlin (Office: Forestry Building 4, rm. 325; jskvarla@uga.edu)

Course description: Advanced theory 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 theoretical population 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 theoretical models. The weekly order of classes will roughly follow this scheme 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 1-5 are due on 9/28, Labs 6 and 7 are due on 10/23 and Labs 8-10 are due at the Final Exam. Unless permission is obtained in advance, the earned score will be reduced by one letter grade for each late day.

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).

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 Chapter 1 from the textbook before class on 8/21). Reading assignments for class discussions and a manual for computer labs can be downloaded from WebCT. This is the only use of WebCT for this course.

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

Wk	*Day*	*Date*	*Topic*	*Instructor*	*Chapter*
			SECTION I: SINGLE-SPECIES POPULATION DYNAMICS		
1	Th	8/16	Lecture: Introduction	JD	
	Fri	8/17	Lab 1: Introduction to R	JD/JS	
2	Tu	8/21	Lecture: Population growth	JD	1
	Th	8/23	Discussion: Lewontin & Cohen (1969); Lutz et al. (2001); Savage et al. (2004)	JD	
	Fri	8/24	Lab 2: Introduction to Differential Equations	JD/JS	Appx 1,5
3	Tu	8/28	Lecture: Individual variation	BG	2
	Th	8/30	Discussion: (2005); Kendall & Fox (2002)	BG	
	Fri	8/31	Lab 3: Demographic stochasticity	JD/JS	
4	Tu	9/4	Lecture: Structured populations	JD	3,4
	Th	9/6	Discussion: Crouse et al. (1987); Tuljapurkar (1989); Menges (1990)	JD	
	Fri	9/7	Lab 4: Linear Algebra and the Leslie Matrix	JD/JS	Appx 2
5	Tu	9/11	Lecture: Density-dependence	JD	5,6
	Th	9/13	Discussion: Costantino et al. (1995), Dennis et al. (2001), Henson et al. (2001)	JD	
	Fri	9/14	Lab 5: Complex Dynamics	JD/JS	
6	Tu	9/18	Discussion: Hanski et al. (1996); Hanski (1998)	JD	
	Th	9/20	Lecture: Metapopulation dynamics	RP	16
	Fri	9/21	Lab: Help Session	JS	
			SECTION 2: EVOLUTIONARY ECOLOGY		
7	Tu	9/25	Lecture: Life history evolution	RP	7
	Th	9/27	Discussion: Cody (1966), Brown and Sibly (2006)	JD	
	Fri	9/28	Lab: FIRST EXAM	JD/JS	
8	Tu	10/2	Lecture: Spatial population dynamics	BG	
	Th	10/4	Discussion: Bjornstad et al. (1999); Molofsky & Ferdy (2005)	BG	
	Fri	10/5	Lab 6: Life history evolution (reading: Mangel & Clark 1988)		
9	Tu	10/9	Lecture: Evolution of aging	JS	8
	Th	10/11	Discuss.: Williams (1957); Kirkwood (2002); Bronikowski & Promislow (2005)	JD	
	Fri	10/12	Lab 7: Evolution of aging (reading: Partridge & Barton 1993)	JD/JS	
10	Tu	10/16	Lecture: Natural selection 1 (read paper: TBA)	SA	9
	Th	10/18	Lecture: Natural selection 2 (read paper: TBA)	SA	
	Fri	10/19	Lab: Help Session	JS	
			SECTION 3: INTERACTING POPULATIONS		
11	Tu	10/23	Lecture: SECOND EXAM	JS	11-13
	Th	10/25	FALL BREAK		
	Fri	10/26	FALL BREAK		
12	Tu	10/30	Lecture: Consumer-resource dynamics	JD	11-13
	Th	11/1	Discussion: Elton & Nicholson (1942); Krebs et al (1995); Stenseth et al. (1997)	JS	
	Fri	11/2	Lab 8: Interacting Populations I	JD/JS	Appx 4
13	Tu	11/6	Lecture: Competition	TBA	14
	Th	11/8	Discussion: Gause (1934); Tilman (1977, 1996); Fargione et al (2007)	JD	
	Fri	11/9	Lab 9: Interacting Populations II	JD/JS	
14	Tu	11/13	Lecture: Multi-species systems	JD	15
	Th	11/15	Discussion: May (1973), Adler et al. (2006)	JS	
	Fri	11/16	Lab 10: Help Session	JS	
15	Tu	11/20	Lecture: Directly transmitted disease	PR	
	Th	11/22	THANKSGIVING HOLIDAY		
	Fri	11/23.	THANKSGIVING HOLIDAY		
16	Tu	11/27	Lecture: Vector-borne disease	JD	
	Th	11/29	Discussion: Aaron & May (1982); Smith et al. (2007)	JS	
	Fri	11/30	Lab: Review session	JS	
17	Tu	12/4	No class		
	Th	12/6	Review Session	JD	
		TBA	FINAL EXAM	JS	

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.

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	Stochastic simulation
4	Structured populations	Systems of equations	Matrix algebra
5	Density-dependence	Complex dynamics and chaos	Solving nonlinear recursions
		Help Session	
	SECTION 2: EVOLUTIONARY ECOLOGY		
6	Life history evolution	Stochastic optimization	Stochastic dynamic programming
7	Evolution of aging	Deterministic optimization	Adaptive dynamics
		Help Session	
	SECTION 3: INTERACTING POPULATIONS		
8	Consumer-resource dynamics	Population cycles and stability	Systems of differential equations I: Stability analysis
9	Competition	Population cycles and stability	Systems of differential equations 2: Numerical solution
10		Help Session	