BIOS 4428 Population Dynamics & BIOL 6428 Population Dynamics

TR 12:30-1:45 | College of Computing 052

Instructors:
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Course description: This course examines the ecological factors that cause fluctuation and regulation of natural populations and emphasizes the utility of mathematical models to assess the dynamics of populations. Topics include demographic and environmental stochasticity, metapopulation dynamics, structured populations, the role of species interactions, and micro-evolutionary processes such as population genetics, quantitative genetics, and evolution of life histories. Classroom discussion of primary scientific literature in the form of journal articles will be a major component of the course. As scientists, you need to effectively read, share, and critique research. This course can fulfill a Biology elective. *(Students who have received credit for BIOL 4803 Population Biology may not take this course for credit.)*

Pre-requisite: Ecology (BIOS 2300 or BIOS 2310 or BIOL 2335 or BIOL 2337)

Course goals: By the end of this course, you should

1) Be able to explain ecological and evolutionary processes occurring at the population level, including
   - The factors influencing the dynamics of single species populations
   - The causes and consequences of variation in populations
   - Interspecific interactions between two populations of different species
2) Further your scientific skills, including
   - Evaluation of primary literature to critique experimental design, data presentation, and conclusions drawn from data
   - Identifying interesting questions and evaluating hypothesis tests
   - Interpreting and using mathematical models in biology
   - Presenting scientific ideas verbally, visually, and in writing

Materials:

- Stevens, H. 2021. Primer of Ecology at https://hankstevens.github.io/Primer-of-Ecology/
- R or RStudio downloadable from https://cran.r-project.org/ (more information will be provided on Canvas to guide you through using R)
- Primary literature articles distributed through Canvas

Course Assessment:

BIOS 4428:

In-class exercises	20 %
Discussion Participation	10 %
Discussion Pre-class Questions	5 %
Project: "Blog Post"	15 %
Bi-Weekly Reflections	10 %
Exams (2)	25 %
Final Exam	15%

BIOL 6428

In-class exercises	15 %
Discussion leading (Grads only)	10 %
Discussion Participation	10 %
Discussion Pre-class Questions	5 %
Project: "Blog Post"	15 %
Bi-Weekly Reflections	10 %
Exams (2)	20%
Final Exam	15%

In-class exercises: These exercises will be undertaken in-class (typically in small group)s and graded for effort and accuracy. Success in this class depends on attendance and active participation. 100% attendance is expected. In general, we do not excuse students from these daily assignments, and will arrange for independent completion and submission after your absence. Please come talk to us if you have opportunities (interviews, etc) that are not covered by official absences so that we can discuss options.

Discussion Leading: Each 6428 student will be expected to lead class discussion once during the semester on the assigned primary research article for that day. You will sign up for an article/date during the first week of class. Discussion leading involves giving a short summary of the article to the class (10 minutes max), providing several questions or prompts for the class to discuss, and fostering an inclusive and evidence-based discussion in the classroom. We are available to help you prepare for this assignment, and we expect you to meet with the instructor lead for your assigned discussion day (see schedule below) in the week before you lead discussion (or earlier!). Leading discussion takes careful preparation, planning, and practice to do well. The Discussion Leading grade will be based on three components: your accurate and succinct summary of the paper(s); the quality of your discussion questions in terms of their ability to generate and sustain discussion; and additional insight material to help the class understand the research, such as information on the study system, how it connects to ideas from class, diagrams to explain the experimental design, information about the statistical approach, etc..

Discussion Participation: Regular and insightful participation in classroom discussions is expected from everyone who is not actively leading the discussion. Discussion participation is 10% of your final grade:

A = regular participation, usually well thought out and useful contributions (10%);
B = regular participation, sometimes useful, sometimes not (8%);

C = occasional participation, but generally useful (6%);
D = occasional participation, but generally non-substantive, adding little new information (4%);
F = present by rarely contributed (2%) or absent (0%).

We reserve the right to assign + or – grades (e.g., B+ may equal 9%). Discussion participation will be updated every week on Canvas / PostEm.

Discussion Pre-class Questions: Each student is expected to fully participate in the discussions led by their classmates. To ensure this, for each peer-led discussion day you will prepare a detailed question or idea to submit on Canvas before coming to class. These Canvas assignments will be 5% of your course grade as part of participation.

Blog Post: You will select a topic of clear and obvious connection to this course and write an engaging summary in the style of a science communication blog post. We will provide examples and a rubric during the first week of class. Your topic should be structured around a central question about population dynamics and should provide a well-cited summary of the relevant research addressing this question. Speculative ideas for new research are welcome as long as they are substantiated with published evidence.

Bi-weekly Reflections: These bi-weekly assignments will explore connections to the content, your personal experiences, and class dynamics. Beyond the content-specific questions, reflections help deepen your learning, your personal agency, and your ability to fail forward. You will submit your reflections in Canvas.

Exams: Two written exams will be completed in class. These exams will focus on your comprehension of the concepts from the text and their application to the journal articles. The final exam is non-cumulative and will follow a similar format and be given during our Institute-assigned final exam period.

Covid-related Concerns

These are unprecedented times. The best way for us to learn in this class is face-to-face, but if public health concerns require a shift to an online format then we will support your learning remotely. We may need to shift to remote learning depending on the health status of individuals in our classroom. Our expectation is that everyone who is eligible will be vaccinated and boosted; vaccination significantly reduces likelihood of severe symptoms, including from the Omicron variant of SARS-CoV-2. Because the Omicron variant can be spread by vaccinated individuals, we also expect that everyone who is able to will wear a mask, correctly covering mouth and nose, when indoors. Both of these expectations are based on current CDC guidance. As that guidance is updated, we will communicate any new expectations. Weekly asymptomatic surveillance testing should be part of everyone's regular routine, regardless of vaccination status (https://mytest.gatech.edu/).

Excused Absence Documentation

Typically, all excused absences are cleared through the Institute. Given the ongoing pandemic, we expect that you may need to join the class remotely due to Covid-19 exposure and/or quarantine. Please communicate with us promptly and we will share a BlueJeans link to participate in class. If you miss multiple classes because of illness (Covid-19 or other) or emergency, you should work with the Dean of Students office to provide documentation of your excused absence (studentlife.gatech.edu, 404-894-6367, select "request assistance" to communicate with the Dean's office), which they will then communicate with us. Because their communication pipeline can be quite slow (weeks), we encourage you to let us know of your absence and anticipated return to school so we may make appropriate accommodations for missed assignments and test(s).

Inclusivity & Diversity

In an ideal world, science would be objective. However, much of science communication is subjective and is historically built on a small subset of privileged voices. In this class, we will make an effort to read papers from a diverse group of scientists and stakeholders, but limits still exist on this diversity. We acknowledge that it is possible that there may be both overt and covert biases in the materials due to the lens with which they were written. Please contact the instructors (in person or electronically) with concerns, or to bring suggestions to improve the quality of the course materials. Furthermore, we strive to create a learning environment for our students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, and ability). To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let us know.
- We are all on the continuum of learning about diverse perspectives and identities. If a particular topic or something that was said in class (by anyone) makes you feel uncomfortable, please talk to us about it.
- As a participant in course discussions, you should strive to honor the diversity and perspectives of your classmates.

Laptop/cell phone policy:

With the exception of classes when we need computers to complete in-class work, the general expectation is that you will not have your devices out during class. Notetaking during lectures, activities, and discussion is on the whole more effective for learning and synthesis when using pen and paper. We all have emergencies and things that come up: If you are in a situation where you are expecting a call, please quietly excuse yourself to the hallway to take the call.

Academic Integrity: Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit www.catalog.gatech.edu/policies/honor-code/ or www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing* on a quiz, exam, or assignment will

be reported to the Office of Student Integrity, which will investigate the incident and identify the appropriate penalty for violations.

* Plagiarism is the unattributed use of the words or ideas of others. If you have any questions regarding your assignments and plagiarism, we encourage you to consult with any of us *before you submit* the assignment.

Learning Accommodations: If you have learning needs that require accommodations for you to succeed in this course, please contact The Office of Disability Services as soon as possible (disabilityservices.gatech.edu) to make an appointment to discuss your needs and to obtain an accommodations letter. We will arrange to accommodate your learning needs based on their recommendations.

Course Schedule (subject to modification)

Date	**Day**	**Who**	**Topic**	**Focal Reading**	**Paper for Discussion**
11-Jan	T	CS	Intro to Population Dynamics	Stevens Ch 1: Theory in Ecology	
13-Jan	R	LG	Designing ecological studies		Heffner et al 1996
18-Jan	T	CS	Density-independence 1	Stevens Ch 3: Simple density-indep growth	
20-Jan	R	CS	Density-independence 2		Bouley et al 2021 wild dogs reintroduced to Gorongosa
25-Jan	T	LG	More demography	Stevens Ch 4: Density-indep demography	
27-Jan	R	LG	Density-dependent growth 1	Stevens Ch 5: Density-dependent growth	
28-Jan	*F*		*Blog Post Topic due*		
1-Feb	T	LG	Density-dependent growth 2		TBD on Canvas
3-Feb	R	CS	Populations in space 1	Stevens Ch 6: Populations in space	
8-Feb	T	CS	Population in space 2		Armstrong et al 2021 Cons Bio metapop patch dynamics
10-Feb	R	-	**Exam 1**		
15-Feb	T	CS	Population structure and inbreeding 1	Coop: Allele and genotype frequencies	
17-Feb	R	CS	Population structure and inbreeding 2		Kardos et al 2018 Nature inbreeding in wolf population conservation
22-Feb	T	CS	Selection models 1	Coop: One Locus Selection Models & Mut-Seln Balance	
24-Feb	R	CS	Selection models 2		Cummings et al 2002 Ecol Applications Fecundity selection in sunflowers Discussion Leader: ____ (optional slot)
1-Mar	T	LG	Lotka-Volterra models of competition and mutualism	Stevens Ch 7: Direct competition and mutualism	
3-Mar	R	LG	Lotka-Volterra models of competition and mutualism		TBD on Canvas Discussion Leader: ____
8-Mar	T	LG	Enemy-victim interactions: predator-prey	Stevens Ch 8: Consumer-resource interactions	

Date	Day	Who	Topic	Focal Reading	Paper for Discussion
10-Mar	R	LG	Enemy-victim interactions: predator-prey		TBD on Canvas Discussion Leader: ____
15-Mar	T	LG	Enemy-victim interactions: host-parasitoid	Stevens Ch 9: Host-parasitoid relations	
17-Mar	R	-	**Exam 2**		
22-Mar	T	-	SPRING BREAK		
24-Mar	R	-	SPRING BREAK		
29-Mar	T	LG	Disease 1	Stevens Ch 10: Disease	
31-Mar	R	LG	Disease 1		TBD on Canvas Discussion Leader: ____
1-Apr			*Blog Post draft due*		
5-Apr	T	CS	Applied Ecological Genetics		
7-Apr	R	CS	Applied Ecological Genetics		TBD on Canvas Discussion Leader: ____
12-Apr	T	CS	Quantitative Genetics 1	Coop: The phenotypic resemblance between relatives	
14-Apr	R	CS	Quantitative Genetics 2		TBD on Canvas Discussion Leader: ____
19-Apr	T	LG	Conservation Population Biology		
21-Apr	R	LG	Conservation Population Biology		TBD on Canvas Discussion Leader: ____
22-Apr			***Blog Post due***		
26-Apr	T	Both	Synthesis		
5-May	R	-	11:20am – 2:10 pm **Final exam**		