Theoretical Ecology (Biol 599/765)

Location: Jones 214

Time: T and TH 2:50-4:05pm

Instructor: Dr. Tad Dallas (tdallas@mailbox.sc.edu)

Office: 601 EWS (Coker is the main building, and EWS is the other side of the elevators)

Drop-in hours: Th from 1:00 - 2:40pm

Course Overview:

This course will familiarize students with the central concepts of theoretical ecology, providing an underlying mathematical basis to the processes that govern natural systems. Emphasis will be placed on population and community ecology, exploring (mostly) discrete time models of population and community dynamics, with clear links to empirical data.

Course Goals:

Over the course, it is expected that students gain

- an understanding of theoretical concepts and their relationship to natural systems
- a confidence around applying analytical and simulation based approaches to ecological data
- an ability to read and understand primary literature

Textbook:

We will be reading through the *Illustrated Guide to Theoretical Ecology* by Ted J Case. ISBN: 9780195085129. This textbook is required.

Syllabus Subject to Change:

Changes to the syllabus may be made during the semester. The most up-to-date and current syllabus will always be available on the course website (on Github).

list of due dates:

- February 9: first homework due
- February 16: final project proposal due
- March 2: first paper summary due
- March 2: second homework due
- March 30: third homework due
- April 20: second paper summary due
- April 27: fourth homework due

- May 2: final project turned in and presented

Grading

There will be a total of 500 points, consisting of 4 assignments, a paper summary, some attendance/participation points, and a final project.

Undergraduate-level grading

Item	Points	Total
Assignments	4 x 75	300
Attendance/Participation	50	50
Paper summary	50	50
Final exam	100	100

Graduate-level grading

Item	Points	Total
Assignments	4 x 50	200
Attendance/Participation	50	50
Paper summary	2 x 50	100
Project	100	100
Final exam	50	50

Assignments:

All assignments are due by immediately before the start of class on the day indicated. Assignments should be submitted as instructed. Assignments are not collaborative, and I expect that each student will complete the assignment independently.

Late Assignments:

All assignments are expected to be electronically submitted by the due date. I will not accept any assignment that is submitted after the deadline and the assignment will receive the grade of 0. This course is an upper-level class and you are expected to work at the appropriate level and be responsible for your work. All deadlines are posted with the syllabus or any changes will be announced ahead of time.

Attendance:

Much of the material presented will not be available if you aren't in class to hear it. You should come to class. If you do not, you may struggle. Part of the class will be discussing relevant papers. If you do not

participate in paper discussions, clearly demonstrating that you have read and understand the nuances of the work, this will affect your grade. Attendance and participation will be worth 50 points.

Paper summaries:

The goal of the paper summary is to get you reading and understanding theory-heavy research published in peer-reviewed journals. I expect that these papers will dive deeper into some aspect of theoretical ecology that we covered in class, and could be tailored to your own personal interests. If you need help finding papers, do not hesitate to reach out. I really like the journal *Theoretical Ecology*, but you can find theory-heavy papers in many journals, including *Proceedings of the Royal Society B*, *American Naturalist*, and *PNAS*. These papers must include a model and be theory-heavy, meaning that it is not simply using a fancy statistical approach to a scientific question, but actually derive some of their results from an underlying theoretical model (we will cover the difference between statistical and phenomenological modeling in the first week, but feel free to send me a message for clarification). Undergraduates will do one of these paper summaries (about a page long, clearly presenting the question, methods, and results, paying attention to tying it into what we've learned in class). Graduate researchers will do two of these (1-2 pages, more detailed in terms of model insight and structure - read the supplemental material of the article, as I want you to know the article back to front).

The first paper summary is due before March 2, the second before April 20.

Project:

Graduate researchers in the course will do a course-long project. The project will be a demonstration of your learning and allow you to use the new tools and concepts you have acquired in the course. This could take many forms, including the analysis of a commonly used model in ecology, a review of some application of theory and empirical data (e.g., the theory of species-area relationships), and many others.

More information on the final project and its components are provided below. The three core parts are 1) the proposal, 2) the implementation, and 3) the presentation

The project is worth 100 points

Final project proposal

Please prepare a short proposal on your final project idea by February 16. The proposal should include:

- Title
- Description of the project (at least half of a page)
- Potential roadblocks, data issues, etc.

Project Guidelines (100 points total)

proposal

- 10pts Proposal, turned in on time, with clear background and outline of questions

implementation

- 70 pts Project Substance: Objectives, Code, Visualization.
  - 20pt: project is correct scope, addresses the question, and has tangible output
  - 20pt: project is engaging and well researched
  - 10pt: project is free from clear errors in analysis or interpretation
  - 10pt: visualizations and tables (if present) compliment the overall findings
  - 10pt: references are included and appropriate.

presentation

- 20pts Final presentation
  - 10pt: presentation is engaging, structured well, and highlights project findings
  - 10pt: style, handling questions, etc.

Final exam:

The final exam will be worth 50 points (100 points for undergraduates), consisting of a mixture of coding and high-level conceptual questions.

The final exam will be **Tuesday, May 2 - 4:00 pm**.

Academic honesty

Cooperation has a limit. You should not copy your code or answers directly with other students. Feel free to discuss the problems with others, but write your own solutions. Penalties for cheating are severe – they range from a zero grade for the assignment or exam up to dismissal from the University, for a second offense. Rather than copying someone else's work, ask for help. You are not alone in this course! If you invest the time to learn the material and complete the projects, you won't need to copy any answers.

You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation.

The first tenet of the Carolinian Creed is, "I will practice personal and academic integrity."

Diversity and inclusion

The university is committed to a campus environment that is inclusive, safe, and respectful for all persons, and one that fully embraces the Carolinian Creed. To that end, all course activities will be conducted in an atmosphere of friendly participation and interaction among colleagues, recognizing and appreciating

the unique experiences, background, and point of view each student brings. You are expected at all times to apply the highest academic standards to this course and to treat others with dignity and respect.

Accessibility, disability, and triggers

I am committed to ensuring course accessibility for all students. If you have a documented disability and expect reasonable accommodation to complete course requirements, please notify me at least one week before accommodation is needed. Please also provide SDRC

https://sc.edu/about/offices_and_divisions/student_disability_resource_center/

documentation to me before requesting accommodation. Likewise, if you are aware of cognitive or emotional triggers that could disrupt your intellectual or mental health, please let me know so that I can be aware in terms of course content. Diversity, Ethics, and the Carolinian Creed [credit to Dr. David Moscowitz] This course works to foster a climate free of harassment and discrimination, and it values the contributions of all forms of diversity. The decision to enter university and pursue advanced study is a choice that entails commitment to personal ethics expressed in the Carolinian Creed (www.sa.sc.edu/creed): "I will discourage bigotry, while striving to learn from differences in people, ideas and opinions." Likewise, the Student Code of Conduct (STAF 6.26 (http://www.sc.edu/policies/ppm/staf626.pdf) stresses, "The University of South Carolina strives to maintain an educational community that fosters the development of students who are ethical, civil and responsible persons."

Title IX and gendered pronouns

This course affirms equality and respect for all gendered identities and expressions. Please don't hesitate to correct me regarding your preferred gender pronoun and/or name if different from what is indicated on the official class roster. Likewise, I am committed to nurturing an environment free from discrimination and harassment. Consistent with Title IX policy, please be aware that I as a responsible employee am obligated to report information that you provide to me about a situation involving sexual harassment or assault.

Disability services

Student Disability Resource Center (http://www.sa.sc.edu/sds/): The Student Disability Resource Center (SDRC) empowers students to manage challenges and limitations imposed by disabilities. Students with disabilities are encouraged to contact me to discuss the logistics of any accommodations needed to fulfill course requirements (within the first week of the semester). In order to receive reasonable accommodations from me, you must be registered with the Student Disability Resource Center (1705 College Street, Close-Hipp Suite 102, Columbia, SC 29208, 803-777-6142). Any student with a documented disability should contact the SDRC to make arrangements for appropriate accommodations.

Student Success Center

In partnership with UofSC faculty, the Student Success Center (SSC) offers a number of programs to assist you in better understanding your course material and to aid you on your path to success. SSC programs are facilitated by professional staff, graduate students, and trained undergraduate peer leaders who have previously excelled in their courses.

SSC services are offered to all UofSC undergraduates at no additional cost. You are invited to call the Student Success Hotline at (803) 777-1000, visit the SSC website (www.sc.edu/success), or stop by the SSC in the Thomas Cooper Library on the Mezzanine Level to check schedules and make appointments.

Counseling Services

Counseling Services (https://sc.edu/about/offices_and_divisions/student_health_services/medical-services/counseling-and-psychiatry/index.php): The University offers counseling and crisis services as well as outreach services, self-help, and frequently asked questions.

Mental Health

If stress is impacting you or getting in the way of your ability to do your schoolwork, maintain relationships, eat, sleep, or enjoy yourself, please reach out to any of our mental health resources. Counseling & Psychiatry offers individual and group counseling and psychiatric services. You can schedule an appointment at (803) 777-5223 or on MyHealthSpace.

Interpersonal Violence

Interpersonal violence - including sexual harassment, relationship violence, sexual assault, and stalking - is prohibited at UofSC. Faculty, staff, and administrators encourage anyone experiencing interpersonal violence to speak with someone, so they can get the necessary support and UofSC can respond appropriately. If you or someone you know has been or is currently impacted by interpersonal violence, you can find the appropriate resources at the Stop Interpersonal Violence (http://www.sc.edu/stopsexualassault) website.

Technical support

If you have problems with your computer, technology, IT-related questions, support, including Blackboard, please contact the Division of Information Technology (DoIT) Service Desk at (803) 777-1800 or submit an online request through the Self-Service Portal (https://scprod.service-now.com/sp) or visit the Carolina Tech Zone.

The Service Desk is open Monday - Friday from 8:00 AM - 6:00 PM (Eastern Time). If you are located in the Columbia, SC area, the Thomas Cooper Library at UofSC has computers for you to use in case you encounter computer issues/problems. If you are not located in the Columbia, SC area, most regional campuses and public libraries have computers for public use.

Schedule

Week	Topic	Chapter(s)
1	Course logistics + Background	1
2	Population growth and individual variation	1-2
3	Age and stage structure	3-4
4	Constrained population growth	5-6
5	Life history tradeoffs	7
6	Evolutionary theory of aging	8
7	Density-dependent selection	9
8	Resources and predation	10-11
9	Spring break	
10	Predation and competition	12 & 14
11	Multi-species communities	15
12	Metapopulations	16
13	Disease	–
14	Macroecological scaling	–
15	Wrap up and flex time	–
16	Grad project presentations	
	Final exam: Tuesday, May 2 - 4:00 pm	