Ecological Dynamics
Graduate Syllabus
(QSB/ES 256)
Fall, 2019

Lecture time:	Lecture: MW 3-4:15
Lecture location:	Classroom 110

Instructor: Justin D. Yeakel (jdyeakel@gmail.com)
Science and Engineering Bldg., Rm. 288
Office hours: MW 1-2

I. **Course Description:** This course fulfills a credit for the QSB and ES graduate student, and provides a survey of theoretical ecology, involving a tour through population dynamics, stochastic processes, and network ecology. Both analytical and numerical (computational) approaches will be used to build and examine dynamic models, as well as to assess the role of theoretical vs. empirical approaches to understand ecological processes. A significant portion of the course will be focused on designing, analyzing, and synthesizing an individually-chosen research topic in ecological theory. Students should have a basic understanding of, or previous introduction to the fundamentals of ecology as well as calculus. *Letter Grade or S/U.* This a 4-unit course.

II. **Criteria for Undergraduate Enrollment**: Advanced upper-division undergraduate students may benefit and enjoy the course offerings, however their enrollment in the course is contingent on a sufficiently advanced understanding of basic ecological principles and mathematical tools. In order to enroll into the course, undergraduate students must have taken an Introduction to Biology course (BIO 001 or equivalent) and Fundamentals of Ecology (BIO 148 or equivalent), in addition to Calculus I (MATH 011 / 021 or equivalent), and demonstrate satisfactory knowledge of basic ecology and calculus in accordance with the instructor's expectations for the course.

III. **Course Goals and Outcomes:**

a. ***Course Goals:***

- Become familiar and comfortable with basic theoretical models in ecology and understand how these models are used to gain information about biological systems
- Interpret the strengths and weaknesses of theoretical models
- Learn how to interpret models both mathematically and graphically
- Learn how to formulate your own ecological questions into the framework of a theoretical model
- Become comfortable with the basic layout and implementation of code in a programming environment. Students will gain greater exposure to learning how to explore theoretical models with code during the Discussion sections.

b. ***Learning Outcomes:*** At the end of the course, students should be able to:

General Learning Outcomes

- Critically analyze ecological models
- Know the basic operations of the R programming language
- Analyze the graphical output of theoretical models
- Formulate their own research interests via a mathematical or computational model

This course connects to the QSB learning outcomes by:

- **Quantitative and Systems Biology (PLO 1):** Providing a foundational understanding of theoretical models used to examine the quantitative traits of populations and communities. Establishing a basic understanding of probability theory to explore stochastic population and community dynamics. Emphasizing the formulation of theories/concepts in a programming environment. Exploring and modified classical models via programming to gain intuition and understanding of the model at hand.
- **Communication (PLO 3):** Designing, evaluating, synthesizing, and reporting on an individually-chosen topic in theoretical ecology. The final result of this research topic will be a written report in the format of a chosen peer-reviewed publication, as well as a verbally-communicated presentation of the design and results of the project. Throughout the latter half of the course, students will communicate their ideas and preliminary results with each other to refine approaches/conclusions of the final project, as well as the best way to communicate results.
- **Scholarship and Research Ability (PLO 4,5):** Providing a Discussion section where topical papers in quantitative ecology are read, understood, and dissected.

This course connects to the ES learning outcomes by:

- **Major Concepts and Principles:** Providing a fundamental understanding of the essential processes used to construct theoretical models of populations and communities with an emphasis on environmental implications. Establishing connections between environmental and conservation-oriented processes (e.g. land use changes) to their potential ecological impacts through the lens of mathematical methods in biology. Emphasizing the links between population/community dynamics and human resource use.
- **Applications and Analysis of Tools and Data:** Describing, analyzing, and critically evaluating the benefits and drawbacks of different ecological models in qualitatively or quantitatively understanding dynamics at the individual-, population-, and community-scale. Emphasizing the confrontation between models and empirically-derived data, as well as the difficulties inherent to mapping theoretical observations to those made from observational or experimental data.
- **Communicate Environmental Science Issues to a Wider Community:** Building, exploring, and communicating an individually-chosen theoretical research topic with emphasis on communicating the problem, design, and results in a way that is approachable to a non-scientist. The final project will require students to write up their self-chosen question/methods/results/discussion in the format of a peer-reviewed publication, as well as present their results to the rest of the class. Emphasizing communication with peers while constructing and exploring a research topic during the second half of the course.

IV. **Format and Procedures:**

1. This course is structured as follows: 2 1 hour and 15 minute lecture per week. Lectures will be interactive, involving both formal lecturing, discussions, and group exploration.
2. A final project will be chosen during the semester, and will involve original research by the student. Instead of a ‘final exam’, the student will engage in a mini-symposium where he/she will present their results, as well as a description of their results/findings. The grade for this project will be based on both the implementation of the project and active participation in the class.

V. **Course Requirements & Grading Procedures:**

a. ***Class Attendance and Participation Policy***:
Students are expected to attend all lectures. It has been shown that a student's performance in a course is ***closely*** coupled to their attendance.

b. ***Required and Supplemental Readings***:

Required Textbook: *Readings will be provided on the course website.*

Course Website: http://jdyeakel.github.io/teaching/ecodyn/
Information, lectures, notes, and important dates/alerts related to the course will be posted here.

c. ***Course Assignments and Projects:***
Assignments (including homework, final project summary, and report) should be handed in on time. Late assignments will only be accepted that calendar week and will automatically receive one letter grade lower.

Homework Assignments: Practice assignments will be occasionally assigned in class and consist of both problem sets in theoretical methods and short coding projects that will introduce students to exploring ecological theory in a simple coding environment.

Final Project: Each student will create a project during the course of the semester. These will be original research projects, and preferably deal with a subject that the student is interested in. These projects will necessarily have to be completable during the time period of the course. The student will first submit a summary of what the project aims to accomplish, and will finish with a presentation to the class detailing the findings of their project and a summary of their methods and results. The project will be graded on its originality, creativity, and findings. Both mathematical derivations and/or computer code will have to be provided in the appendices of the final report.

d. ***Grading***: Your final grade will be based on: lecture attendance/participation (10%), homework assignments (40%) and the final project (50%).

Letter Grading Scale: A: (90-100%); B: (75-90%); C: (65-75%), D: (50-60%), F: (<50%)

VI. **Academic Integrity:** Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty.

a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy (http://studentlife.ucmerced.edu/what-we-do/student-judicial-affairs/academicy-honesty-policy). Any work submitted by a student in this course for academic credit will be the student's own work or clearly identified group work.

b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied ***will both automatically receive a zero for the assignment***. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

d. Examples of academic dishonesty include:
    - using unauthorized materials during an examination
    - plagiarism - using materials from sources without citations
    - altering an exam and submitting it for re-grading
    - using false excuses to obtain extensions of time or to skip coursework

e. Take responsibility for honorable behavior. Collectively, as well as individually, make every effort to prevent and avoid academic misconduct, and report acts of misconduct you witness to me.
    - When an instructor specifically informs students that they may collaborate on work required for a course, the extent of the collaboration should not exceed the limits set by the instructor.
    - Know what plagiarism is and take steps to avoid it. When using the words or ideas of another, even if paraphrased in your own words, you must cite your source. Students who are confused about whether a particular act constitutes plagiarism should consult the instructor who gave the assignment.
    - Know the rules --- ignorance is no defense. Those who violate campus rules regarding academic misconduct are subject to disciplinary sanctions, including suspension and dismissal.

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations required for student with disabilities. Requests for academic accommodations are to be made during the first 3 weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations. The instructor will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please speak with the instructor during the 1st week of class regarding any potential academic.