Population Ecology

(Biology 471 / 571)

--- Winter 2022 ---

Lecture / discussion-
Time: *TR 12:00pm – 1:20pm*
Place*: 253 STB*

Computer Lab
Time: *T 2:00pm – 3:50pm*
Place*: 112 HUE*

Instructor Info -

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Overview

All organisms are part of a population regardless of whether it is a Douglas Fir, a coyote, a mosquito, or a bacterium. Populations are simply defined as collections of individuals of the same species. Population ecology is the study of the size, distribution, and dynamics of populations and their underlying processes. This course will examine the dynamics of individual populations but then also consider how multiple populations behave across landscapes and how interactions with other species impact populations. Afterall, populations and species do not exist in a vacuum; they are embedded in whole ecosystems. This course will focus on the underlying theories of population ecology (via mathematical models) but will also highlight how population dynamics underlies important outcomes for humans too, such as species responses to climate change, conservation biology, pest control, and – yes – disease dynamics. The computer lab portion of the class will give you hands-on experience building and interpreting a variety of population models, while also building widely transferable quantitative skills.

Learning Objectives

By successfully completing this course, students will be able to:

- explain central ecological theories about which mechanisms influence the distribution and abundance of individual in populations.
- apply simple mathematical models to describe demographic properties in populations and estimate population growth.
- understand and apply demographic analyses, survivorship curves, and basic models of population dynamics.
- compare different types of interactions between species and their consequences for population dynamics
- summarize how populations change in time and space.
- synthesize and interpret ecological data quantitatively and visually
- simulate population dynamics using R statistical software, and visualize results in a high quality html reports using Markdown
- critically evaluate primary literature in the area of population ecology

Course Materials

We use parts of two textbooks, both available electronically:
1. Vandermeer, John H., and Goldberg, Deborah E. 2013. *Population Ecology : First Principles - Second Edition. (hereafter referred to as "VanGold") available as* E-book via UO. (check library website)
2. Stevens, H. 2009. *A Primer of Ecology with R*. available as pdf on Canvas
In addition to these textbooks, there will be required readings posted from the primary scientific literature. These readings will either be available for download as pdf files or accessible for free over the internet with UO access. ***(No textbook or course packet from bookstore required)***

Assignments & Grading

Grading Scheme

- 40% Midterm Exams (2 x 20%)
- 20% Computer exercises
- 20% Lab projects
- 10% Paper reviews
- 10% Discussion participation

There will be no curve applied (e.g. everyone can possibly get an A).
The assignments for this course are designed to encourage thinking about the material in different ways, while building critical-thinking skills for evaluating scientific studies and practical quantitative skills.

Exams (40%). There will be two exams in this class, either in-person or take-home (t.b.d.). The purpose of the exams is to instigate deeper thinking about the course topics and to demonstrate your progress in understanding the material. I will discuss in greater detail in class what the exams will be like, but in general they will be centered more on your conceptual understanding of the material rather than details of the mathematical models.

Computer exercises (20%). For the first six weeks of class, we will complete worksheets in the computer lab that guide you through implementation of different population models using R software.

Lab Project (20%). Students will conduct a "project" that builds on what has been learned during the computer lab. There will be time available to work on this project during several lab periods. Details of the expectations will be distributed and discussed in the first week or so of class. The projects will be presented to the class as a presentation in the final week of class.

Paper reviews (10%). Each week you will be asked to write a short review of a paper from the primary literature that is relevant to that week's topic. The goals are threefold: (1) to engage more deeply with the material and prepare for class discussions, (2) to learn how to critically evaluate primary scientific work, and (3) to practice writing about scientific ideas. **I will post a separate template for these reviews** to prompt our thinking about different aspects of the papers. All students will complete a review each week and one pair of students will take the lead on guiding discussion of the paper with participation from the whole class.

Discussion participation (10%). We will all get the most out of this class if everyone participates. During the class period we will work our way through the readings in order to better understand the concepts (for book chapters) and the context of the research and flaws and strengths (for primary articles). Participation is very important in a discussion-centered course such as this, as it is for science generally (in graduate school and beyond).

Course Policies

COVID Prevention & Containment

Prevention:

- Wear your **mask** and make sure it fits you well
- **Stay home** if you're sick
- **Get to know your neighbors** in class, and let them know if you test positive
- **Get tested** regularly
- Watch for **signs and symptoms** with the daily symptom self-check
- **Wash your hands** frequently or use hand sanitizer

Containment: If a student in class tests positive for COVID-19, everyone should:

- Expect and follow guidance in classroom notification
- Answer the call if contacted by the Corona Corps (541-356-2292)
- Isolate if you test positive or are symptomatic
- Quarantine if you are a close contact
- Test weekly if you are unvaccinated or partially vaccinated
- Stay home if symptomatic and complete the UO COVID-19 case and contact reporting form if you test positive or are a close contact of someone who tests positive.

Support: The following resources are available to students.

- University Health Services or call (541) 346-2770
- University Counseling Center or call (541) 346-3277 or (541) 346-3227 (after hrs.)
- MAP Covid-19 Testing
- Corona Corps or call (541) 346-2292
- Academic Advising or call (541) 346-3211
- Dean of Students or call (541)-346-3216

Communications

Office Hours:

I will host office hours in whatever way I can this quarter, depending on COVID circumstances, to be determined in the first week of classes. I will also establish a running discussion forum on our Canvas called "Class Questions and Answers" for the entire group to ask and answer questions as they come up. I welcome meetings outside my regular office hours, too, knowing that there is considerable uncertainty in all of our lives right now. Just email me to set a time. If you contact me with a question, I will try to respond within one business day. I typically provide feedback on assignments within one week.

***Why* should you reach out to me?**

I enjoy talking with students about the course materials and related topics, so please contact me if you're confused or just excited about discussing something. I'm also happy to talk about how (or whether) what we're learning relates to current events, career choices, or other classes you can take UO. Beyond these course-related topics, please get in touch with me if you are having a hard time with the class or other aspects of your academic career. I understand these are difficult times for many of us, in many different ways, so I would be happy to listen and/or strategize with you to find solutions. I will do everything I can to help you succeed. If there are deeper challenges that would benefit from professional help, please see below ("*Your well-being*") for some ideas regarding available support on campus.

Academic Integrity & Classroom Conduct

I expect everyone to follow University rules and guidelines for behavior. Academic dishonesty, which includes cheating and plagiarism, is a serious offense and will be treated according to the guidelines in the student conduct code (located at conduct.uoregon.edu). This doesn't mean you shouldn't talk with other students about what you are thinking or writing; it does mean that when you write something, it should be in your own words, not copied from someone else.

My guiding principle for conduct within this course is **mutual respect**. Our classroom should be a place where each of us is treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Classroom courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name, but I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the quarter (or before) so that I may address you properly.

Accessibility

I encourage students with disabilities, including "invisible" disabilities like chronic diseases, learning disabilities, and psychiatric disabilities to discuss with me as soon as possible what appropriate accommodations might be helpful. You are also encouraged to contact the Accessible Education Center in 164 Oregon Hall at 541-346-1155 or uoaec@uoregon.edu.

Your well-being

This continues to be a hard time for people in many different ways. The pandemic can exacerbate existing challenges associated with college life and life in general. If any aspects of your life are not going well, there are UO resources that could help. I would encourage you to pursue the following resources if they would be helpful or get in touch with me directly if it would help to discuss any extenuating circumstances. Getting help is a courageous thing to do—for yourself and those you care about.

University Health Services help students cope with difficult emotions and life stressors. If you need general resources on coping with stress or want to talk with another student who has been in the same place as you, visit the Duck Nest (located in the EMU on the ground floor) and get help from one of the specially trained Peer Wellness Advocates.

University Counseling Services (UCS) has a team of dedicated staff members to support you with your concerns, many of whom can provide identity-based support. All clinical services are free and confidential. Find out more at counseling.uoregon.edu or by calling 541-346-3227 (anytime UCS is closed, the After-Hours Support and Crisis Line is available by calling this same number).

Basic Needs. Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course is urged to contact the Dean of Students Office (346-3216, 164 Oregon Hall) for support. The UO Basic Needs Resource Guide includes resources for food, housing, healthcare, childcare, transportation, technology, finances, and legal support.

Course Schedule

Generally, the **first** meeting of the week (Tuesday) will consist of a lecture to introduce the week's topic and a presentation of exercises by the assigned group. The **second** meeting of the week (Thursday) will consist of a follow-up discussion of concepts from Tuesday and a discussion of the primary literature assignment for the week. See computer lab schedule (Tuesdays) on following page.

Week	Date	Topic	Readings
1	Jan 4,6	Introduction Density-independent growth Density-dependent growth	VanGold Ch. 10, Ch1 ***Primary Article 1: to be posted on Canvas***
2	Jan 11, 13	Structured populations – age, size	VanGold Ch. 2 ***Primary Article 2: to be posted on Canvas***
3	Jan 18, 20	Life History Evolution Complex dynamics	VanGold Ch. 3 & 4 (subsets) ***Primary Article 3: to be posted on Canvas***
4	Jan 25, 27	Spatial Dynamics Metapopulations; Source-sink	VanGold Ch. 5 ***Primary Article 4: to be posted on Canvas***
5	Feb 1, 3	Predator-Prey / Consumer-Resource	VanGold Ch. 6 ***Primary Article 5: to be posted on Canvas***
6	Feb 8, 10	Disease dynamics	VanGold Ch. 7 ***Primary Article 6: to be posted on Canvas***
7	Feb 15, 17	Inter-specific Competition	VanGold Ch. 8 ***Primary Article 7: to be posted on Canvas***
8	Feb 22, 24	Facilitation & Mutualisms	VanGold Ch. 9 ***Primary Article 8: to be posted on Canvas***
9	Mar 1, 3	Applications: Conservation Biology: PVA, Climate change, pest control	VanGold Ch. ***Primary Article 9: to be posted on Canvas***
10	Mar 8, 10	Exciting Future Topics in Population Ecology	VanGold Ch. 10 (revisit) ***Primary Article 10: to be posted on Canvas***

Computer Lab Schedule

Note: readings to be updated

Week	Date	Topic	Activity / Assignments due / Reading
1	Jan 4	Introduction to R Introduction to R markdown	Worksheet 1
2	Jan 11	Density-independent growth Density-dependent growth Simulating data Parameter estimation 101	Worksheet 2 / ***Worksheet 1*** Stevens Ch1,3
3	Jan 18	Annual Plant models	Worksheet 3 / ***Worksheet 2*** pdf to be posted on Canvas
4	Jan 25	Structured populations – age, size	Worksheet 4 / ***Worksheet 3*** Stevens Ch2
5	Feb 1	Interactions: Competition / Predator-Prey / Consumer-Resource (?)	Worksheet 5 / ***Worksheet 4*** Stevens Ch5,6
6	Feb 8	Disease models	Worksheet 6 / ***Worksheet 5*** Stevens Ch6
7	Feb 15	Projects Intro to simulation & parameter estimation	***Worksheet 6***
8	Feb 22	Projects	
9	Mar 1	Projects	
10	Mar 8	Project Presentations	***Project presentations***