

NRM 4309/5409

Population Dynamics

Instructor: Justin French

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RAS 128

12:30 PM - 1:45 PM, Tuesday and Thursday

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Office Hours: Fridays, 1:00 PM to 2:00 PM, or by appointment.

1 Course Overview

This course is intended to give the student a reasonably gentle introduction to the field of population dynamics, which is the study of how population sizes change through time. We start with first principles, and steadily generalize into more detailed (and useful) views of how populations change. Population dynamics are the scientific backbone of wildlife management, so this course is designed to give you both an academic and practical understanding of the field. Since most of you probably want to be a biologist, the material will be worthless to you if you don't know how to apply it in the field. On the other hand trying to do the leg work without clearly understanding why you are doing it will get you nowhere.

Each week we will spend a lecture on a topic from Pop-Dy theory, then we will spend one on application of that theory. Homework assignments will be practical exercises to help get your arms around how to make management decisions based on what you have learned. By the end of the class you should be able to:

1. Frame management problems in terms of population outcomes
2. Select relevant theory to use in addressing management questions or problems
3. Estimate population parameters with real data
4. Use your knowledge to make sound management decisions

2 Required Text

Vendermeer, J. H. and D. E. Goldberg. 2013. Population Ecology: First Principles. Second Edition. Princeton University Press. Princeton, New Jersey USA.

Available at: <http://sulross.textbookx.com/institutional/index.php?action=browse#books/3393782/>

I like this book because the authors build the concepts and equations incrementally and thoroughly. This book covers topics beyond what we will touch on in class, but by starting with first principles you will have the tools to learn those things on your own when you need them. The material in the book can be a little dense sometimes, but those that dive deep will be rewarded on exam day.

3 Assignments

All assignments in this class will be done in R, which is a free statistical analysis package (and so much more, as you will see). I do not assume you know anything about statistics or programming, so don't be scared. R is the most rapidly growing tool in our field and will soon be an essential skill, much like GIS has become. The idea is to give you some elementary exposure to this excellent tool and not force you to pay for something that is much less capable. It is best that you install both R and R Studio, which is a convenient interface. They are available for free download at:

- **R:** <https://cloud.r-project.org/>
- **R Studio:** <https://rstudio.com/products/rstudio/download/>

Each regular assignment will be made available on Monday of the week it is assigned and will be due the following Monday. Late submissions will not be accepted unless prior arrangements are made (implying there was a good, foreseen reason to be late), except under reasonable extenuating circumstances.

4 Graduate Project

Since this is a stacked course, graduate students are expected to meet a higher expectation. To that end, each graduate student will complete and present a simulation of the population dynamics of their study species and use the information gained to inform management. The specifics of the project will be determined by myself and the student by mid-semester. This project counts as 20% of the final grade for graduate students.

5 Grading Policy

Grades are based on weekly assignments and 3 exams, the last of which is cumulative. Assignments and tests each contribute 50% of your final grade (40% each for graduate students). However, if your grade on the cumulative final exam is higher than your overall average *and you have turned in ALL assignments*, I will replace your final course grade with the final exam grade.

Letter grades follow: $100 > A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$. There is no curve.

6 Attendance

Showing up is the only way to get the material you need. If you don't come to class, your grade will reflect it with no penalty needed from me. In the event of an excused absence, make arrangements with me to get over material ahead of time.

7 Academic Dishonesty

Academic dishonesty includes copying, sharing, or obtaining information from an unauthorized source, attempting to take credit for the intellectual work of another person, falsifying information, and giving or receiving information about a test, quiz, or assignment to other students. Any use of generative AI on coursework will result in immediate failure of the class. Any student involved in academic dishonesty will receive no credit (0) for work done and/or may be penalized in accordance with published University Rules.

8 Counseling and Accessibility Services

Sul Ross State University is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartz, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8691. E-mail: mschwartz@sulross.edu.

9 Course Schedule (Tentative)

- **Week 1 (8/26-8/30):** Course Intro: Pop-Dy and Wildlife Management
 - Lecture 1: Overview, management as a science, goal setting, and measurement
 - Lecture 2: Estimating population sizes
 - Exercise: How big is the population?
- **Section 1: Single Populations**
 - **Week 2 (9/2-9/6):** Birth and Death 1
 - * **Reading:** V&G: Chapter 1; p.1–17
 - * Lecture 1: Petri dishes, paramecium, and walking before we run
 - * Lecture 2: Estimating population growth rates
 - * Exercise: How fast is the population growing?
 - **Week 3 (9/9-9/13):** Birth and Death 2
 - * **Reading:** V&G: Chapter 1; p.9–30 (Review is intentional)
 - * Off Monday for Labor Day
 - * Lecture 1: Finite resources and population regulation
 - * Lecture 2: Estimating a changing growth rate
 - * Exercise: Living and breeding...

- **Week 4 (9/16-9/20):** Structured Populations
 - * **Reading:** V&G: Chapter 2; p.30–39
 - * Lecture 1: Structured Populations - No D.D.
 - * Lecture 2: Structured Populations - With D.D.
 - * Exercise: How fast is the (age-structured) population growing?

- **Week 5 (9/23-9/27):** Applications of Simple Models
 - * **Reading:** V&G: Chapter 3; p.73–80
 - * Lecture 1: Informing Management
 - * Lecture 2: Assessing Management
 - * Exercise:

- **Week 6 (9/30-10/4):** First Exam
 - * Lecture 1: Review
 - * Lecture 2: Exam

- **Section 2: Pop-Dy of Communities**
 - **Week 7 (10/7-10/11):** Predation
 - * **Reading:** TBD
 - * Lecture 1: Lotka-Volterra
 - * Lecture 2: Uses and Limitations of L-V
 - * Exercise: TBD

 - **Week 8 (10/14-10/18):** Competition
 - * **Reading:** TBD
 - * Lecture 1: Lotka-Volterra: Round 2
 - * Lecture 2: New uses and Limitations of L-V
 - * Exercise: TBD

 - **Week 9 (10/21-10/25):** Mutualisms
 - * **Reading:** TBD
 - * Lecture 1: TBD
 - * Lecture 2: TBD
 - * Exercise: TDB

 - **Week 10 (10/28-11/1):** Second Exam

- **Section 3: Populations in Space**

- **Week 11 (11/4-11/8):** Spatially structured populations 1 - Metapopulations
 - * **Reading:** Lee, D. E. and D. T. Bolger. 2017. Movement and source-sink dynamics of a Masai giraffe metapopulation. *Population Ecology*. 59:157-168.
 - * Lecture 1: Space, movement, and extinction
 - * Lecture 2: None, due to Thanksgiving holiday
 - * Exercise: Birds-eye View of a Metapopulation
- **Week 12 (11/11-11/15):** Spatially structured populations 2 - Continuous Space
 - * **Reading:** TBD
 - * Lecture 1: Habitat selection, movement, and spatial distribution
 - * Lecture 2: Relating selection to Pop-Dy
 - * Exercise: Where will the speedgoats be?
- **Week 13 (11/18-11/22):** Uncertainty in Pop-Dy
 - * **Reading:** None this week.
 - * Lecture 1: Stochasticity in Population Dynamics
 - * Lecture 2: Guest lecture - Correlation among demographic rates
 - * Exercise: Birds-eye View of a Metapopulation
- **Week 14 (11/25-11/29):** Frontiers in Pop-Dy
 - * **Reading:** V&G: Chapter 4; p.81–91, 122–125
 - * Lecture 1: Cool things scientists are trying to figure out.
 - * Lecture 2: None, due to Thanksgiving holiday
 - * Exercise: None, enjoy your holiday.
- **Week 15 (12/02-12/6):** Review
 - * No class meetings this week.
- **Week 16 (12/9-12/13):** Final Exam
 - * TBD (see SRSU Final Exam Schedule): Final Exam - In Person