

WFSC 624 Dynamics of Populations | Fall 2019

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Course Material: <https://eCampus.tamu.edu>

Course Description

Principles of population dynamics and their applications to assessment and management of animal and plant populations. Use of quantitative methods for understanding population dynamics.

Prerequisite

One semester of undergraduate calculus or equivalent knowledge (preferably two semesters of calculus).

Learning Outcomes

By the end of this course, students will acquire the following skills:

- (0) understanding the basic processes affecting population dynamics.
- (1) building population models based on biological information,
- (2) analyzing the models using mathematical software R,
- (3) interpreting the results,
- (4) making recommendations for management and conservation actions based on the results

Schedule*

Week 1 <Total Expected Hours 12 HR>

Lecture*: Course introduction & What are population dynamics? (1.5 HR)

DISCRETE TIME POPULATION MODEL

Lecture*: Age structured model (Leslie Matrix Model) (1.5 HR)

Review of Lecture Material (3 HR)

Reading Assignment (3 HR)

LAB 1: Introduction to R

Lab Instruction Video** (1 HR)

Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions

Week 2 <Total Expected Hours 12 HR>

Lecture*: Simple matrix algebra; Stage structure (Lefkovitch Matrix Model) (1.5 HR)

Lecture*: Asymptotic growth rate, stable stage distribution, and reproductive values (1.5

HR) Review of Lecture Material (3 HR)

Reading Assignment (3 HR)

LAB 2: Geometric growth

Lab Video** (1 HR)

Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions

Week 3 <Total Expected Hours 12 HR>

Lecture*: Eigenvalue, eigenvector, transient dynamics, sensitivity and elasticity (1.5 HR)

Lecture*: Examples: Loggerhead Sea Turtles, Right Whale, and Killer Whale (1.5 HR)

Review of Lecture Material (3 HR) Reading

Assignment (3 HR)

LAB 3: Introduction to matrix population models

Lab Video** (1 HR)

Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions

Week 4 <Total Expected Hours 12 HR>

Lecture*: Lifecycle classification, Life event calculations (1.5 HR)

Lecture*: Density dependence I (1.5 HR)

Review of Lecture Material (3 HR)

Reading Assignment (3 HR)

LAB 4: Stable stage, Reproductive value

Lab Video** (1 HR)

Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions

Week 5 <Total Expected Hours 12 HR>

Lecture*: Density dependence II (1.5 HR)

Lecture*: Two sex, Supplementation, and Stochasticity (1.5

HR) Review of Lecture Material (3 HR)

Reading Assignment (3 HR)

LAB 5: Sensitivity and elasticity

Lab Video** (1 HR)

Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions, First report on matrix population model project

Week 6 <Total Expected Hours 12 HR>

Lecture*: Demographic Stochasticity (1.5 HR)

Lecture*: Environmental Stochasticity (1.5 HR)

Review of Lecture Material (3 HR)

Reading Assignment (3 HR)

LAB 6: Density dependence

Lab Video** (1 HR)

Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions

Week 7 <Total Expected Hours 12 HR>

Lecture*: Review (1.5 HR)

Lecture*: Life table analysis, Analysis of environmental fluctuation (Time-series analysis) (1.5 HR)

Review of Lecture Material (3 HR)
Reading Assignment (3 HR)
LAB 7: Demographic and Environmental Stochasticity
Lab Video** (1 HR)
Work on Lab Assignment (2 H)
Submissions: Lab Report, Lab Discussions

Mid-Term Exam October 15 (Tuesday)

SOME STATISTICS

Week 8 <Total Expected Hours 12 HR>

Lecture*: Analysis of count data (state-space method, multivariate stat, regression) (1.5 HR)
Review of lecture material (1.5 HR)
Preparation for Exam (7.5 HR)

CONTINUOUS-TIME MODEL

Week 9 <Total Expected Hours 12 HR>

Lecture*: Capture-recapture statistics (1.5 HR)
Lecture*: Other miscellaneous statistics in population ecology (1.5 HR)
Review of Lecture Material (3 HR)
Reading Assignment (3 HR)
LAB: Work on MPM Project
Lab Video** (1 HR)
Work on Lab Assignment (2 H)
Submissions: Second report on matrix population model project

Week 10 <Total Expected Hours 12 HR>

Lecture*: Continuous time model, Exponential growth (1.5 HR)
Lecture*: Predator prey model (1.5 HR)
Review of Lecture Material (3 HR)
Reading Assignment (3 HR)
LAB 8: Fallacies in statistical analyses
Lab Video** (1 HR)
Work on Lab Assignment (2 H)
Submissions: Lab Report, Lab Discussions

Week 11 <Total Expected Hours 12 HR>

Lecture*: Competition, mutualism, and others (1.5 HR)

Other Topics in Population Ecology

Lecture*: Discrete vs. continuous models, Infectious disease 1 (1.5 HR)
Review of Lecture Material (3 HR)
Reading Assignment (3 HR)
Lab 9: Exponential growth and ODE solver
Lab Video** (1 HR)
Work on Lab Assignment (2 H)
Submissions: Lab Report, Lab Discussions

Week 12 <Total Expected Hours 12 HR>

Lecture*: Infectious disease 2 (1.5 HR)
Lecture*: Biological invasion (1.5 HR)
 Review of lecture material (3 HR)
 Reading Assignment (3 HR)
Lab 10: Solving a system of ODEs I
 Lab Video** (1 HR)
 Work on Lab Assignment (2 H)

Submissions: Lab Report, Lab Discussions; Final report on matrix population model project

Week 13 <Total Expected Hours 12 HR>

Lecture*: Metapopulation dynamics (1.5 HR)
 Review of lecture material (1.5 HR)
 Preparation for Presentation (7.5 HR)

Thanks Giving Holiday: No Class

Week 14 <Total Expected Hours 12 HR>

Student Presentation 1 (1.5 H)
 Comments on other students' presentations (3.5 HR)
 Preparation for Final Exam (10 HR)
 Reading Assignment (3 HR)

Submission: Comments on student presentations

FINAL EXAM: December 11 8:00 AM – 10 AM (2 HR)

* Lecture will be broadcasted real time using Zoom and recorded for all students.

** Laboratory instruction video is available for all students. Local students will also meet once a week. The meeting will be broadcasted using Zoom. Distance students will also interact with local students and instructor via eCampus.

TAMU Academic Calendar: <http://registrar.tamu.edu/General/Calendar.aspx>

Textbooks (recommended but not required)

Matrix Population Models 2nd Edition by Hal Caswell. Sinauer Associates, Inc. ISBN: 087893121X.

Population Ecology: First Principles 2nd Edition by Vandermeer and Goldberg, Princeton University Press ISBN: 9781400848737

Lectures

Local class will meet on Tuesdays and Thursdays from 12:45 PM to 2:00 PM. It will be broadcasted (using Zoom) for distance students. Recorded lectures will be available on eCampus by the following morning.

Laboratory

Instruction video will be available for each laboratory on Monday for all students. Students are expected to watch the video (approximately 1 hour) *before* the laboratory session. The times for laboratory session for local students will be arranged after the first lecture. The laboratory session is primarily for asking questions and working on the project. Local students will post all of the questions and answers discussed during the local lab section on eCampus. The distance students will ask question on eCampus and interact with other students (both local and distance students) and the instructor.

Assignments will require the use of software R, which will be available free. Students are encouraged to

interact with other students to discuss laboratory material using an online discussion.

Laboratory assignments are not tests. Students are expected to obtain help from other students and/or the instructor to complete the tasks. In the last five years, I have never had a student who can complete lab assignments without any help!

Reports and Presentation

Students will work on a matrix population model report (three drafts and final report). Students are also required to present the results from the matrix population model analyses. Local and Galveston students will present the results in class (recorded), and other students will submit recorded presentations. These videos will become available. Rubrics for grading the reports and presentation will be provided separately (around mid September).

Exams

One mid-term is given and worth 15%. There will be no question related to R on the exam. The use of calculator is not permitted (nor needed). Distance students will take the exam online (proctored by Examity). There will be a final exam (25%)

In-Person Discussion

Students are required to have one (if you are active in class or asking questions using emails) or two in-person discussion(s). Please visit the instructor in his office or have Skype conference call (Zoom or phone can be used if you are not able to use Skype).

Technology

Students are required to have “high speed” internet access (e.g. campus network, DSL, Cable) and have basic computer skills. These skills include the use of Skype (recommended, but not required), Remote Desktop Access to campus computers (via <https://voal.tamu.edu>), and watching streamed video files. To get help for Mac or Linux computers, please seek help from the campus IT staff (<http://its.tamu.edu>). If you plan to use a government owned computer for this class, please coordinate with your IT staff. There may be some restrictions on the installation of software (e.g. for VOAL), use of software (e.g. Skype), and internet access (firewall).

Determination of Final Course Grade (FCG)

1. Ten laboratory assignments (each is worth 4% of FCG)
Report/Lab Quiz: 2%
Online Discussion: 2%
2. A stage structured model project (16 % of FCG)
8% Report
8% Presentation/Comments
3. Exam 1 (15% of FCG)
4. Final Exam (25% of FCG)
5. Instructor-student discussion (either coming to office or via Skype/phone) 4%

Letter Grade	A	B	C	D	F
Percentage	[100%+, 90%]	(90%, 80%]	(80%, 70%]	(70%, 60%]	(60%, 0%]

Absences

If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a time frame not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details <http://studentrules.tamu.edu/rule07>). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit <http://disability.tamu.edu>.

Academic Integrity Statements

AGGIE HONOR CODE

“An Aggie does not lie, cheat, or steal or tolerate those who do.”

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System.

For additional information, please visit: <http://aggiehonor.tamu.edu>

Title IX Statement on Limits to Confidentiality

Texas A&M University and the College of Agriculture and Life Sciences are committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws provide guidance for achieving such an environment. Although class materials are generally considered confidential pursuant to student record policies and laws, University employees — including instructors — cannot maintain confidentiality when it conflicts with their responsibility to report certain issues that jeopardize the health and safety of our community. As the instructor, I must report (per Texas A&M System Regulation 08.01.01) the following information to other University offices if you share it with me, even if you do not want the disclosed information to be shared: allegations of sexual harassment, sexual assault, dating violence, stalking, or discrimination when they involve TAMU students, faculty, or staff, or third parties visiting campus. These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In many cases, it will be your decision whether or not you wish to speak with that individual. If you would like to talk about these events in a more confidential setting, you are encouraged to make an appointment with the Student Counseling Service (<https://scs.tamu.edu>).

Students and faculty can report non-emergency behavior that causes them to be concerned at <http://tellsomebody.tamu.edu>.