QERM 514: Analysis of Ecological and Environmental Data
Spring 2021

Meeting Times and Location

- Mon & Wed 10:30-11:20 at https://washington.zoom.us/j/92713706546
- Fri 8:30-11:20 at https://washington.zoom.us/j/95954677932

Instructor

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Communication

If you have questions, please don't delay in reaching out. You can address shorter questions to me at email (sconver@uw.edu) and I will do my best to respond within 24 hours. For longer or more complex questions, please email me or talk to me at the end of class about setting up a Zoom meeting. If multiple students have similar questions, I will set up small group meetings. I also encourage you to start Discussions in Canvas so that I or your classmates can respond to you and benefit from the discussion.

Course Description

This 4-credit course will allow students to become comfortable employing a large class of statistical models commonly used in ecology and environmental science. These models are the basis for most statistical analyses conducted in these fields. They include linear models (such as ANOVA and regression models) along with models that assume non-normal error distributions (including logistic, Poisson, and Gamma regression), and models that allow for multiple random terms (mixed models). We will focus on conceptualizing analyses, implementing analyses, and making inference from the results.

Learning Objectives

By the end of the quarter, students should be able to:

- Identify an appropriate statistical model based on data and an analytical question.
- Understand the assumptions behind a chosen statistical model and evaluate whether assumptions are reasonably met in a given situation.
- Conceptualize, implement, and interpret statistical analyses based on the models covered in this course.
- Fit models in a variety of **R** libraries and work with model outputs.

Prerequisites

Students in this course should have a working knowledge of **R** including the ability to load **R** libraries, import data, perform data manipulation, and get help. Students should be comfortable with basics of probability and statistics.

Technology

I will provide all course materials on Canvas. The course website is: https://canvas.uw.edu/courses/1450843. Lectures will be posted on Canvas prior to class, and all readings will be posted on Canvas at least one week ahead of class. Quizzes and all assignments will be posted on Canvas and submitted by you on Canvas.

We will use **R** throughout the course, so have it downloaded and running. I use RStudio and you may find it useful, but it is not necessary.

Teaching Methodology

Lecture: Course meetings on Mondays, Wednesdays, and the first hour on Fridays will consist of lectures with small-group breakouts for discussion. I encourage you to download lectures from Canvas before coming to class. I will record lectures on Zoom and post the links on Canvas as soon as they are available. Sometimes I randomly call on students in class; there is evidence that this is an effective approach to increase student learning and participation. That said, I know that everyone can occasionally have the kind of day where they just aren't up for being called on. If this is you in a given class, add an "X" in front of your Zoom name, e.g., change "Sarah Converse" to "X Sarah Converse" at the start of class. Alternatively, send me a private chat.

Lab: Lab time (scheduled for 2 hours on Fridays) will involve demonstration of code relevant to the lecture topics and breakout group collaboration on practice problems. I will provide answers for practice problems but it is most valuable for you to work through these problems thoroughly on your own before consulting answers.

Readings: Please complete assigned readings before class. I will provide all readings in Canvas. Readings will draw heavily from *Linear Models with R, Second Edition* by Julian Faraway (2014), *Extending the Linear Model with R, Second Edition* by Julian Faraway (2016), *Mixed Effects Models and Extensions in Ecology with R* by Alain Zuur et al. (2009), and a variety of other sources, mostly from the primary literature.

Evaluation

Quizzes: We will have 8 quizzes over the course of the quarter. Quizzes will be available on Canvas from 8am Monday mornings until 5pm on the same day. Quizzes will have a 30-minute time limit. Because course content builds in complexity, quizzes are an important tool for both of us to check that you are understanding foundational concepts. Quizzes will be a mix of multiple choice and short answer. Your quiz grade will be based on your 5 best quizzes.

Homework: We will have 4 homework assignments over the course of the quarter. There will typically be 3-5 problems per homework assignment, and problems will typically require you to

build a model based on information and data provided, implement the model, and interpret the results. Homework will be assigned on Fridays and will be due one week later.

Project: For your class project, you will choose a dataset and complete an analysis of that dataset. Your project plan will be due May 5 and your final report will be due June 7. During the last week of classes, you will give a presentation in class on your project. I will provide more detail on the project early in the quarter.

Your evaluation in this course will be based on assignments as follows:

Assignment	Points	Percent of Grade
Quiz 1	20	4%
Quiz 2	20	4%
Quiz 3	20	4%
Quiz 4	20	4%
Quiz 5	20	4%
Homework 1	50	10%
Homework 2	50	10%
Homework 3	50	10%
Homework 4	50	10%
Project Plan	40	8%
Project Presentation	60	12%
Project Final Report	100	20%

Final grades will be converted from a percentage to a grade based on the chart below.

100-98%	97-96%	95-94%	93-92%	91-90%	89-88%	87%	86%	85%
4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2
84%	83%	82%	81%	80%	79%	78%	77%	76%
3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3
75%	74%	73%	72%	71%	70%	69-0%		
2.2	2.1	2.0	1.9	1.8	1.7	0.0		

Policy on Missed Work and Excused Absences

Completing homework and project components on time is required. The only exceptions will be excused absences associated with religious holidays, pre-approved professional activities, or an injury or illness of the student or immediate family member. A makeup homework or alternate due date will be determined in these cases. Verification of these events will be needed.

Notification of anticipated absences should occur as early as possible. Because I am dropping the 3 lowest quiz grades, I will not give make-up quizzes.

Academic Integrity

I expect graduate students to adopt the strict academic integrity standards of professional scientists and to adhere to the University Student Conduct Code. This requires that your work reflects your own intellectual efforts. Presenting someone else's work as your own represents academic misconduct, as does assisting someone else in committing academic misconduct. The Student Conduct Code defines prohibited conduct and describes how the University holds students accountable. All suspected cases of academic misconduct will be handled according to University regulations.

In this course, it is critical that you:

1. Cite any literature that informs your homework answers or project. I reserve the right to deduct points on assignments if sources are not cited.
2. Take quizzes independently on Canvas. If students work together on quizzes, I will report these cases of academic misconduct to the appropriate Dean representative and if the student is found responsible for misconduct, the grade on the assignment will be a 0.

Inclusivity

I am committed to providing an inclusive learning environment where diverse perspectives are recognized, respected, and seen as a source of strength. In this course, I will strive to create a welcoming space where people with the full diversity of backgrounds and experiences feel included and engaged. Any language or behavior that excludes or intimidates others in this course will not be tolerated. This applies to all course participants: instructor, students, or guests. If you are experiencing disrespect or harassment in this course, I encourage you to let me know. If you feel more comfortable, please reach out to CQS Director Tim Essington (essing@uw.edu) or to SAFS Director Andre Punt (aepunt@uw.edu). I encourage all course participants to adopt welcoming and inclusive language, to listen respectfully to other viewpoints, to accept constructive criticism, and to show courtesy and respect to others.

Disability Accommodations

It is the policy and practice of the University of Washington to create accessible learning environments consistent with federal and state law, including establishing reasonable accommodations for all students. If you have already established accommodations with Disability Resources for Students (DRS), please activate your accommodations via myDRS so that we can discuss how they will be implemented in this course.

If you have not yet established services through DRS, and you have a temporary health condition or permanent disability that requires accommodations, contact DRS directly (disability.uw.edu (Links to an external site.)) to set up an Access Plan. DRS facilitates the interactive process that establishes reasonable accommodations. Conditions requiring

accommodation include but are not limited to mental health, attention-related, learning, vision, hearing, physical or health impacts.

In assessing whether you require reasonable accommodations through DRS, please note that full participation in this course requires the following types of engagement:

1. The ability to attend 1-hour lectures 3 times per week, plus a 2-hour lab once per week.
2. The ability to complete online quizzes.
3. The ability to complete homeworks.
4. The ability to complete a project and an accompanying presentation to the course participants.

Religious Accommodations

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (Links to an external site.). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (Links to an external site.)

Safety

Call SafeCampus at 206-685-7233 anytime – no matter where you work or study – to anonymously discuss safety and well-being concerns for yourself or others. SafeCampus's team of caring professionals will provide individualized support, while discussing short- and long-term solutions and connecting you with additional resources when requested.

Schedule

Week	Day	Date	Topic	Readings	Assignments
1	M	3/29	Course introduction		
	W	3/31	Course overview		
	F	4/2	Linear models		
	F Lab	4/2	Simulating data in R		
2	M	4/5	Linear models, continued	JF1 Ch 2	*Quiz on Canvas, 8am – 5pm*
	W	4/7	Inference		
	F	4/9	Inference, continued	JF1 Ch 3 & Ch 4	*Homework 1 available on Canvas at 5pm*
	F Lab	4/9	Linear models in R		
3	M	4/12	Model diagnostics	JF1 Ch 6	*Quiz on Canvas, 8am – 5pm*
	W	4/14	Problems with model errors	JF1 Ch 8	
	F	4/16	Transformations	JF1 Ch 9, O'Hara and Kotze 2010	*Homework 1 due on Canvas at 5pm*
	F Lab	4/16	Diagnostics and Solutions		
4	M	4/19	Guest lecture – Staci Amburgey		*Quiz on Canvas, 8am – 5pm*
	W	4/21	Design matrices, Part 1	Venables 2018	
	F	4/23	Design matrices, Part 2		*Homework 2 available on Canvas at 5pm*
	F Lab		Developing and interpreting design matrices		
5	M	4/26	Maximum likelihood estimation		*Quiz on Canvas, 8am – 5pm*
	W	4/28	Model selection	JF2 Appendix A	
	F	4/30	Model selection, continued	Burnham and Anderson 2002 Ch1 & Ch 2,	*Homework 2 due on Canvas at 5pm*

				Hooten and Hobbs 2015, Johnson 1999	
	F Lab		Model selection in R		
6	M	5/3	Mixed models	JF 2 Ch 10-11	*Quiz on Canvas, 8am – 5pm*
	W	5/5	Mixed models, continued		*Project plan due on Canvas by 5pm*
	F	5/7	Paper discussion	JF2 Ch 8	*Homework 3 available on Canvas at 5pm*
	F Lab		Mixed models in R		
7	M	5/10	Introduction to GLMs	JF2 Ch 2-3	*Quiz on Canvas, 8am – 5pm*
	W	5/12	Modeling binary data		
	F	5/14	Overdispersion in binary data	JF2 Ch 5	*Homework 3 due on Canvas at 5pm*
	F Lab		Modeling binary data in R		
8	M	5/17	Modeling count data		*Quiz on Canvas, 8am – 5pm*
	W	5/19	Overdispersion in count data		
	F	5/21	Modeling excess zeros	JF2 Ch 13	*Homework 4 available on Canvas at 5pm*
	F Lab		Modeling count data in R		
9	M	5/24	Mixed models with nonnormal errors		*Quiz on Canvas, 8am – 5pm*
	W	5/26	Review/Catchup		
	F	5/28	Course Synthesis		
	F Lab	5/28	Open lab		*Homework 4 due on Canvas at 5pm*
10	M	5/31	Memorial Day Holiday		
	W	6/2	Presentations on class projects		
	F	6/4	Presentations on class projects		*Final Projects due on Canvas, 6/7 at 5pm*
	F Lab	6/4	Presentations on class projects		