

# RNR 621: Applied Statistics - Fall 2022, 3 units

## Description

An intermediate course in statistical methods for the applied sciences, with emphasis on applications in ecology and biology. Fundamentals of inference, estimation, and testing, with emphasis on generalized linear models implemented in the R software environment.

## Meetings

Lecture: Monday and Wednesday, 11:00-11:50, ENR2 N350  
In-person with the option to join remotely via Zoom  
<https://arizona.zoom.us/j/86023395230?pwd=eIFhbXlwNnJaQUVxdVlWUjFVxSWw1Zz09>  
Passcode = snre

Lab: Monday 1:00-3:50, ENR2 N250  
Live-online via Zoom  
<https://arizona.zoom.us/j/86824827255?pwd=Y2Z6Wlo2Q3NMVzd3MFRVdExcVdnQT09>  
Passcode = snre

## Instructor

Bob Steidl <steidl@arizona.edu>  
Office: N310 ENR2, 520-626-3164, hours by appointment

## Prerequisites

An introductory statistics course such as MATH 263 or equivalent

## Course Objectives

Develop a cohesive framework for analyzing data and making reliable inferences

- Characterize population attributes based on sample data, with emphasis on understanding and quantifying uncertainty
- Explore a general strategy for conceptualizing models for data analysis based on scientific questions
- Develop and implement models within the frameworks of general and generalized linear models
- Interpret results from analyses and use these as the basis for drawing reliable conclusions
- Use the R programming environment to organize and explore data, to run models, and visualize results

## Learning Outcomes

At the conclusion of the course, you will be able to:

- Understand the foundations of statistical inference
- Design models for analysis for an array of data-collection scenarios, including observational and experimental studies
- Choose and apply tools to evaluate model assumptions and fit
- Evaluate and interpret output from statistical software packages
- Write concise summaries of analyses appropriate for results sections of scientific papers

## Texts and Software

- Ramsey, F. and D. Schafer. 2013. The statistical sleuth: A course in methods of data analysis, 3<sup>rd</sup> edition. Cengage Learning. Note, the 2<sup>nd</sup> edition will work too.

We will also draw material from other books, journal articles, and online resources. Useful reference texts include:

- Dunn, P. K. and G. K. Smyth. 2018. Generalized linear models with examples in R. Springer.
- Quinn, G. P. and M. J. Keough. 2002. Experimental design and data analysis for biologists. Cambridge University Press.

For computational software, we will use R: <https://cran.r-project.org/>

## Assessments

Grades are based on ~10 homework assignments (25-75 points each, 60% of the total grade), a midterm exam (~150 points, 15%) and a final exam (~200 points, 25%), both with in-class and take-home portions.

The date and time of the final exam are on the Final Exam Schedule:

<http://www.registrar.arizona.edu/schedules/finals.htm>. Final Exam Regulations described here:

<https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>.

## Grading Scale and Policies

Scale: A =  $\geq 90\%$ , B = 80-89%, C = 70-79%, D = 60-69%, E =  $< 60\%$

Please stay up on the assignments. I will accommodate requests for late submissions provided they are made at least 48 hours before the assignment is due. Otherwise, late assignments will be reduced by 10% each day they are late for five days. After that date, I will still accept assignments, but with a 50% penalty.

## Academic Integrity

I encourage you to share your ideas and to discuss freely the principles and applications of course materials, including homework exercises. However, **you must write up answers to all assignments independently** unless you are instructed otherwise. You are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

## Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on course-related tasks and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

## Accessibility and Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu>) to establish reasonable accommodations.

## University Policies

All university policies related to syllabi are available here: <https://academicaffairs.arizona.edu/syllabus-policies>.

## Schedule

Week	Dates	Lecture topics	Reading
1	22-24 Aug	What is statistics? The basics of sampling	
2	29-31 Aug	Summarizing data	
		Drawing reliable conclusions	R&S Ch. 1
3	7 Sept	Estimation (no class Monday, Labor Day)	Q&K Ch. 2:14-25
4	12-14 Sept	Testing	R&S Ch. 2, Q&K Ch. 3:14-25
5	19-21 Sept	t-tools and assumptions	R&S Ch. 3
6	26-28 Sept	Multiple samples	R&S Ch. 4, Ch. 5
7	3-5 Oct	Multiple samples	R&S Ch. 5, Ch. 6
8	10-12 Oct	Simple linear regression	R&S Ch. 7, Ch. 8
9	17-19 Oct	Multiple regression	R&S Ch. 9, 10
		Midterm exam	
10	24-26 Oct	Introduction to statistical models	D&S Ch. 1, Ch. 2
11	31 Oct - 2 Nov	Introduction to generalized linear models	Buckley 2015, D&S Ch. 3 (skim)
12	7-9 Nov	Generalized linear models	R&S Ch. 20
13	14-16 Nov	Generalized linear models	R&S Ch. 21
14	21-23 Nov	Generalized linear mixed-models	R&S Ch. 22
15	28-30 Nov	Errors and statistical power	Higgs 2013, Steidl and Thomas 2001
16	5-7 Dec	Wrap up, Final exam	

R&S = Ramsey & Schafer

Q&K = Quinn & Keogh

D&S = Dunn & Smyth