Experiments in Ecology and Agriculture

ENY 6934, Spring 2022, 3 credit
Delivery: 100% online synchronous
Time and location: T/R from 1:55pm-3:50pm
Zoom: insert here when available

Instructor: Phil Hahn, **office:** Steinmetz 2109, **phone:** (352) 273-3960, **email:** hahnp@ufl.edu
Office Hours: After class (11:30am-12pm) or by appointment (email to arrange a time) in my office or Zoom.

Course description: This applied research methods and analysis course addresses common challenges of biological data, such as dealing with nested experimental designs, repeated measurements, and non-normal distributions using the program R.

Prerequisites: STA6093 or equivalent.

Additional recommendations: A basic understanding of R/RStudio is recommended. If you are new to R, please watch the video on Canvas under the Module "Introductory materials and resources."

Learning outcomes:
By the end of the course, students will be able to:

- Propose biological questions and formulate hypotheses to test them.
- Construct appropriate (and creative) statistical models that are commonly used in agricultural and natural resource studies using freely available packages in R.
- Analyze, visualize, interpret, and report the results of statistical models using formats acceptable for publication.
- Critique results of analyses reported by peers and in the literature.
- Locate R documentation and use new R packages and functions.

Textbooks (recommended):

- *Experimental Design and Analysis for Biologists.* Quinn, G.P. and Keough, M.J. (2002) Cambridge Press. (Available as ebook through UF Library).
- *Mixed Effect Models and Extensions in Ecology with R*. Zuur, A.F. et al. (2009) Springer. (Available as ebook through UF Library).
- *The R Book*. Crawley, M.J. (2012) Second Edition. Wiley. (Available as ebook through UF Library).
- *R for Data Science*. Grolemund, G. and H. Wickham. (2017) (Available free online: https://r4ds.had.co.nz/)
- *How to Do Ecology.* Karban, R., Huntzinger, M. and Pearse, I. (2017) Princeton Press. (Available in UF Marston Science Library).

Materials (freely available online):

- R software: available for free download at r-project.org
- R Studio: helpful alternative to the default R graphical user interface (GUI)

- Tidyverse: a collection of user-friendly R packages designed for data science that share an underlying design philosophy, grammar, and data structures.

Readings (see course schedule for dates)

1. Karban et al. (2017). How to do Ecology. Chapter 1-2.

2. Broman, K.W. and Woo, K.H. (2018). Data organization in spreadsheets. The American Statistician 72: 2-10.

3. Zuur et al. (2010) A protocol for data exploration to avoid common statistical problems. Methods in Ecology and Evolution 1:3-14.

4. Harrison et al. (2018) A brief introduction to mixed effects modelling and multi-model inference in ecology. PeerJ 6:e4794. PAGES 1-19.

5. Harrison et al. (2018) A brief introduction to mixed effects modelling and multi-model inference in ecology. PeerJ 6:e4794. PAGES 20-26.

6. Karban et al. (2017). How to do Ecology. Chapter 3-5.

7. Hurlbert, S.H. (1984) Pseudoreplication and the design of the ecological field experiments. Ecological Monographs 54:187-211.

8. Gelman, A. and Loken, E. (2014) The statistical crisis in science. Data-dependent analysis--a "garden of forking paths"-- explains why many statistically significant comparisons don't hold up. American Scientist 102:460-465.

9. Wasserstein and Lazar. (2016) The ASA's statement on p-values: context, process, and purpose. The American Statistician 70: 129-133.

Structure of the Course: This is a synchronous online course. All lectures will be over Zoom. Students are expected to attend class, actively participate in discussions, breakout groups, and class activities. Synchronous participation via Zoom includes verbal discussions, chat-based questions/comments, and interaction within breakout groups. Lectures will be recorded and available on Canvas so students can review the material after class.

Attendance and Make-Up Work: Students are expected to attend all sessions via Zoom. Please contact the instructor in advance if you plan to miss a class. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Assessments

Lead discussion: Most weeks there will be a discussion reading. Students will sign up in groups (2-3 students per group) to lead one discussion (~30 minutes). A rubric is posted on Canvas describing how these discussions will be assessed.

R challenges: Most weeks we will have a problem to complete in R (10 challenges worth 10 points each). We will begin these problems in class working in groups and students will post their results on Canvas by the end of the week.

Quizzes: There will be 4 online quizzes (25 points each) based on the lecture material and readings over the course of the semester. Quizzes will focus on writing R code, interpretation of data, and statistical results. There will be no quizzes during weeks that homework assignments are due. Expect to spend 1-2 hours on each quiz.

Homework assignments: Students will complete 2 written homework assignments (50 points each). The homework will be structured similar to a Methods: *Data analysis* and Results section of a journal article. The assignment should be ~2 pages of text, plus figures/tables. Full instructions and a rubric are posted on Canvas.

Final project (and proposal)**:** Students will submit a project proposal (50 points) and completed project (100 points). The final project will allow students to dig deeper into a topic covered in class. The project will be based on the formal analysis of real data (i.e., data from your thesis or other agreed-upon data that needs to be analyzed, or data sets provided to students who don't have their own data). The project will take the form of a homework assignment but will require a full methods section that describes the experimental design and data collection, formatted tables, and graphics.

Grade Breakdown

Category	Points	Percent of total	Due Date
Lead discussion	50	10%	Varies
R Challenges (10 total)	100 (10 points each)	20% (2% each)	Varies
Quiz 1	25	5%	Jan 14
Quiz 2	25	5%	Jan 28
Quiz 3	25	5%	Feb 18
Quiz 4	25	5%	Apr 1
Homework 1	50	10%	March 5
Homework 2	50	10%	Apr 8
Project proposal	50	10%	March 18
Project	100	20%	Apr 27
Total	**500**	**100%**	

Final Grade

Scale: percentage	Letter grade	Minimum points required
93-100	A	465
90-92.99	A-	450
87-89.99	B+	435
83-86.99	B	415
80-82.99	B-	400
77-79.99	C+	385
73-76.99	C	365
70-72.99	C-	350
60-69.99	D	300
0-59.99	E	≤ 299

Course Timetable

Starting week	Module	Topic	Recommended Readings	Discussion Topic/Paper	Assessment
5-Jan	1	Data visualization and linear models I: Continuous variables, graphing scatterplots	G&W-3		R1
10-Jan	1	Data visualization and linear models II: Categorical variables, graphing bar plots and box plots	G&W-3	Karban 1-2	R2, Quiz 1
17-Jan	2	Data management	Q&K-2, G&W-5	Broman & Woo 2018	R3
24-Jan	2	Data exploration		Zuur et al. 2010	R4, Quiz 2
31-Jan	3	Generalized linear models, distributions and count data	Q&K-13	Harrison et al. 2018	R5
7-Feb	3	GLM - Proportions and survival	Q&K-13		R6, Begin HW 1
14-Feb	3	AIC and model selection		Harrison et al. 2018	R7, Quiz 3
21-Feb	4	Research design basics, fixed vs. random effects	Q&K-10, Z-5	Karban 3-5	R8, Begin project
28-Feb	4	Advanced designs, blocking and variance components	Q&K-11	Hurlbert et al. 1984	HW 1 due
7-Mar		SPRING BREAK – NO CLASS			
14-Mar	4	Advanced designs, split-plots and repeated measures	Q&K-12	Gelman & Loken 2014	Begin HW 2; Proposal due
21-Mar	4	Contrasts	Q&K-12	Wasserstein & Lazar 2016	R9, Project check in
28-Mar	5	Generalized linear mixed models			R10, Quiz 4
4-Apr	5	GLMMs (con't), overdispersion	Z-13		HW 2 due
11-Apr	5	GLMMs (con't), zero inflation			
18-Apr		Catch up and review			
Mar 16 – Apr 20		Independent project			Project due

Quizzes, homework assignments, and proposal will be due by the end of the listed week (Friday at 11:59pm).
R Challenges (indicated by R#) will need to be submitted to Canvas by the end of the week (Friday at 5pm EST).
Project will be due by April 27th at 5pm EST.
Recommended reading codes: G&W = Grolemond and Wickham (2017) R for Data Science; Q&K = Quinn and Keough (2002) textbook; Z = Zuur et al. (2009) textbook.

Grades and Grade Points: For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Academic Honesty: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment*."
It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

Online recording policy: Our class sessions will be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Software Use: All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Statement of diversity, equity, and inclusion: It is my goal that students from diverse backgrounds, as well as differences in learning styles and personality, will be welcomed and well served in this course. My definition of diversity includes race, ethnicity, gender, sexual orientation, physical ability, cultural, academic or economic background. I plan to present the material in such a way that it is accessible and relatable to all students. I encourage you to contact me if you have suggestions for how I can improve upon this goal. It is also expected that students will treat each other with respect and no harassment of any kind will be allowed. To report harassment, inappropriate behavior, or discuss issues with a neutral party, please contact the UF RESPECT Team.

Services for Students with Disabilities: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation
0001 Reid Hall, 352-392-8565, https://disability.ufl.edu/

Campus Helping Resources: Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu Counseling Services Groups and Workshops Outreach and Consultation Self-Help Library Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu/
- Career Connections Center, First Floor JWRU, 392-1601, https://career.ufl.edu/.

Student Feedback and Complaints:
I am always interested to hear feedback from students on how to improve this course. The goal, overall, is for students to get as much out of this course as possible. Please contact me with any thoughts or comments you have that might improve the course. When possible, I will incorporate this feedback immediately. Other times, changes may be implemented to improve future versions of this course. To register formal complaints, please refer to the following:

- Residential Course: https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/
- Online Course: http://www.distance.ufl.edu/student-complaint-process

In-Class Recording Policy:
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.