

# Experiments in Ecology and Agriculture

ENT 6934, Spring 2020, 1 credit

**Time and location:** Tuesday, 2:00pm-3:30pm, Room 1027 Steinmetz Hall

**Instructor:** Phil Hahn, hahnp@ufl.edu

**Office Hours:** Immediately after class or by appointment (email to arrange a time) in my office or over Skype/Zoom.

**Meetings:** We will meet on Tuesdays at 2:00pm-3:30pm in Steinmetz Hall Room 1027. If you are on campus in Gainesville you are expected to attend in person. If you are a remote student at a Research and Education Center, you will join this synchronous class by Zoom.

**Course Description:** This one credit seminar course will touch on three major themes related to designing experiments and making biological inference: 1) asking biological questions, posing hypotheses, and designing experiments to test them, 2) managing, manipulating, and visualizing data using R, and 3) analyzing and interpreting experimental data. This course will be broken into three main sections following the major themes: 1) Introduction to Experimental Design (week 1-4), 2) manipulating, visualizing, and analyzing data in R (week 5-10), and 3) analyzing real experimental data (week 11-14). During the first section, the instructor will present background material (15-20 min) and we will discuss a reading in class. During the second section, we will manipulate data and create graphs together in class using existing data from ecological or agricultural experiments. During the third section, students will analyze data from their thesis/dissertation (or alternatively a dataset they find online in consultation with the instructor). Students will give two oral presentations during this third section, a presentation of their experimental design and a presentation of their final results.

**Prerequisites and Expectations:** STA 6093 or equivalent is highly recommended. A basic understanding of R is highly beneficial. If you have no experience with R or RStudio, please watch at least 30 minutes and run the examples in one of the videos below prior to the first day of class.

- A comprehensive overview to the basics of R and RStudio. Covers installing R and RStudio, data types, data operators, conditional statements, loops, functions. (~1 hours). <https://www.youtube.com/watch?v=fDRa82lxzaU>
- A comprehensive overview to R and RStudio. Covers downloading R and RStudio, installing packages, data types, plotting, basic statistics (~2 hours). Video shows R on a Mac, but should be accessible to PC users. [https://www.youtube.com/watch?v=\\_V8eKsto3Ug](https://www.youtube.com/watch?v=_V8eKsto3Ug)

## Learning Objectives:

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

- ask biological questions and pose hypotheses to test them.
- design robust experiments.
- 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.

**Required Materials:**

*How to Do Ecology*. Karban, R., Huntzinger, M. and Pearse, I. (2017) Princeton Press.  
Additional readings will be posted online.

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

**Attendance and Make-Up Work:** Students are expected to attend all sessions either in person or 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>

**Evaluation & Grading**

**Discussion papers:** During the first four weeks of the course we will discuss readings during the last hour of class. Individuals or small groups of students will be selected to lead the discussion. All students should come prepared with questions and comments about the readings. If you know you will miss a discussion ahead of time, you can contribute to the discussion by sending two questions or comments to the instructor prior to class.

**Experimental design proposal:** Students will present a brief (~5 min) presentation using PowerPoint on the general design of their experiment. What question will be addressed? What are your hypotheses? What are the treatments and controls?

**Experimental results presentation:** Students will briefly (~5 min) present the (preliminary) findings of their experiment.  
See course schedule for due dates.

**Available Points**

Category	Points
Participation in discussion	40 (10 pts each)
Lead discussion	10
Proposal presentation	50
Final presentation	50
<b>Total</b>	<b>150</b>

**Final Grade**

Scale: percentage	Letter grade	Minimum points required
90-100	A	135
80-89	B	120
70-79	C	105
60-69	D	90
0-59	E	<88

## Weekly Course Schedule

Week	Topic	Discussion Paper
<b>Intro to experimental design</b>		
1	Posing questions and hypotheses	Karban 1-2
2	Experimental design basics	Karban 3
3	Randomized block designs and split-plots	Hurlbert et al. 1984
4	Introduction to linear models	Karban 4
<b>Intro to analyzing experimental data using R</b>		
5	Intro to R: Data management and manipulation	Borer et al. 2009
6	Intro to R: Data visualization	Weissgerber et al. 2015
7	Basic statistics (linear models)	Wasserstein 2016
8	Two-way ANOVA	
9	Analysis of randomized block designs	
10	Analysis of split-plot designs	
<b>Experimental design and analysis</b>		
11	Students present design proposal (question, hypothesis, and experimental design).	
12	Analyze data and create graphs	
13	Analyze data and create graphs	
14	Students present results of their findings (question, hypothesis, and results).	

**\*\*Schedule subject to change\*\***

### Reading List for Discussion Posts:

1. Karban et al. (2017) How to do Ecology. Chapter 1: Picking a Question & Chapter 2: Posing Questions.
2. Karban et al. (2017) How to do Ecology. Chapter 3: Using Experiments to Test Hypotheses.
3. Hurlbert, S.H. (1984) Pseudoreplication and the design of the ecological field experiments. Ecological Monographs 54:187-211.
4. Karban et al. (2017) How to do Ecology. Chapter 4: Analyzing Experimental Data.
5. Borer, E.T. et al. (2009) Some simple guidelines for effective data management. Bulletin of the Ecological Society of America. April 2009 205-214.
6. Weissgerber, T.L. et al. (2015) Beyond bar and line graphs: Time for a new data presentation paradigm. PLoS Biology 12:e1002128.
7. Wasserstein, R.L. and Lazar, N.A. (2016) The ASA's statement on p-values: context, process, and purpose. American Statistician 70:129-133.

**Online Course Evaluation Process:** Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>.

Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/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>.

**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.

**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](http://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/](http://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>