Statistical Methods for Bioscience II

Statistics/F&W Ecology/Horticulture 572, Spring 2020

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office:	148 Animal Sciences	TBD
office hours:	M 1-3pm, W 9-11am, or by appointment	T 1-3p, R 1-2p

Lecture time and location:

TR 11:00AM - 12:15PM
1651 Mosse Humanities Building

Requisites:

F&W ECOL/HORT/STAT 571 or graduate/professional standing. Proficiency with material from F&W ECOL / HORT / STAT 571 will be assumed.

Course Objective:

As in Statistics 571, the goal is to provide students in bioscience with a thorough grounding in modern statistical procedures. The emphasis will be on understanding underlying concepts rather than on an extensive coverage of a wide range of topics. The development of the ability to interpret results and to evaluate critically the methods used is of paramount importance. To a large extent the assignments will involve the analysis of data sets that approach the "real-world" complexity of data encountered in research. Substantial use will be made of the computer in conducting such analyses.

Description:

Polynomial regression, multiple regression, two-way ANOVA with and without interaction, split-plot design, subsampling, analysis of covariance, elementary sampling, introduction to bioassay.

Tentative Topics:

- **Continuing Simple Linear Regression:** Assessing assumptions, examining residuals, remedies for violated assumptions. (Chs. 1 & 2)
- **Multiple Linear Regression (MLR):** Fitting, evaluating, interpreting and testing. Sums of squares, multicollinearity, polynomial regression, qualitative predictors. (Chs. 3-6)

- **Model Selection for MLR**: Measures of model quality, best subsets, sequential selection. (Ch. 7)
- **Logistic Regression**: Fitting, evaluating, interpreting, and testing. (Ch. 8)
- **Extending One-Way ANOVA:** Alternate model formulation, expected mean squares, power, contrasts. (Ch. 9)
- **Factorial Designs:** 2x2 and general designs. Estimating and interpreting main effects and interactions.(Ch. 10)
- **Block Designs:** Fitting, evaluating, interpreting. Randomized complete block designs, Latin squares, randomization. (Chs. 11 & 12)
- **Mixed Effects Models:** Fixed vs. random effects, subsampling, split-plot designs. (Chs. 13 & 14)

Text:

Reference materials will be provided in class and online at Canvas.

Homework Policy:

- Homework assignments are due each week on Friday, on canvas, by 4:00 pm. Assignments will be returned by discussion section. Credit will not be given for homework turned in late.
- Homework assignments should be well organized and neat. It is required that you show your work in order to receive credit.
- You may discuss homework problems with others including your peers, your TA and instructor, but you must write up your homework solutions by yourself in order to receive credit. Similarly, you must write your own computer code and obtain your computer output independently.
- The two lowest scores will be dropped when computing an average score for your homework at the end of the semester. Please use this "Drop Two" policy wisely and contact the instructor if you have a concern that is not adequately covered by this policy. This policy excludes the first homework assignment: the 571 exam.
- Submit your homework electronically on Canvas. To submit, click on the Assignments tab, then click the assignment you want to submit. Click the blue box near the top right labeled 'Submit Assignment.' On the 'Select Submission Type' screen, click on the 'File Upload' tab, then click 'Choose File' to browse for the file. You may add comments for the grader if desired, then click the 'Submit Assignment' box. Give Canvas a little time, then look in the top right for confirmation that the assignment was received.
- Your submission should be a single PDF document. If you have scanned written pages, printed output, graphs, etc., please use a program such as Adobe Acrobat to combine the separate pages into a single document before submitting. Acrobat is available at most of the infolabs on campus. Handwritten pages can be scanned at most infolabs as well, or with phone apps, such as CamScanner (free version).

- You will not be able to submit an assignment after the submission deadline, so please plan ahead. It is recommended you begin the submission process at least 5 minutes prior to the submission deadline, since it sometimes takes some time for Canvas to accept an assignment. Any assignments that are not received by the submission deadline will earn zero points.
- Assignments will be graded electronicially. You can view any comments or annotations on Canvas by clicking on Grades, then the assignment. For comments, click on the comments icon, or for annotations, click the assignment name, then 'View Feedback.'
- Homework can be hand-written, or typed, or a combination of both, but must be well organized, neat, and legible to receive full credit.
- You must show work to receive full credit. For problems involving R, this may require providing the code and/or output obtained. Any code or output provided should be edited for neatness and readability.
- Unless otherwise specified by a problem, you can always use either R or Tables A, C, or D to compute probabilities.

Exams:

There will be an in-class midterm, a take-home midterm, and a final exam. The exams will cover lecture materials, readings, and homework material. Exams will be open-book and open-notes. The first midterm will take place during class time on **February 27**, the take-home midterm will be distributed on April 9 after lecture, and **due Thursday April 16** at the beginning of lecture. The final exam will take place on **Thursday May 7** at 12:25 pm.

Block the time for the exams now — missed exams will not be permitted except when extenuating circumstances prevail. Vacation travel does not constitute an acceptable reason for missing an exam.

Grading:

The homework will count 20%, the in-class midterm will count 20% the take-home midterm will count 30%, and the final will count 30%.

Discussion Sections:

Attendance is strongly advised. It's the best place to ask questions in a small group, to connect with other students and form study groups, to get practice of new concepts, and get help with computing questions. Discussions WILL meet the first week of class, so the first discussion will be on January 22nd. You may attend a discussion for which you are not officially enrolled, but we ask that you try to attend the same section most of the time, and that you approve any switch with your TA. If you have a laptop, we recommend you bring one.

section times and locations

311	312	313
W 11:00AM - 11:50AM	W 12:05PM - 12:55PM	R 8:50AM - 9:40AM
1143 Mechanical Engineering Building	224 Ingraham Hall	106 School of Social Work Building

Credit Information:

This course is 4 credits. The class meets for two 75-minute lecture class periods and one 50-minute discussion section each week, and carries the expectation that students will work on course learning activities (readings, homeworks, studying, etc.) for about 3 hours for every class period.

Computing:

We will be using R, and optionally, an R interface called R Studio, as well as SAS. R is a free, open-source, and extremely flexible package, and is available for download online at: `www.cran.r-project.org/`. R Studio is available for free from `www.rstudio.com/products/rstudio/download/#download`. Some experience with R will be expected, as R should be familiar from 571. SAS is available as a free download for PCs from DoIT for most graduate students. If you use a Mac, or if you do not have free access to SAS through DoIT, SAS is available at several of the computer labs around campus. No prior experience with SAS is expected.

Rules, Rights, and Responsibilities:

See: `https://guide.wisc.edu/graduate/`

Academic Calendar and Religious Observances

See: `https://secfac.wisc.edu/academic-calendar/#religious-observances`

Academic Integrity

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but are not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion. For detailed information, please see: `https://conduct.students.wisc.edu/academic-misconduct/`.

Standards of Ethical Conduct in Data Analysis and Data Privacy

The members of the faculty of the Department of Statistics at UW-Madison uphold the highest ethical standards of teaching, data, and research. They expect their students to uphold the same standards of ethical conduct. Standards of ethical conduct in data analysis and data privacy are detailed on the ASA website: `https://www.amstat.org/ASA/Your-Career/Ethical-Guidelines-for-Statistical-Practice.aspx`, and include:

- Use methodology and data that are relevant and appropriate; without favoritism or prejudice; and in a manner intended to produce valid, interpretable, and reproducible results.

- Be candid about any known or suspected limitations, defects, or biases in the data that may affect the integrity or reliability of the analysis. Obviously, never modify or falsify data.
- Protect the privacy and confidentiality of research subjects and data concerning them, whether obtained from the subjects directly, other persons, or existing records.

By registering for this course, you are implicitly agreeing to conduct yourself with the utmost integrity throughout the semester.

Accommodations for Students with Disabilities

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform instructors of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Instructors will work either directly with the student or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

Diversity and Inclusion

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background - people who as students, faculty, and staff serve Wisconsin and the world.

Complaints

If you have a complaint about a TA or course instructor, you should feel free to discuss the matter directly with the TA or instructor. If the complaint is about the TA and you do not feel comfortable discussing it with him or her, you should discuss it with the course instructor. Complaints about mistakes in grading should be resolved with the instructor or TA, as appropriate, in the great majority of cases. If the complaint is about the instructor (other than ordinary grading questions) and you do not feel comfortable discussing it with him or her, contact the Director of Undergraduate Studies, Professor Cecile Ane, cecile.ane@wisc.edu. If your complaint concerns sexual harassment, please see campus resources listed at `https://compliance.wisc.edu/titleix/resources/`. In particular, there are a number of options to speak to someone confidentially. If you have concerns about climate or bias in this class, or if you wish to report an incident of bias or hate that has occurred in class, you may contact the Chair of the Statistics Department Climate and Diversity Committee, Professor Karl Rohe (karlrohe@stat.wisc.edu). You may also use the University's bias incident reporting system, which you can reach at `https://doso.students.wisc.edu/bias-or-hate-reporting/`.

Designations:

Level - Intermediate L&S
Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Instructional Mode

Face-to-face