Catalog course description: Examines research design from statistical perspective, showing how data analysis is largely determined by research design and its implementation. Reviews statistical tools for analysis of ecological data in the context of design. Prerequisite: Graduate standing.

Why take WILD 6500? WILD 6500 takes the task of experimental design, and uses it to give you a broad introduction into three aspects of ecological research: statistical methods, computational methods, and communicating data analysis. The course is intended to help you build basic skills, while at the same time developing broader insights into statistical methodologies.

How to succeed in WILD 6500:

- Put in the time. Anticipate investing 2-3 hours out of class for each hour of lecture.
- Rewrite your notes after every lecture. This forces you to interact with the lecture material more slowly, and helps you identify areas where you’re uncertain of what’s going on.
- Re-do homeworks prior to exams, focusing on problems that you missed the first time through. Re-do problems enough times that you can do them “cold”. Identify a set of warm-up problems (the ones you know you struggle with most) to do in the morning before the test.
- Be patient with yourself in R. It is completely normal to struggle with R at the beginning; my goal is to help you get through that struggle as quickly as possible.

Office Hours: Group work time Tuesdays 3-5 PM in NR 202; One-on-one meeting time by appointment at my office, NR 132

Course Web Page: https://usu.instructure.com/courses/494086


Topics: WILD 6500 is intended to provide a broad introduction to the statistical and computational skills you will need as researchers. The course should help you develop proficiency in three broad areas:

- Statistical methodology (both mathematical underpinnings and general concepts)
- Computation (basic computational logic, as well as applied skill in R)
- Communication (writing about data analysis and designing figures)

Mathematical and statistical fears: My goal in this course is that you make progress from your starting point as an analyst, programmer, and writer. “Progress” will mean different things for different people; I want you to learn as much as possible, and I’m here to help you succeed.

Grading is based on about 1,000 total points: 250 points each of probability, linear modeling, and experimental design homeworks; and 250 points allocated across a midterm and a final exam.

Exams: Exams are in-class and worked individually. They will be pencil-and-paper, and are intended to assess your knowledge of statistical methodology.

Homeworks: Homework will take on one of two forms:

- Short-answer homeworks (~ 1/week)
- Statistical reports (~ 4/semester)
I will grade a subset of problems on each homework, and post a complete key outside my office following grading. In order to get full credit on homeworks, you must re-do any problems for which you receive less than full credit (using the key if you want), and submit re-dos to me within one week. If you submit complete revisions, you will earn full credit for the assignment.

**Statistical reports** will be graded for content, organization, and communication quality. Of particular note:

- Reports must be typed and no longer than 2 pages.
- Your report should have 4 (titled) sections: Introduction, Methods, Results, and Scope of inference.
- The R code and output used to complete a homework should be included in an appendix unless otherwise noted. Answer each question using proper English sentences.
- Key Tables or Figures that summarize evidence to support your scientific conclusions should be included (in the Appendix or the Main Text), labeled, and referenced from report’s body.

As with homeworks, you will have an opportunity to revise and resubmit your reports for full credit following initial grading. Revised reports should be submitted within one week of when they are returned.

**Group office hourse:** Held every Tuesday from 3-5 in NR 202. If you are struggling at all, please attend – this is the time when I can help you most effectively with both R and the statistical contents of the course.

**Statistical learning objectives:** By the end of this course, you should be able to

- Identify an appropriate probability model for a particular response of interest
- Be able to translate a scientific question into a preliminary statistical model
- Understand how interactions, higher-order terms, and categorical variables enter a linear model
- Write out a set of covariates in the form of a design matrix, and use that matrix to generate a set of parametric expectations under a particular model
- Have a basic comprehension of dimensionality in linear models, and describe basic tests for dimensionality
- Understand and graphically check linear modeling assumptions
- Understand and explain the role of a null distribution in a statistical test
- Understand the roles that replication and sampling variation play in statistical inference, and be able to relate that to ecological study design

**Computational learning objectives:** By the end of this course, you should be able to

1. Write code compliant with standard modern style conventions, that includes sufficient annotation
2. Use basic logic (&, |, ifelse, !, etc.) and indexing
3. Write for-loops, ifelse statements, and while statements
4. Design and write functions
5. Be able to test for and correct simple bugs
6. Conduct basic data aggregation and cleaning
7. Design and construct effective data visualizations
8. Conduct all statistical analyses presented in lecture

**Help:** Feel free to collaborate on homeworks, BUT each student must hand in an independent write-up unless the homework explicitly states otherwise. Email is the best way to reach me with questions, and I encourage you to ask questions early and often, especially on R. If you email me with an R question, please paste in any relevant code and output.

**Disability Statement:** USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn 101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.