WILD 540 Research Design
WILD 541 Research Design Lab

Instructors:

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Objectives and Grading

Course Objectives:

The lecture will review scientific methods, critically thinking about questions posed in research, and the approach is taken to collect data to answer them. Specifically, we will explore issues of scientific inference, examine classic experimental and survey design, explore designs for common wildlife and fisheries questions, and investigate quasi-experiments (impact assessments). In this class, students will critically review the literature, discuss specific design issues, and practice designing experiments and surveys.

The lab will introduce wildlife biology students to the R statistical analysis environment to enhance the learning objectives of the lecture. Students will be expected to learn R programming skills, R data management, and R graphing functions, as well as an introduction to statistical analysis in R. Labs will be designed to expose students to elements of research design, including basic probability theory, basic frequentist statistical approaches, sampling design, statistical power, maximum likelihood, generalized linear models and extensions.

Materials: We have a Moodle page to exchange readings, data sets, and assignments for this class. Let us know if you have any problems using Moodle.

Grading:

Participation (25%): This is a graduate class. Therefore, it will be a mix of lectures, computer labs, and discussions. We expect you to come with the assigned readings completed and ready to discuss the topic. Full credit for participation points requires regular discussion in addition to attendance.
**Problem sets & assignments (50%):** Throughout the semester, there will be assignments in lecture and lab that will ask you to demonstrate proficiency at R, general statistical concepts, apply issues that we discuss in class, examine outcomes of different designs, evaluate design considerations, develop sampling or experimental designs for specific problems, and comment on designs.

**Class project (25%):** The project for both lecture and lab will focus on your graduate student project (or similar exercise). Through a series of assignments, you will be developing the design of your project, explicitly evaluating your design’s strengths, weaknesses, and power. Your work will be presented to the class for feedback at the end of the semester. This assignment counts for both the lecture and lab portion of the course.

**TENTATIVE SCHEDULE and READINGS**

This is a toolbox course to help you understand the array of designs, trade-offs, and approaches. These are the general topics to be covered, but the exact schedule and depth of certain topics will depend on the graduate students in the class. Lab activities will complement the lecture and assigned throughout the semester.

**Week 1 - Course overview, strengthening science, and scientific inquiry**

- Aug 28: Class goals and introductions.
- Aug 30: Scientific understanding & strengthening science (Platt 1964)
- Sep 1: Need to get the basics right (Anderson 2001)

Assignment 1: Facing our common mistakes (Due Sept 7th – by email)

**Week 2 - Hypotheses**

- Sept 4: No Class Labor Day
- Sept 6: Guest Lecture Dr. Sarah Sells – hypotheses (Sells et al. 2018)
- Sept 8: Developing research questions and plans

Lab 1 – continued

**Week 3 - Developing plans and types of studies**

- Sept 11: Developing research questions and plans
- Sept 13: Types of field studies and relationships with inference strength
- Sept 15: Minimal requirements for experiments & pseudoreplication

Assignment 2: Delving into a research question (Due Sept 19th)
**Week 4 - Experimental Designs**

Sept 18: Linking questions to designs
Sept 20: Basic Designs - random versus fixed effects, factorial
Sept 22: Basic Designs - Blocking, split-plot, nested and repeated measures.

**Week 5 - Experimental Design**

Sept 25: Factorial Designs and Blocking
Sept 27: Tree snail design exercise
Sept 29: Sampling

**Week 6: BACI - examples of designs from the field**

Oct 2: Sampling
Oct 6: Sampling – large scale sampling, GRTS

**Week 7: Sampling**

Oct 9: Sampling – cluster, double-sampling, etc.
Oct 11: Student preliminary project presentations (*also during lab*)
Oct 13: Student preliminary project presentations

**Week 8: Preliminary Project Presentations**

Oct 16: Student preliminary project presentations
Oct 18: Data Visualization Lab
Oct 20: TBD

**Week 9: Sampling and Sample Size**

Oct 23: Determining sample size
Oct 25: Determining sample size
Oct 27: Guest Lecture: Dr. Sara Williams – distance sampling

**Week 10 – Capture-recapture**
Oct 30: Capture-recapture
Nov 1: Capture-recapture
Nov 3: Capture-recapture

**Week 11 – Wildlife Society Conference week**

Nov 6-8: Time to work on class project (*also during lab*)
Nov 10: Veteran’s Day – no classes

**Week 12 – Monitoring and habitat**

Nov 13: Occupancy analysis
Nov 15: Habitat Selection Analyses
Nov 17: Population Monitoring

**Week 13**

Thanksgiving week – no class

**Week 14**

Nov 27: Population Monitoring
Nov 29: Discuss Ethics of Experiments, IACUC, RCR (*during lecture*)

Final Presentations (*during lab*)

Dec 1: Final Presentations

**Week 15**

Dec 4: Final presentations
Dec 6: Final presentations (*also during lab*)
Dec 8: Final presentations

**Add/drop information:** Please review the add/drop information and include the relevant information for your syllabus- [https://www.umt.edu/registrar/students/drop-add/default.php](https://www.umt.edu/registrar/students/drop-add/default.php)

**Academic calendar:** In case you were wondering when the semester ends- [https://www.umt.edu/provost/academiccalendar/](https://www.umt.edu/provost/academiccalendar/)