

NRES 776 Syllabus

Lisa Koetke & Sunny Tseng

Fall 2023

Advanced statistical analyses for natural resource sciences

- **Lecture:** Tuesday and Thursday 12:30 - 13:20 pm
- **Lab:** Thursday 8:00 - 10:50 am
- **Location:** In person: 5-177 Lecture & 8-362 Lab; Virtual: zoom link
- **Course website:** UNBC Moodle (everything is there!)

This course provides advanced, practical training in the analysis of quantitative data. The course focuses primarily on advanced univariate statistics that can be applied to both experimental and observational data. This focus includes a full exploration of generalized linear models, including linear, logistic, and mixed models. Students also receive instruction in the principles of experimental design, data management, and the review and reporting of statistical results. Labs focus on using R statistical software to manipulate, display, and analyze data.

Instructors

name	email	office	office hour
Lisa Koetke	lisa.koetke@unbc.ca	10-2086	Tue. 13:30 - 14:30
Sunny Tseng	stseng@unbc.ca	https://unbc.zoom.us/j/6088522970?pwd=cjJhOVRqMmk0bkJlN2tJajJrTWNYdz09	Tue. 13:30 - 14:30

Schedules

Lecture schedule Lecture content will introduce the principles of experimental design and discuss a variety of statistical methods used to analyze experimental and observational ecological data.

Date	Lecture ID	Tentative topic	Instructor	Location
Sept 7, Thu.	Lecture 1	Course introduction	Sunny	Virtual
Sept 12, Tue.	Lecture 2	Basic concepts of statistics in ecology	Sunny	Virtual
Sept 14, Thu.	Lecture 3	Graphics and data visualization	Sunny	Virtual
Sept 19, Tue.	Lecture 4	Descriptive statistics	Sunny	Virtual
Sept 21, Thu.	Lecture 5	Probability and distributions	Sunny	Virtual
Sept 26, Tue.	Lecture 6	Hypothesis testing	Sunny	Virtual
Sept 28, Thu.	Lecture 7	Experimental design	Sunny	Virtual
Oct 3, Tue.	Lecture 8	Test of difference in means	Lisa	In Person
Oct 5, Thu.	Lecture 9	Comparing more than two means	Lisa	In Person
Oct 10, Tue.	Lecture 10	Linear regressions	Lisa	In Person

Date	Lecture ID	Tentative topic	Instructor	Location
Oct 12, Thu.	Lecture 11	Linear regressions	Lisa	In Person
Oct 17, Tue.	Lecture 12	Analyzing multiple factors	Lisa	In Person
Oct 19, Thu.	Lecture 13	Multiple regression	Lisa	In Person
Oct 24, Tue.	Lecture 14	Model selection	Lisa	In Person
Oct 26, Thu.	Lecture 15	Model selection and model averaging	Lisa	In Person
Oct 31, Tue.	Lecture 16	Generalized linear models	Sunny	Virtual
Nov 2, Thu.	Lecture 17	Generalized linear models	Sunny	Virtual
Nov 7, Tue.	Lecture 18	Generalized linear models	Sunny	Virtual
Nov 9, Thu.	Lecture 19	Generalized linear models	Sunny	Virtual
Nov 14, Tue.	Lecture 20	Mixed-effect models	Lisa	In Person
Nov 16, Thu.	Lecture 21	Mixed-effect models	Lisa	In Person
Nov 21, Tue.	Lecture 22	Multivariate analyses	Lisa	In Person
Nov 23, Thu.	Lecture 23	Multivariate analyses	Lisa	In Person
Nov 28, Tue.	Lecture 24	Project 2 presentation	Sunny & Lisa	In Person
Nov 30, Thu.	Lecture 25	Project 2 presentation	Sunny & Lisa	In Person
Dec 5, Tue.	Lecture 26	Project 2 presentation	Sunny & Lisa	In Person

Lab schedule The labs will include a tutorial demonstrating code and techniques, practice exercises, and a discussion of the weeks' readings. Labs will emphasize hands-on statistical analysis and interpretation of results from quantitative observations and manipulative experiments. Analysis will be done using R Statistical Software.

Date	Lab ID	Tentative topic	Instructor	Location	Discussion	Note
Sept 14, Thu.	Lab 1	Intro to R	Sunny	Virtual	NA	NA
Sept 21, Thu.	Lab 2	Data visualization	Sunny	Virtual	Presenting data graphically	Lab 1 due
Sept 28, Thu.	Lab 3	Data summarizing	Sunny	Virtual	Presenting statistical results	Lab 2 due
Oct 5, Thu.	Lab 4	Comparing two means	Lisa	In Person	Hypothesis testing	Lab 3 due
Oct. 12, Thu.	Lab 5	Comparing more than two means	Lisa	In Person	Problems with p-values	Lab 4 due
Oct. 19, Thu.	Lab 6	Project 1 presentation	Sunny	In Person	NA	Project 1 due
Oct. 26, Thu.	Lab 7	Multiple regression	Lisa	In Person	Questionable research practices	Lab 5 due
Nov. 2, Thu.	Lab 8	Model selection	Lisa	In Person	Model selection	Lab 7 due
Nov 9, Thu.	Lab 9	Generalized linear models	Sunny	Virtual	Generalized linear models	Lab 8 due
Nov. 16, Thu.	Lab 10	Generalized linear models	Sunny	Virtual	Generalized linear models	Lab 9 due
Nov. 23, Thu.	Lab 11	Mixed-effect models	Lisa	In Person	Decolonizing quantitative research	Lab 10 due
Nov. 30, Thu.	Lab 12	Multivariate analyses	Lisa	In Person	NA	Lab 11 due; Project 2 due

Assessments of learning

Grade distribution

Letter	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Percent	90.0 - 100.0	85.0 - 89.9	80.0 - 84.9	77.0 - 79.9	73.0 - 76.9	70.0 - 72.9	67.0 - 69.9	63.0 - 66.9	60.0 - 62.9	57.0 - 59.9	53.0 - 56.9	50.0 - 52.9	<50.0

Lab assignments (50%)

- Due: every Thu. midnight
- Submission: a R file named as “NRES776_ *lastname* _lab_X.R”. Submit to course website.
- Description: For these assignments, you will analyze data sets using a variety of techniques learned in class. A demonstration of lab assignments will be included in the beginning of each lab. Students are encouraged to finish the lab during the course lab time.

Project 1 (15%)

- Due: Oct.19 at midnight
- Submission: oral presentation, a PDF file named as “NRES776_ *lastname* _project_1.pdf” submitted to course website.
- Description: Working with the instructor, students will develop an analysis strategy to examine data relevant to their research area. You will develop the project starting with a research question, data visualization, and list hypotheses. Making it as a research proposal that you are going to apply funding with. There will be a 5 mins presentation component as well as a 2-pages report.

Project 2 (20%)

- Due: Dec. 7 at midnight
- Submission: oral presentation during lecture times Nov. 28 to Dec. 5, a PDF file named as “NRES776_ *lastname* _project_2.pdf” submitted to course website.
- Description: Your second project will build off of Project 1. Using the same dataset, you will answer your research questions and test your hypotheses using methods learned in the second portion of the semester. This project will include a 5-minute presentation and a written report of your methods and results.

Discussion paper presentation (10%)

- Due: one of the lab session
- Submission: oral presentation
- Description: You will have 5 mins to present a discussion paper during the lab period and lead a 20 mins discussion based on the papers. You can sign up for the paper you would like to present. All students are expected to read the discussion paper before each lab and participate discussion. Guidelines on leading a discussion will be provided.

General participation (5%)

- Description: You will be evaluated by your involvement in course discussion, and providing feedback to other students' presentation.

Resources

Books

- Whitlock, MC and Schluter, D. 2015. The Analysis of Biological Data. 3rd Edition. Roberts and Company Publishers.
- Gotelli, N.J., and A.M. Ellison. 2013. A Primer of Ecological Statistics (2nd Edition). Sinauer Associates Inc., Sunderland, MA.
- Zuur, AF, Ieno, EN and Smith, GM. 2007. Analysing Ecological Data. Springer. eBook available through UNBC library: <http://prxy.lib.unbc.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=254638&site=ehost-live&scope=site>

Online resources

- R for Data Science by Hadley Wickham and Garrett Grolemund at <http://r4ds.had.co.nz/>
- Foundations of Statistics with R by Darrin Speegle: <https://bookdown.org/speegled/foundations-ofstatistics/>
- Repository of Bookdowns on a variety of topics related to data analysis, R, and statistics: <https://bookdown.org/home/tags/statistics/>

Territorial acknowledgement

UNBC is located on and serves diverse traditional territories that are home to numerous First Nations and other Aboriginal groups. The Prince George campus is situated on the traditional territory of the Lheidli T'enneh, part of the Dakelh (Carrier) First Nations. For further information about Territories on which UNBC campuses are located, please see: <https://www2.unbc.ca/indigenous-resource-dati/traditional-territory-acknowledgement>

Access resource centre

The Access Resource Centre (ARC) provides services to students with documented health conditions and/or disabilities. The conditions can range from temporary to permanent and include but are not limited to:

- chronic health issues (e.g., Crohn's, Diabetes, HIV, Lupus)
- hearing and visual impairments
- learning disabilities
- mental health challenges (e.g., anxiety disorder, borderline personality disorder, depression disorder)
- neurological disabilities (e.g., ADHD/ADD, Autism Spectrum Disorder, Epilepsy, Concussion, Migraines, Multiple Sclerosis)
- mobility and other physical disabilities.

ARC staff are available, by appointment, to meet with you to determine which academic accommodations can be put in place to support you in achieving their academic goals, provide referrals, and help advocate for you. Students who may have a need for academic accommodation are encouraged to contact ARC:

- Email at arc@unbc.ca,
- Phone at 250-960-5682 (toll free 1-888-960-5682), or
- Stop by 5-157.

More details are available at the Access Resource Centre website.

Academic dishonesty

Do NOT do Copying and Pasting! While it may seem a quick way to answer an exam or assignment question, this constitutes plagiarism – whether the text is from an online source (including AI systems like ChatGPT), another student’s assignment, or even another assignment of yours! Students who fail to put their answers into their own words will automatically receive 0% on the particular assignment/lab/exam in question. If the nature of the act is considered serious, recommendations for further disciplinary action will be forwarded to the Dean. Please ask the instructor for more information if you do not understand this prohibition. Note that ignorance of these policies will not be accepted as a defense. Students guilty of such activities may receive a zero on the particular assignment/exam/lab in question. If deemed sufficiently severe by the instructor, the offense could lead to sanctions that include reprimand, reduction of grade, or suspension. All matters of Academic Misconduct at UNBC require instructors to submit a formal report to the Chair and Office of Registrar, which will be placed in the student’s academic file.