

Multivariate Analysis for Community Ecology
ESS 655, Fall 2020

Instructor

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Office hours: by arrangement on MS Teams

Schedule

Wednesdays, 9:00 – 11:40 am in [NESB A302](#).

The course will meet for 10 weeks, starting Sept 16, through Nov 18.

We will hold an organizational meeting on Wed, Aug 26 at 9:00 am.

Overview

In this 2 credit course, students will learn popular techniques for analyzing multivariate data characteristic of community ecology, including ordination, classification, and permanova. Students gain conceptual understanding of the methods, and will practice implementing these techniques on a dataset of their choice. By the end of the semester, students will be comfortable running community analyses within the R software package and have the skills necessary to perform a multivariate analyses that will stand up to peer review.

With these techniques, students will be able to answer questions such as:

- How are taxa distributed with respect to environmental gradients or treatments?
- Do groups of species form distinct “communities”?
- What factors underly patterns of species distributions?
- How do these patterns change through time?

Learning objectives

1. Explain the reasons for using multivariate analyses to a colleague.
2. Critique multivariate analyses found in published literature.
3. Develop and troubleshoot R code for running statistical tests and generating graphics.
4. Conduct multivariate analyses on real data that will stand up to peer review.

Course Details

- We will meet weekly for a combined lecture/lab/discussion in NESB A 302. Please bring a laptop running R to these sessions.
- The format of the course will be informal and flexible. I would like to steer the content towards topics that will help you.
- Most weeks, there will be a short assignment to complete on your own.
- Ideally, you should have a dataset of your own with which to apply the techniques learned in the course. The standard data structure is a matrix of species occurrences in plots/samples, with associated environmental/treatment data for each sample.
- A journal-style manuscript (which may lead to a thesis chapter or a publication) will be due at the end of the semester.
- Your grade will be assessed based on a term paper and presentation (40%), weekly assignments (50%), and participation (10%).
- I intend to record lectures and place them on Canvas for your reference.

Assignments and Grading

- Weekly lab assignments (approx 5@ 10 pts each = 50 points)
- Term paper and presentation (40 points) due at end of semester
- Participation (10 points)
- Total 100 points; grading on conventional scale

Course schedule (tentative...check Canvas for updates)

Week	
1	Why use multivariate analysis? Structure of multivariate datasets Method selection
2	Patterns among variables: (Principle Components Analysis, Factor Analysis)
3	Ordination I: methods based on weighted averaging (Reciprocal Averaging, Detrended Correspondence Analysis)
4	Ordination II: constrained ordination (Canonical Correspondence Analysis)
5	Ordination III: methods based on sample dissimilarity (Non metric Multidimensional Scaling, distance-based Redundancy Analysis)
6	Classification: agglomerative and divisive methods (Clustering, K means)
7	Testing for group differences: (Multi response permutation procedures, MANOVA, PERMANOVA)
8	Comparing groups: (Indicator Species Analysis, Discriminant Analysis, Random Forests, CART)
9	Community dynamics: successional vectors; topics of interest
10	Student presentations Course wrap up

Suggested text

- McCune, B, and J.B. Grace. 2002. Analysis of Ecological Communities. MjM Software Design, Gleneden Beach, Oregon. Available for \$45 online at <https://www.pcord.com/book.htm> or on Amazon.
- Articles from the primary literature will be posted on Canvas.

Academic integrity

Students are encouraged to help each other out in this class, but ultimately assignments that are turned in must be the student's own. Plagiarism will result in lost credit for the plagiarized work, failure of the assignment, or failure of the course. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog. (<http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity>)

Important COVID information for Students

All students should fill out a student-specific symptom checker each day before coming to class (<https://covidrecovery.colostate.edu/daily-symptom-checker/>). In addition, please utilize the symptom checker to report symptoms, if you have a positive test, or exposed to a known COVID contact. If you know or believe you have been exposed or are symptomatic, it is important for the health of yourself and others that you report it through this checker. You will not be in trouble or penalized in any way for reporting. If you report symptoms or a positive test, you will receive immediate instructions on what to do and CSU's Public Health Office will be notified. Once notified, that office will contact you and most likely conduct contact tracing, initiate any necessary public health requirements and/or recommendations and notify you if you need to take any steps. For the

latest information about the University's response, please visit the CSU COVID-19 site (<https://covidrecovery.colostate.edu>). **Please also inform an instructor if you cannot come to class because you are sick or quarantined.**