



UNIVERSIDADE FEDERAL DE SANTA CATARINA
PÓS-GRADUAÇÃO EM ECOLOGIA

SYLLABUS



SEMESTER 02 / 2026

1. COURSE IDENTIFICATION

CODE	COURSE	NUMBER OF STUDENTS		WORKLOAD / SEMESTER
ECO41001	Multivariate Analysis	Min.: 4	Max.: 20	60 h (4 credits)

2. SCHEDULE

August 18th to September 4th. Tuesday, Wednesday and Friday mornings (8:30-12 am) and afternoon (2-5 pm), exceptionally Tuesday.

Lectures, exercises, and discussion will be held as on-site activities (PG 9, block D, ground floor)

3. INSTRUCTORS

Dr. Rafael Barbizan Suhs (rbsuhs@gmail.com)

Dr. Daniel Dutra Saraiva (daniel.dutra.saraiva@gmail.com)

Dr. Luis Carlos Pinto (luismacedosoares@gmail.com)

4. COURSE OFFER

Graduate Program in Ecology or in related fields

5. SYLLABUS

Introduction to multivariate data analysis; Main R packages; The multivariate data, types of data used in ecological studies and correlated areas; Q mode and R mode; Data transformation and standardization; Distance and (dis)similarity measures, association matrices; Hierarchical Cluster Analysis and Indicator Species Analysis; Unconstrained ordination; Constrained Ordination; Testing hypotheses with multivariate data (PERMANOVA, GLMmv).

6. GOALS

To train MSc and PhD students in their first steps in multivariate data analysis. We expect that all students who finished the course will have a background to apply Multivariate Data Analysis in their projects.

7. PROGRAM CONTENT

- The multivariate data, types of data used in ecological studies and correlated areas.
- Data transformation and standardization.
- Q mode and R mode, Distance and (dis)similarity measures, association matrices.
- Hierarchical Cluster Analysis and Indicator Species Analysis.
- Unconstrained ordination.
- Constrained Ordination.
- Testing hypotheses with multivariate data (PERMANOVA, GLMmv).

8. DESCRIPTION OF METHODS

The course will encompass theoretical and practical lectures using R software. Additional readings aiming to cover the key topics of the theory. Discussion about the applicability of multivariate data analysis based on students' experiences.

9. ASSESSMENT

Frequency and participation in lectures and other activities developed in R, after the end of each lecture + a graded final report.

10. DETAILED SCHEDULE

When? *	What?	Who?
August 18 th	Overall introduction, multivariate data structure, Q mode and R mode, exploratory data analysis, data standardization and transformation	Rafael
August 19 th	Distance and (dis)similarity measures, association matrices	Luis
August 21 th	Hierarchical Cluster Analysis, Indicator Species Analysis (IndVal) Introduction to ordination methods, Principal Component Analysis (PCA)	Daniel
August 25 th	Correspondence Analysis (CA and DCA), ordination of qualitative data (MCA) Principal Coordinate Analysis (PCoA) and non-metric Multidimensional Scaling (nMDS)	Luis
August 26 th	Canonical ordination, Redundancy Analysis (theory and practice), Canonical Correspondence Analysis	Luis
August 28 th	Testing hypothesis in multivariate data: permutations, PERMANOVA and Mantel test. Linear Models (LMmv) and Generalized Linear Models (GLMmv) for multivariate abundance data.	Daniel / Rafael
September 1 st	Practical activity with student data	Rafael / Luis
September 2 nd	Practical activity with student data	Rafael / Luis
September 04 th	Presentation of results and interpretations based on the analysis of student data and course evaluation	Rafael / Luis

* Morning (8:30–12:00 am) and Afternoons (2:00-5:00 pm)

11. BASIC LITERATURE

Borcard D., Gillet F., Legendre P. (2018). 2 ed. Numerical ecology with R. Springer, London.
Legendre P., Legendre L. (2012). 3 ed. Numerical Ecology. Elsevier, Amsterdam.
Rodrigues da Silva F., Gonçalves-Souza T., Paterno G. B., Provete D. B., Vancine M. H. (2022). Análises Ecológicas no R. Nupeea e Canal 6, Recife/São Paulo.
Gotelli N.J., Ellison A.M. (2011). A Primer of Ecological Statistics. Oxford University Press.