



UNIVERSIDADE FEDERAL DE SANTA CATARINA
PÓS-GRADUAÇÃO EM ECOLOGIA



SYLLABUS

SEMESTER 02 / 2023

1. COURSE IDENTIFICATION

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

2. SCHEDULE

August 17th to October 5th. Thursday mornings (8:30-12 am) and afternoon (2-5 pm), exceptionally Tuesday 05/09 due to the holiday.

Lectures, exercises, and discussion will be held as on-site activities (in Florianópolis city; Specific detail will be released after enrollment)

3. INSTRUCTORS

Prof. Eduardo L. Hettwer Giehl, and Prof. Luis Macedo Soares

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?
August 17 th	Overall introduction, multivariate data structure, Q mode and R mode, data standardization and transformation
August 24 th	Distance and (dis)similarity measures, association matrices
August 31 th	Hierarchical Cluster Analysis, Indicator Species Analysis (IndVal)
September 05 th Tuesday	Introduction to ordination methods, Principal Component Analysis (PCA), Correspondence Analysis (CA and DCA), ordination of qualitative data (MCA)
September 14 nd	Principal Coordinate Analysis (PCoA) and non-metric Multidimensional Scaling (nMDS)
September 21 th	Canonical ordination, Redundancy Analysis (theory and practice), Canonical Correspondence Analysis
September 28 th	Testing hypothesis in multivariate data: ANOSIM, PERMANOVA and Mantel test.
October 05 th	Linear Models (LMmv) and Generalized Linear Models (GLMmv) for multivariate abundance data.
To be scheduled	Students will be challenged to apply any multivariate method on their own data sets and report their results.

* 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.