



UNIVERSIDADE FEDERAL DE SANTA CATARINA  
PÓS-GRADUAÇÃO EM ECOLOGIA

SYLLABUS



SEMESTER 02 / 2022

**1. COURSE IDENTIFICATION**

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

**2. SCHEDULE**

August 25<sup>th</sup> to October 27<sup>th</sup>. Thursday mornings (9-12 am) and afternoon (2-5 pm)

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 25	Overall introduction, multivariate data structure, Q mode and R mode, data standardization and transformation
September 1 <sup>st</sup>	Distance and (dis)similarity measures, association matrices
September 8 <sup>th</sup>	Hierarchical Cluster Analysis, Indicator Species Analysis (IndVal)
September 15 <sup>th</sup>	Introduction to ordination methods, Principal Component Analysis (PCA), Correspondence Analysis (CA and DCA), ordination of qualitative data (MCA)
September 22 <sup>nd</sup>	Principal Coordinate Analysis (PCoA) and non-metric Multidimensional Scaling (nMDS)
September 29 <sup>th</sup>	Canonical ordination, Redundancy Analysis (theory and practice), Canonical Correspondence Analysis
October 20 <sup>th</sup>	Testing hypothesis in multivariate data: ANOSIM, PERMANOVA and Mantel test.
October 27 <sup>th</sup>	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 (9:00–12:00 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.  
 Gotelli N.J., Ellison A.M. (2011). A Primer of Ecological Statistics. Oxford University Press.  
 Lepš J., Šmilauer P. (2003). Multivariate Analysis of Ecological Data using Canoco. Cambridge University Press, Cambridge.