Ecological data analysis in R (OCEAN 5098)

Information

Time: Tuesday 13:20- 16:20 (Spring Semester - odd year)

Lecturers: Vianney DENIS

Credits: 3

Description

This course is mainly designed to introduce students with the use of R language. It will introduce popular R functions to sort, visualize and analyze data in ecology. Broad topics covered will include: introduction to R language and basic functions, data manipulation, graphics, maps, linear model, parametric and non-parametric analysis, multivariate analysis, etc.

Aim and objectives

The aim of this course is for the students to get familiar with R language. This course will explore the multiple advantages of using R language for formatting reports, preparing presentations, exploring and analyzing ecological, data creating and sharing project. The cours will assume hat students have no prior knowledge in R or other programming languages. It will start from scratch, i.e. downloading R and installing it on your computer. Along this class, you will be introduced to RStudio GUI, Rmarkdown, and GitHub repositories that complete harmoniously the use of R.

At the end of this class, student should:

- see the multiples advantages of using R in comparison with Excel;
- not be afraid of using code to organize, visualize and analyze data;
- become a self-learner, able to explore and solve problem;
- analyze and valorize scientifically simple data sets;
- know several statistical tools for the analysis of ecological data in particular;
- help and recommend on the use of R.

Tentative Schedule

Schedule is susceptible to changes according to progress of the class

Week	Day	Date	Tentative Topic	Content
1	Tue	———	Introduction: First step	Introduction R, R Studio, Markdown, GitHub

Week	Day	Date	Tentative Topic	Content
2 & 3	Tue	———	Data manipulation, basic graphics and statistical functions	Manipulate dataset, basic operation, make and edit a plot
4 & 5	Tue	———	Data exploration	Summarize dataset, preliminary analyses
6	Tue	———	Ecological resemblance	Association coefficient, similarity matrix
7	Tue	———	Numerical classification	Cluster analysis
8 & 9	Tue	———	Unconstrained ordination	PCA, PCoA, nMDS
10 & 11	Tue	———	Constrained ordination	Redundancy and cannonical analysis
12 & 13	Tue	———	Generalized Linear Model	Linear regression, and GLMs
14	Tue	———	From traits to functions	—

Evaluation & Final Assignment

Each week students prepare an example of the application of the things learned in previous class . One student randomly chosen will introduce its example at the beginning the class (using Rmarkdown).

For the final assignment, group (2-3 students) will pick up a research topic along the semester, and will prepare a report emphasis methodology and results (scientific format). Introduction and discussion can be presented as bullet points. Report should be sent as a markdown file before the last class of the semester. Do not wait the last minute!

Requirement

This course requires students to bring/use their own personal computer.

References & Readings

Borcard, D., Gillet, F. and Legendre, P. (2018) Numerical Ecology with R. Springer. DOI: 10.1007/978-3-319-71404-2

Paradis, E. (2005) R for beginner. Available among many others documentation at https://cran.r-project.org/other-docs.html (page frozen and no longer actively maintained)

Ramette, A. (2007) Multivariate analyses in microbial ecology. FEMS Microbiology Ecology, 62: 142-160. DOI: 10.1111/j.1574-6941.2007.00375.x

Xie, Y., Allaire, J.J.,Grolemund, G. (2020) R Markdown: The Definitive Guide. Chapman & Hall/CRC. The online version of this book is free to read here.

Zuur, A. F., Ieno E. N., Smith, G. M. (2007) Analysing Ecological Data. Springer. DOI: 10.1007/978-0-387-45972-1

Zuur, A. F. (2010) A protocol for data exploration to avoid common statistical problems. Methods in Ecology and Evolution, 1: 3-14. DOI: 10.1111/j.2041-210X.2009.00001.x