Syllabus

Course Description

Course Title	Statistical methods for agricultural and environmental research
Course Code	46086
Course Title Additional	
Scientific-Disciplinary Sector	NN
Language	English
Degree Course	PhD Programme in Mountain Environment and Agriculture - Major in Ecology, Environment and Protection of Mountain Areas
Other Degree Courses (Loaned)	
Lecturers	Prof. Dr. Camilla Wellstein, Camilla.Wellstein@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33786 Prof. Damiano Zanotelli, Damiano.Zanotelli@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/18696 dr. Fiona Jane White, FionaJane.White@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/50468 Prof. Luigimaria Vittorio Borruso, luigimaria.borruso@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/30124 dr. Maria Dolores Asensio Abella, MariaDolores.AsensioAbella@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/45187 dr. Massimiliano Calvia, Massimiliano.Calvia@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/50382

	Prof. Massimo Tagliavini, Massimo.Tagliavini@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/209
Teaching Assistant	
Semester	First semester
Course Year/s	1
CP	4
Teaching Hours	40
Lab Hours	20
Individual Study Hours	60
Planned Office Hours	by appointment
Contents Summary	Introduction to the course; Data distribution. Error types. Dependent and independent variables; quantitative and qualitative factors; fixed and random factors; Experimental designs for agricultural sciences. Introduction to R. Data exploration. Data representation. Student's t Test; Student's t Test; Introduction to linear models; one- and two-ways ANOVA: assumptions, data transformation. Post-hoc test for multiple comparisons. Linear mixed models: Analysis of repeated measurements in time and space. Analysis of split-plot designs and nested models. Analysis of Covariance. Simple linear regression and correlation, multiple regression, breaking point analysis. Experimental designs for environmental sciences. Non-parametric test and non-parametric post-hoc tests. Principal component analysis of communities (part 1). Alpha, beta and gamma diversity. Cluster analysis. Principal Coordinate Analysis (PCA). Principal component analysis of communities (PCoA). Non-metric Multi Dimensional Scaling (NMDS). Permutational multivariate ANOVA (PERMANOVA). Introduction into the statistical analysis of non-experimental data (e.g., surveys). Introduction into advanced regression and related analysis (e.g., structural equation modelling, propensity score matching)
Course Topics	Module 1 - Introduction to the course; Data distribution. Error types. Dependent and independent variables; quantitative and qualitative factors; fixed and random factors; Experimental designs for agricultural sciences.

	Module 2 - Introduction to R. Data exploration. Data representation. Module 3 - Student's t Test; Introduction to lineal models; ANOVA: assumptions, data transformation, one- and two-ways. Post-hoc test. for multiple comparisons. Missing data. Linear mixed models: Analysis of repeated measurements in time and space. Analysis of split-plot designs and nested models. Introduction to the analysis of covariance. Module 4 Least Squares linear regression and correlation, multiple linear regression, breaking point analysis. Module 5 - Experimental designs for environmental sciences. Non-parametric test and non-parametric post-hoc tests. Module 6 - Alpha, beta and gamma diversity. Cluster analysis. Principal Coordinate Analysis (PCA). Principal component analysis of communities (PCoA). Non-metric Multi Dimensional Scaling (NMDS). Permutational multivariate ANOVA (PERMANOVA). Module 7 - Introduction into the statistical analysis of non-experimental data (e.g., surveys): cross-sections, time series and panel data analysis.
Keywords	Experimental designs, data exploration, data analysis
Recommended Prerequisites	Descriptive statistics Basic knowledge of R
Propaedeutic Courses	
Teaching Format	frontal lessons and exercises
Mandatory Attendance	compulsory
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding Knowledge and understanding of main concepts and statistical methods for agricultural and environmental research. Applying knowledge and understanding Ability to choose the most suitable statistical approach to be used for tackling statistical problems in agricultural and environmental sciences. Ability to check the requisites a dataset should possess to become suitable for statistical analysis. Making judgements

	Ability to choose the most suitable statistical approach to be used for tackling statistical problems. Communication skills Ability to prepare graphs and tables using outcomes from statistical analysis. Learning skills. Ability to autonomously adapt the methods and tools to tackle novel statistical questions also taking advantage of the open-source software "R ".
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	After the frontal teaching part, students must complete five class assignments, each of them on one teaching module, which will prove the students' command on statistical procedures using R.
Evaluation Criteria	Skills in critical thinking. Ability to choose suitable statistical approaches. Ability to correctly choose the statistical model and to understand the results of a statistical analysis.
Required Readings	Handouts of the material presented and R scripts made available to the students.
Supplementary Readings	Gomez, K.A. and Gomez, A.A. (1984) Statistical Procedures for Agricultural Research. 2nd Edition, John Wiley and Sons, New York, 680 p.
Further Information	Students are required to install Rstudio software on their computer RStudio (https://posit.co/download/rstudio-desktop/). R ("The R Project for Statistical Computing" at https://www.r-project.org)
Sustainable Development Goals (SDGs)	Quality education