Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Statistical methods for agricultural and environmental research
Course code	46086
Scientific sector	ND
Degree	PhD Program Mountain Environment and Agriculture
Semester	1st
Year	2024-2025 (40th cycle)
Credits	4
Modular	*Yes*

Total lecturing hours	40
Attendance	Compulsory
Prerequisites	Basic knowledge of descriptive statistical methods; probability concepts; counting methods (normally taught in Master courses).
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Specific educational objectives	The course aims at providing the PhD students with applied statistical knowledge entitling them to tackle statistical problems they will encounter during their research activity in the different fields of agricultural or environmental research. Case studies and graphical aspects are approached with software "R".

Module 1	
Lecturer	*Massimo Tagliavini*
Scientific sector of the lecturer	AGRI-03/A
Teaching language	English
Office hours	by appointment
List of topics covered	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.
Teaching format	*Frontal lectures.*

Module 2	
Lecturer	*Luigimaria Vittorio Borruso*
Scientific sector of the lecturer	AGRI-06/B
Teaching language	
Office hours	by appointment
List of topics covered	Introduction to R. Data exploration. Data representation.
Teaching format	*Frontal lectures, exercises.*

Module 3	
Lecturer	*Massimo Tagliavini and Maria Dolores Asensio Abella*
Scientific sector of the lecturer	AGRI-03/A
Teaching language	English
Office hours	by appointment
List of topics covered	Student's t Test; Introduction to lineal models; ANOVA: assumptions, data transformation, one- and two-ways. 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.
Teaching format	*Frontal lectures and exercises*

Module 4	
Lecturer	*Damiano Zanotelli*
Scientific sector of the lecturer	AGRI-03/A
Teaching language	English
Office hours	by appointment
List of topics covered	Simple linear regression and correlation, multiple regression, breaking point analysis
Teaching format	*Frontal lectures, exercises*

Module 5	
Lecturer	*Camilla Wellstein and Fiona Jane White*
Scientific sector of the lecturer	BIOS-01/C
Teaching language	English
Office hours	by appointment
List of topics covered	Experimental designs for environmental sciences. Non-parametric test and non-parametric post-hoc tests.
Teaching format	*Frontal lectures, exercises.*

Module 6	
Lecturer	*Luigimaria Vittorio Borruso*
Scientific sector of the lecturer	AGRI-06/B
Teaching language	English
Office hours	by appointment
List of topics covered	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).
Teaching format	*Frontal lectures, exercises.*
Module 7	
Lecturer	*Massimiliano Calvia*

Scientific sector of the lecturer	AGRI-01/A
Teaching language	English
Office hours	by appointment
List of topics covered	Introduction into the statistical analysis of non-experimental data (e.g., surveys): cross-sections, time series and panel data analysis.
Teaching format	*Frontal lectures, exercises.*

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 ".

Assessment	*1. Class and home assignments during the course and* *2. written project work at the end of the course, that will prove the students' command on statistical procedures more suitable to their research fields using R.*
Assessment language	*English*
Evaluation criteria	*Clarity of answers, ability to work in a team, ability to plan an experiment and correctly analyze the resulting data, mastery of the R programming language, skills in critical thinking.*

Required readings	Handouts and R scripts made available to the students.
Software	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)