

# Syllabus

## *Course Description*

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

	Prof. Massimo Tagliavini, Massimo.Tagliavini@unibz.it <a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/209">https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/209</a>
<b>Teaching Assistant</b>	
<b>Semester</b>	First semester
<b>Course Year/s</b>	1
<b>CP</b>	4
<b>Teaching Hours</b>	40
<b>Lab Hours</b>	20
<b>Individual Study Hours</b>	60
<b>Planned Office Hours</b>	by appointment
<b>Contents Summary</b>	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)
<b>Course Topics</b>	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.

	<p>Module 2 - Introduction to R. Data exploration. Data representation.</p> <p>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.</p> <p>Module 4 Least Squares linear regression and correlation, multiple linear regression, breaking point analysis.</p> <p>Module 5 - Experimental designs for environmental sciences. Non-parametric test and non-parametric post-hoc tests.</p> <p>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).</p> <p>Module 7 - Introduction into the statistical analysis of non-experimental data (e.g., surveys): cross-sections, time series and panel data analysis.</p>
<b>Keywords</b>	Experimental designs, data exploration, data analysis
<b>Recommended Prerequisites</b>	Descriptive statistics Basic knowledge of R
<b>Propaedeutic Courses</b>	
<b>Teaching Format</b>	frontal lessons and exercises
<b>Mandatory Attendance</b>	compulsory
<b>Specific Educational Objectives and Learning Outcomes</b>	<p>Knowledge and understanding</p> <p>Knowledge and understanding of main concepts and statistical methods for agricultural and environmental research.</p> <p>Applying knowledge and understanding</p> <p>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.</p> <p>Making judgements</p>

	<p>Ability to choose the most suitable statistical approach to be used for tackling statistical problems.</p> <p>Communication skills</p> <p>Ability to prepare graphs and tables using outcomes from statistical analysis.</p> <p>Learning skills.</p> <p>Ability to autonomously adapt the methods and tools to tackle novel statistical questions also taking advantage of the open-source software "R".</p>
<b>Specific Educational Objectives and Learning Outcomes (additional info.)</b>	
<b>Assessment</b>	<p>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.</p>
<b>Evaluation Criteria</b>	<p>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.</p>
<b>Required Readings</b>	<p>Handouts of the material presented and R scripts made available to the students.</p>
<b>Supplementary Readings</b>	<p>Gomez, K.A. and Gomez, A.A. (1984) Statistical Procedures for Agricultural Research. 2nd Edition, John Wiley and Sons, New York, 680 p.</p>
<b>Further Information</b>	<p>Students are required to install Rstudio software on their computer RStudio (<a href="https://posit.co/download/rstudio-desktop/">https://posit.co/download/rstudio-desktop/</a>). R ("The R Project for Statistical Computing" at <a href="https://www.r-project.org">https://www.r-project.org</a>)</p>
<b>Sustainable Development Goals (SDGs)</b>	<p>Quality education</p>