Course code	Course	Teacher(s)
A	***Basic***	
A1	**Basic Statistics**	M. Borga, G. Zuecco
	Prerequisites:	Given the different academic and personal experiences of the students, and in order to develop a common understanding of the topic prior to class, we will ask the students to complete a placement test and to take a MOOC with an introduction to statistics.
	Target skills and knowledge:	The goal of the course is to provide the students with an understanding of basic statistical terms, learn methods for describing statistical data and provide basic skills in hypothesis testing and statistical inference.
	Course contents:	Part I: Descriptive statistics: 1.1 Introduction: descriptive statistics and statistical inference; 1.2 Variable types 1.3 Tables and Graphical presentation of data 1.4 Measure of central tendency, measure of variation Part II: Normal distribution: 2.1 Normal distribution: normal distribution and the empirical law, Z table, The Central Limit Theorem Part III: Statistical inference – parametric statistics and hypothesis testing: Part IV: Nonparametric statistical inference: Part V: Relationship between variables: 5.1 Linear relationship between two variables: ▪ Pearson correlation coefficient ▪ Linear regression.
	Assessment plan:	Written examinations based on exercises designed to test the basic knowledge acquired during the course
	Planned learning activities and teaching methods:	The course will be held using Zoom. Each topic will consist of a theoretical lecture followed by practical exercises in Excel
	Additional notes about suggested reading:	The material used for the course will be made available to students through the Moodle platform of the Ph.D. School
	Textbooks (and optional supplementary readings):	
A2	**Applied Statistics with applications in R**	A. Cecchinato
	Prerequisites:	Basic knowledge of descriptive statistics and R programming language
	Target skills and knowledge:	The overall course goal is to give the participants knowledge on statistical methods and data analysis, with particular emphasis on the application of Analysis of Variance techniques using R software
	Course contents:	Introduction to hypothesis testing How to state a null hypothesis and alternative hypothesis How to identify type I and type II errors and interpret the level of significance Analysis of variance (ANOVA): One-way ANOVA Two-way ANOVA Two-way ANOVA and interactions ANCOVA Exercises and applications with R software
	Assessment plan:	Team Project: Data will be provided to a team composed of two to three students and asked to employ techniques learned throughout this course to analyze the data set, interpret and report results. Final Exam: Written examinations. A written examination consists of exercises designed to test the basic knowledge acquired during the course.

	Planned learning activities and teaching methods:	The course will be done in classroom with the use of own laptop Each topic will consist of a theoretical class followed by practical exercises in R
	Additional notes about suggested reading:	The material used for the course will be made available to students through the Moodle platform of the Ph.D. School at https://elearning.unipd.it/scuolaamv/login/index.php
	Textbooks (and optional supplementary readings):	Crawley, M. J. (2012). The R book. John Wiley & Sons. Kabacoff, R. I. (2010). R in Action. manning. Eventual additional material will be provided during the course.
A3	**Advanced Statistics with R: Experimental design in lab and field**	R. Mantovani, N. Dal Ferro
	Prerequisites:	Basics of R programming languages, the previous courses of Applied Statistics with R (Prof. Cecchinato)
	Target skills and knowledge:	The overall course goal is to give the participants knowledge on experimental designs and their statistical data analysis
	Course contents:	Planned scientific experiments vs. field experiments Experimental designs and test of hypotheses Orthogonal contrasts and comparison of means Randomized block design, Complete and incomplete factorial designs, Latin square design, Nested models, Split-plot model and analysis of longitudinal data
	Assessment plan:	Students will be asked to solve some practical exercises during the lessons, with the possibility to do it in small groups and under the assistence of the teacher. The final exam will consist in a written text including some short questions and some practical exercises similar to the ones proposed during the lessons
	Planned learning activities and teaching methods:	Each lessons will consist in a teorethical part followed by practical examples and exercises in R. Students will use their own laptop and will have internet access in the classroom to access the course material and share exercises files
	Additional notes about suggested reading:	All the material of the course will be provided online in the Moodle platform some days before the beginning of the lessons
	Textbooks (and optional supplementary readings):	Crawley, M. J. (2012). The R book. John Wiley & Sons Kabacoff, R. I. (2010). R in Action. manning
A4	**Applied Statistics with R mixed models**	C. Sartori
	Prerequisites:	Basics of R programming languages, the previous courses of Applied Statistics with R (Prof. Cecchinato and Prof. Mantovani-Dal Ferro)
	Target skills and knowledge:	The course is aimed to provide knowledge about mixed models and their application in experimental plans and data analysis. Animal science and crop science case studies will be proposed. Participants will achieve some skill to solve mixed models analysis using R software
	Course contents:	Mixed models theory (including some basics of Matrix Algebra) Mixed models vs. general linear models (GLM) Mixed models analysis with R Mixed models for experimental design: Randomized Block Design, Nested Design Mixed models and longitudinal data: designs with repeated measurements
	Assessment plan:	Students will be asked to solve some practical exercises during the lessons, with the possibility to do it in small groups and under the assistence of the teacher. The final exam will consist in a written text including some short questions and some practical exercises similar to the ones proposed during the lessons
	Planned learning activities and teaching methods:	Each lessons will consist in a teorethical part followed by practical examples and exercises in R. Students will use their own laptop and will have internet access in the classroom to access the course material and share exercises files

	Additional notes about suggested reading:	All the material of the course will be provided online in the Moodle platform some days before the beginning of the lessons
	Textbooks (and optional supplementary readings):	Crawley, M. J. (2012). The R book. John Wiley & Sons. Kabacoff, R. I. (2010). R in Action. manning.
A5	**Scientific Writing in English**	M.E. Olson
	Prerequisites:	No prior knowledge is required
	Target skills and knowledge:	
	Course contents:	-How and why to publish in high impact factor journals -Scientific writing is a group process -Scientific writing follows a simple formula -The "Winning Formula" to structure your manuscript -The importance of the "gap" -Paragraph structure -Connecting paragraphs and sentences -Traps that English sets for non-native speakers -Titles, abstracts, cover letters, and replying to reviewers
	Assessment plan:	
	Planned learning activities and teaching methods:	
	Additional notes about suggested reading:	All the material of the course will be provided online in the Moodle platform some days before the beginning of the lessons
	Textbooks (and optional supplementary readings):	
A6	**Ethics in scientific research**	A. Borovecki
	Prerequisites:	No prior knowledge is required
	Target skills and knowledge:	Basic knowledge on the main ethical issues in carring out scientific research
	Course contents:	General introduction to ethics of science, research misconduct (falsification, fabrication, plagiarism, conflicts of interests), responsible authorship and peer review, mentorship issues, data management issues, basics regarding animal and human research.
	Assessment plan:	Each student will be assigned an exercise based on literature review and class discussion
	Planned learning activities and teaching methods:	6 hours of frontal teaching, personal reading and class discussion on the students' presentations
	Additional notes about suggested reading:	
	Textbooks (and optional supplementary readings):	PPT presentation as well as suggested readings will be available on the Moodle platform
A7	**Ethics in writing and reviewing**	M. Borga
	Prerequisites:	None
	Target skills and knowledge:	This course will provide a guide on ethical issues in scientific publishing and reviewing
	Course contents:	Four main topics will be examined: 1. plagiarism; 2. multiple submissions; 3. conflict of interest; 4. authorship. Guidelines for the review activity will be discussed with the class
	Assessment plan:	Each student will be assigned a case study, with the request to provide indications on the emerging ethical issues
	Planned learning activities and teaching methods:	
	Additional notes about suggested reading:	

	Textbooks (and optional supplementary readings):	Committee on publication ethics. Available from: https://publicationethics.org/ accessed on 08/08/18.
A8	**The evaluation of research output: the italian assessment framework**	E. Defrancesco
	Prerequisites:	None
	Target skills and knowledge:	Students will be aware on the Italian system of research quality assessment which periodically evaluates researchers communities, including PHD courses
	Course contents:	The main characteristics of the periodical VQR exercise will be addressed as well as the main results of the evaluation rounds. The adopted methodology will be critically analysed, by examining its pros and cons. Finally some recent international experiences as well as proposals by the reseach community will be analysed.
	Assessment plan:	
	Planned learning activities and teaching methods:	Lectures and discussion with the PHD students on implications for their research output
	Additional notes about suggested reading:	
	Textbooks (and optional supplementary readings):	PPT presentation as well as suggested readings will be provided to the students (available on the Moodle platform)
A10	**Healt and safety training**	on line course
	Synopsis: see web site https://elearning.unipd.it/formazione/course/view.php?id=114	BASIC COURSE IN HEALTH AND SAFETY: "GENERAL TRAINING" (4 hours)
A11	**Introduction to R for statistical analysis**	G. Zuecco
	Prerequisites:	Knowledge of descriptive statistics, variable types and graphical representation of data, see also the content of the course Basic Statistics (M. Borga, G. Zuecco). Installation of R and RStudio is requested before the start of the course.
	Target skills and knowledge:	The goal of the course is to: introduce the participants to R programming language and software environment, learn how to import data sets and compute descriptive statistics in R.
	Course contents:	1. Basic information on R and RStudio; 2. Basic syntax; 3. Numerical operations with vectors and matrices; 4. Import of data sets; 5. Descriptive statistics; 6. Graphical representation of data (histograms, boxplots and scatter plots).
	Assessment plan:	The examination will consist of practical exercises assigned to the participants during the course.
	Planned learning activities and teaching methods:	The course will be held in Zoom. The participants will be introduced to the topic and the goals of the course, and then examples and practical exercises will be presented using R.
	Additional notes about suggested reading:	The material used for the course and supplementary readings for self-study will be made available through the Moodle platform.
	Textbooks (and optional supplementary readings):	R tutorials can be found at https://www.tutorialspoint.com/r/index.htm and https://www.statmethods.net/r-tutorial/index.html
A12	**Basic data analysis with R for Veterinary Science**	E. Giaretta
	Prerequisites:	Microsoft Excel. Fundamental concepts of centrality and dispersion measures.
	Target skills and knowledge:	The course aims at training the participants on the use of R for data handling, descriptive statistics and basic statistical inference.

		Participants will develop R programming skills necessary to perfom data analysis.
	Course contents:	The collection of the data. Installation of R and Rcmdr plugin. Descriptive statistics with R. Parametric and non-parametric test. Correlation and linear regression. Exercises and applications with R software
	Assessment plan:	Team Project: Data will be provided to a team composed of two to three students and asked to employ techniques learned throughout this course to analyze the data set, interpret and report results. Final Exam: Written examinations in R. It consists of exercises in R on the different databases, designed to test the basic knowledge acquired during the course.
	Planned learning activities and teaching methods:	The course will be held in Zoom
	Additional notes about suggested reading:	The material used for the course and supplementary readings for self-study will be made available through the Moodle platform.
	Textbooks (and optional supplementary readings):	Crawley MJ Statistics. An introduction using R. John Wiley & Sons Ltd, 2005; Crawley MJ The R book. John Wiley & sons Ltd, 2007; Murrell PR graphics. Chapman & Hall/CRC-Taylor and Francis, 2006; Larson-HallJ. A guide to doing statistics in second language research using R. Taylor and Francis. PetrieA. & Watson P. Statistics for veterinary and animal science. Blackwell publishing, 2006
B	***Soft skills: research organization and communication***	
B1	**Introduction to Mendeley**	A. Leonardi
	Prerequisites:	None
	Target skills and knowledge:	Ability to organize and manage a scientific bibliography by using a professional reference manager software
	Course contents:	Install, know and use Mendley, the reference manager software.
	Assessment plan:	Produce an example of your bibliography
	Planned learning activities and teaching methods:	The seminar will focus on introducing the basics of the software and will go through its main functions for producing a bibliography, citing within word documents, and collaborate with other scientis.
	Additional notes about suggested reading:	
	Textbooks (and optional supplementary readings):	https://www.mendeley.com/
B2	**How to present a scientific paper**	D. Pettenella
	Prerequisites:	None
	Target skills and knowledge:	The course will provide knowledge on how to organize the strucure, select the contents and the editing format tor an effcective oral communication of scintific contents
	Course contents:	The course is organized in 5 modules: Preparation points, Organisation & order, Set the pace, Personal attitude and behaviour, Preparing visuals that are useful
	Assessment plan:	The assessment will be carried out asking each student to prepare a presentation with PP or similar SW

	Planned learning activities and teaching methods:	Frontal lectures with open discussion. Case studies. One practical exercises
	Additional notes about suggested reading:	In the Moodle platform some manuals and links are available
	Textbooks (and optional supplementary readings):	See the Moodle platform
B3	**How to prepare a scientific paper**	S. Segato, B. Sturaro
	Prerequisites:	The student should have some basic knowledge about the scientific publishing.
	Target skills and knowledge:	The student acquires general knowledge on: how to plan a scientific publication; writing a scientific paper; following its peer review process.
	Course contents:	The course has the following framework: - Analysis of the publishing process - Basis for a successful scientific literature review - The structure of a scientific paper - The process of paper's submission - The peer review process
	Assessment plan:	At the end of the teaching program, students will submit a final homework made of a scientific summary on a given topic supported by a short literature review that is going to be evaluated by the course responsibles.
	Planned learning activities and teaching methods:	The evaluation will take into account the student's attendance and active participation to the teaching activity and the quality of the submitted homework.
	Additional notes about suggested reading:	
	Textbooks (and optional supplementary readings):	Writing and Presenting Scientific Papers by Birgitta Malmfors, Phil Garnsworthy and Michael Grossman, 2nd ed., Nottingham University Press (2004)
B4	**Dissemination of science: contents and tools**	M. Polidoro
	Prerequisites:	No prior knowledge is required
	Target skills and knowledge:	
	Course contents:	
	Assessment plan:	
	Planned learning activities and teaching methods:	
	Additional notes about suggested reading:	
	Textbooks (and optional supplementary readings):	
B5	**Data collection from questionnaires to participatory approaches**	L. Secco, C. Burlando, R. Cassin, R. Da Re, E. Pisani
	Prerequisites:	No prior knowledge is required
	Target skills and knowledge:	The course is focused on data collection through questionnaires, observation and group interviews.
	Course contents:	1. Introduction on the total survey error and the bias generated by measurement error. 2. Questionnaires design and question wording. 3. Participatory observation. 4. The interviewer effect. 5. Group interview and participatory techniques.6. Concrete application to research!

	Assessment plan:	
	Planned learning activities and teaching methods:	Frontal lessons, group work, "experiments", role games.
	Additional notes about suggested reading:	
	Textbooks (and optional supplementary readings):	See the Moodle platform
B6	**Ecosystem services and products from ideas to business**	An online course on how to start up innovative business related to natural resources
	see the web site of the course in the Moodle platform	https://www.ecostarhub.com/e-learning-course/
B7	**English and Italian languages (frontal teaching)**	Centro Linguistico di Ateneo
	see http://cla.unipd.it/en/	
B8	**English and Italian languages (on line courses)**	Centro Linguistico di Ateneo
	see http://cla.unipd.it/en/	
B9	**Course on "Ecology information" (in Italian and in English)**	LERH Mountain Lab - S. Vito di Cadore
	see: http://intra.tesaf.unipd.it/Sanvito/Index.asp	
B13	**Course on "Research Integrity"**	A. Squartini, M. Giantin
	Prerequisites:	To have a background in research
	Target skills and knowledge:	The program aims to foster the internalization of the principles of European Code of Conduct for Research Integrity and strives to facilitate the cultivation of scientific virtues among trainers and researchers.
	Course contents:	The program offers a new blended-learning course open to PhD students. The following contents are planned: - Self declaration approach - Debate and dialogue - Middle position - Dilemma game - Virtues and norms.
	Assessment plan:	The course is divided into three sessions. The first session should preferentially be carried out online independently by each participant before the second session with teachers will begin. Participants are then expected to fill three exercises independently, before the third session with teachers, in which personnel experiences will be directly presented and discussed by participants. The activity with teachers comprehends a short presentation of the contents followed by work in groups and plenary discussions.
	Planned learning activities and teaching methods:	The course will be held preferentially face-to-face in Agripolis. If not possible for COVID19 restrictions, the course will be held online on ZOOM platform. Planned activities: - April 16th 2021, 14.00 – 18.00 - April 23rd 2021, 9.00 – 13.00 - April 30th 2021, 14.00 – 18.00 - May 7th 2021, 14.00 – 18.00. - May 21st 2021, 9.00 – 13.00 and 14.00 – 18.00. The course will be given in English or in Italian (in Italian if only Italian students will be present)
	Additional notes about suggested reading:	Participants are expected to carefully read/listen to the following online modules, which will be used for training: (1) The European Code of Conduct for Research Integrity https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-

		Research-Integrity-2017.pdf (2) Introduction to research integrity - a module that introduces the basic principles of research integrity and asks you to apply the European Code of Conduct to your own context. https://embassy.science/wiki/Instruction:6ceba4e4-fb32-4953-9138-5436807fcde6 Read carefully all the text and look/listen to the video: http://courses.embassy.science/introduction_to_research_integrity/story.html (3) Introduction of Virtue Ethics to Research Integrity - a module that introduces the relevance of virtue ethics to research integrity and asks you to reflect about research integrity issues. https://embassy.science/wiki/Instruction:86f47366-a189-4395-9301-36ddb6d1fc68 Read carefully all the text and look/listen to the video: http://courses.embassy.science/introduction_of_virtue_ethics_to_research_integrity/story.html (4) Virtue ethics applied under current research conditions - a module that addresses more systemic issues, like performative pressures in research, and relates these to virtue ethics and the individual experience of the researcher. https://embassy.science/wiki/Instruction:43c900ea-a317-4528-8ece-1f3fb3564867 Read carefully all the text and look/listen to the video: http://courses.embassy.science/virtue_ethics_applied_under_current_research_conditions/story.html
	Textbooks (and optional supplementary readings):	Lecture: The varieties of goodness (http://www.giffordlectures.org/books/varieties-goodness)
C	***Research quantitative methods***	
C2	**Geomatics and Digital Terrain Modelling**	A.Masiero
	Prerequisites:	No prior knowledge is required
	Target skills and knowledge:	The main goal of this course it that of gaining familiarity with 3D data acquisition and basic manipulation
	Course contents:	Quick review/elements of geodesy and cartography, GNSS, positioning and navigation 3D data acquisition systems, focusing in particular on photogrammetry (some free and commercial tools will be shown) and laser scanning Point cloud registration and georeferencing Generation of orthophoto/DSM/DTM Spatial data manipulation: denoising, filtering, basics on information extraction from 2D/3D data. Examples and applications
	Assessment plan:	Students will develop a short project, with the aim of showing their understanding of the most relevant subjects learnt during the course, providing a final report in a scientific paper-like format.
	Planned learning activities and teaching methods:	Theoretical lessons will be followed by practical examples. Students will have the possibility of experimenting such examples directly on their computers, thanks to the use of either free/open source software, or commercial software but with licenses provided by the University
	Additional notes about suggested reading:	Slides and other course materials will be provided before of the lessons
	Textbooks (and optional supplementary readings):	Slides provided by the teacher will be the main "textbook". Optional textbooks: Basics of Geomatics , Mario A. Gomarasca. Springer, 2009. Digital Terrain Modelling, El Sheimy, Valeo, Habib. Artech House, 2005. Other references might be provided during the course, if needed.
C3	**Spatial Statistics**	M. Borga, G. Zuecco
	Prerequisites:	Students should have a basic knowledge of ArcGIS, and should know how to import raster and vector data in ArcGIS.

	Target skills and knowledge:	The goal of the course is to learn the most common interpolation methods, how to apply them to different spatial datasets and obtain a basic knowledge on optimal spatial estimation methods.
	Course contents:	1. Basic on spatial statistics and interpolation methods, 2. Exercises on interpolation methods (inverse distance weighted and spline), 3. Basic on optimal spatial estimation methods and kriging, 4. Exercises on kriging.
	Assessment plan:	Class exercises assigned and supervised by the teachers.
	Planned learning activities and teaching methods:	Lectures will be held using Zoom. Theory is followed by practical examples. Exercises on interpolation methods are carried out using ArcGIS, under the supervision of the teachers. Students can also work on their datasets and discuss them with the teachers.
	Additional notes about suggested reading:	Slides, text and solutions of the exercises are provided by the teachers by the Moodle platform and email.
	Textbooks (and optional supplementary readings):	
C4	**Introduction to programming in Python**	M. Zaramella
	Prerequisites:	No prerequisites
	Target skills and knowledge:	Data analysis using Python tools: Numpy and Scipy. Basic statistics and model fitting.
	Course contents:	1. Python variables 2. Writing scripts 3. Control flows 4. Functions 5. Numpy 6. Plot using Matplotlib 7. Scipy and model fitting
	Assessment plan:	Class exercises assigned and supervised by the teacher.
	Planned learning activities and teaching methods:	The class were conducted through: 1) Brief introduction of the topic and declaration of the goals 2) Scripting from Python environment following the teacher's directions 3) Laboratory work under the supervision of the teacher. Gruop work is optional but recommended.
	Additional notes about suggested reading:	http://resources.arcgis.com/en/communities/python/; http://docs.qgis.org/testing/en/docs/pyqgis_developer_cookbook/
	Textbooks (and optional supplementary readings):	Class textbook and exercise provided by the teacher
C5	**Spatial statistics in socio-economic research**	F. Pagliacci
	Prerequisites:	Basic notions of statistics and econometrics. Basic knowledge and use of R.
	Target skills and knowledge:	The goal of the course is to provide students with main competencies in spatial statistics and spatial econometrics. At the end of the course, the students will be able to: i) analyze lattice (regional) data characterized by spatial dependence; build simple econometric models to address the main problems related to the spatial analysis in socio-economic research; critically compare alternative spatial analyses and models.
	Course contents:	1 Introduction to spatial statistics and types of spatial data; 2 Lattice data, regions, and space modelling (proximity and spatial weights matrices); 3 Measures of global spatial autocorrelation; 4 Cross-sectional models with spatial autocorrelation: SAR model; SEM model; Spatial Durbin models; 5 Exercitation with R
	Assessment plan:	Students will develop a short project, applying the techniques learnt during the course.
	Planned learning activities and teaching methods:	Theoretical lessons will be followed by practical examples, using the software R. Proactive participation of the students is strongly recommended.
	Additional notes about suggested reading:	Slides are provided by the teacher on the Moodle platform
	Textbooks (and optional supplementary readings):	Slides provided by the teacher will represent the "textbook". Additional readings are suggested on the Moodle platform

C6	**Econometric models to inform environmental resources management and food policies**	M. Thiene, C. Franceschinis
	Prerequisites:	The course does not require any prerequisite. However, knowledge of descriptive statistics and basic knowledge of the R software (data import and basic syntax) could be helpful. Installation of R is required before the course (detailed installation instructions will be sent).
	Target skills and knowledge:	The course allows participants to: i) understand how to explore and identify factors that influence environmental resources/services management and demand for food; ii) acquire skills on data collection and data analysis concerning environmental services demand and food choices; iii) acquire knowledge on discrete choice models; iv) learn how to estimate discrete choice models in R; v) apply discrete choice models for the analysis of food and environmental services demand; vi) understand how to use results from econometric analysis to inform environmental resources management and food policies.
	Course contents:	1. What methods can be used to provide policy makers with relevant information regarding management of natural resources, determinants of environmental services selection and food choice? 2. Basic theoretical background on discrete choice models 3. Discrete choice models estimation in R 4. Tutorial session on valuation and management of environmental resources and drivers of food demand
	Assessment plan:	
	Planned learning activities and teaching methods:	The course will be held in Zoom. Participants will be explained how to collect and analyze data to investigate the factors that drive demand for food and environmental resources. Then, participants will be introduced to discrete choice models and they will estimate a variety of model specifications in R within a tutorial session focused on valuation and management of environmental resources and drivers of food demand.
	Additional notes about suggested reading:	The course material will be made available in the Moodle platform.
	Textbooks (and optional supplementary readings):	None