C3A Manifesto of Studies 2020-21

Please note:
Attendance of 75% is expected for ALL courses.
It may also be possible to follow additional courses offered by other UniTN Departments/Centres.

Course title	Lecturer(s)	N hrs	ECTS	Synopsis and Skills Learned	Evaluation procedure	Notes and Pre-requisites	Month/year
Laboratory health and safety (LHS)	C3A and FEM health and safety officers and consultants (org. by UNITN)	12	N.A.	**Summary:** Lectures and practicals in general laboratory safety procedures, equipment use, and basic first aid. **Description:** Legally required basic (4 hours) and specific (8 hours) training in health and safety and risks connected to work activities. **Skills acquired:** knowledge of basic chemical manipulation, laboratory skills, biological hazards, fire and radiation safety and basic first aid.	Multiple choice quiz	Obligatory for all PhD students (unless certificate of previous courses available)	01/2021
BASIC AND ADVANCED COURSES (CONFERMATI A MANIFESTO)							
Invasive Species and Tree health	**Nicola La Porta**	16	2	**Summary:** the aim of the course is to provide basic knowledge on the role of the introduction and spread of invasive alien species in Europe on plant health and sustainability of natural environmental management. Specific case studies concerning representative Alpine ecosystems will provide examples of the possible methodological approaches. The course will consist of lectures and group works on real cases. **Module 1 (8 hours):** main alien invasive pathogens on trees. Their introduction and spread by global trade and human movements. Effects of climate changes and further opportunities for aliens on their establishment and impact. **Module 2 (8 hours):** main alien invasive trees and their effect in terms of biodiversity and landscape losses. Associated risks and possible challenges.	Final written test	1st year	From 9 November to 3 December 2020 (2 hours classes twice a week) - days to be defined

Food authenticity and origin	**Federica Camin,** Luana Bontempo, Roberto Larcher, Matteo Perini	16	2	**Summary:** The course will be focused on the topics of food authenticity and origin traceability. Issues such as legislative requirements, commercial impact and consumer protection, as well as the applicable analytical tools will be addressed. The course will consist of lectures and group works on real cases. **Module 1 (4 hours):** concepts and meaning of food authenticity, origin traceability, legislative requirements, tools to tackle these problems and to protect consumers and dishonest producers **Module 2 (4 hours):** stable isotope ratios techniques **Module 3 (4 hours):** mineral profile techniques **Module 4 (4 hours):** other analytical approaches	Article presentation chosen by the Phd Student	2nd year	November – December 2020 or January-February 2021 (to be decided)
Molecular Plant Breeding	**Silvia Vezzulli**, Laura Costantini, Fabrizio Costa, Lorenza Dalla Costa, Umberto Salvagnin	40	5	**Summary**: This course will present the most advanced frontiers in Plant Breeding, the science of creation, the fixation and selection of superior plant phenotypes. This course is organized in four modules for a total of 40 hours distributed in 20 lectures. The students will acquire knowledge about the principles undertaking the control of important agricultural traits and will be introduced to the several strategies to date available for a DNA-guided precise selection in different species, distinguished also by a different ploidy level. **Module 1** (12 hours): Molecular markers and Marker-Assisted Selection: it will introduce the basic concept of plant breeding and the genetic control of simple mendelian traits. **Skills acquired**: knowledge of the types of molecular markers and their employment in Marker-Assisted Selection (MAS). **Module 2** (8 hours): Mapping of quantitative trait loci in experimental populations: it will introduce the analysis of quantitative traits. **Skills acquired**: use of molecular markers in constructing genetic linkage maps and in detecting quantitative trait loci (QTL) in progenies. **Module 3** (10 hours): Molecular dissection of complex traits in germplasm collection: alternative methods of QTL mapping employing complex and more structured genetic background will be presented.	Presentation	1st year	12 November 2020 - 11 February 2021 (2 hours on Tuesday and Thursday from 10:00 to 12:00)

				Skills acquired: Linkage Disequilibrium (LD) analysis and the detection of QTL through Association Study (AS) approaches, introducing to the principle of Genomic Selection (GS). **Module 4** (8 hours): Technological evolution in the field of genetic engineering: from GMOs to New Plant Breeding Technologies (NPBTs). **Skills acquired**: knowledge of the state-of-the-art genome modification technologies with a methodological focus on their strengths and weaknesses. **Final exam** (2 hours): Oral presentation.			
Exploring Biodiversity using DNA-barcoding and molecular clocks	**Omar Rota-Stabelli**	12	1.5	**Summary**: A combination of lectures and practicals using phylogenetic methods to explore the diversity within ecosystems and understand how species (or varieties/strains) of bacteria, viruses, insects, plants and fungi have evolved through time. The course is organised in 3 lessons: 1. Introduction to molecular phylogenetics with a particular emphasis on species phylogenies and DNA barcoding (4 hours); 2. A focus on estimating divergence times of organisms using molecular clocks and on how to use this technique for paleobiological and paleoecological reconstructions (4 hours); 3. A journal club where students present and discuss a paper chosen form the literature on either barcoding or molecular clocks (4 hours). **Skills acquired**: practical tools for studying the evolution and diversification of species (molecular phylogenetics, DNA barcoding, estimates of divergence times using molecular clocks); skills in presenting and discussing scientific articles on biodiversity.	Presentation	1st year	WEEK OF 9-13 DECEMBER 2020
The transmitters: the fascinating life of insect vectors of plant pathogens	Daniele Cornara	20	2.5	**Arguments and general structure:** 1) Lecture: “Basic knowledge on vector transmission of plant pathogens” 2) Lecture/Case study: “Vectors of Xylella fastidiosa” 3) Lecture/Case study: “Aphids, thrips, whiteflies and mealybugs transmission of viruses” 4) Lecture/Case study: “Psyllids transmission of Ca. Liberibacter spp.” 5) Practice: “How to set-up a transmission study”	Final oral exam; attendance to at least 75% of the course is mandatory for admittance to the final exam	1st year	14-18 December 2020

				6) Practice: “Electrical Penetration Graph: introduction and how to use it in transmission studies” **Objectives/main goals:** Overall, the students will acquire basic knowledge about the role of the insects in the epidemiology of plant pathogens, together with the fundamental skills needed to approach the research on the complex interaction insect-pathogen-host plant. Furthermore, they will be introduced to the concept of multidisciplinary and how integration of knowledge from different fields/topics is essential for the study of vector-borne diseases. Finally, lectures will be integrated with practical lessons focusing on: i) how to plan and conduct a transmission experiment from field surveys to pathogen detection in lab; ii) the Electrical Penetration Graph (EPG), and how real-time monitoring of the probing/feeding behavior of a vector can furnish fundamental breakthroughs for the understanding of a vector-borne plant pathogen epidemiology			
Evaluation of agri-food products and policies	**Simone Cerroni**	24	3	**Summary/Description:** The course provides students with an in-depth description of state-of the-art methods and tools that are used to evaluate the demand for innovative food products (e.g., lab meat, antibiotic-free products) and welfare benefits generated by environmental and agri-food policies of recent relevance (e.g., climate change, sustainable consumption). Among the methodologies covered in the course: stated preferences (i.e., discrete choice experiments), experimental methods (i.e., experimental auctions) and randomized control trials. The course also provides principles of statistics and econometrics to be used in data analysis. Classes will consist of 7 standard frontal lectures, 1 tutorial on statistics and econometrics, 1 tutorial on research ethics in policy evaluation, and 3 interactive practical lectures. **Skills acquired:** The course will improve knowledge and understanding of new trends and policies in the agri-food sector. Students will familiarize with methods and tools for demand and policy evaluation that can be useful in the job market. Strengths and limitations of these methods will be covered to stimulate critical thinking and the elaboration of new research ideas. The course also aims to improve	- Oral presentation of an academic paper (20%) - Oral presentation and short report on the development of an experimental protocol (40%) - Oral presentation and short report on conducted data analysis (40%)	1st year	December 2020 (dates to be defined)

				students' knowledge and understanding of principles of statistics and econometrics applied to evaluation problems.			
GEOframe Winter School	Riccardo Rigon, Giuseppe Formetta, Marialaura Bancheri (CNR-Ercolano Napoli)	64	8	Program 2019/20 (to be updated): The second edition on the Winter School on GEOframe will be held between January 8 and 17, 2020 at the Department of Civil, Environmental and Mechanical Engineering of University of Trento. The course is devoted to Ph.D. Students, Post-docs, Young researchers an aims to make the participants to run their own simulations on their own catchments and estimate the hydrological budget components. To have an idea of the topics, the interested researchers should give look at the material (slides, video etc. of the 2019 Winter School). For students is possible also to participate only to the second week (at the same cost, but saving some lodging) but, in that case, is mandatory to follow the on-line courses and tutorials relative of 8-9-10 January topics and having done the exercises before December 15. We will offer online support to them up to that date and no support whatsoever between 13-17 of January for clear reasons of course efficiency. The material of the first three days will be available on the Winter School website from November 15, 2019. With respect to the 2019 School, there will be more practice and more detailed material on Evapotranspiration and Rainfall-Runoff. For every 40 minutes of talk there will be 70 minutes of supervised exercise for a total of 8 hour a day of activities.			7-14/01/2021
Ecological and epidemiological modelling	**Roberto Rosà**, Andrea Pugliese,	16	2	**Summary:** 8 hours of lectures on the basis of eco-epidemiological models with application both in agriculture and public health. 8 hours of practical exercises with software R using experimental data from agriculture and public health case studies. **Description:** this course will provide an insight on the development and analysis of ecological and epidemiological models with applications in agriculture and public health. **Skills acquired:** conceptual ideas and mathematical tools needed for implementing ecological and epidemiological models, especially population dynamic models as well as epidemiological models.	Presentation or report	2nd year Students are expected to know the basic concepts of mathematics and statistics. Prior knowledge of open source	11-22/01/2021

						software R use is also required	
Introduction to Nonparametric Analysis	Valerio Mazzoni	16	2	**Summary:** Introduction to the basic concepts of descriptive statistics and probability theory **Description:** the following techniques will be studied: contingency tables and goodness-of-fit tests; hypothesis testing about the probability of an event, on a single sample, on two paired samples and on two independent samples; the case of more than two (dependent/independent) samples; tests for the trend detection and correlation; measures of association and related hypothesis testing methods; non parametric inference (Jackknife and Bootstrap). **Skills acquired:** use of nonparametric techniques to solve hypotheses testing problems where the conditions for parametric tests are not fulfilled	Written exam	1st year: no prerequisites required	4 classes, twice a week, from 26/1 al 5/2/2021 (Tuesdays and Fridays)
Sustainable production and consumption from a social perspective	Emanuela Bozzini, Francesca Forno, Natalia Magnani	24	3	**Summary:** The objective of this course is to critically discuss the transformations in patterns and practices of production and consumption, giving particular attention to sustainability ideas and practices. The class will be articulated in three main modules (8 hours each). **Module 1 (8 hours):** Overview of long-term trends in agricultural production and its sustainability **Skills acquired:** Knowledge on historical trends in agricultural production, resource use, chemical input across world regions; knowledge on issues of sustainability of current agricultural systems in relation to demography, urbanization and resource depletion. **Module 2 (8 hours):** Consumer Culture and Society. This module offers the opportunity to engage with sociological theories of consumption and contemporary consumer society. **Skills acquired:** Familiarity with sociological concepts to investigate changes in consumption practices and lifestyles, with a special attention on food consumption trends. The focus will be on the practice of consumption with regard to lifestyle, consumer subjectivity, meaning making, sustainability and 'food diversity'.	Final written report or presentation	1st year	EB: 11-12-13 January FF: 18-19-20 January NM: 25-28 January + 1 February

				Module 3 (8 hours): Social innovation and sustainability. The module aims to introduce students to sociological theories and debates concerning the development of social innovation for sustainability. **Skills acquired:** familiarity with debates on sustainability and social innovation, with a special attention to food and food systems.			
Insects as a Sustainable Feed Alternative	S. Dabbou	12	1.5	**Summary**: The aim of the course is to provide an overview on insects and the increasing interest basic knowledge on the use of insects in animal feed. **Description**: The course is organised in 3 lessons: 1. Introduction on Insects and legislation (2 hours). 2. Insect rearing (case study: Black Soldier Fly) (3 hours). 3. Potential of insect meal in monogastric animal farm nutrition (3 hours). Practical activities: 1. A journal club where students present and discuss a paper chosen from the literature on this topic (2 hours). 2. Oral presentation where students choose and present the interesting topics on Insect as feed (2 hours). **Skills acquired**: Tools for studying the importance of insects as animal feed; skills in presenting and discussing scientific articles on this topic.	Oral Presentation	1 st Year (no prerequisites required).	18-20 -25-26 January 2021
Innovative methods in crop protection	**Gianfranco Anfora,** Ilaria Pertot, Michele Perazzolli, Gerardo Puopolo, Valerio Mazzoni, Emanuela Bozzini	16	2	**Summary:** The course will give an overview about regulation aspects and innovative procedures for the control of plant pathogens and insects on major crops. **Module 1 (4 hours):** Regulatory provisions on pesticides and biopesticides. This module will provide details on novel regulatory provisions on plant protection products and sustainable use of pesticides with a focus on the European Union. Skills acquired: knowledge of policy principles and provisions informing EU regulation on plant protection products. **Module 2 (6 hours)**: Innovative approaches for pathogen control. This module will provide details on innovative approaches to control plant pathogens. Skills acquired: knowledge of new generation tools for biological control of pathogens.	Final written test	1st year	January-February 2021

				Module 3 (6 hours): Innovative approaches for insect control. The aim of this module is to provide expertise on the principles of plant protection strategies and alternative methods to the use of synthetic chemicals, including biological control and integrated pest management. **Skills acquired:** knowledge of the pioneering low impact techniques for the integrated management of insect pests (i.e. semiochemicals, natural enemies, sterile insect technique); to learn the main types of existing bioagrochemicals, their mode of action, their application strategies, the advantages and disadvantages deriving from their application.			
Plant Physiology and Genetics of Fruit Ripening	**Fabrizio Costa**, Nicola Busatto, Brian Farneti, Michele Perazzolli	24	3	**Summary:** The course will provide the basics of plant physiology, focusing on phenology and fruit ripening. A special attention will be also given to the genetic mechanisms undertaking important physiological pathways and innovative plant physiology for precision agriculture. **Module 1 (4 hours)** Smart plant physiology. This module will provide specific knowledge of plant physiology with particular attention to new tools for precision agriculture. **Skills acquired:** knowledge of plant physiology and precision agriculture aspects. **Module 2 (7 hours)** Fruit ripening physiology. This module will provide a general description of the type of fruits and their mode of ripening. The interplay between different hormones in regulating the fruit ripening will be discussed, introducing, moreover, the genetic analysis addressed to the detection of the main loci controlling fruit ripening related pathways. **Skills acquired:** knowledge of ripening physiology and the interplay among several hormones **Module 3 (7 hours):** Genetic regulation of fruit ripening. This module will present the road map of the functional analysis carried out to date to disclose the main regulating mechanisms of fruit ripening. The state of the art of the molecular and biotech techniques used to date to investigate the fruit ripening processes will be also discussed, from recombinant DNA to OMIC approaches. **Skills acquired:** investigation of the molecular mechanisms regulating fruit ripening using the most advanced biotechnology approaches	Presentation	1st year	Module 1: 15 - 22 January 2021 Module 2: 26-28 January and 2 February 2021 Module 3: 4-9-11 February 2021 Module 4: 16-18-22 February 2021

				Module 4 (6 hours): Fruit quality and postharvest physiology. This module will be dedicated to underlying the relationship between fruit ripening and fruit quality, and how fruit quality can be investigated. To this end, classic and novel methodologies will be illustrated. The last part of the course will be devoted to postharvest, discussing how fruit change during storage and which are the most modern postharvest technologies oriented to preserve fruit quality. **Skills acquired:** understanding of the regulatory processes underlying fruit quality and their impact in the postharvest physiology			
Data exploration	Pietro Franceschi	12	1.5	**Summary**: data exploration and visualization, introduction to some of the bioinformatical and biostatistical tools/concepts used to explore a multidimensional dataset (PCA, Clustering, Linear Modeling, ...). **Description:** The aim is to highlight the advantages and limitations of each approach. **Skills acquired:** During the course the different aspects will be illustrated by live R/Python sessions on publicly available datasets. The students will be also encouraged to bring their own data to discuss and (possibly) analyse them. **See also: https://www.unitn.it/drbs/38/teaching-program** **CIBIO Manifesto of Studies 2019-2020 (which will be repeated in 2020-2021)** **This course is offered by CIBIO UNITN, but may be repeated on the FEM campus if demand is high.**	Individual/ Group reports and discussion on assigned topics	1st year	CIBIO Educational offer – February 2021
Exploring gene evolution using phylogenetics and phylogenomics	**Omar Rota-Stabelli**	12	1.5	**Summary**: Evolution can deepen our understanding of biological processes by revealing how things come to be the way we currently observe them. Useful evolutionary tools are those based on phylogenetic trees: they aim at understanding how genes evolved in different species and can provide important clues for understanding the molecular bases of organism biology. **Description**: This introductory course will provide the theoretical and practical bases of some tree-based methods using human and	Presentation	1st year	Indicative period: February 2021

				Drosophila as main model organisms. The course is divided in three lessons: 1. Introduction to molecular phylogenetics from sequence alignment to Bayesian inference with a particular emphasis on gene phylogenies (4 hours); 2. A focus on phylogenomics, the study of how genes evolve in different genomes, with particular emphasis in detecting gene family expansion/contraction and selection in the species of interest (4 hours); 3. A journal club where students present and discuss with the others a paper chosen form the literature (4 hours). **Skills acquired**: practical tools for studying gene evolution using phylogenetics and phylogenomics; skills in presenting and discussing scientific articles on evolutionary biology. **See also:** https://www.unitn.it/drbs/36/teaching-activities **CIBIO Manifesto of Studies 2019-2020 (which will be mostly repeated in 2020-2021)**			
Aquatic ecosystems in natural and human impacted environments	**Monica Tolotti,** Maria Cristina Bruno, Walter Bertoldi, Guido Zolezzi	24	3	**Summary:** The course provides an insight on the physical, chemical, ecological and biological properties and dynamics of freshwater ecosystem, considering natural conditions (Module 1) and the effects of human stressors (Module 2). Specific case studies of different freshwater ecosystems will provide examples of the possible methodological approaches. **Module 1 (12 hours):** Aquatic ecosystem in natural conditions. This module addresses the main variables and processes driving the habitat dynamics in natural freshwater ecosystems. **Skills acquired:** ability to describe and interpret aquatic habitats in running waters and lakes, across time and space, including physical, chemical, morphological variables, such as flow, temperature, nutrients, and foodweb descriptors and the effects of vegetation on the above. **Module 2 (12 hours):** Aquatic ecosystem under direct and indirect human stressors. This module provides insight on direct (e.g., pollution, water withdrawals, engineering) and indirect (land use and climate change).	Presentation	1st year	1-5 February

				Skills acquired: methods to recognize and quantify stressors such as source and point pollution, hydro-morphological alterations, thermal alterations, extinction and creation of habitats; methods for mitigation /restoration strategies (e-flows, morphological restoration, sediment augmentation)			
Advanced Econometrics	Carlo Fezzi	24	3	The course provides students with knowledge and understanding of a diverse range of econometric approaches https://www.unitn.it/drss/em/221/curriculum	Final examination to be defined	1st year	End of February 2021
Experimental Economics	Matteo Ploner	24	3	The course provides students with knowledge and understanding of principles of experimental economics https://www.unitn.it/drss/em/221/curriculum	Final examination to be defined	1st year	SRS educational offer - February-March 2021
Environmental data management and analysis with GIS	**Marco Ciolli**, Alfonso Vitti, Paolo Zatelli	40	5	**Summary:** 13 lectures and 7 practicals in Numerical cartography and GIS **Module 1 (26 hours):** Numerical cartography and GIS. Introduction to GIS theory, tools and data, Cartographic projections, reference systems and their transformations, GRASS GIS: features, structure and usage, data I/O, Thematic maps, Geoprocessing, network analysis, WebGIS, Geostatistics, Digital data sources, Spatial databases. **Skills acquired:** selection of suitable Geographic Information Systems, digital spatial data acquisition and processing. Selection and management of the correct datum and execution of map reprojections. Understanding of the information content of different digital map formats and knowledge of digital spatial information data sources. Knowledge of the Free and Open Source Software GRASS and QGIS. Creation of thematic maps and application of geoprocessing, network analysis and geostatistics. Introductory knowledge of spatial data base management and image analysis. **Module 2 (14 hours):** hand-on experience in the use of GRASS and QGIS for environmental applications. **Skills acquired:** datum selection and map data input and output, maps reclassification, rasterization and interpolation. Creation of reports. Accomplishment of simple map processing for typical GIS tasks. Creation of a complete environmental model in a GIS.	Presentation	1st year	DICAM educational offer – March 2021

Animal Conservation in Theory and Practice	**Francesca Cagnacci,** Federico Ossi, Heidi C. Hauffe	24	3	**Summary** Conservation biology strives to describe, understand, and forecast biodiversity dynamics by applying ecological and evolutionary theory within the contexts of resource management, economics, sociology and political science. This course will explore the motivation for preserving biodiversity at all levels (genetic, species, ecosystem), available decision-making tools, and the consequences of various interventions, covering mainly terrestrial and freshwater ecosystems and including wild animal and plant species. **Module 1 (8 hours)** Principles of conservation biology. We have entered the Anthropocene, the Era of humans, where human impact is widespread in all biomes. The module will cover the essentials of conservation biology science, its area of application, and the analysis of major threats of humans on ecosystems. **Skills acquired:** theory of conservation biology and fields of application. **Module 2 (8 hours)** Conservation of terrestrial mammals in the Alps. The module will use the principle acquired in Module 1 to analyse conservation cases of terrestrial mammals in the Alpine range. **Skills acquired:** application of conservation biology theory to terrestrial mammals **Module 3 (8 hours)** Conservation genetics. The interactive module will focus on the application of genetics, genomics and metagenomics to conservation science, including wildlife forensics, and the importance of preserving genetic variation. **Skills acquired:** principles of conservation genetics/genomics with practical examples of current research, and active discussion of case studies.	- Project exam (problem-solution analysis) with written part and presentation for Outreach	1st year	End of March – beginning of April 2021
Production and characterization of fermented foods	**Roberto Larcher,** Tiziana Nardin, Raffaele Guzzon, Tomas Roman	16	2	**Summary:** The course aims to provide, through a series of monographic seminars, notions about current issues or innovative trends in the transformation of raw food, with particular reference to traditional fermented foods. Ample space will also be given to analytical techniques for the characterization of food.	Written exam	2nd year	End of March – beginning of April 2021

				Module 1: Oenological treatments and technological fermentation management. **Module 2:** Evolution of microbiota through wine oenological fermentations, influence of technological and environmental variables and impact on wine quality; Wine spoilage microorganisms, risk for wine quality and human health, and innovative approaches at the winery and wine hygiene. **Module 3:** Chemical characterisation of fermentative compounds; Identification and quantification of metabolites; Chromatographic separation and analytical detection: profiles of minerals, sugars, amines, amino acids, organic acids, vitamins and volatile compounds; Targeted and untargeted profiles; Models of origin and botanical traceability; **Skills acquired**: familiarity and ability to interpret and describe fermentative processes and define quality controls.			
Science of cooking	Eugenio Aprea, Flavia Gasperi, Isabella Endrizzi	24	3	**Summary**: the aim of the course is to provide the notions of general chemistry, organic chemistry and the physical states of the main food systems. In particular, it focuses on the world of molecules and their reactions to understand what food is and what happens during cooking and food preparation. **Module 1** (10 hours): Fundamentals: The basic concepts of the matter and its forms will be revised as well as the importance of the atomic and molecular forces, focusing on food systems. An overview of the main properties of aqueous solution will be given, recalling the concept of colligative properties and the definitions of pH and water activity. Description of the basic molecules of food (carbohydrates, lipids, proteins and water) and their nutritional, chemical and technological properties will be provided. **Skills acquired:** Knowledge of food constituents and their physical and chemical properties.	Written exam and Presentation	1st year	March-April 2021

				Module 2 (6 hours): Heat transfer and effects on foods: Methods of heat transfer will be discussed also in relation to the different cooking methods. The modification of the main constituents of food during preparation and cooking will be revised with a focus on the Maillard Reaction and its implication for the final quality of food systems. **Skills acquired:** The student will be able to predict the effect of cooking on final product as a function of its composition and modality of energy transfer. **Module 3** (8 hours): How to measure the impact of cooking processes on food quality. The module is based on practical activities. The effects of preparation and cooking on real foods will be evaluated through instrumental measurements and/or sensory evaluations of the characteristics of the products (eg. texture, color, taste, ...). The data will be processed by the students who will also prepare a report to describe and explain the observed phenomena. **Skills acquired:** Knowledge and "hands-on" on the principal methods and instruments to measure physical, chemical and sensory modifications of food.			
Field sampling and Spatial Ecological Modelling	**Marco Ciolli,** Clara Tattoni	40	5	**Summary:** 18 hours lectures, Basis of Field sampling techniques and Spatial Ecological modelling using GIS and GPS; 10 hours field sampling work with measuring instruments and GPS; 12 hours practical Exercises with basis of GIS Ecological modelling with QGIS and R. **Module 1 (28 hours):** Theoretical and practical basis of field sampling techniques and data collection and spatial ecological modelling. Exploration of field data and how they can be used/misused, How to perform sampling in the forest and GPS data collection in the field, basis of spatial ecological modelling, overview of various modelling techniques with special reference to landscape ecology, land use change modelling and scenarios development, Vegetation Analysis and cartography, basis of remote sensing for vegetation. Forest landscape change detection, Markov Chain scenarios and Landscape Ecology indexes and parameters. **Skills acquired:** How to select sampling areas in the field and the reliability and limits of field data. Importance of data understanding	Presentation	1st year	DICAM educational offer – May-June 2021

				and of sampling procedures. Data acquisition and critical interpretation of data sources. Improving GPS data sampling in the field. **Module 2 (12 hours):** Practical exercises with a Special focus on Land use change, Vegetation Analysis and cartography, basis of remote sensing for vegetation, Past Forest landscape change detection, Production of Markov Chain scenarios future/past and Landscape Ecology indexes and parameters and modelling of different pollution sources. Overview of various modelling techniques. Comparison of different techniques, pros and cons. Alien species modelling and study cases. Interpretation of Model results and validation. GIS and R Practice on sample data. **Skills acquired: It will give a thorough introduction to the** How to use and combine the data in a GIS to perform geospatial analysis and ecological modelling. How to use QGIS plugins and basic use of R as a GIS.			
Other basic and advanced Courses open to C3A PhD Students - schedule to be defined							
Integrated river morphodynamics	**Guido Zolezzi,** Walter Bertoldi, Marco Tubino	32	4	**Summary:** The general aim of the course is to show how the integration of different approaches can lead to a comprehensive insight into river morphodynamics. The course strategy is to focus on one specific morphodynamic pattern, i.e. alternate bars in channelized streams, a subset of river bars that can be taken as an example of other patterns evolving at different time and spatial scales. Basic knowledge of fluid mechanics and sediment transport are recommended **Module 1 (20 hours):** Analytical theories of river bars. This module provides an overview of assumptions and outcomes of analytical morphodynamic theories and a step-by-step development of a linear stability analysis for free bars in straight channels. **Skills acquired:** learn the "machinery" that lays behind the linear stability analysis of free bars, and, more in general, behind linear stability analyses in morphodynamic problems and develop and use simple computational tools to predict the main properties of free bars in straight channels.	Presentation	1st year	DICAM educational offer dates to be defined

				Module 2 (8 hours): Bars in rivers: processes, forms and implications for river behaviour. This module describes river bars in different fluvial systems, their relationship with river planform style, the effect of flow unsteadiness, the role of vegetation, and the relationship with hyporheic flow. **Skills acquired:** develop an understanding of how to integrate multiple approaches to investigate morphodynamics of river bars **Module 3 (4 hours):** Numerical simulation of river bars. This module illustrates the potential of 2D numerical models resolving the shallow water equations to investigate alternate bars dynamics and quantify their properties. **Skills acquired:** ability to use a 2D numerical model to reproduce alternate bars dynamics.			
Statistical methods and data analysis	Stefano Siboni	32	4	**Summary:** illustration of the basic mathematical tools for the analysis and modeling of experimental data and to introduce and analyse the statistical models implemented by computational procedures, underlining their limitations and the interpretation of the results **Description:** topics encompass short recalls about errors in experimental measurements, random variables, functions of random variables. Then sample theory is introduced, for small and large samples. The main content of the course concerns hypothesis testing, related to kind or parameters of statistical populations, comparison of statistical populations, Pearson's linear correlation coefficient, 1 and 2 way ANOVA, linear regression model **Skills acquired:** general understanding of how statistical tests work, that she/he can appropriately use the basic statistical tests and also easily understand and apply further, more specific tests not presented in the course The aim of the course is to illustrate the basic mathematical tools for the analysis and modelling of experimental data, particularly concerning the main statistical methods. The idea is not simply to describe and discuss the "cooking recipes" for the statistical treatment	Written exam		DICAM educational offer – dates to be defined

				of data, but also to introduce and analyse in a critical way the statistical models implemented by the computation procedures, stressing their limitations and the actual interpretation of the results.			
Behavioural Economics	Luigi Mittone	48	6	The course provides students with knowledge and understanding of principles of behavioural economics https://www.unitn.it/drss/em/221/curriculum	Final examination to be defined	1st year	DEM educational offer – dates to be defined
SOFT SKILLS							
How to write a research project (SOFT SKILLS)	**Ilaria Pertot**	16	2 Type B	**Summary:** Basic knowledge on how to prepare a research project proposal. The EU funding scheme and the evaluation process. Opportunities for project proposal application (4 hours lesson and 16 hours project preparation) **Funding opportunities in the H2020 and FP9**	Project proposal	2nd or 3rd year	22-26 March 2021
Technical Scientific English	**Felicity Hope**	24 or 16	3 or 2 type B	Courses of Technical-Scientific English (Academic Writing, Presentations and Academic Writing II) addressed to PhD Students of the scientific area.	Final test	N.A.	I Semester – II Semester