

Faculty of Agricultural, Environmental and Food Sciences

PhD programme in MOUNTAIN ENVIRONMENT AND AGRICULTURE

Website:

<https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/phd-mountain-environment-agriculture/>

Duration: 3 years

Academic year: 2024/2025

Start date: 01/11/2024

Official programme language: English

1 position financed by European Social Fund Plus

Programme contents:

The full-time PhD programme foresees lectures and research activities. The PhD programme is based on the following milestones:

- Students develop and organize their research plan in the first six months of the course together with their supervisor and defend it in front of the PhD Committee.
- Students prepare, within 12 months of starting the programme, a public seminar in which they discuss the state-of-the-art of their research topic.
- Students take part in at least one international conference where they are expected to deliver an oral paper or present a poster.
- Students spend at least three months abroad conducting research.
- Students attend and pass specific compulsory courses and additional courses or summer/winter schools.

In order to be admitted to the final exam, PhD students must have at least one scientific paper, as first author, accepted for publication in an international peer-reviewed journal. Only in exceptional cases, the PhD Committee can authorize motivated exceptions.

Stages of the PhD:

During the first year PhD students attend courses, prepare and submit their research plan under the guidance of the main supervisor, and they also present a seminar on the state-of-the-art in the area of interest. PhD students are encouraged to develop an excellent command on methodological techniques and to start preliminary research activity. In the second and third year, they are expected to carry out research activities according to the research plan and schedule, to spend a training period in a foreign university or research centre, to process data and on to write the thesis.

Along the three-year period, PhD students are also required to attend seminars, summer/winter schools, present contributions to international conferences and write scientific papers for high-ranked international journals. The dissertation is expected to be a collection of scientific papers with a comprehensive introduction, discussion and conclusion. The final thesis must be written in English and include an abstract. Each PhD student is supervised by a main supervisor and two co-supervisors, at least one of whom is external to the PhD Committee.

This PhD course consists of 2 *curricula*.

Curriculum 1: Sustainable agricultural production systems

Producing healthy food through agricultural systems that avoid negative environmental impacts is one of the main challenges globally as well locally. The expertise of the research groups covers soil fertility, plant physiology and biochemistry, entomology, plant pathology, crop management, animal science, agricultural machinery, and agricultural economics, with special reference to problems of mountain areas. Studies mainly deal with the complexity of biological systems, the interactions among organisms, precision farming, livestock performance and welfare, the effects of climate change and economic system evaluations.

The research activity aims at improving the quality of agricultural products and the sustainability of the production process at local, national and international level, by developing production systems and novel technologies that increase yields, the quality of the products and animal health and welfare, while reducing the use of non-renewable resources, environmental pollution and production costs.

Short Description of the research groups

Soil ecology (Prof. T. Mimmo, Prof. L. Borruso)

The research group is primarily focused on studying soil ecology and how biotic and abiotic factors affect the biogeochemical cycles of nutrients in the soil and rhizosphere. They use a multidisciplinary approach that analyses the chemical, biochemical, and physiological mechanisms involved in plant nutrient acquisition, translocation, and allocation. The group also examines the interactions between plant roots, soil, and microorganisms (such as bacteria and fungi), particularly in relation to biotic and abiotic stress. Further, the research group explores the role of taxonomic and functional biodiversity in soil health.

Insect chemical ecology and apiculture (Prof. S. Angeli)

The research group addresses issues related to the evolutionary biology of chemically mediated insect-plant interactions of agricultural ecosystems. The main goal is to provide novel tools to control pest insects in an environmentally friendly manner, with a chemical ecology approach. In particular, we combine different methodologies including GC-MS chemical characterization, electroantennography and behavioral assays to discover how host plants respond to insect attacks through the releasing of volatile compounds and which ecological functions these compounds may mediate. Our studies in apiculture focus on Varroa-Apis interactions, impact of insecticides, and monitoring of pesticides.

Applied molecular entomology (Prof. H. Schuler)

Our research group is broadly interested in the evolutionary ecology of insect pest species. We are using a combination of genomic and population genomic approaches as well as in vivo experiments in laboratory and semi-field experiments. One of our primary research questions addresses the association of microbes with insects and their impact on the ecology and evolution of their hosts. In particular we study insect vectors of phytoplasma diseases, we investigate the associations of bark beetles with symbiotic bacteria and fungi to understand their role in the population dynamics of this important pest species. Moreover, we study the invasion dynamics of invasive insect species. Our research combines fundamental and applied aspects of the biology of insect pest species with the orientation towards a more sustainable pest management.

Fruit tree physiology and ecosystems (Prof. M. Tagliavini, Prof. C. Andreotti, Prof. D. Zanutelli, Dr. D. Asensio)

The research focuses on the exchange of carbon, mineral nutrients, water and energy between soil, plants and atmosphere in orchards and in vineyards under climate change and multiple environmental (in cooperation with Prof. G. Wohlfahrt, University of Innsbruck, and Dr. G. Niedrist, Eurac Research). Research approaches include eco-physiological, micrometeorological, isotopic,

biochemical, biotechnological and biometric methods, as well as the application of spectral analysis. The final aim is the enhancement of the use efficiency of resources in crop production systems and the development of sustainable management techniques with special emphasis on the quality of the produces.

Agrofood economics, management and marketing (Prof. C. Fischer)

The research activity in this area aims at improving the competitiveness of farms and agribusiness enterprises and the agrofood sector as a whole in South Tyrol and elsewhere. Current approaches and topics include: food supply and value chain economics and management; agribusiness economics and management; market analysis and marketing research; food marketing; tourism and agritourism; regional, agricultural and rural development (in cooperation with Dr. T. Streifeneder); grassroots collective action, alternative agro-food networks, consumer study, sustainable consumption, statistical data evaluation and econometrics (cross-section, time series and pooled datasets).

Molecular and Structural Biology (Dr. K. Janik, Dr. S. Benini)

The Department of Molecular Biology and Microbiology and the Functional Genomics group of the Laimburg Research Center apply modern molecular biology techniques to decipher the functions of plant proteins and pathogens and to answer several research questions relevant to agriculture. The studies, carried out in collaboration with Dr. Alberto Ceccon, head of the NMR Spectroscopy Laboratory at the Laimburg Research Center, employ molecular biology, crystallography and NMR analysis to investigate the biophysical properties of molecules of an important plant pathogen.

Animal Science (Prof. M. Gauly, Prof. J. Sölkner, Dr. T. Zanon)

Research activities in the Animal Science Group focus on relevant questions of livestock production. For dairy cattle, evaluations and improvements of existing production systems is the main area of research. In particular, commonly used dairy cattle breeds are compared in terms of performance and functional traits (health, welfare) and different production systems are evaluated. For beef cattle, the group focuses on the development of high-quality beef production systems. In addition, grazing activity and grassland use depending on breed and species is another focus of the work.

Grassland farming (Dr. G. Peratoner, Prof. M. Gauly)

The research focuses on productive and environmental aspect of forage systems (addressing both meadows and pastures), depending on the management intensity and on the site conditions and meteorology. Research approaches include the analysis of vegetation dynamics, forage yield, forage production and nutrient fluxes by means of biometric methods and statistical modelling, with possible applications at the interface with remote sensing. The final aim is providing scientifically sound information and innovation for a sustainable agronomic management of grassland resources under the climatic and topographic challenges of the mountain agriculture.

Technologies for agroforestry innovations (Prof. F. Mazzetto, Dr. G. Carabin)

The topics involve the application of digital technologies for the management of agricultural and forestry processes in mountainous environments. The aims are: a) to improve the quality of farm management as a whole; b) to optimize the use of machines and process equipment, with the aim of mitigating environmental impacts (i.e.: reduction of drift phenomena during phytosanitary treatments, containment of energy consumption and related carbon footprints, optimization of the water footprint); c) enable the development of alternative niche crops to traditional mountain farming practices, creating alternative sources of income through new models of agriculture designed for extreme environments; d) improve ergonomic and safety conditions for farm operators. Research approaches include both laboratory activities, where the functionality of the machines can be tested in controlled environments and with particularly sophisticated measurement systems, and field activities, to evaluate the functionality of possible prototypes in their real working contexts. Investigation methodologies will include both the use of various types of sensors (including ground

sensing and LiDAR), including new generation sensors, and modeling approaches for physical, environmental and management processes.

Curriculum 2: Ecology, environment and protection of mountain areas

The evaluation of the effects of management and climate change on natural ecosystems and humankind is at the core of this subject area: main topics include biodiversity, water quality, protection from natural disasters, and the mitigation of climate change through the maintenance or enhancement of carbon stocks. The use and development of advanced technologies for monitoring and the functional study of ecosystems, including innovative approaches, such as those involving the use of stable isotopes, are some of the features of this area.

Short Description of the research groups

Interdisciplinary landscape, vegetation and conservation ecology (Prof. C. Wellstein, Prof. N. Hölzel)

The working group addresses regional to global environmental issues, such as biodiversity research, functional diversity, climate change research, nature conservation, ecosystem restoration and sustainable and resource-efficient land use. We apply a large set of methods tailored for the scale of interest ranging from biogeography to molecular ecology and study various ecosystems, habitats and land-use types. We pursue studies on a global scale and focus on Europe, South America and South Africa. Our research covers Mediterranean, temperate and alpine regions. We combine research on ecological patterns and processes, management and conservation, under natural environmental variation and human impact.

Forest ecology (Prof. R. Tognetti, Prof. L. Montagnani, Dr. E. Tomelleri)

The focus of this research group is the ecology of montane forests and their dynamics in response to natural and human-induced perturbations with special emphasis to climate change and including the biogeochemical cycles. The group studies the ecophysiology of forests, integrating functional traits and processes over a range of temporal and spatial scales. The range spans from the single tree (physiology, IoT, proximal sensing) to stand and watershed (biodiversity, resilience, eddy covariance, lidar, UAVs), up to regional and national scales (climate-smart forestry, remote sensing).

River processes and natural hazards mitigation (Dr. A. Andreoli, Prof. L. Mao)

The group investigates the complex dynamics of mountain basins through their hydrological and sediment transport processes and by analyzing their morphological evolution, with a special focus on glacierized environments and on debris flow catchments. The activities are mostly related to field monitoring, GIS modelling and laboratory analysis, and tracers for both water runoff (EC, isotopes) and bedload transport (passive integrated transponders, PITs) are utilized. Ecohydrological issues relative to natural and anthropic-related vegetation are also investigated, as well as modern early warning systems and soil bioengineering techniques.

Research projects and supervisors		
Curriculum 1 Sustainable agricultural production systems		
Title	Supervisor(s)	Curriculum
<p>1. Endosymbiotic bacteria of insects and their potential use for sustainable pest control (cf: Smart Specialisation Strategy Innovazione e Ricerca Alto Adige 2030 - Smart Specialisation Strategy (RIS3) della Provincia Autonoma di Bolzano - Alto Adige – only available in Italian and German)</p> <p>Description - Bacteria play a crucial role in the biology and ecology of many insects, forming symbiotic relationships that can range from mutualistic to parasitic. Wolbachia, a widespread endosymbiont, is known for inducing cytoplasmic incompatibility, affecting the reproductive success of infected and uninfected individuals. This phenomenon has implications for the population dynamics and evolution of host species and has the potential to be used as an alternative approach for insect pest control. In this project Wolbachia will be characterized in agricultural insect pests and the role of this symbiont on the host species will be studied.</p> <p>We are looking for an enthusiastic candidate with a background in Agricultural or Biological Sciences, Agricultural Biotechnology, Ecology and Evolution. Competences with molecular genetic methods, next generation sequencing and bioinformatics as well as experience with ecological studies and field work are desired. The candidate should be fluent in English.</p>	Prof. Schuler H.	1

Admission requirements

- One cycle degree according to the former Italian system: all
- Master degree (laurea specialistica/magistrale if obtained in Italy): all
- Foreign degrees - Applicants who have obtained their degrees abroad must have university education of at least five years and hold the requisites listed below.
- Participants must also be under the age of 35 years, to be understood as up to the day before the participant's thirty-fifth birthday. The requirements must be fulfilled at the time of the deadline of the relevant call for applications (11th July 2024).

Candidates are expected to have acquired an appropriate educational, and/or cultural and/or professional background in the field of agricultural, environmental, biological, animal or geosciences.

To apply for the PhD programme, applicants must upload in the application portal:

- A motivational letter written in English (max. 1 page).
- Curriculum vitae (CV) (in English and possibly following the EU format that can be downloaded here <https://europass.cedefop.europa.eu/en/documents/curriculum-vitae>).
- The CV should include the list of publications, presentations at conferences, awards, and any experience or activity that prove her/his qualification.
- Copy of the master degree (laurea specialistica/magistrale) or of the one-cycle degree (former Italian system) or of an equivalent foreign degree, with the final mark/grade and the marks obtained in each exam. For foreign degrees, if the marking system is different, the mark will be transformed. Those who have not obtained the diploma yet, but plan to get it before the enrolment date, must submit a certificate bearing the marks obtained in each exam.

If certificates or diplomas are awarded by **Italian** public bodies, the relevant **self-certifications** must be completed in the portal.

If the certificates or diplomas are awarded by **foreign** bodies, the certificates or diplomas must be uploaded to the portal.

Other documents to be included in the application if available:

- reference letters, written in English from a university lecturer or a researcher from a research institute (drawn up in the year of the call or in the previous one);
- copy of the publications (including the master thesis, published or accepted);
- any English language certificate at level B2 or higher.

Evaluation criteria and process

Admission to the programme is based on the evaluation of a) the academic qualification as it appears from the CV and other documents, b) of the motivational and reference letters, and c) on the outcome of the interview.

For those applicants who fulfil the admission requirements, the Evaluation Committee will first evaluate the application and draw up a short list of applicants admitted to the interview. The Committee will select the best applicants based on a comparative assessment.

The following points will be awarded:

- up to 23 points for the academic qualification of the applicant to successfully carry out a PhD program in Mountain Environment and Agriculture, as it appears from the CV, from the master's mark/grade, from the motivational letter and from the other documents;
- up to 7 points for the congruence of the academic qualification with the topic(s) chosen by the candidate among those present in the list of available projects visible in the dedicated portal;
- up to 20 points for the interview. During the interview, the commission will evaluate the scientific qualification of the candidate to carry out the research project in the area(s) of interest.

As the program is offered in English, candidates must possess adequate English skills which will be assessed during the interview.

Points awarded for the academic qualification (A) and for the congruence of the curriculum with the topics (B) will entitle the Commission to prepare a shortlist of candidates, who will be invited to the interview (C). The lowest score to be admitted to the final ranking list is 25/50. One ranking per each curriculum will be issued. The final score will be used for ranking the applicants and to prepare A) the list of all admitted candidates and B) the list of candidates entitled to receive the fellowships. If two or more applicants have the same score, the younger candidate will be given priority.

The ranking list will be published on the website of unibz ([Ranking lists / Free University of Bozen-Bolzano \(unibz.it\)](https://www.unibz.it)).

Examination dates:

Description	Date	Place
Personal Interview	23 rd – 24 th July 2024	The interview will be held in presence at unibz. Exceptions for an online interview might be granted upon request.