



## 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:** 2023/2024

**Start date:** 01/11/2023

**Official programme language:** English

#### 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 have to 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 two 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, 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*

##### **Agricultural chemistry (Prof. T. Mimmo, Dr. L. Borruso)**

The research activity of the group of Agricultural Chemistry focuses on the biogeochemical cycles of nutrients in the rhizosphere as affected by biotic and abiotic factors. In particular, the activities are carried out by a multidisciplinary approach including chemical, biochemical, physiological, microbiological and molecular aspects of the mechanisms involved in the nutrient acquisition, translocation and allocation and the interactions occurring within the rhizosphere between plant roots, soil and microorganisms (both bacteria and fungi) affected by biotic and abiotic stress.

##### **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, Dr. D. Zanutelli)**

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)**

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, and Dr. Stefano Benini, head of the Laboratory of Bioorganic Chemistry and Biocrystallography at the University of Bolzano, 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, Dr. I. Pouloupoulou, Dr. H. Gamper)**

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)**

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. L. Montagnani, Dr. E. Tomelleri, Prof. R. Tognetti, Prof. H. Pretsch)**

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 (Prof. F. Comiti, 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
1. Adaptation strategies to climate change in viticulture	Prof. C. Andreotti	1
2. Estimation of the forage quality of mountain permanent meadows based on environmental and management-related factors.	Dr. G. Peratoner, Prof. M. Gauly	1 Funding institution: Laimburg Research Center
Curriculum 2: Ecology, environment and protection of mountain areas		
Title	Supervisor(s)	Curriculum
3. Molecular ecology and environmental chemistry as a tool for the cultural heritage conservation	Dr. L. Borruso	2



**When submitting their application, applicants must indicate on the portal a maximum of 3 research topics chosen from the list of titles indicated. The choice is not binding.**

### **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 done their degrees abroad must have university education of at least five years and hold the requisites listed below.
- B2 level certification of English (or higher).

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 mark obtained in each exam.
- English Language certification at level B2 (or higher levels).

Language skills are demonstrated on the pre-registration portal (in the "upload language certificates" and/or "register for language examinations" sections) after completing the pre-registration form in the "create/manage applications" section. **If the language skills are demonstrated by a high school diploma/diploma or master's degree, the diploma must also be uploaded a second time in the above section.**

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

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

### **Linguistic competence can be proven by:**

1. If the **main language of instruction in the final year of the diploma** is English, it counts as C1.
2. **A bachelor's or master's degree** in English certifies the C1 level. Unibz graduates must upload the language certificates they have obtained or declare that they have passed the language examinations at the Unibz Language Centre (B2, B2+ or C1).
3. **A recognised language** certificate (see the list of recognised certificates from the Language Centre: [unibz-recognised-language-certificates-v2.pdf](#)). **Please note:** the certificate must not have been obtained more than 5 years before the application for recognition.



### 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).

### 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 on the basis of a comparative assessment.

The following points will be awarded:

- up to 23 points for the academic qualification of the applicant as it appears in the CV and in the other documents, for the motivational and reference letters;
- up to 7 points for the congruence of the curriculum with the topics indicated in the list of available projects, which will be chosen by the candidate in the dedicated portal;
- up to 20 points for the interview.

The final score is the sum of the previous scores. The maximum score is 50. The lowest score to be admitted to the ranking list is 25/50. The final score is used for ranking the applicants and to establish A) the list of the admitted candidates and B) the list of candidates entitled to receive the fellowships. Separate rankings will be drawn up for the two externally funded projects. 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 ([www.unibz.it](http://www.unibz.it)).

### Examination dates:

Description	Date	Place
Personal Interview	19 September 2023	At unibz for those living in Italy. For other admitted candidates, the opportunity will be offered, as an alternative to physical presence at the unibz spaces, to take the interview by videoconference - Microsoft TEAMS unless otherwise notified.

### PhD-positions and grants

#### Total PhD-positions:

**3**

PhD-Positions MD 118/2023 under PNRR:

2 (1 for curriculum 1, 1 for curriculum 2)

PhD-positions with other grants:

1 (3 for curriculum 1)

#### PhD scholarship bound to specific research topics/areas:





1 scholarship with bound research topic in collaboration with Laimburg Research Centre

Research topic:

- Estimation of the forage quality of mountain permanent meadows based on environmental and management-related factors.

2 scholarships with bound research topic and minimum 6-month study period abroad and minimum 6-month in companies or research centers (or Public Administrations, including museums, institutes and training institutions of the Ministry of Culture in the case of the second research topic) pursuant to MD 118/2023 funded by PNRR:

Research topics:

- Adaptation strategies to climate change in viticulture
- Molecular ecology and environmental chemistry as a tool for the cultural heritage conservation