



Freie Universität Bozen
Libera Università di Bolzano
Università Lìedia de Bulsan

Faculty of Science and Technology

PhD programme in MOUNTAIN ENVIRONMENT AND AGRICULTURE

Website:

<http://www.unibz.it/en/sciencetechnology/progs/phd/phdmountainenvironment/default.html>

Duration: 3 years

Academic year: 2020/2021

Start date: 01/11/2020

Official programme language: English

Programme contents:

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

- Students develop and organise 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, 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 as a PhD student, you attend courses, prepare and submit your research plan under the guidance of the main supervisor, and you 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, you 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 abstracts in German and Italian.

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. We focus our research mainly on plant crops and livestock systems suitable for the mountain areas. The expertise covers soil fertility, plant physiology and biochemistry, entomology, plant pathology, agricultural engineering, crop management, animal science, agricultural economics and law. 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 evaluation. The research 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 welfare, while reducing the use of non-renewable resources, environmental pollution and production costs.

Short Description of the research groups

Fruit tree physiology and ecosystems (Prof. M. Tagliavini, Prof. C. Andreotti, Dr. L. Montagnani, Dr. A. Zanella and Dr. D. Zanutelli)

The research group carries out research 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) or biotic stresses conditions. Research approaches include eco-physiological, micrometeorological, isotopic, biochemical, biotechnological and biometric methods, as well as the application of smart technologies. 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 produce also during the post-harvest fruit life.

Animal Science (Prof. M. Gaudy, Prof. J. Sölkner, Dr. I. Pouloupoulou, Dr. G. Miribung, Dr. H. Gamper)

Research activities in the Animal Science Group focus on relevant questions of livestock production in mountain regions. 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. The control of endoparasitic infections is one of the focal research areas in all species including small ruminants and chicken.

Agricultural chemistry (Prof. T. Mimmo, Prof. C. Huck, 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.

Bioorganic chemistry and Bio-Crystallography (Dr. S. Benini)

This area of research is dedicated to the study of the structure and function of biomolecules involved in the pathogenicity of *Erwinia amylovora* the bacterium causing "Fire Blight" in Rosaceae plants

(apple, pear, etc.). Our research is currently focusing on the study of carbohydrate active enzymes and proteins involved in iron metabolism in bacteria and fungi. We investigate proteins, enzymes, carbohydrates and DNA at the atomic level mainly by structural biology using the most powerful tool available to date: X-ray crystallography.

Insect chemical ecology and apiculture (Dr. S. Angeli and Prof. J.A.Pickett)

The research group address 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 (e.g. GC-MS chemical characterization, electroantennography and behavioural 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.

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

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; resource economics and water footprint; food marketing; tourism and agritourism; regional, agricultural and rural development (in cooperation with Dr. T. Streifeneder); market analysis and marketing research; statistical data evaluation and econometrics (cross-section, time series and pooled datasets).

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, 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 (Dr. C. Wellstein, Prof. N. Hölzel, and Dr. G. Bonari)

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, the Near East, Russia and North- 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. G. Tonon, Prof. H. Pretsch, Dr. M. Ventura)

The carbon and nitrogen cycles of temperate and Mediterranean forests and their dynamics in response to natural and human-induced perturbations with special emphasis to climate change is

the focus of this research group. The group studies the physiological ecology of woody plants, integrating plant attributes and processes over a range of temporal and spatial scales, from the leaf- (gas exchange, leaf traits, nitrogen content, proximal sensing) to tree- and stand-scale (water use, growth rate, allometric relationships, hydraulic architecture), up to forest ecosystem and catchment scales (canopy exchange, vegetation shift, litter, SOM decomposition, remote sensing). A special attention is paid to the Biochar option as climate change mitigating strategy.

River processes and natural hazards mitigation (Prof. F. Comiti, Prof. L. Mao, Prof. G. Bischetti)

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.

Earth Observation (Dr. M. Zebisch)

We integrate remote sensing techniques with interdisciplinary approaches to monitor and to understand key environmental dynamics in mountain regions and related climate and disaster risks. Our research fields and projects address the most current and pressing societal challenges in mountain environments, such as: the role of mountains as water towers; sustainable management of natural resources (agriculture, forestry, nature protection); risk management in the context of natural hazards and climate change.

Agroforestry Engineering (Dr. R. Gallo)

The research activities of the Agroforestry Engineering group concern: (1) study and optimization of agricultural and forestry mechanization in mountain areas, with special regard to safety issues, power systems, automation and perspective of field robot applications; (2) the introduction of farm and forestry information systems, enabling the use of advanced information management practices (including the automation of crop and operational monitoring solutions) and of precision farming and forestry techniques; (3) the certification of the performances of farm and forestry machinery, with a focus on power units and sprayers. All these activities are carried out with a multidisciplinary approach that applies engineering in a mountain context highly conditioned by sustainable needs.

Possible research projects and supervisors (this is only a partial list of available projects, other topics dealing with the activity of the research groups can be matter of study)		
Curriculum 1: Sustainable agricultural production systems		
Title	Supervisor/s	Curriculum
1. Climate extremes and grapevine physiology	Prof. M. Tagliavini, Prof. C. Andreotti, Prof. G. Wohlfahrt, Dr. L. Montagnani, Dr. D. Zanotelli	1

2. Identifying water sources for apple trees by stable isotope techniques	Prof. M. Tagliavini, Dr. D. Zanotelli.	1
3. Biomolecular characterization of the amylovoran biosynthetic pathway in the plant pathogen <i>Erwinia amylovora</i>	Dr. S. Benini	1
4. Carbohydrate-active enzymes in the plant pathogen <i>Erwinia amylovora</i> .	Dr. S. Benini	1
5. Alternative ways of disease control in livestock production in mountain areas	Prof. M. Gauly, Prof. J. Sölkner	1
6. Implementation of new breeding traits in local cattle breeds for a sustainable dairy farming in mountain areas	Prof. M. Gauly, Prof. J. Sölkner	1
7. Soil –plant-microorganism interaction driving nutrient dynamics in the rhizosphere to unravel nutrient mobilization and uptake processes in cultivated plants	Prof. T. Mimmo Prof. C. Huck	1
8. Valorisation of biomasses of agricultural origin and their effect on soil quality	Prof. T. Mimmo, Prof. C. Huck	1
9. Chemical ecology of insect-plant interactions of agricultural ecosystems	Dr. S. Angeli, prof. J.A.Pickett	1
10. Combined effects of pesticides and nutrition on the health of honeybees	Dr. S. Angeli, prof. J.A.Pickett	
11. Socioeconomic impact assessment of agritourism activities on farm and regional development in South Tyrol via farm panels	Prof. C. Fischer and Dr. T. Streifeneder	1 (Grant in collaboration with EURAC Research)
12. Smart metabolomics for sustainable horticulture	Dr. A. Zanella	1 (Grant Laimburg Research Center)

Curriculum 2 Ecology, environment and protection of mountain areas		
Title	Supervisor/s	Curriculum
13. Effect of mixture on forest growth under a changing climate.	Prof. G. Tonon, Prof. H. Pretszch, Dr. M. Ventura	2
14. Climate-smart forestry in mountain regions	Prof. G. Tonon, Prof. H. Pretszch, Dr. M. Ventura	2
15. Large floods and large wood transport in mountain basins	Prof. F. Comiti, prof. G. Bischetti, Prof. L. Mao	2
16. Hydrology and sediment transport in glacierized catchments	Prof. F. Comiti, prof. G. Bischetti, Prof. L. Mao	2
17. Next frontiers of nature conservation: valuing mountain pine forests in a millenary human-impacted context	Dr. C. Wellstein, Dr. G. Bonari	2
18. Steppe plants in the Alps and Kazakhstan: an ecological, functional and physiological comparison in biodiversity conservation hotspots and core distribution areas	Dr. C. Wellstein, Prof. N. Hölzel	2

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.
- Candidates are expected to have acquired an appropriate educational, and/or cultural and/or professional background, field of agriculture, biology or the environment in or earth sciences.

B2 level certification of English (or higher).

Application for both PhD curricula is not foreseen.

To apply for the PhD programme, applicants must indicate in the application portal max. 3 research topics from the list of the topics included in the PhD curriculum they have applied to.

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).

In case your final certificate has been awarded by an **Italian** public institution, you need to submit a self-declaration. In case your final certificate has been awarded by a **foreign** public institution, you need to upload a scanned copy of the original diploma.

You can demonstrate your language proficiency in the application portal (in the section "upload language certificates" and/or "enrol for language exams") after you have created an application in the section "create/manage applications".

You can demonstrate language proficiency through:

1. **The main teaching language in your final high school year** if German, Italian or English (recognised as C1) (Latin upper secondary schools: recognised as B2 in German and Italian).
2. **A bachelor or master degree** in Italian, German or English (recognised as C1). unibz graduates must upload the language certificates obtained and/or declare that they have passed language exams at the unibz Language Centre (B2, B2+ or C1)
3. **A recognised language certificate** (see the list of recognised certificates: <https://www.unibz.it/en/services/language-centre/study-in-three-languages/>). If you cannot upload the certificates, you can send them by e-mail as PDF files or deliver them in person to the Language Centre by the application deadline (see "Deadlines" section).
4. **Language exams organised by the unibz Language Centre**. You can register for these exams online through the application portal (in the section "enrol for language exams") after you have filled out your application in the section "create/manage applications". The registration periods are indicated in the "Deadlines" section. If you start your application outside a language exams registration period, you must return to the portal during one of the periods indicated above in order to register for an exam.

Information regarding the structure of the language proficiency exams, their duration, their administration, and typical processing time for the publication of the results can be found on the following webpage: <https://www.unibz.it/en/services/language-centre/language-exams/>.

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 (published or accepted).

Evaluation criteria and process

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

For those applicants who fulfil the admission requirements, the Selection Committee will first evaluate the application and draw up a short list of applicants admitted to the interview. The interview will make use of media such as video-conferencing. The Committee will select the best applicants on the basis of a comparative assessment.

The following points will be awarded:

- up to 28 points for the academic qualification of the applicant as it appears in the CV, for the motivational and reference letters;
- up to a maximum of 7 points for the coherence of the curriculum with the topics chosen by the candidate;
- up to 15 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 fellowship. If two or more applicants have the same score, the younger candidate will be given priority.

The rank list will be published on the website of unibz (www.unibz.it/phd) and at the notice boards of the Faculty of Science and Technology.

Examination dates:

Description	Date	Place
Personal Interview	22 and 23 July 2020	Online via the software platform Microsoft Teams

PhD-positions and grants

Total PhD-positions:	11
PhD-Positions with grants from the University:	6 (4 for curriculum 1 and 2 for curriculum 2)
PhD-positions with other grants:	2

PhD scholarship bound to specific research topics/areas:		
TopicArea	Positions	Founder
Socioeconomic impact assessment of agritourism activities on farm and regional development in South Tyrol via farm panels	1	in collaboration with EURAC
Smart metabolomics for sustainable horticulture	1	Laimburg Research Center

PhD-positions without grant:	2 (1 for curriculum 1 and 1 for curriculum 2)
PhD-positions for foreign students, who already have a grant:	1