



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: 2019/2020

Start date: 01/11/2019

Official programme language: English

Programme contents:

This is a full-time programme. The final thesis must be completed in English and must have a complete abstract in German and Italian. PhD students should therefore benefit from the special multilingual opportunities that the University offers, which include various events in Italian, German or other languages (seminars, optional courses, social events, etc.). The PhD programme comprises lectures and research activities that can be completed at the Free University of Bozen/Bolzano and at universities abroad. The time spent abroad can be at one of the foreign universities with which this University has an agreement or at other universities or research centres.

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 co-supervisors. At the latest after six months, students must defend their research plan in front of the PhD Course Committee.
- students have to 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 have to take part in at least one international conference where they are expected to deliver a paper or present a poster;
- students must spend at least three months abroad conducting research;
- students must attend specific compulsory courses, focused on improving their English language, the analysis of literature and writing scientific articles and on advanced statistics as well as other courses or summer school courses approved by the PhD Course Committee, and pass the relevant exam.
- In order to be admitted to the final exam, students must have written a scientific paper as first author. The paper must have been submitted for publication in an international peer-reviewed journal. Only in very exceptional cases, the PhD committee can authorize motivated exceptions.

Stages of the PhD:

The research activities are spread over five stages that end after 2, 6, 12, 24 and 36 months. At the end of each stage, students have to meet the PhD Course Committee to present their project and results. The PhD Course Committee evaluates students' work and provides suggestions if necessary.

First stage (first 2 months): the PhD Course Committee meets the students in order to identify the

internal supervisor best suited to the needs of the student research. Students then meet the supervisor to decide on their research topic respectively to the areas listed in the public call. Students also start to work on the study plan that is then to be approved by the PhD Course Committee.

Second stage (2nd - 6th month): after an exhaustive review of the literature concerning their subject area, students must prepare and present their research programme that has to be approved by the PhD Course Committee. Students will follow courses that are relevant to their individual study plan.

Third stage (6th - 12th month): students start their research as fieldwork and/or in the lab and can also attend courses and summer schools. Students prepare their public seminar that will take place at the Free University of Bozen/Bolzano in which they discuss the state-of-the-art of their research topic. They will also present to the PhD Course Committee their research programme that they want to conduct abroad in the following year and propose, for approval, two co-supervisors, one of them should belong to the external university or research centre.

Fourth stage (12th - 24th month): students continue their research and finish any courses that they have been following. At this stage it is likely that some of this time will be spent abroad. In this or the following stage students are also expected to take part in an international conference to present their results and they will begin to prepare the manuscript(s) for publication in peer-reviewed journals.

Fifth stage (24th - 36th month): students finish their research and any experiences abroad; they finish writing their thesis.

This PhD course consists of two curricula. The activity of each research group within each curriculum is shortly described below along with a general description of the research framework of each curriculum.

Curriculum 1: Agriculture and products of mountain areas

This area of research is aimed at understanding the mechanisms of agricultural and forest systems in order to steer management towards a sustainable use of environmental, social and economic resources. In this context, the studies are characterised by extremely heterogeneous approaches and topics, which makes detailed analysis and combined analysis crucial. In this sense, the common denominator in sustainable management is the possible interaction between very different types of research, ranging from the biochemistry of the soil/plant ratio to the ecology of the landscape and cost-benefit analysis. Another distinguishing element of this area is the socio-economic analysis of production systems and the life cycle of agro-forestry products. Finally, the development of advanced technologies and tools that provide descriptions of innovative features of mountain agriculture without affecting the specificity of production is a further element that strongly characterises research in this area.

Short Description of the research groups that refer to this curriculum

Fruit tree ecophysiology and ecosystems (Prof. M. Tagliavini, Prof. C. Andreotti, Dr. D. Zanotelli)

This group carries out research on the exchange of carbon, mineral nutrients, water and energy between soil, plants and atmosphere in fruit tree ecosystems. Researches are conducted through ecophysiological, micrometeorological, isotopic and biochemical methods and include the exploitation of functional biodiversity in the agroecosystem. Our aim is the enhancement of the resource use efficiency and fruit quality in agricultural systems for mountain areas.

Animal Science (Prof. M. Gauly)

Research activities in the Animal Science Group will focus on relevant questions of livestock production in South Tyrol. For dairy cattle, evaluations 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 production intensity (low input vs. high input) is evaluated. In addition, new forms of dairy production (i.e., communal barns) are developed. 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 areas for sheep and goats. In chicken, the use of mobile houses for broiler and egg production with the use of dual-purpose chicken is of main importance.

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

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 and molecular aspects of the mechanisms involved in the nutrient acquisition, translocation and allocation.

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.). 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)

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. In particular, we combine different approaches (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 pollutants

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; food marketing; tourism, agricultural and rural development; market analysis and market/ing research; statistical data evaluation and econometrics (cross-section, time series and pooled datasets).

Agroforestry Engineering (Prof. F. Mazzetto, Dr. M. Bietresato)

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, conventional and non-conventional fuels, 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 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.

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 that can see many variations in research. Biodiversity, water quality, protection from natural disasters, the mitigation of climate change through the maintenance or enhancement of carbon stocks are just some of the resources or environmental features that characterise the research area. 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 that refer to this curriculum

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

The working group addresses regional to global environmental issues, such as Biodiversity Research, Functional Diversity, Climate Change Research, Ecosystem Restoration and Biogeochemical cycles, Sustainable and resource-efficient Land Use and Landscape. We apply a large set of methods ranging from biogeography to molecular ecology and study various ecosystems and land-use types. We perform our research in the Mediterranean, temperate and alpine regions of Europe including the Alps and Apennines. We also focus on Russia and South Africa and work at the global scale. We combine research on ecological patterns and processes 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, Dr. V. Coviello)

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 (riparian vegetation) and anthropic (orchard) vegetation are also investigated by the group, as well as modern early warning systems and management strategies for river corridors.

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.

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 : Agriculture and products of mountain areas

Title	Supervisor/s	Curriculum
1. Water use efficiency and carbon fluxes in fruit trees and vineyards	Prof. C. Andreotti Prof. M. Tagliavini, Dr. D. Zanotelli	1
2. Biomolecular characterization of the amylovoran biosynthetic pathway in the plant pathogen <i>Erwinia amylovora</i>	Dr. S. Benini	1
3. Siderophore mediated iron uptake in the plant pathogen <i>Erwinia amylovora</i> and in <i>Aspergillus fumigatus</i>	Dr. S. Benini	1
4. Animal Welfare in Livestock Production in South Tyrol	Prof. M. Gauly,	1
5. Sustainability of Dairy Production in South Tyro	Prof. M. Gauly,	1
6. Development and testing new field and farm technologies for cereal cultivation in steep lands, as a new strategy for ensuring sustainable farming systems on high mountain areas	Prof. F. Mazzetto	1
7. The problem of chemicals drift during spraying activities in mountain orchards: methodologies for testing the phenomenon in indoor and outdoor conditions from a certification perspective	Prof. F. Mazzetto	1
8. Strategies for improving the engine efficiency and the performances of agricultural machines operating in mountain areas	Dr. M. Bietresato Prof. F. Mazzetto	1
9. 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
10. Valorisation of biomasses of agricultural origin and their effect on soil quality	Prof. T. Mimmo Prof. C. Huck	1
11. Chemical ecology of insect-plant interactions of agricultural ecosystems	Dr. S. Angeli	1
12. Combined effects of pesticides and nutrition on the health of honeybees	Dr. S. Angeli	1

Curriculum 2 Ecology, environment and protection of mountain areas

Title	Supervisor/s	Curriculum
13. Climate-smart forestry in mountain regions	Prof. G. Tonon Prof. H. Pretszch	2
14. Sediment transport and morphological processes in mountain rivers	Prof. F. Comiti, Prof. L. Mao, Dr. V. Coviello	2
15. Seismic monitoring of debris flows and coarse bedload transport	Prof. F. Comiti, Prof. L. Mao, Dr. V. Coviello	2
16. Living at the longitudinal range margin: An ecological, functional and physiological comparison of continental steppe plants and vegetation remnants in the Central Alps with core areas of distribution in Kazakhstan	Dr. C. Wellstein, Prof. N. Hölzel	2
17. Braun-Blanquet revisited: A resurvey of Central Alpine dryland vegetation under the impact of ongoing land-use and climate change.	Dr. C. Wellstein, Prof. N. Hölzel	2
18. Nitrogen and carbon dynamics in forests and peatlands	Dr. M. Ventura Prof. G. Tonon	2
19. Earth Observation for monitoring the ecological status of mountain grasslands	Dr. M. Zebisch Dr. C. Wellstein	2 (1 grant in collaboration with Eurac)

Admission requirements - Evaluation criteria for examinations/qualifications

Degrees from the old Italian system: all

Master (laurea specialistica/magistrale): all

Foreign degrees

Applicants who have done their degrees abroad must have university education of at least five years and hold the prerequisites listed below.

Other:

The prerequisites for admission to doctoral programmes are related to having acquired an appropriate educational, and/or cultural background, and/or have worked in the field of agriculture, biology or the environment, and/or in the area of life sciences and earth sciences. All formal qualifications related to the PhD research and study areas, earned at the master's level both at national or foreign universities, are accepted.

Admission to the programme is based on the assessment of applicants through: their CV and academic qualifications, their motivational letter and an interview. Their level of English will be assessed during the interview.

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 of each PhD curriculum.

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

- 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>).
- master degree (laurea specialistica) or degree from the old Italian system or 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 yet obtained the diploma, but that probably will get it before the date of enrolment, must submit a certificate bearing the mark obtained in each exam.

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),
- list of publications (published, being published or submitted for publication), with related links, if possible,
- any language certificates

For those applicants with the pre-requisites only, the Evaluation Committee will first evaluate the CV, cover letter, and the applicant's qualifications, including publications and the reference letters if available, and will then draw up a list of applicants admitted to the next stage of the selection process. This will consist of an interview in which their knowledge of English will also be assessed. The interview can make use of media such as video-conferencing, telephone and the like. 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 applicant's CV, cover letter and qualifications, including publications and reference letters
- up to 7 points for the appropriateness of the CV compare to the topics of the proposed projects
- 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 ranklists is 25/50. The final score is used for the ranking of applicants and to establish access to the PhD programme and who will receive grants. If two or more applicants have the same score, a lot will be drawn to decide on the allocation of places.

The ranklist 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	July 25 th and 26 th 2019	Main building of the Free University of Bolzano, piazza Università 1, Bolzano

PhD-positions and grants

Total PhD-positions: 13
PhD-Positions with grants from the University: 7 (5 grants for curriculum 1, 2 grants for curriculum 2)
PhD-positions with other grants: 1

PhD scholarship bound to specific research topics/areas:		
TopicArea	Positions	Founder
Earth Observation for monitoring the ecological status of mountain grasslands	1	EURAC in collaboration with Free University of Bolzano

PhD-positions without grant: 2 (1 for curriculum 1 and 1 for curriculum 2)
PhD-positions for foreign students, which have already a grant: 3