Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Public Competition
for the admission to the PhD programmes
41st cycle
Academic year 2025/26
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: 2025/26

Start date: November 1st, 2025

Official language: English

Art. 1 - POSITIONS

1. A total of **9** positions are available for the PhD programme in **Mountain Environment and Agriculture**; the programme is divided into the following curricula: Curriculum 1 **Sustainable Agricultural Production Systems** and Curriculum 2 **Ecology, Environment and Protection of Mountain Areas**

2. All information about the PhD programme in general, the schedule and its structure as well as the possible research projects listed below can be found at the following link: https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/phd-mountain-environment-agriculture/

3. **Positions with unibz scholarship: 3**

of which for Curriculum 1: 2

for Curriculum 2: 1

Positions without scholarship: 0

Positions tied to subject-related scholarship: 6

4. The following list of research projects and related supervisors and linked to positions financed with a unibz scholarship or without a scholarship is listed for illustrative purposes only, as other topics inherent to the activities of the various research groups at the university may be the subject of study.

Research projects and supervisors

Curriculum 1 Sustainable agricultural production systems		
Title	**Supervisor(s)**	**Notes**
1. Plant-microorganism interactions and soil biodiversity **Description.** The interaction among plants, microorganisms, and soil fauna is crucial in regulating soil fertility and enhancing ecosystem resilience. This PhD project aims to investigate the influence of root exudates on microbial diversity and soil fauna, focusing on biogeochemical processes and rhizosphere dynamics. The candidate is expected to work with methodologies based on soil chemistry, environmental DNA (eDNA), and metagenomics to investigate the effect of soil composition on microbial diversity and soil fauna. The outcomes will provide novel insights to promote sustainable soil management and, more broadly, soil health. **Required knowledge:** The ideal candidate should have a solid background in soil chemistry, experience in molecular soil (agro)-ecology, and wet lab techniques. Proficiency in data analysis R environment and fieldwork experience are highly desirable.	Prof. T. Mimmo and Prof. L. Borruso	
2. Stomatal optimality in the face of climate extremes **Description**. In order to allow for the diffusion of carbon dioxide into leaves, and thus photosynthesis, vascular plants have to open their stomata, which inevitably leads to the loss of water vapor through transpiration. The photosynthetic uptake of carbon dioxide is regarded a benefit for plants, as the assimilated carbon allows for maintaining existing and growing new biomass and investing in defense and reproduction, while transpiration, conversely, is regarded a cost. It has thus been suggested that plants should adjust stomatal conductance in order to maximize the benefit of carbon sequestration, while at the same time minimizing the associated costs of transpiration and indeed, such optimal behavior has been observed experimentally and is used as a basis for modeling plant photosynthesis and transpiration. What is unknown though, is whether plants also behave optimally when exposed to extreme climatic events, such as heatwaves or droughts. The goal of this PhD project is to investigate whether different grapevine varieties behave optimally during extreme climatic events. To that end the PhD student will conduct leaf gas exchange measurements and analyze existing prior data both from lab experiments under controlled conditions as well as field manipulations using a variety of stomatal optimality models based on	Prof. G. Wohlfahrt, Dr. A. Asensio, Prof. M. Tagliavini	

different theoretical assumptions. The PhD student is expected to have a strong background in plant ecophysiology, an interest in mathematical simulation models and skills in programming and analyzing complex datasets.		
3. Assessing and certifying the safety conditions of agricultural and forestry machinery in mountainous environments **Description**. In mountainous areas, fatal tractor rollover accidents are still among the most significant risks for the agricultural and forestry sectors. Just in South Tyrol, there is an average of one fatal accident per month, and more or less serious accidents in the sector are now higher than on construction sites. In the laboratory of Agro-Forestry Innovations of unibz, located at the Bolzano Technology Park, a tilting and rotating platform with four independents, shifting platforms has been realized, capable of reproducing various conditions for extreme mountain environments and mapping the stability performance of agricultural machinery according to the environmental working conditions. The platform, unique in its kind, combines the measurement of actual rollover performance conditions with their estimation through modelling approaches, thus creating a sort of 'digital twin' that can be used for both design and certification purposes for agricultural machinery. The aim of the project is to generate 'stability maps' in the laboratory for different types of tractors (normally in use in the Alpine region) and make them available to agricultural operators driving the vehicles, so that - by means of special displays and sensors- the stability conditions can be highlighted in real time, alerting them in advance of possible increases in risk margins. In addition, since the maps are essentially based on geometric parameters (direction of advancement, inclination of the ground), for each type of tractor it will also be possible to digitally map (on GIS supports) the risk levels of the different farm areas of an agricultural or forestry company, preparing thematic maps useful for managing safety conditions according to new Smart Agriculture and Smart Forestry approaches. **Required knowledge**: We are looking for a highly motivated and collaborative PhD candidate with a background in agricultural and/or forestry sciences, rather than in technical domains such as mechanical, electronic or information engineering, but with a genuine and strong interest in developing a professional profile in the field of agricultural (or forestry) engineering. Candidates should have strong oral and written communication skills and a keen interest in the application of Information Technologies in the production processes carried out in the agricultural or forestry sector. Candidates should also have the ability to	Prof. F. Mazzetto, Dr. G. Carabin	

work in a interdisciplinary team. Past experiences with GIS platforms and programming, as well as competences in statistical data analysis and fieldwork practices, are preferential.		
4. Developing and assessing alternative niche-crop based mountain farming systems mediating between economic and environmental sustainabilty needs **Description.** Agricultural production systems in mountainous contexts have historically been characterised as activities in marginal areas, in which the economic viability of the enterprises they represent is only guaranteed by external subsidies of various kinds, the provision of which is usually motivated by political, social and economic objectives to contrast the progressive depopulation of mountains. However, support policies at the international level are destined to contract. It is therefore necessary to identify new models of agricultural development capable of responding resiliently to these trends, also by considering the adoption of new cultivation systems - often based on crops hitherto considered 'niche' - as well as facilitating the adoption of farm processing systems capable of guaranteeing greater added value than simple primary production. It is from these approaches that production chains have emerged in recent times as alternatives to those commonly adopted in alpine pastures based on the FORAGES-MILK- CHEESE transformation, and for example consisting of the sequence CEREAL-FLOUR-BREAD rather than CEREAL-MALT-BEER. In addition to these, there is also a growing interest in PISTACHO cultivation, with the associated production of high value-added dried seeds. Regardless of the solution, all these sectors have one common problem: the difficulty of managing field and post-harvest mechanisation chains in a mountainous context featured by its related environmental, economic and social issues. In particular, for certain operations (e.g. cereal harvesting on sloping terrain), the difficulties take on such constraining aspects as to make consideration of the cereal chain practically unfeasible. The aim of the project concerns: 1) a critical analysis of mechanisation problems for alternative supply chains to animal production, with particular attention also to the logistics of the production and distribution chain; 2) the performance of field tests on machine prototypes previously made to overcome mechanisation problems; 3) the execution of comparative and integrated analyses of supply chains, through methods that include both environmental assessment through LCA and multi-criteria analysis (AMC). In carrying out this work, we will have the opportunity to interact both with the farmers of the companies involved,	Prof. F. Mazzetto, Dr. G. Carabin	

and with the local institutional actors interested in assessing all the possible impacts on the territory. **Required knowledge**: We are looking for a highly motivated and collaborative PhD candidate with a background in agricultural sciences, rather than in technical domains such as mechanical, electronic or information engineering, but with a genuine and strong interest in developing a professional profile in the field of agricultural engineering. Candidates should have strong oral and written communication skills and a keen interest in the introduction of technological innovation (including digitalisation and Information Technologies) in the production processes of the mountain agricultural sector. Candidates should also have the ability to work in a interdisciplinary team. Past experiences with CAD and GIS platforms, as well as competences in statistical data analysis and fieldwork practices, are preferential.		
5. Identifying and editing genes for drought resistant apple trees. **Description**. Apple and grapevine are the main crops grown below 1500 m a.s.l. in South Tyrol. Domesticated apple varieties are grown on dwarfing rootstocks that are highly sensitive towards low water availability. Future climate scenarios with more intense and prolonged drought periods, necessitate improving drought resistance in apple trees to ensure apple production and improve water use efficiency. However, drought tolerance is a complex trait, relying in part on root system architecture adaptations, whose genetic mechanisms are largely unknown in apples. This project aims to apply a translational approach, in order to identify candidate genes with a role in root system architecture adaptations towards water stress in apple. Our goal is to obtain molecular details of water stress adaptation in apple, and to develop drought resistant rootstock for apple cultivation through genome editing. **Key words:** Drought resistance, root system architecture, genome editing **Required knowledge**: We are looking for a highly motivated and collaborative PhD candidate with a background in agricultural science, biology or molecular biology. Candidates should have strong oral and written communication skills and a keen interest in molecular biology with an advanced understanding for plant development and physiology. They should have the ability to work in a interdisciplinary team. Experience with molecular cloning, imaging and bioinformatic approaches are preferential.	Dr. S. J. Unterholzner, Dr. T. Letschka, Prof. T. Mimmo	Project co-funded by the Research Centre Laimburg

6. Host-parasitoid Interaction: Molecular characterization and biological role of non-hatched parasitic wasps in stink bug egg masses **Description**. The research project is part of the long-term monitoring of the effects of the release of the parasitoid *Trissolcus japonicus* on the Asian Stinkbug (*Halyomorpha halys*) and native stink bug species in South Tyrol. The main objective is to evaluate the parasitisation efficacy of *T. japonicus*, evaluating both its impact on the target population and potential effects on non-target species through host-parasitoid interactions. The invasion of *H. halys* has caused severe damage to Italian crops since 2004, with its presence documented in South Tyrol since 2019. Traditional control methods (physical barriers, insecticides and pheromone traps) have proved insufficient, leading to the start of a national release programme of *T. japonicus* in 2020. Field monitoring of stink bug eggs revealed the presence of closed eggs, raising questions about the presence of parasitoids unable to complete their development. Although, these parasitoids may still contribute to biological control, their identification is important for accurately assessing the effectiveness of the programme and specificity of the biological control agent. This project aims to explore molecular methods for the identification of parasitoid species within closed eggs. Furthermore, the analysis of interactions between hosts and parasitoids, both autochthonous and allochthonous, will contribute to the understanding of the ecological dynamics and impact of exotic insect introduction. In the long term, the results may be applied to agroecosystem management, supporting the monitoring of *T. japonicus* and other parasitoids, to optimise biological control strategies. **Keywords**: *Trissolcus japonicus*, *Halyomorpha halys*, Biological control, Host-parasitoid interactions, Molecular ecology **Required knowledge:** We are looking for an enthusiastic candidate with a background in agricultural or biological sciences, bioinformatics, ecology and evolution. Competences with molecular genetic methods as well as experience with ecological studies and field work are desired. The candidate should have excellent communication skills and should be fluent in English.	Prof. H. Schuler	Project co-funded by the Research Centre Laimburg
7. Monitoring carbon fluxes and drought impacts on alpine biomes by high-resolution time-series of vegetation biophysical variables from multi-sensor Earth Observation data. **Description.** The PhD aims to improve the estimation of biophysical variables of alpine vegetation from Earth	Dr. M. Castelli, Dr. C. Notarnicola, Prof. D. Zanotelli, Prof. M. Tagliavini	Project co-funded by EURAC Research

Observation (EO) data and will contribute to quantifying the interdependent effects of climate change on vegetation productivity and health. The first objective of the PhD is to generate and validate a time-series of biophysical variables (biovars, including mainly leaf area index and fraction of absorbed photosynthetically active radiation) as a proxy for vegetation productivity and health using EO. Spatially and temporally consistent, cloud-free time-series of biovars are necessary for long-term evaluations at the regional scale and will be obtained by exploiting synergies between various sensors onboard EO satellites. In particular, the PhD will use optical sensors with different spatial and temporal resolutions, and SAR sensors which are not affected by atmospheric conditions. To fuse multi-sensor data, tailored machine learning-based techniques will be developed, also addressing the challenges deriving from the highly heterogeneous land cover and complex terrain of the Alps. The second objective is to exploit the newly developed biovars timeseries for two concrete case studies, in synergy with running projects of the Institute for Earth Observation: 1) estimating the terrestrial carbon sinks in South Tyrol to guide policymakers in decisions about greenhouse gas emissions to limit global warming, and 2) quantifying changes in vegetation productivity and consequent yield losses to inform risk management instruments and mitigate the consequences of droughts for farmers, with a focus on mountain grasslands. The PhD will work in close collaboration with the Biosphere and Hydrosphere research group of the Institute for Earth Observation of Eurac Research (M. Castelli, C. Notarnicola), which focuses on monitoring and modeling spatial-temporal dynamics of the terrestrial water cycle, vegetation conditions, and land cover in mountainous regions, leveraging Earth Observation (EO) data in physical and data driven models. The PhD will benefit from the ongoing collaboration between Eurac Research and the research groups of Prof. Tagliavini and Prof. Zanotelli at the University of Bolzano, as well as Prof. G. Wohlfahrt at the University of Innsbruck. This collaboration complements Eurac Research competences with a solid background on plant physiology and agrometeorology, which is crucial for the validation and interpretation of biophysical variables derived from EO data against in situ measurements, as well as for effective use of EO-derived biophysical variables for estimating carbon fluxes from different biomes in South Tyrol. **Required knowledge:** the ideal PhD candidate should demonstrate: i) a solid understanding of the primary remote sensing techniques currently used for vegetation monitoring, ii) experience in handling geospatial data and pre-processing remote sensing data, particularly from optical sensors, iii) proficiency in at least one programming language (R or		

Python) and familiarity with GDAL, iv) a good knowledge of the main biomes characterizing the Province of Bolzano, v) expertise in techniques for measuring in situ vegetation biophysical variables, and vi) excellent written and oral English skills.		
8. Assessing the potential of traditional agroforestry systems to contribute to agricultural transformation in the context of climate change **Description.** The PhD project aims to improve the understanding of the multiple ecological and socio-economic benefits and values of traditional agroforestry systems (TAS) and their potential to contribute to successful agricultural transformation, particularly in the context of climate change and the current biodiversity loss. Specifically, the project will be developed around two main objectives: The first objective is to better understand the potential of TAS as good practice examples for biodiversity conservation in agriculturally dominated landscapes. This will include the identification of key ecological and biological indicators, and the in-field monitoring of different functional groups (i.e. plants, insects/pollinators and birds) that are widely used in agro-ecological research as key proxies for ecosystem functions and services. The second objective is to generate quantitative and qualitative evidence on the role and potential of TAS as Nature-based Solutions (NbS) towards successful agricultural transformation. This will include the assessment and mapping of several material and non-material ecosystem services (ES), and the initiation of a stakeholder engagement process finalized at a comprehensive understanding of the enabling and hindering factors that can stabilize or trigger shifts in farming practices. The regional focus of the project will be set on South Tyrol (Northern Italy), with traditional orchard meadows (GER. Streuobstwiesen) as the case study agroforestry system. **Keywords:** climate change, biodiversity loss, transformation, adaptation, ecosystem services, stakeholder engagement. **Required knowledge**: the ideal PhD candidate should demonstrate: i) proven experience in biological monitoring and stakeholder engagement processes; ii) familiarity with the concepts of Agroforestry, Nature-based Solutions (NbS) and Ecosystem Services (ES); iii) solid knowledge of spatial analyses and Ecosystem Services modelling; iv) good knowledge of the main biomes and landscapes characterizing the Province of Bolzano; v) very good interpersonal and collaborative/organizational skills to integrate into an international working group, vi) excellent	Dr. L. Egarter Vigl and Prof. D. Zanotelli	Project funded by EURAC Research

communication skills in Italian and English, German is an advantage. The PhD project will be broadly embedded in an international setting as part of the EU Biodiversa+ project TRANSFOrm (Traditional agroforestry systems as Nature-based Solutions (NbS) to face multiple societal challenges), where Eurac Research is a partner in a consortium consisting of seven partner institutions and six case studies across Europe (IT, ES, PT, AT, IL, LT). On a more practical level, the project will be implemented in close collaboration with the Landscape Ecology and Biodiversity research groups of Eurac Research's Institute for Alpine Environment (L. Egarter Vigl & M. Anderle), which focuses on monitoring and modelling the spatio-temporal dynamics of biodiversity, ecosystem services and land use change in mountain regions, mainly using both quantitative and qualitative research approaches. The PhD will benefit from the collaboration between Eurac Research and the research groups of Prof. Zanotelli at the University of Bolzano and Prof. M. Dainese at the University of Verona. This collaboration complements Eurac Research's competences with a solid background in plant physiology and sustainable agro-ecological practices, which is crucial for identifying the values and benefits of biodiversity and ecosystem services, as well as for engaging with a wide range of local and national stakeholders.		
9. Factors influencing the outbreak of the Woolly apple aphid **Description**: The woolly apple aphid (Eriosoma lanigerum) is a significant pest on apple. These aphids feed on the plant's phloem and are significantly weakening infested trees. The infestation by the woolly apple aphid and the limited control strategies poses major challenges in apple production. Significant differences in woolly apple aphid infestation densities within and between orchards suggest that numerous unknown factors are influencing the spread and infestation density of this insect. This project aims to identify factors that play a role in the infection dynamics of the woolly apple aphid through systematic surveys in practical orchards. We will conduct a comprehensive multifactorial analysis to understand factors which are influencing the outbreak of the woolly apple aphid. This project will be conducted in collaboration with the Research Centre Laimburg and the Südtiroler Beratungsring für Obst- und Weinbau as well as by marketing organizations, which also ensure financing and provision of farm-related information. **Keywords**: pest insects, wooly apple aphid, plant health, multifactorial analysis.	Prof. H. Schuler	Project funded by Alpoma

Required knowledge: The candidate should be capable of performing complex data analyses and should have statistical skills to analyze and interpret comprehensive results, should have in-depth knowledge in soil science, plant physiology, and biotic and abiotic factors influencing plant health, should be willing to work intensively on-site in apple orchards and conduct laboratory analyses. The candidate should be able to clearly and precisely communicate research findings and should be able to collaborate in an interdisciplinary team.		
Curriculum 2: Ecology, environment and protection of mountain areas		
Title	**Supervisor(s)**	**Notes**
10. Enhancing Forest Productivity and Resilience: Exploring Tree Water Sources and Limitations at Renon Supersite **Description.** Forests play a crucial role in the terrestrial water cycle, regulating exchanges of water between the land surface and the atmosphere. However, as environmental disturbances become more frequent, forest hydrological cycles may shift. Alterations in canopy cover influence the water inputs to soils, affecting ecosystem function. Vapor pressure deficit and soil water availability are two key interacting factors that constrain transpiration and vegetation productivity. However, the relative importance of these factors in driving water and carbon flux responses to forest disturbances remains unclear. Stable water isotopes serve as tracers of hydrologic processes and can provide insights into ecosystem-atmosphere water exchange. This study investigates the water sources at the Renon Supersite to disentangle the effects of atmospheric and soil water deficits on tree and canopy functioning. By integrating productivity estimates from sap flow measurements, ^{13}C-derived water-use efficiency, and meteorological data with eddy covariance fluxes, this research aims to improve our understanding of plant functional traits and their role in forest ecosystem processes. **Key words**: Climate change, Forest productivity, Stable isotopes, Canopy interception, Tree transpiration. **Required knowledge:** The PhD student will conduct research on the interactions between ecophysiological processes and environmental drivers in mountain environments, adopting interdisciplinary methodologies. Candidates should have advanced understandings of forest ecophysiology, forest hydrology, and forest productivity. Preferred qualifications include the ability to work in an interdisciplinary team and experience with eco-physiological instrumentation and proficiency in Python, R, or MATLAB for	Prof. R. Tognetti and Prof. L. Montagnani	

data processing and statistical analysis. Experience with stable isotope analyses is also advantageous.		
11. Informing Post-Disturbance Forest Management: Examining Decomposition Dynamics and Their Effects on Forest Regeneration **Description.** Recent increases in forest tree mortality are expected to enhance deadwood abundance, potentially leading to elevated atmospheric CO_2 levels. Litter decomposition plays a crucial role in nutrient cycling and storage within forest ecosystems. However, the mechanisms driving decomposition processes in mountain forests—particularly in human-modified landscapes—remain poorly understood. This research quantifies decomposition dynamics and their relationships with environmental conditions across varying forest structures and management practices, utilizing chronosequences and long-term experimental plots. This study investigates decomposition alongside vegetation dynamics and soil physicochemical and biochemical properties. As forest canopy structure develops following disturbance, it may influence ecosystem functions by altering abiotic conditions. However, additional abiotic factors independent of canopy structure may also regulate decomposition. This study aims to elucidate how forest structure and environmental variables shape decomposition processes through their effects on soil biogeochemistry. **Key words**: Deadwood degradation, Forest regeneration, Litter decomposition, Stand structure, Soil biogeochemistry. **Required knowledge**: The PhD student will conduct research on the interactions between biogeochemical processes and environmental drivers in forest ecosystems, adopting interdisciplinary methodologies. Candidates should have advanced understandings of disturbance ecology, soil biogeochemistry, and stand mensuration. Preferred qualifications include the ability to work in an interdisciplinary team and experience with laboratory analysis, as well as proficiency in Python, R, or MATLAB for data processing and statistical analysis. Experience with LiDAR measurements is also advantageous.	Prof. R. Tognetti and Prof. L. Montagnani	
12. Identifying tipping point in climate change and consequences on alpine hazards **Description.** The Alps are undergoing accelerated climate change, characterized by rising temperatures and an increasing frequency of extreme precipitation events. These changes push the region closer to critical tipping points, where self-reinforcing feedback loops could make risk management exceedingly difficult. Understanding and analyzing the processes driving these dynamics are crucial	Dr. M. Zebisch and Dr. A. Andreoli	Project co-funded by Eurac Research

for developing timely interventions to mitigate negative trends. This project leverages climate and hydrological monitoring data from South Tyrol to create conceptual models for Alpine river basin management. By identifying key tipping points, these models will inform proactive strategies to prevent their crossing. Ultimately, the models will provide alternative management approaches to enhance climate resilience and mitigate hazards and risks in Alpine river basins. **Key words:** Climate change and resilience, Tipping points, Alpine watersheds, Hydrogeological processes, Natural hazard and risk mitigation **Required knowledge:** The PhD student will conduct research on the interactions between climate forcing and geomorphological processes in mountain environments, adopting various interdisciplinary methodologies. Candidates should have advanced understandings of climate change processes, precipitation patterns, and river basin dynamics in mountain environments. Ability to work in Interdisciplinary team and experience with Python, R, or MATLAB for large data set processing, statistical analysis, simulation, and model development are preferential.		
13. The challenge of sustainable forest rejuvenation under ungulates browsing in mountain landscapes **Description.** Combining existing data on population densities of ungulates, land-cover types, vegetation and climate with field work, the PhD student will study the interactions of browsing and forest rejuvenation in mountain landscapes of the Southeastern Alps. The analysis of ongoing dynamics touches traditional land-use practices and their modern development in one of the most emblematic mountain regions worldwide. Results of the study will contribute to closing research gaps of ecological sustainability and be integrated into management strategies and forest practices. **Keywords:** Sustainability, browsing, forest rejuvenation, landscape ecology. **Required knowledge:** candidates should possess a basic knowledge in plant, ecosystem and landscape ecology. Quantitative skills (statistics in R, (Q)GIS), experience in forest or animal ecology and willingness to do field work in a high mountain environment are beneficial.	Prof. C. Wellstein/R. Tognetti/L. Montagnani/T. Zanon.	

Short Description of the research groups

Curriculum 1 Sustainable agricultural production systems

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.

Plant genetics (Dr. S.J. Unterholzner, Prof. T. Mimmo)

The research group studies genetic mechanisms of plants adaptation towards abiotic stress. They use a multidisciplinary approach to analyze genetic, molecular, and physiological details involved in agricultural traits related to root development. Their main interest is to understand developmental programms controlling root developmental plasticity and their role in nutrient uptake as well as in abiotic stress adaptation. The group combines genetics techniques (genome editing, tissue specific and inducible genome editing and gene expression) with transcription factors analysis and molecular imaging and employ primarily the model plant Arabidopsis thaliana, but are setting up translational approaches to test their working hypothesis also in crop plants such as barley, tomato and apple.

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

The research group investigates the evolutionary biology of chemically mediated insect-plant interactions in agricultural ecosystems, with the goal to develop environmentally friendly pest control strategies through a chemical ecology approach. We study how host plants respond to insect attacks by releasing volatile compounds and the ecological functions they mediate. Using GC-MS, GC-EAD, PTR-MS, and behavioral assays such as olfactometry, arena tests, and field trials, we have achieved significant breakthroughs. These include the "Female Removal (FR)" technique for *Cydia pomonella*, based on kairomonal lures, and an attractive lure for *Drosophila suzukii* using yeast volatiles, with ongoing efforts to optimize these strategies for field applications. Beyond insect-plant interactions, our research extends to apiculture, where we study impact of insecticides on honey bees and pesticide monitoring to improve agricultural sustainability. By integrating chemical ecology with applied research, we develop innovative and scalable solutions for sustainable pest management.

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. Zanotelli, Dr. D. Asensio)

The research focuses on eco-physiological processes that affect the use efficiency of resources and allow for the development of more sustainable production systems in orchards vineyards and berry crops. We study the exchange of CO_2, mineral nutrients, water and energy between soil, plants and atmosphere. Part of the activity investigates adaptation measures that can be adopted to cope with

multiples summer stressors, like extreme summer heat, drought and high solar radiation (in cooperation with Prof. G. Wohlfahrt (University of Innsbruck), with Dr. G. Niedrist (Eurac Research) and with Dr. M. Thalheimer (Laimburg Res. Center) as well as agroecological management techniques that the sustainability of management practices. Research approaches include eco-physiological, micrometeorological, isotopic, biochemical, biometric methods, as well as modeling and the application of spectral analysis. The final aim is the enhancement of the use efficiency of resources in crop production systems, the development of sustainable management techniques that enhance the quality of the produces.

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

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; agritourism; regional, agricultural and rural development (in cooperation with Dr. T. Streifeneder, Eurac); agricultural cooperatives, alternative agro-food networks, consumer studies, sustainable consumption, statistical data evaluation and econometrics (cross-section, time series and pooled datasets).

Grassland farming (Dr. G. Peratoner, Dr. T. Zanon)

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

Interdisciplinary landscape, vegetation and conservation ecology (Prof. C. Wellstein, Dr. F. J. White, 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, Prof. E. Tomelleri)

Our research group focuses on understanding montane forest ecology and how these ecosystems respond to both natural and human-induced changes, particularly in relation to climate change. We place special emphasis on biogeochemical cycles and aim to integrate our findings into management strategies that preserve and enhance forest functionality and resilience. Our studies range from examining the ecophysiology of individual trees using advanced technologies like IoT and proximal sensing, to exploring biodiversity and resilience at stand and watershed levels with methods such as eddy covariance, lidar, and UAVs. We also scale up to regional and national levels, employing remote sensing techniques and climate-smart forestry approaches.

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.

Center for Climate Change and Transformation (Eurac Research: Dr. M. Zebisch, Dr. M. Pittore, Dr. A. Dunant, Dr. A. Crespi)

At Eurac's Centre for Climate Change and Transformation (CCT) scientists from several Eurac Research Institutes and Centers are working together in an inter- and trans-disciplinary way to study how climate change impacts Earth's ecological and social systems and to better understand the cause-effect relationships which lead to key risks. For this PhD program two Research Lines are of relevance: Climate and Weather: better understanding weather and climate variability and climate change, including extremes, and providing accurate and timely climate analyses and projections to support hazard and risk modelling with respect to current and future trends. Natural Hazards: investigating, quantifying, and predicting the dynamics of natural hazards in space and time, with a specific focus on data-driven, multi-scale approaches and their relation to climate change. Furthermore, we develop robust, transdisciplinary methodologies for conceptualize and assess of multi-risk conditions and analyze risk governance processes focusing on the interface between research, policy and praxis.

5. The application for admission must state the preference for one curriculum and for a maximum of 2 research projects. The preference expressed will be indicative of the interests of the applicant and not binding for the selection committee.

6. Subject-related scholarship positions will have separate rankings. Separate rankings will be also compiled for each Curriculum. Winners of subject-related scholarships must conduct research related to the specified topic. These will be assigned preferentially to applicants who make a specific request in their application.

7. Pursuant to the general part of the present call for applications, the number of positions may be increased as a result of funding provided by other universities, public research bodies or qualified private companies. Notice of such an increase will be given exclusively on the unibz web page dedicated to PhD programs. Applicants wishing to obtain eligibility for any additional subject-related scholarships may make an explicit request to the selection committee during the interview, in order to allow it to assess the specific eligibility.

Art. 2 – ADMISSION REQUIREMENTS

1. Application to the present public competition for the admission at the PhD programme in Mountain Environment and Agriculture may be presented pursuant to art. 4 of the general part of the present call for application, without limitations regarding gender, age or citizenship, by:

a) Applicants holding a postgraduate degree as per Ministerial Decree no. 509/1999, a postgraduate degree as per Ministerial Decree no. 270/2004, a degree of the former Italian university system of the following degree classes: all;

b) Applicants who have obtained their degrees abroad, that must hold an equivalent degree.

c) Applicants achieving one of the above-mentioned titles within the enrolment deadline. In the latter case, applicants will be conditionally admitted to the public competition and are **required to present the qualification by the enrolment deadline, under penalty of forfeiting admission to the programme;**

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

2. Language requirements: a good/very good knowledge of English is required, which will be assessed during the interview.

Art. 3 – APPLICATION FOR ADMISSION

1. In addition to the documentation listed in the general part of the present call for applications, the following documents must be uploaded to the application portal:

a) Motivation letter in English language (maximum 1 page), stating your preference for research projects (maximum 2) and a detailed motivation for such choice. Briefly present your background. Explain the skills and the methodologies you have already acquired that would entitle you to successfully carry out a PhD program in the research topic(s) you've chosen.

b) Updated curriculum vitae in English pursuant to the European format, downloadable at the following link: https://europass.cedefop.europa.eu/en/documents/curriculum-vitae

c) up to a maximum of 2 letters of reference, written in Italian, German or English by a university lecturer or researcher from a research institute.

d) copy of the publications (published, in print or submitted) including the master dissertation (pdf version).

In addition to the documentation under a-d, if available, please upload:

e) any English language certificate at level B2 or higher (see the list of certificates recognized by the Language Centre: https://www.unibz.it/it/services/language-centre/study-in-three-languages/). Please note: the certificate must not have been obtained more than 5 years before the application for recognition.

Art. 4 – SELECTION PROCEDURE

1. The selection procedure consists of three phases:

a) applications will be examined ex officio for completeness and fulfilment of the formal requirements; applicants excluded due to incomplete applications or lack of requirements will be notified on the dedicated unibz web page. The publication will have the nature of a notification to all effects. No individual communications will be made.

b) The selection committee will assess the complete applications in accordance with Article 5, considering the qualifications and attached documentation referred to in Article 3. Applicants who reach the minimum score referred to in Article 5 will be admitted to the interview. Admission to the interview, as well as the relevant dates and times, will be communicated on the unibz dedicated web page. Individual communications will be sent in due time to the e-mail address indicated in the application form to applicants admitted to the interview.

c) Interviews may be held in person or by videoconference, at the applicant's request to the selection committee and will be evaluated in accordance with the criteria set out in article 5. Applicants must ensure the use of a webcam to enable them to identify themselves to the selection committee by showing a valid identity document or passport, under penalty of exclusion from the public competition.

2. Absence from the tests and/or interviews, non-connection, unavailability of the applicant on the appointed day and/or time or non-exhibition of a valid identity document or passport are a cause for exclusion from the public competition.

3. If technical problems occur after the start of the induvial interview by videoconference, if the problem concerns one or more members of the selection committee, the interview is deferred to another date ex officio; if the problem concerns the applicant, the committee may, subject to the principles of non-discrimination and equal treatment of applicants, postpone the test to another date for justified reasons.

4. Once the examinations have been completed, the relevant selection committees draw up rankings on the basis of the scores obtained by the applicants in the individual tests.

Art. 5 – EVALUATION CRITERIA

1. The selection committee carries out a comparative assessment of the applicants. For applicants who have expressed a preference for positions tied to subject-related scholarships, the committee also ascertains their suitability for the specific subject.

2. The following scores will be awarded during the evaluation of the documents submitted with the application under Article 3:

a) up to a maximum of 23 points for the academical qualifications: scientific proximity of the qualification to the PhD in Mountain Environment and Agriculture, as evidenced by the CV, master's degree/grade, motivation letter and other documents and certificates;

b) Up to a maximum of 7 points for the congruence of the curriculum with the theme chosen by the candidate among those indicated in the list of projects available on the dedicated portal;

3. Applicants who reach the threshold of 18/30 points will be admitted to the interview. Admission to the interview and the relevant dates and times will be communicated on the unibz dedicated web page. Individual communications will be sent in due time to the e-mail address indicated in the application form only to applicants admitted to the interview.

4. The following elements will be assessed during the interview: aptitude for research; possession of a language level appropriate to the language of the programme; argumentative capacity in relation to the theoretical and methodological hypotheses of the research project presented. As the PhD program is offered in English, candidates must have an adequate language level (corresponding to at least intermediate level, B2), which will be ascertained during the interview. A maximum of 20 points will be awarded. The interview is considered passed if at least 12/20 points are obtained.

5. The final score is made up of the sum of the scores obtained in the assessment of the documentation and interview. Applicants and candidates who have obtained at least 30/50 points will be eligible. In the event of a tied score, the applicant with the youngest age will have priority.

Art. 6 – RANKING

1. Applicants and candidates will be admitted to the programs in the order of their ranking until the number of positions available is reached. In the event of equal merit, the applicant who is younger in age shall prevail. In the event of successful placement in more than one ranking list, the winner must exercise the option for only one position. Separate rankings will be drawn up for each curriculum and position tied to a subject-related scholarship.

2. The final rankings will be published on the unibz website on the page dedicated to PhDs. Such publication has the value of an official communication. No individual communications will be made.