

**CORSO LAUREA MAGISTRALE IN SISTEMI AGRICOLI INTELLIGENTI E SOSTENIBILI IN
AREE MONTANE**

MASTER IN SMARTE NACHHALTIGE LANDWIRTSCHAFTSSYSTEME IN BERGGEBIETEN

Contenuto degli insegnamenti

Inhalt der Lehrveranstaltungen

Primo anno / Erstes Jahr

Livestock production systems in mountain areas (6 ECTS)

The Module will cover the following topics: 1. Structures of animal production in mountain areas, 2. Production and management systems of dairy and beef cattle, 3. Production and management systems of pigs, 4. Production and management systems of small ruminants (sheep and goat), 5. Production and management systems of poultry, horses, 6. Production and management systems of horses, 7. Production and management of non-domesticated species (e.g. deer)

Mountain crop ecosystems (3 ECTS)

The course aims to impart a scientific background to understand the ecological and productive dynamics of crop ecosystems in mountainous regions. Building on an understanding of environmental resources and regulatory factors, it will focus on efficient production practices (e.g., efficient water use, orchard floor management, nutrient application, and optimal utilization of light). Emphasis will also be placed on advancements in smart digital agriculture and the guiding principles of agroecological transition.

Sustainable soil management

- **Module 1: Soil Protection** (3 ETCS)

The course aims to provide knowledge for understanding and managing soil conservation issues. It emphasizes the critical role of soil in ecosystems and examines various threats to soil health and quality. These threats include erosion, pollution, sealing, compaction, loss of organic matter and soil biodiversity, chemical contamination, and the impacts of global change. Also, key topics will include soil health indicators and health conservation techniques and the relevant legislation. The course will also include practical field excursions to complement theoretical knowledge, providing hands-on experience in soil protection practices.

- **Module 2: Molecular Agroecology & Biochemistry** (3 ETCS)

The course provides a comprehensive understanding of molecular approaches to agroecology and biochemistry. It focuses on the biochemical and molecular interactions within agroecosystems, including plant-soil interactions, nutrient cycling, and the role of soil biodiversity processes in sustainable agriculture. Key topics include enzymatic activities in soils linked with biogeochemical cycles, soil biomass, and the application of next-generation sequencing based on environmental DNA for soil biodiversity monitoring in agroecosystems. Relevant laboratory techniques will also be covered. The course will include practical exercises related to laboratory activities and data analysis derived from environmental DNA and biochemical data, providing students with a comprehensive knowledge of molecular and biochemical to be applied in agro-ecosystems.

Smart agricultural technologies (6 ECTS)

The course aims to provide students with the basic knowledge and strategies to introduce digitization solutions in agricultural farm processes. First of all, the concept of Smart Agriculture will be defined, as a management strategy that uses information technologies to collect data from multiple sources in view of their subsequent use in the context of decisions concerning production activities. From this, the demands for innovation in terms of the need to introduce farm information systems and their technological implications on the machine equipment of farms will be analyzed.

The course will be articulated in the following topics: 1) Data-information transformation cycle and roles of Farm Information Systems (FIS); 2) Classification of hardware and software technology components of a FIS; 3) Technologies for environmental, crop and operational monitoring; 4) Data storage and tools for their digital processing (DBMS, GIS, CAD); 5) Tools for data evaluation (diagnostics, prescriptive functions, multi-criteria evaluations); 6) Technologies for automation and traceability of processes, and their related impacts on agricultural machinery; 7) Prospects for advanced automation, robotization and their integration functions in a FIS; 8) Advantages and limits in the use of artificial intelligence in farm processes

Rural and agricultural development

The course introduces the topic of sustainable development of mountain areas. Theoretical concepts as well as practical approaches to rural and agricultural development are presented and discussed. One focus is tourism and the production and marketing of regional and local products both food and non-food. By reviewing applied economic development and related literature, the student gains an in-depth understanding of the underlying theories. By acquiring professional skills and knowledge about project management students become familiar with practical implementation tools too. The discussion of practical examples from the European alpine area and excursions to projects and organizations dealing with tourism and regional product development complements the course work. Thus, students should gain an overview of the use of rural development instruments and the mastering planning methods.

- **Module 1: Agricultural development, sustainable tourism and regional products (6 ECTS)**

The module will cover the following topics: (1) Introduction; (2) Definitions and concepts of economic development; (3) Agricultural transformation and integrated rural development – globally and locally; (4) EU and international rural and mountain development policies, programmes and initiatives; (5) Tourism fundamentals: definitions, facts and figures; (6) Sustainable tourism: definitions, concepts and examples; (7) Regional products and geographic indications (8) Local products, the circular economy and global value chains; (9) Mountain products and island farming; (10) Presentation of study projects; (11) Summary and conclusions.

- **Module 2: Rural project design and management (3 ECTS)**

The module is a practical introduction to project development and management. It shows the applicability of project management in regional development as well as in tourism and food industry by focusing on (1) Feasibility checks and systematic creation of project ideas; (2) Project phases, types and context (stakeholder analysis); (3) Project plans (scope planning, work breakdown structure, scheduling, resource planning, cost estimating); (4) Project realization (motivation, controlling, getting projects back on track); (5) Project termination and evaluation.

Plant and livestock health (6 ECTS)

Part 1: Sustainable plant protection

The module will cover the following topics: 1. Principles of plant health, 2. Most important pests and diseases, 3. Sustainable plant protection, 4. Integrated pest management, 5. Biological control of plant pests, 6. Plant health in a changing world, 7. Case topics selected by the students.

Part 2: Livestock health

The course will cover the following topics: 1. Basics of disinfection and hygiene, 2. Most common diseases in cattle, small ruminants, pigs and poultry, 3. Disease control, 4. Integrated disease management, 5. Sustainable agriculture and biological control, 6. Climate change and diseases in livestock, 7. Case topics selected by the students.

Forage crops and grassland management (6 ECTS)

The course will cover the following topics: 1. Biology and agronomic traits of the main forage species; 2. Relationship between climate, management; Intensity, yield, botanical composition and forage quality; 3. Fertilisation with farm dung; 4. Management of pastures and meadows; 5. Forage conservation; 6. Grassland establishment and improvement.

Smart design and planning of mountain livestock and grassland management technologies (6 ECTS)

Part 1 will cover the following topics:

1. Systematic of livestock farming systems;
2. Environmental requirements to livestock farming on grassland;
3. Conceptual farm building for livestock in mountain regions;
4. Smart technologies for livestock (grazing, fodder production, in the barn, livestock management systems, animal observation, animal welfare detection, production observation);
5. smart waste management systems
6. Renewable Energy supply for livestock farming;
7. LCA for system evaluation

Part 2 will cover the following topics:

1. definition, technology of grassland management,
2. complexity of an animal farm system - grazing and forage production
3. requirements for grassland management;
4. process steps and machinery of grassland management
5. tools/devices for smart farming technology (telemetry, telecommunication, sensors, data processing, GIS mapping, variable rate technology, evaluation);
6. farm management and information systems (FMIS);
7. Examples from Practice

Farm management and entrepreneurship (6 ECTS)

The course in Farm Management and Entrepreneurship aims to provide students with basic theoretical and empirical knowledge on how to develop an entrepreneurial mindset and manage a business in the agri-food sector. The main objectives are:

- First, introduce students to basic economic and management thinking;
- Second, provide students with the basics of general management and corporate finance;
- Third, introduce students to entrepreneurship, providing them with the tools to open and manage an agri-food business;

At the end of the course the student has a general overview of the agri-food business, knowing the fundamental steps to manage it successfully.

Transversal agricultural knowledge and skills

The course introduces the topic of Microbiology of farming systems and geomatics. Theoretical concepts as well as practical approaches are presented and discussed. Students will become familiar with the positive or negative role of microorganisms in the mountain farms, including animal health. By acquiring professional skills and knowledge about geomatics tools students become familiar with practical implementation of them.

- **Module 1: Microbiology of farming systems** (3 ECTS)

This module will cover the following topics: (1) Revision of the main concept of microbial ecology in environments, including molecular-based knowledge; (2) Microbiology of grass, forages and silages; (3) Microbiology of rumen and livestock gut systems; (4) Basis on pathogenic microorganisms and animal health, including farm-related food spoilers; (5) Bee microbiology; (6) Antibiotic resistomes and the One Health approach, including agricultural soils, manure and irrigation waters; (7) PC-based laboratory including data analysis and survey of existing knowledge on the topic.

- **Module 2: Geomatics** (3 ECTS)

The module will cover the following topics: (1) Introduction; (2) Definitions and concepts of geomatics; (3) geomatics for smart and sustainable agricultural systems in mountain areas; (4) Fundamentals of cartography and digital cartography; (5) Introduction to Geographic Information System (GIS), Global Positioning System (GPS), unmanned aerial vehicle (UAV) and remote sensing (RS); (6) spatial analysis and basics of geostatistics; (7) Laboratory (PC based) of GIS and RS; (8) Laboratory (external) of GPS and UAV; (9) Summary and conclusions.

Secondo anno / Zweites Jahr

Wildlife management in mountain areas (6 ECTS)

The course will cover the following topics: 1. Wildlife ecology 2. Wildlife research 3. Wildlife monitoring 4. Wildlife control and handling (e.g. fencing, hunting) - Human wildlife conflict- Examples from various countries 5. Wildlife health management, Hygiene risks, Biosecurity 6. Predator management for livestock 7. Conservation and reintroduction projects and wildlife management and enforcement mechanisms in Europe and worldwide