



Universität für Bodenkultur Wien

University of Natural Resources and Life Sciences, Vienna

Curriculum

for the Master's Programme in

Mountain Forestry

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§ 1 QUALIFICATION PROFILE

The Master's Programme in Mountain Forestry is a degree programme which serves to deepen and extend students' pre-vocational academic education, building on the basis provided by a bachelor degree programme (§ 51 [2] item 5 of the Universities Act UG 2002, Federal Law Gazette BGBl I no. 81/2009). The programme fulfils the requirements of Directive 2005/36/EC on the recognition of professional qualifications, article 11, letter e.

1a) Knowledge and personal and professional skills

Graduates of the Master's Programme in Mountain Forestry have specialised knowledge on ecological characteristics of mountain forests, on the social and economical dynamics within mountain regions and on silvicultural measures and technical methods suitable for and adapted to mountain environments. They can analyse complex ecological and socio-economic settings in mountain regions and their interactions. They know participatory methods in development research and are able to analyse multiple stakeholder interests. Based on the knowledge of ecological and socio-economic characteristics, their ability to apply analytical tools and their command of site adapted silvicultural practices, they are able to sustainably manage mountain forests as well as to plan and implement forest conservation schemes.

They can develop, evaluate and justify sustainable forest management concepts and can autonomously lead the implementation of such concepts in different institutional settings.

Based on participating in compulsory modules, graduates of the Master's Programme in Mountain Forestry gain the following qualifications in the following fields of expertise:

Ecology of Mountain Forests:

Master's Programme in Mountain Forestry graduates are able to describe ecological characteristics of mountain forest ecosystems, identify site specific limiting ecological factors, describe natural dynamics and identify the ecological effects of management strategies on mountain forest ecosystems based on these specific characteristics.

Economics and Social Science:

Master's Programme in Mountain Forestry graduates are able to characterize the role of specific social and economical settings of sustainable natural resource management of mountain regions. They are able to apply scientific methods including participatory approaches for analyzing social and economical characteristics of mountain regions. They recognize the role of multiple stakeholder interests for management of mountain forests and are able to integrate these into management strategies which they develop and / or implement.

Inventory of mountain forest resources and resource monitoring tools:

Master's Programme in Mountain Forestry graduates are able to identify, develop and implement suitable methods for resource inventories and monitoring, thereby ensuring sustainability of resource use in forests.

Forest Engineering:

Master's Programme in Mountain Forestry graduates are able to identify, develop and implement adapted and appropriate technological methods for sustainable management of mountain forests.

Forest Management for Ecosystem Services:

Master's Programme in Mountain Forestry graduates are able to integrate ecological, socio-economical characteristics of mountain regions, analyse interactions between these factors and derive management strategies for sustainable provision of multiple ecosystem services.

In at least one of these fields, students specialise by obtaining qualifications from elective courses and by carrying out their diploma thesis.

1b) Professional qualifications

The Master's Programme in Mountain Forestry delivers knowledge to enable a broad approach to the management of mountain forest areas with special emphasis on ecological, social and economical circumstances of developing countries.

Master's Programme in Mountain Forestry graduates contribute significantly to the conservation and sustainable management of forests in their home countries. Master's Programme in Mountain Forestry graduates work in governmental organisations, non-governmental organisations (NGO), and national parks in conservation and natural resource management. They work in international organisations as consultants and as experts in research for development in mountain regions.

Learning outcome Master's Programme in Mountain Forestry:

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Master's Programme in Mountain Forestry graduates are able to describe ecological characteristics of mountain forest ecosystems affecting the conservation and management of mountain forests.	Master's Programme in Mountain Forestry graduates are able to identify site specific ecological aspects of mountain forest ecosystems.	Master's Programme in Mountain Forestry graduates are able to adapt concepts for conservation and management strategies for mountain forest areas on the specific ecological and social and economical demands of different environments.	Master's Programme in Mountain Forestry graduates are able to analyze the socio-economical and ecological effects of management and conservation strategies and activities for given mountain areas.	Master's Programme in Mountain Forestry graduates are able to recognize limiting ecological factors in given mountain forest ecosystems and develop site specific management strategies for sustainable provision of ecosystem services.	Master's Programme in Mountain Forestry graduates are able to assess effects of management and conservation strategies on ecological and economical characteristics.
Master's Programme in Mountain Forestry graduates are able to characterize the role of specific social and economical settings of mountain regions for management and conservation in these areas. They know social scientific methods including participatory approaches for analyzing social and economical characteristics of mountain regions.	Master's Programme in Mountain Forestry graduates recognize the role of multiple stakeholder interests for management of mountain forests. They are able to identify suitable social sciences and economical methods for analysis and concepts for application in mountain forestry including community based resource management concepts.	Master's Programme in Mountain Forestry graduates are able to integrate multiple stakeholder interests into management thereby collaborating with local land users in a participatory way.	Master's Programme in Mountain Forestry graduates are able to analyze the resource basis of mountain forests using adapted inventory systems and to monitor changes in resources in mountain forests.	Master's Programme in Mountain Forestry graduates are able to contrast income possibilities before and after the implementation of conservation and management strategies and to critically assess outcomes and arising problems and difficulties.	Master's Programme in Mountain Forestry graduates are able to grade different management strategies according to their usability for the given framework conditions and to asses and interpret effects and outcomes of management strategies already in place.
Master's Programme in Mountain Forestry graduates are able to describe analytical tools for assessing and monitoring resources in mountain forests.	Master's Programme in Mountain Forestry graduates are able to identify suitable methods for resource inventories and monitoring.	Master's Programme in Mountain Forestry graduates are able to apply appropriate tools and methods to support decision making in natural resource management.	Master's Programme in Mountain Forestry graduates are able to compare and contrast different management strategies to sustain the provision of different ecosystem services in mountain forest regions.	Master's Programme in Mountain Forestry graduates are able to revise existing management strategies and establish mountain forest conservation and management and operational plans.	
Master's Programme in Mountain Forestry graduates are able to describe forest technological methods adapted to mountain forests for sustainable management.	Master's Programme in Mountain Forestry graduates are able to identify adapted technological methods for sustainable management of mountain forest.	Master's Programme in Mountain Forestry graduates are able to illustrate the effects of management and conservation strategies on ecological characteristics of the ecosystems in question as well as on the livelihood of different groups of land users.	Master's Programme in Mountain Forestry graduates are able to appraise the effects of management and conservation strategies on income of local land users.		
Master's Programme in Mountain Forestry graduates are able to describe different management strategies and silvicultural measures applied in mountainous regions.	Master's Programme in Mountain Forestry students are able to discuss management aspects supporting the income generation of land users in mountainous areas.				

§ 2 ADMISSION REQUIREMENTS

Admission to the Master's Programme in Mountain Forestry is conditional on the successful completion of a degree (Bachelor's/Master's or equivalent) in Forestry or a related discipline from an accredited university or university-like institution must show competences in basics in natural sciences, economics, social sciences as well as technical sciences.

In particular, applicants have to proof that they passed at least one course dealing with each of the following subjects during their academic study:

- Mathematics or statistics,
- Chemistry,
- Botany, ecology,
- Zoology, entomology or wildlife studies,
- Silviculture,
- Economics and social sciences,
- Technical sciences.

Eligibility for admission to the Master's Programme in Mountain Forestry has to be established by proof that these conditions are met. If requirements listed above are not fulfilled, applicants have the possibility to acquire missing knowledge. The University of Natural Resources and Life Sciences BOKU, Vienna will decide upon courses which have to be taken in order to fulfil prerequisites of admission.

§ 3 PROGRAMME STRUCTURE

3a) Duration, total ECTS credits, and structure

The programme consists of courses and other requirements worth a total of 120 ECTS credits. This is equivalent to a duration of four semesters (a total of 3,000 60-minute credit hours). The programme is divided into:

Compulsory courses	58 ECTS credits
Master's thesis	30 ECTS credits (<i>excl. Master seminar</i>)
Master seminar	2 ECTS credits
Elective courses	20 ECTS credits
Free electives	10 ECTS credits

The following Modules are composed of compulsory (and elective) courses, all compulsory courses in all modules have to be taken by students:

Compulsory courses: 58 ECTS credits (see § 4)					
Introduction to mountain forestry and scientific skills	Ecology of Mountain Forests	Economic and social dimensions in mountain forestry	Inventory and Monitoring	Forest Management for goods and environmental services	Forest Engineering

Elective courses should be used for specialisation. Students have to select one out of the five Modules for specialization, **10 ECTS** credits are required for completion.

Further **10 ECTS** credits have to be taken out of the elective courses pool of **at least 2 additional** modules. Modules to choose elective courses from are:

Elective courses: total of 20 ECTS credits (see § 5) 10 ECTS credits out of one Module, 10 ECTS credits out of at least two additional Modules				
Ecology of Mountain Forests	Economic and social dimensions in mountain forestry	Inventory and Monitoring	Forest Management for goods and environmental services	Forest Engineering

3b) Three-pillar principle

The three-pillar principle is the central identifying characteristics of both the bachelor's and master's programmes offered at the University of Natural Resources and Life Sciences, Vienna. In the master's programmes, the sum of the compulsory and elective courses must be made up of at least:

- 15% technology and engineering
- 15% natural sciences
- 15% economic and social sciences, law,

The master's thesis, compulsory internship and free electives are excluded from the three-pillar rule.

3c) Courses with a restricted number of participants

For courses with a restricted number of participants, the instructor of a master's level course is entitled to give first priority to students enrolled in a master's programme (i.e. students enrolled in a bachelor's programme will only be admitted to the course if places are still available after all master's level students have been accommodated). When accepting master's program students into a course, the following priority criteria with regard to the students' course requirements shall be applied: compulsory course, elective course, free elective.

§ 4 COMPULSORY COURSES

The Master's Programme in Mountain Forestry consists of 6 Modules. Students have to take all compulsory courses of all 6 Modules to graduate from the Master's Programme in Mountain Forestry.

The Master's Programme in Mountain Forestry is composed of the following Modules with compulsory courses:

MODULE - Introduction to mountain forestry and scientific skills

Compulsory courses	type	SWS	ECTS
Field Camp I - Introduction to mountain forestry and forest sciences	VX	3	2
Methods of data collection, management and analysis	VU	1,5	2
Scientific methods and writing skills	VS	1	1
Master seminar	SE	2	2
Master's thesis			30

Learning outcome Module – Introduction to mountain forestry and scientific skills:

Knowledge

- Outline** scientific projects according to standards of scientific writing,
- Arrange** data collection and data management.

Comprehension

- Identify** research questions for a given project,
- Construct** scientific projects and data collection methods.

Application

- Apply** data collection methods to identified research questions,
- Illustrate** research work carried out, research project outline and methods.

Analysis

- Appraise** research work carried out,
- Analyse** data collected according to data analysis methods adequate for given research question,

Determine and **illustrate** results.

Synthesis

Summarise research carried out and results,
Compose own research template.

Evaluation

Interpret results from scientific work,
Defend findings and recommendations given,
Evaluate literature and give recommendations accordingly.

Learning outcome courses Module – Introduction to mountain forestry and scientific skills

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Field Camp I - Introduction to Mountain Forestry	Recall ecological, social, economical and political aspects concerning mountain forests, their management and conservation, Name facts on mountain forests and forestry in Austria and in various other regions of the world	Identify and consider important issues of mountain forest ecology, management and conservation, Consider the relevance of research on mountain forests, Recognise the design of the MSc. Mountain Forestry curriculum	Relate the examples of mountain forestry shown and discussed to other case studies, Apply recommendations for studying at BOKU University, e. g. to choose elective lectures and to find an appropriate topic and a supervisor for the Master thesis, Develop skills to interact and study in an intercultural environment	Appraise the global importance of mountain forests for various ecosystem services	Recognise ecological, social, economical and technological aspects concerning mountain forests in the field and relate their interrelationship and complexity	Evaluate various options of forest management and conservation regarding their impact on mountain forests and ecosystem services
Methods of data collection, management and analysis	Identify methods of data collection, management and analysis	Illustrate data collection set up, relevant management of data and methods of data analysis, Construct research questions for given projects	Develop data collection methods for given questions, Employ data management methods	Debate different data analysis methods depending on given questions, Identify best usable data analysis for given questions	Arrange data collected for analysis, Integrate data analysis, interpretation into scientific writing, Justify and argue interpretation of results	Evaluate data collection and analysis for improvement in future work,
Scientific methods and writing skills	Recall fundamentals of scientific work and scientific communication, Name theoretical and practical skills in collecting scientific information	Express skills in scientific writing and structuring of various types of scientific publications	Compute and apply scientific visuals, Develop oral scientific presentation, Develop research questions for given projects	Plan scientific writing and structuring of various types of scientific publications, Appraise oral scientific presentations	Write various types of scientific publications	Evaluate scientific publications and presentations
Master seminar	Present and describe Master Thesis project carried out	Discuss research question applied to MSc. project, Explain data collection, management and analysis carried out during MSc. project	Demonstrate results achieved during MSc. project	Appraise results achieved during MSc. project,	Formulate results of the MSc. project in comparison to other projects in the same research field	Interpret results of MSc. project

MODULE – Ecology of Mountain Forests

Compulsory courses	type	SWS	ECTS
Mountain forest dynamics and fire ecology	VS	3	3
Mountain forest soils and forest nutrition	VU	2	2,5
Field Camp II -Concepts and methods of site ecology, forest growth and yield	PJ	2,5	3
Mountain forest climatology and headwater hydrology	VU	3	2,5

Learning outcome Module – Ecology of Mountain Forests:

Knowledge

- Describe** concepts of forest dynamics; disturbances and the role of fire in forest ecosystems,
- Identify** dominating soil processes and soil classification systems,
- Define** issues concerning forest management and skills needed for site classification, site mapping and growth,
- Describe** the interaction of climate elements and hydrological processes in mountains and mountain forests.

Comprehension

- Recognize** different disturbance agents for forest dynamics, plant tradeoffs leading to species co-existence, plant adaptations to fire and consequences of fire suppression,
- Identify** various forest soils, nutrient cycling processes and effects of soil management,
- Discuss** skills for site classification, site mapping and growth and yield inventories,
- Interpret** interactions of climate, mountains and mountain forest, and influence of forest management on head water hydrology.

Application

- Apply** knowledge on disturbance ecology, species coexistence and fire ecology to forest management and nature conservation,
- Assess** mineral nutrition, plant-soil-feedback mechanisms and management of mountain soils,
- Apply** site classification, site mapping and growth and yield inventories methods,
- Assess** the impact of climate and on management on head water hydrology in mountain regions and mountain forest.

Analysis

- Analyse** ecological factors driving tree regeneration and resilience of ecosystems to perturbations,
- Compare** different mountain forests in terms of mechanisms allowing for species coexistence,
- Analyse** chemical and physical properties of forest soils, calculate nutrient supply, water storage capacity etc.,
- Question** effects of management of mountain soils,
- Combine** site classification, mapping and growth/yield inventories to forest management strategies,
- Appraise** the effects of climate on forests in mountain regions,
- Connect** forest management strategies to arriving problems in head water hydrology.

Synthesis

- Integrate** species traits and disturbance characteristics to explain dynamic processes in mountain forest ecosystems,
- Recognize** soil functions and production limits,
- Generate** site classifications, site mapping, as well as growth and yield inventories,
- Integrate** mountain specific climatic effects and hydrological processes into forest management strategies.

Evaluation

- Assess** the effects of different disturbances on structure and composition of mountain forest ecosystems,
- Assess** and **judge** management of mountain soils,
- Assess** and **interpret** site classifications, site mapping, as well as growth and yield inventories,
- Evaluate** these mountain specific forest management procedures and their effects on hydrological processes.

Learning outcome courses Module – Ecology of Mountain Forests

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Forest dynamics and fire ecology	<p>Describe different concepts of forest dynamics; the role of fire in forest ecosystems</p> <p>Identify disturbances in mountain forest ecosystems</p> <p>Describe mechanisms allowing for tree species coexistence in mountain forest ecosystems</p> <p>Describe the ecological role of fire in different mountain forest ecosystems</p> <p>List different methods used in tree regeneration ecology</p>	<p>Recognize the role of difference disturbance agents for forest dynamics</p> <p>Describe plant tradeoffs leading to species coexistence in mountain forests</p> <p>Describe plant adaptations to fire</p> <p>Describe consequences of fire suppression in different mountain forest ecosystem</p>	<p>Apply knowledge of disturbance ecology and species coexistence to forest management and nature conservation</p> <p>Apply knowledge on fire ecology of different mountain forest ecosystems in forest management and conservation</p>	<p>Analyse resilience of different mountain forest ecosystems to perturbations</p> <p>Analyse ecological factors driving tree regeneration</p> <p>Compare different mountain forests in terms of mechanisms allowing for species coexistence</p>	<p>Recognize factors driving mountain forest dynamics</p> <p>Integrate species traits and disturbance characteristics to explain dynamic processes in mountain forest ecosystems</p>	<p>Assess the consequences of fire regulation and suppression in different mountain forest ecosystems</p> <p>Predict the effects of different disturbances on structure and composition of mountain forest ecosystems</p>
Mountain forest soils and forest nutrition	<p>List soil classification systems (incl. soil morphology);</p> <p>Identify dominating soil processes; recall mineral nutrition of higher plants</p>	<p>Identify special properties of mountain soils and effects of soil management,</p> <p>Differentiate various forest soils</p> <p>Describe nutrient cycling processes</p>	<p>Examine mineral nutrition in mountain forests,</p> <p>Assess the management of mountain soils</p> <p>Assess plant-soil-feedback mechanisms</p>	<p>Connect mineral nutrition in mountain forests and the degradation of mountain soils,</p> <p>Question the effects of management of mountain soils</p> <p>Analyze and interpret chemical and physical properties of forest soils</p> <p>Calculate nutrient supply, water storage capacity etc.</p>	<p>Recognize soil functions and production limits</p>	<p>Assess and judge management of mountain soils</p>
Field Camp II- Concepts and methods of site ecology, forest growth and yield	<p>List basic skills needed for site classification, site mapping and growth and yield inventories,</p> <p>Define issues concerning forest management on a multidisciplinary level</p>	<p>Discuss skills needed for site classification, site mapping and growth and yield inventories,</p> <p>Describe and discuss aspects of mountain forest management</p>	<p>Apply skills learned for site classification, site mapping and growth and yield inventories,</p> <p>Assess strategies used for forest management on a multidisciplinary level</p>	<p>Outline site classifications, site mapping, as well as growth and yield inventories,</p> <p>Combine forest management strategies for a best possible management strategy</p>	<p>Generate site classifications, site mapping, as well as growth and yield inventories</p>	<p>Assess and interpret site classifications, site mapping, as well as growth and yield inventories</p>
Mountain forest climatology and headwater hydrology	<p>Describe the interaction of climate elements, mountains and mountain forests,</p> <p>Identify hydrological processes in small forest catchments</p>	<p>Interpret interactions of climate, mountains and mountain forest,</p> <p>Recognise the influence of forest management on head water hydrology</p>	<p>Assess the impact of climate on mountain regions and mountain forest,</p> <p>Examine and illustrate the influence of management on head water hydrology</p>	<p>Appraise the effects of climate on forests in mountain regions</p> <p>Connect forest management strategies to arriving problems in head water hydrology</p>	<p>Integrate mountain specific climatic effects on forests into forest management strategies,</p> <p>Explain hydrological processes and how they can be affected by forest management</p>	<p>Evaluate these mountain specific forest management procedures,</p> <p>Evaluate forest management strategies by their effects on hydrological processes</p>

MODULE - Economic and social dimensions in mountain forestry

Compulsory courses	type	SWS	ECTS
Forest resource economics	VS	3	4,5
Mountain forest policy	SE	3	4,5
Participatory methods in development research and practice	SE	2	3
Project management in development co-operation	VS	3	2

Learning outcome Module – Economic and social dimensions in mountain forestry:

Knowledge

Describe basic concepts of environmental, forest, and managerial economics, of policy studies, participatory approaches, planning, implementation and monitoring of measures, in particular also in developing countries.

Comprehension

Understand and **explain** various concepts of costs, values, specific valuation methods for eco-system services, natural resource management theories,

Recognize the role of development projects and of different approaches of collaborative research and management within their social context,

Recognize different capabilities of local stakeholders/people for managing resources.

Application

Assess forest management from a resource economic perspective,

Apply policy analysis conception to mountain forestry issues,

Conceptualize meaningful development cooperation projects as well as state of the art participatory processes.

Analysis

Economically **assess** forestry operations and accounts,

Analyze the role of forest resource management institutions, forest policy instruments and stakeholder constellations for mountain forest management,

Debate stages of project cycles in the context of developing countries, as well as the integration of participatory methods in natural resource management.

Synthesis

Provide an **integrated account** of economic values of forests, considering the interrelation of various forest products and services,

Develop research approaches for mountain forest,

Plan rural development projects, their implementation and monitoring, and **design** the application of participatory methods in training examples.

Evaluation

Evaluate the economic implications of mountain forest management, research results on mountain forest policy and natural hazards prevention, rural development projects, and applications of various participatory methods.

Learning outcome courses Module – Economic and social dimensions in mountain forestry

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Forest Re-source Eco-nomics	Describe basic concepts of environmental economics, Recall basic understanding of managerial as well as forestry economics	Explain the various concepts of cost and values, such as opportunity cost and option value, Describe valuation techniques such as TCM, HPM and CVM, Discuss methodological issues of forest accountancy data networks	Calculate forestry-specific ratios such as the indicating percent, Assess forests from the viewpoint of resource economics	Assess forestry accounts at the national level, Compare various valuation techniques	Establish the total economic value of forests, Relate economic implications of the various forest uses and services	Assess economic implications of mountain forestry
Mountain forest policy	Outline basic concepts of social science, and policy studies, Describe the concepts of sustainable forest management, multiple use forestry, natural hazards prevention as well as the political processes behind	Differentiate theory vs. ideology, Differentiate policy advice vs. policy research, Understand forest politics and policies addressing mountain areas from international to local level, Discuss different perceptions risk in mountain forests	Highlight burning issues in sustainable mountain forest management, illustrated by international cases, Apply methods of policy analysis on practical case studies, Connect and relate their own experiences and material from their home countries to theoretical concepts and practical case studies	Analyse the roles of actors and institutions in mountain forest policy and management as well as in natural hazards management and policy, Assess the formulation, implementation and effectiveness of policy instruments applied in mountain forestry and natural hazards management	Develop a research design for a hypothetical empirical study, Explain factors for success in mountain forest policies, Summarise insights of empirical cases of policies for mountain forest management and natural hazards prevention	Evaluate research results on mountain forest policy and natural hazards prevention, Interpret sociological questions relating to risk, forest policy and natural hazards management
Project management in development co-operation	List economic and environmental constraints in developing countries, Describe methods of planning, implementation and monitoring & evaluation employed in rural development projects	Describe the nature and role of development projects as interventions into complex social systems	Construct meaningful development cooperation projects taking into account the environmental, socio-political and economic conditions in developing countries	Debate methods of the project cycle including stakeholder and problem analyses, goal-oriented planning, monitoring and evaluation in the context of natural resources management in developing countries	Plan rural development projects, Organise the implementation and monitoring of rural development projects	Evaluate rural development projects
Participatory methods in development research and practice	List different participatory methods and approaches and how they evolved Describe approaches and methods used in developing countries and why they are used	Identify different epistemologies of different stakeholder groups Identify consequences of different approaches of collaborative research and management Recognise capabilities of local people to manage resources	Apply participatory methods in a self-reflective mode; Assess strengths of different participative approaches Master methods in different professional roles (notably as researcher, process facilitator)	Integrate participatory methods into research on and management of natural resources	Design participatory methods and applications based on training examples	Evaluate different participatory methods Evaluate shortcomings of professional practice

MODULE - Inventory and Monitoring

Compulsory courses	type	SWS	ECTS
Forest inventory	VU	3	3
Modelling of mountain forest ecosystems	VS	2	2,5
Remote sensing and GIS in natural resource management	UE	2	3

Learning outcome Module – Inventory and Monitoring:

Knowledge

- Identify** functions in forest ecosystems and the parameters for forest inventory,
- Recall** major modelling concepts and the parameters needed for forest ecosystem modelling,
- Describe** how to analyse remote sensing data and **arrange** information derived from remote sensing data.

Comprehension

- Associate** different functions and their consequences in mountain forestry,
- Identify** parameters collected for mountain forest inventory,
- Discuss** the main concepts of modelling systems and their components.
- Explain** the use of remote sensing data in geographic information systems (GIS).

Application

- Illustrate** the importance of forest stands for protection against erosion, multiple use, tourism, wood production for fuel wood,
- Examine** different inventory methods for mountain forest ecosystems,
- Assess** specific needs of forest models end-users and simulate examples,
- Use** remote sensing and GIS for forest classification.

Analysis

- Appraise** inventory methods with emphasis on mountain terrain,
- Compare** major modelling concepts and **debate** the outcome of forest modelling,
- Categorize** environmental data for GIS use.

Synthesis

- Plan** forest inventory field work and **argue** specific parameters measured in forest inventory of mountain forests,
- Formulate** modelling,
- Compile** a remote sensing based forest map.

Evaluation

- Evaluate** forest inventory methods and **interpret** results gained,
- Appraise** modelling concepts on the basis of forest management decisions, reproduction, quantification and description of forest ecosystem,
- Interpret** remote sensing based forest maps.

Learning outcome courses Module – Inventory and Monitoring

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Forest inventory	Describe various functions of forest ecosystems in mountain forests, List parameters used for forest inventory, Describe specific features of mountain forest ecosystems (soil processes, mineral nutrition, vegetation dynamics and regeneration ecology)	Associate different functions and their consequences in mountain forestry, Identify forest inventory parameters additionally collected for mountain forest inventory, Associate the specific features of mountain forest ecosystems with implications for management and conservation	Illustrate the importance of protection against erosion, multiple use (including grazing), tourism, wood production for fuel wood or local market needs only, Assess different inventory methods for specific features of mountain forest ecosystems	Analyse protection against erosion, multiple use, tourism, wood production by means of the socio-economic environment in mountain regions, Appraise inventory methods with emphasis on mountain terrain	Plan forest inventory field work with particular emphasis of difficult accessibility and steep terrain in mountain regions, Argue specific parameters measured in forest inventory of mountain forests	Evaluate forest inventory methods used in mountain forests, Interpret results gained from forest inventory
Modelling of mountain forest ecosystems	Recall the three major modelling concepts applied within forest ecosystem modelling, Identify parameters which need to be addressed in forest ecosystem modelling	Differentiate the three modelling concepts, Discuss the main components of the three modelling concepts, Describe conflicting interests (simplicity, observability and biological realism) which needed to be incorporated in forest modelling,	Assess advantages and disadvantages in assessing specific needs of forest models end-users, Employ simulation examples	Compare the three major modelling concepts, Debate the outcome of forest modelling by means of the simulation examples	Formulate advantages and disadvantages of the three major modelling concepts for the simulation examples	Appraise the three modelling concepts on the basis of their support of forest management decisions, reproduction, quantification and description of forest ecosystem
Remote sensing and GIS in natural resource management	Describe how to generate information from remote sensing data, Describe how to analyse remote sensing data	Discuss the use of remote sensing data in a geographic information system	Develop a remote sensing based forest classification, Use a geographic information system for forest classification	Categorize environmental data for the use in geographic information system	Compile a remote sensing based forest map	Interpret remote sensing based forest maps

MODULE - Forest Management for goods and environmental services

Compulsory courses	Type	SWS	ECTS
Natural resource management in mountain forests	VS	4	4
Agro forestry in mountain regions	VS	2	2
The role of forests in mountain risk engineering	VX	2	2
Forest protection	VS	2	2

Learning outcome Module - Forest Management for goods and environmental services:

Knowledge

- Outline** concepts of natural forest resource management systems,
- Identify** mixed species land use systems and ecological interaction within them,
- Outline** past and recent agro forestry systems,
- Identify** abiotic risks, insect pests and forest tree diseases in mountain forests and afforestations.

Comprehension

- Contrast** concepts of natural forest resource management systems in mountain forests,
- Identify** characteristics of mixed land use systems and with special emphasis on mountain areas
- Recognize** traditional and new agro forestry systems and their socio-economic potentials,
- Illustrate** forest management activities and their impact on risks in mountain areas,
- Contrast** damaging factors in forest and natural resource management.

Application

- Develop** concepts of natural forest resource management systems in mountain forestry,
- Assess** socio-economic potentials of different agro forestry systems and mixed species land use systems for their usability in mountain areas,
- Examine** the correlation between risk and different forest management methods and the impact of management on natural hazards,
- Assess** the importance of pests, pathogens and abiotic damaging factors and strategies of disease/pest prevention.

Analysis

- Appraise** concepts of mountain forest management,
- Illustrate** and debate the socio-economic potentials and aspects of agro forestry,
- Contrast** different mixed species land use systems for mountain areas,
- Determine** reduction and measures of natural hazards,
- Contrast** damaging factors in forest and natural resource management.

Synthesis

- Design** and implement management activities and to monitor and evaluate the outcome of operations,
- Design** mixed species land use systems incorporating technical characteristics and socio-economical aspects,
- Develop** forest management strategies for enhanced protection against risks,
- Design** management strategies for examples of forest health problems in plantation forests.

Evaluation

- Evaluate and assess** the outcome of management operations,
- Appraise** the used mixed species land use systems and suggest strategies for improvement,
- Evaluate** catchment based forest management and the effects on risk reduction,
- Appraise** forest management strategies for various risks, pests and tree diseases.

Learning outcome courses Module - Forest Management for goods and environmental services

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Natural resource management in mountain forests	Outline concepts of natural forest resource management systems relevant to mountain forests	Contrast various concepts of natural forest resource management systems relevant to mountain forests	Develop different concepts of natural forest resource management systems used in mountain forestry	Debate and appraise different concepts of mountain forest management activities	Design and implement management activities and to monitor and evaluate the outcome of operations	Evaluate and assess the outcome of management operations
Agroforestry in mountain regions	Recognize agroforestry land use systems Identify ecological interaction in mixed species land use systems Outline past and recent agro forestry systems	Discuss different agroforestry land use systems with special emphasis on mountain areas Recognize socio-economic potentials of agroforestry Identify ecological characteristics of mixed land use systems Explain traditional and new agroforestry systems used in tropical and subtropical regions	Assess agro forestry systems for their usability in mountain areas, Examine the socio-economic potentials of different agro forestry systems, Assess traditional and new agro forestry systems for their use in mountain regions	Contrast different agroforestry systems for mountain areas Illustrate the socio-economic potentials and aspects of agroforestry, Debate traditional and new agro forestry systems for their use in mountain regions used in tropical and subtropical regions	Design an agoforestry system for a given mountain area incorporating technical characteristics and socio-economical aspects	Appraise the current land use systems for given areas and suggest strategies for improvement
The role of forests in mountain risk engineering	Identify the role of mountain forests concerning natural hazards and related risks	Recognize ecosystem services of mountain forests, Identify the protective function of mountain forests	Apply knowledge of dangerous processes for forest management, Relate natural hazards with ecosystems	Debate the economic and environmental effects of mountain forests on risk in mountainous environments, Analyse the ecosystem services of mountain forests,	Design management strategies for forests in areas prone to snow avalanches, landslides, floods and soil erosion	Assess the role of mountain forests in risk management, Identify the limitations of biological protection against natural hazards
Natural hazards and the role of mountain forests in protecting watersheds	Describe risks in mountain areas, Recall measures against risk in mountain areas	Explain catchment based risk minimising strategies, Illustrate the impact of forest management activities on risks in mountain areas	Assess the impact of management on natural hazards, Examine the correlation between risk and different forest management methods	Determine reduction of natural hazards through forest management, Determine measures of risk reduction	Develop forest management strategies for enhanced protection against risks	Evaluate catchment based forest management and the effects on risk reduction
Forest Protection	Name and identify abiotic damaging factors, insect pests and tree diseases in mountain forests, afforestations in mountains and plantation forests	Describe forest health problems and their causes, Contrast the role of abiotic and biotic damaging factors in natural and managed forests and in relation to various ecosystem services, Recognise the interacting	Develop skills for the diagnosis of forest health problems, Develop and apply strategies of disease/pest/damage prevention and management, Assess the global im-	Appraise key factors influencing the occurrence of abiotic damage, the population dynamics of forest pests and the epidemiology of forest tree diseases	Design management strategies for forest health problems, Integrate principles of forest entomology, forest pathology and forest protection into forest and natural resources management	Appraise forest management strategies for ecosystem services in relation to various abiotic risks, insect pests and forest tree diseases in mountain forests, afforestations at high alti-

		factors leading to forest health problems	portance of pests, pathogens and abiotic damaging factors in forest management and conservation			tudes and plantation forests
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MODULE - Forest Engineering

Compulsory courses	Type	SWS	ECTS
Harvesting systems for mountainous regions	VO	2	2
Field Camp III – Integrated forest management applications	PJ	2,5	3
Road network planning	VS	3	3
Cable yarding project	UE	1	1.5

Learning outcome Module - Forest Engineering:

Knowledge

- Describe** economic, ecologic and human dimensions of harvesting methods mountain forests,
- Describe** ecological, economical, technical and participative actions for mountain forest management,
- Describe** modern planning and evaluation methods for road network planning,
- List machine elements and units used for cable yarding projects.

Comprehension

- Recognize** important aspects of occupational health and safety,
- Distinguish** forest management actions based on ecological, economical, technical and participative methods,
- Identify** state of the art planning methods for modern road construction,
- Explain** dimensions of different units for cable yarding projects.

Application

- Relate** economic, ecologic and human (health and safety) dimensions to various harvesting methods,
- Apply** forest management actions based on ecological, economical, technical and participative methods,
- Apply** road network planning networks for decision making,
- Apply** knowledge on dimensions to calculation of cable yarding project.

Analysis

- Compare** harvesting methods according to economical and ecological effects,
- Integrate** ecological, economical, technical and participative methods into forest management,
- Appraise** existing road networks for optimisation and maintenance needs,
- Analyse** on-site situation for cable yarding projects.

Synthesis

- Integrate** economical and ecological aspects into forest harvesting plans,
- Compose** forest management strategies incorporating multidisciplinary aspects,
- Design** road networks and prepare for construction work,
- Design and implement** cable yarding projects.

Evaluation

- Evaluate** economic, ecologic and human dimensions of harvesting methods,
- Appraise** multidisciplinary forest management strategies for their usability in the relevant forest area,
- Evaluate and manage** existing road networks,
- Appraise** cable yarding projects and recommend necessary dimensions of units used for future projects.

Learning outcome courses Module - Forest Engineering

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Harvesting systems for mountainous regions	Describe dimensions within mountain forest harvesting systems, Outline economic, ecologic and human dimensions of harvesting methods	Recognize important aspects of occupational health and safety	Apply important aspects of occupational health and safety during forest harvesting, Relate economic, ecologic and human dimensions to various harvesting methods	Compare various harvesting methods and their economical and ecological effects, Analyse the dimensions within mountain forest harvesting systems	Integrate economical and ecological aspects into forest harvesting plans	Evaluate economic, ecologic and human dimensions of harvesting methods
Field Camp III – Integrated forest management applications	Describe ecological, economical, technical and participative actions for forest management in mountainous regions	Distinguish and explain different forest management actions based on ecological, economical, technical and participative methods	Illustrate and apply different forest management actions based on ecological, economical, technical and participative methods	Integrate ecological, economical, technical and participative methods into forest management	Compose and design situation related forest management strategies incorporating multidisciplinary aspects	Appraise multidisciplinary forest management strategies for their usability in the relevant forest area
Road network planning	Describe modern planning and evaluation methods for road network planning	Identify state of the art planning methods for modern road construction	Apply road network planning networks for decision making	Appraise existing road networks for optimization, and maintenance needs	Design road networks and prepare for construction work	Evaluate and manage existing road networks
Cable yarding project	List machine elements and units used for cable yarding projects	Explain dimensions of units used in different cable yarding projects	Apply knowledge on dimensions to calculation of cable yarding project	Analys on-site situation for cable yarding projects	Design a cable yarding project, Organise the implementation of a cable yarding project	Appraise cable yarding projects, Evaluate on-site findings and recommend necessary dimensions of units used in different projects

§ 5 ELECTIVE COURSES

Elective courses worth a total of 20 ECTS credits are required to complete the master's programme. 10 ECTS credits have to be chosen out of the elective courses pool of **1 Module** for specialisation. The **remaining 10 ECTS credits** have to be taken out of the elective courses pool **of at least 2 Modules**.

Elective courses can be chosen from the following Modules for specialisation:

MODULE – Ecology of Mountain Forests

Elective courses	Type	SWS	ECTS
Biodiversity and conservation of mountain forests	VS	1	2
Effects of air pollutants and nutrient deficiencies on mountain forests	VS	2	3
Chemistry for forestry	VO	1	1
Specific methods on soil analysis	UE	1	1
Physical and selected chemical methods of soil analysis	PR	3	4,5
Forest and water	VS	2	3

Learning outcome Module – Ecology of Mountain Forests (specialisation):

Knowledge

- Describe** diversity concepts, evolutionary basis of diversity, and assessment and monitoring of biodiversity,
Recall methods of spectroscopy and chromatography and analytical methods of soil research,
Outline regional and global hydrological balance and causes and effects of air pollution.

Comprehension

- Describe** methods for managing biodiversity and factors determining species richness,
Describe disease caused by air pollution and nutrient deficiencies of plants,
Explain procedures used for physical and chemical soil analysis in the field and laboratory,
Explain hydrological balance in forests and forest stands in mountain regions.

Application

- Apply** knowledge on driving factors of species diversity to forest management and conservation strategies,
Define nutrient deficiencies, critical levels, critical loads and legislation,
Apply physical and chemical soil analysis methods in the field and laboratory,
Relate components of water balance to forest management and forest stand dynamics.

Analysis

- Analyse** biodiversity in forest ecosystems and consequences of different nature conservation approaches,
Differentiate importance, frequency, long-time effects, toxic consequences and symptom of various air pollutants,
Analyse and **appraise** results gained from physical and chemical soil analysis in the field and laboratory,
Examine forest management strategies on their impact on water balance.

Synthesis

- Integrate** species richness and habitat diversity into forest in forest management and conservation strategies,
Relate pollution sources, symptoms of air pollution disease and possible reductions,
Explain chemical and biochemical processes occurring in forest environments,
Argue results gained from physical and chemical soil analysis in the field and laboratory,
Revise factors influencing soil conditions, water quality and yield,
Identify indicators for soil and water quality degradation due to forest management.

Evaluation

- Assess** diversity indicators and different nature conservation approaches,
Appraise air pollutions and diminishing actions for air pollution disease,
Interpret results gained from physical and chemical soil analysis in the field and laboratory,
Decide on forest management strategies for soil condition, water quality and water yield enhancement.

Learning outcome elective courses Module – Ecology of Mountain Forests (specialisation)

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Biodiversity and conservation of mountain forests	Describe diversity concepts from molecular diversity to species diversity, Describe methods for assessment and monitoring of biodiversity, Describe the evolutionary basis of diversity	Recognize factors determining species richness, Describe the convention on biological diversity, Describe methods for managing biodiversity	Apply knowledge on driving factors of species diversity to forest management and conservation strategies	Analyse biodiversity in different forest ecosystems Analyse the consequences of different nature conservation approaches in different countries	Integrate examples of species richness and habitat diversity in forest in forest management and conservation strategies	Assess values and limits of using plant species diversity as indicator of overall diversity. Evaluate different nature conservation approaches in different countries
Effects of air pollutants and nutrient deficiencies on mountain forests	List air pollution effects on mountain forests, List air pollutants caused by natural and anthropogenic sources	Describe symptoms and biology of disease caused by air pollution, Explain nutrient deficiencies of plants	Identify symptoms of air pollution, Examine possibilities of reduction and monitoring systems of air pollution, Define nutrient deficiencies, critical levels, critical loads and legislation	Differentiate various air pollutants and their importance, frequency, long-time effects and toxic consequences on forest ecosystems, Associate symptoms of diseases with air pollutants causing them	Relate symptoms of air pollution disease to pollution sources and formulate possible reductions for the given pollution source	Appraise air pollutions in mountainous regions, Decide on necessary actions to diminish disease due to air pollution on forest vegetation
Chemistry for forestry	Recall basic tools of chemistry (atoms and molecules, compounds, bonding systems, chemical reactions, reaction in aqueous solution, stoichiometry, thermochemistry)	Identify chemical reactions occurring in our daily life, Describe chemical and biochemical processes in nature, Describe safe handling procedures for chemicals used in forestry	Illustrate natural chemical and biochemical processes, Manipulate chemicals according to safe handling procedures to processes	Appraise the effects of chemical and biochemical processes in nature	Explain chemical and biochemical processes occurring in forest environments,	Assess the importance of chemical and biochemical processes in nature
Specific methods on soil analysis	Recall analytical methods of soil research, Describe methods of spectroscopy and chromatography	Explain analytical soil research methods	Employ analytical soil research methods in the laboratory, Apply methods of spectroscopy and chromatography	Analyse results gained from analytical soil research methods	Explain results gained from analytical soil research methods	Interpret results gained from analytical soil research methods
Physical and selected chemical methods of soil analysis	Recall physical and chemical analytical methods for soil analysis in the field and laboratory	Explain procedures used for physical and chemical soil analysis in the field and laboratory	Apply physical and chemical soil analysis methods in the field and laboratory	Analyse and appraise results gained from physical and chemical soil analysis in the field and laboratory	Argue results gained from physical and chemical soil analysis in the field and laboratory	Interpret results gained from physical and chemical soil analysis in the field and laboratory
Forest and water	Recall physical and chemical characteristics of water, Outline regional and global hydrological balance	Explain hydrological balance within mountain regions on the example of the Alpine region,	Calculate the water balance of forest stands, Relate components of water balance to forest manage-	Analyse the influence of tree species selection to water balance, Examine forest manage-	Revise forest management practices and tree species selection according to their influence on	Evaluate forest management practices according to their impact on soil condition, water quality

		Illustrate hydrology of forests and within forest stands	ment and forest stand dynamics	ment strategies on their impact on water balance (qualitative and quantitative)	soil condition, water quality and water yield, Identify indicators for soil and water quality degradation due to forest management	and water yield, Decide on alternative forest management strategies for soil condition, water quality and water yield enhancement
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MODULE - Economic and social dimensions in mountain forestry

Elective courses	Type	SWS	ECTS
Economics of multiple use forestry	VS	1	1,5
Innovations for Sustainable Forest Management	VS	3	4
Applied development research I	VS	2	3
Applied development research II	VS	2	3
Organisational behaviour and gender issues	VU	2	3
Forest products, marketing and strategy	SE	2	3

Learning outcome Module – Economic and social dimensions in mountain forestry (specialisation):

Knowledge

Describe methods of multiple-use forestry analysis, determinants of innovations in the forest sector, identify strength and weaknesses of different kinds of decision making processes; identify marketing measures; and define paradigms, principles and standards for development research.

Comprehension

Explain economic methods for dealing with multiple-use issues; understand rationales of innovation policies and processes in the forest sectors, and marketing strategies,
Comprehend different approaches of research for development, in particular with regards to poverty reduction and food security,
Recognise societal and organizational structures which limit women's opportunities in organizational contexts.

Application

Assess options for economically optimizing multiple-use forest management; demonstrate innovations systems' functioning based on case studies; and conceptualize marketing strategies,
Organise effective group work with applications of appropriate techniques; translate relevant research ideas into concept notes,
Apply standards of research for development in a research proposal.

Analysis

Analyse the interrelations of multiple forest uses and services, the role of actors and institutions in innovation processes, and forest products marketing strategies,
Identify conflicts due to poor communication and other sources of conflict,
Integrate and **discuss** different disciplinary and interdisciplinary approaches to research for development.

Synthesis

Integrate methodological, conceptual and problem- knowledge for analyzing multiple-use forest management, success and failure of innovation processes and for the development of forest products marketing plans,
Explain how perceptions, stereotyping and selective attention affect work effectiveness; develop a contextualized proposal for research for development,
Organise a small multi-stakeholder knowledge exchange mechanism.

Evaluation

Economically evaluate multiple-use forest management; assess innovation policies and processes; and evaluate forest products marketing strategies,
Defend and critically **assess** proposals for research for development,
Appraise communication practices and judge your abilities to organize and implement interdisciplinary knowledge exchange and learning mechanisms.

Learning outcome elective courses Module – Economic and social dimensions in mountain forestry (specialisation)

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Economics of multiple use forestry	Describe interrelationships of various forest uses, Describe different ways of analyzing of multiple use forestry at business and national level	Explain methods for dealing with multiple-use issues such as trade-off-analysis and benefit-cost analysis	Assess optimization of multiple use forestry at business and policy level	Analyze multiple forest use interactions	Relate problems and knowledge to instruments regarding the economic analysis of multiple use forestry	Judge multiple forestry use according to economic analysis instruments
Innovations for sustainable forest management	Define innovation, List determinants for innovation in forestry and the forest sector	Understand innovation policies and innovation processes in forestry and the forest sector	Demonstrate innovation systems and processes in case studies of innovation projects	Analyse the roles of actors and institutions in innovation processes in forestry and the forest sector	Explain success factors and impediments to innovation in forestry and the forest sector	Assess innovation policies, processes and their outcome, Derive recommendations for actors in order to support innovation
Applied development research I	Define standards for disciplinary development research that contributes to international development goals, List development research paradigms, principles and practices	Describe different disciplinary approaches to "research for development"	Apply standards for disciplinary development research that contributes to international development goals to your own research proposal, Translate relevant development research ideas into concept notes	Integrate different disciplinary approaches into 'research for development', Analyse factors making for a contribution of research for development to improved livelihoods of rural poor, Debate different disciplinary and interdisciplinary research approaches in 'research for development'	Develop a research proposal in development research that contributes to international development goals, Contextualise development research ideas	Defend your research proposal, Evaluate different proposals in research for development'
Applied development research II	Define multi-stakeholder knowledge sharing mechanisms in research for development	Describe how research findings support poverty reduction and food security	Bridge disciplinary boundaries, Moderate interdisciplinary learning and knowledge exchange processes	Analyse needs for bridging disciplinary boundaries, Debate needs for interdisciplinary learning and knowledge exchange	Organise a small scientific conference as a multi-stakeholder knowledge sharing mechanism, Relate disciplinary research findings and insights to the national / global development discourse, Relate research with practice in management of natural resources	Evaluate one's own ability to conceptualise, organise and moderate interdisciplinary learning and knowledge exchange
Organisational behaviour and gender issues	Describe several mechanisms through which human perception leads to bias, Identify strengths and weaknesses of analytical vs. creative decision making processes	Recognize a range of societal and organizational structures which limit women's career opportunities	Organise effective group work, Select appropriate techniques for reaching an agreement and visualizing the results	Identify conflict which originates from poor communication practices and distinguish it from other sources of conflict	Explain how processes such as perceptual distortions, stereotyping and selective attention can affect work effectiveness	Appraise communication practices and formulate recommendations for supportive communication
Forest products, marketing and strategy	Identify marketing measures	Describe and explain marketing tools	Conceptualize marketing strategies	Analyze forest products marketing strategies	Set up a forest products marketing plan	Evaluate forest products marketing concepts

MODULE - Inventory and Monitoring

Elective courses	Type	SWS	ECTS
Remote sensing and GIS in natural resource management	VO	2	3
3P - Sampling	VS	1,5	2

Learning outcome Module – Inventory and Monitoring (specialisation):**Knowledge**

Recall basics of the process of remote sensing and spatial information systems,
Outline 3P sampling methods and parameters for forest stocking.

Comprehension

Describe the use of remote sensing for data acquisition about the environment,
Explain methods for forest inventory and the use of 3-P sampling.

Application

Employ GIS modelling of environmental processes and visualisation techniques,
Develop 3 P-sample plans for forest management districts,
Construct needle and branch mass measurement plans for individual trees.

Analysis

Appraise the use of GIS modelling of environmental processes and visualization techniques,
Analyse data gathered during 3-P sampling.

Synthesis

Plan a GIS modelling project using forest inventory data,
Integrate 3P-sampling data into forest management plans.

Evaluation

Evaluate the remote sensing data for the data acquisition about the environment,
Interpret 3P-sampling data for forest management use and adaptation.

Learning outcome elective courses Module – Inventory and Monitoring (specialisation)

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Remote sensing and GIS in natural resource management	Recall basics of the process of remote sensing (including aerial photography), Describe the fundamentals of spatial information systems	Describe the use of remote sensing for data acquisition about the environment	Employ GIS modelling of environmental processes and visualisation techniques (independent of any particular hardware or software)	Appraise the use of GIS modelling of environmental processes and visualization techniques for different environments	Plan a GIS modelling project using visualization techniques	Evaluate the remote sensing data for the use of data acquisition about the environment
3P - Sampling	Outline 3P sampling methods, Identify parameters for forest stocking	Explain methods used in 3-P sampling, Explain inventory methods for forest management	Develop 3 P-sample plans for forest management districts, Construct needle and branch mass measurement plans for individual trees	Analyse data gathered during 3-P sampling	Integrate 3P-sampling data into forest management plans	Interpret 3P-sampling data for forest management use and adaptation

MODULE - Forest Management for goods and environmental services

Elective courses	Type	SWS	ECTS
Protection and mitigation measures against natural hazards	VX	2	3
Risk management and vulnerability assessment	VS	2	3
Mountain hazard processes	VS	3	4,5
Decision support systems	VS	2	3
Multiple criteria decision making in natural resource management	VS	2	3
Fire management in mountain forest ecosystems	VS	1.5	2
Adapting forest management to climate change	VS	1.5	2
Natural resources management in mountainous areas III - Wildlife problems	VS	1,5	2

Learning outcome Module - Forest Management for goods and environmental services (specialisation):

Knowledge

- Recall** natural disasters, methods for risk analysis and assessment and mitigating measures for object protection,
- Outline** hydrologic and geomorphologic processes,
- List** multiple criteria planning methods (MCDM),
- Recall** managerial decision making and information systems and their characteristics,
- Identify** fire ecosystems and adaptations of flora and fauna,
- Recognise** controversial valuation of bird and mammal wildlife and influencing factors on wildlife abundance and survival.

Comprehension

- Associate** natural disasters with mitigating measures for object protection,
- Explain** the influence of forest and vegetation on disaster processes,
- Discuss** strengths and weaknesses of decision making processes and alternative MCDM-methods,
- Identify** Decision Support System develop tools, models and approaches
- Discriminate** co-evolution vs./plus anthropogenic inputs in fire-ecosystems,
- Discriminate** factors effecting wildlife in natural ecosystems and cultural landscapes.

Application

- Apply** risk analysis and assessments, assess potential impact zones and active and develop passive countermeasures for natural disaster control
- Choose** appropriate decision making supports and MCDM-methods in natural resource management,
- Assess** requirements for decision support and other executive work types and levels,
- Assess** the use of fire for cultivation, protection, and control,
- Prepare** management strategies incorporating ecological factors, anthropogenic influence and the needs of wildlife.

Analysis

- Investigate** countermeasures against and usability for individual natural disasters,
- Compare** decision making approaches and MCDM-methods in natural resource management,
- Appraise** management models for Decision Support Systems,
- Contrast** different methods to use fire for cultivation, protection, and control,
- Appraise** management strategies for wildfire to prevent conflicts with land use and management.

Synthesis

- Design** risk analysis and assessment and countermeasures against natural hazards,
- Integrate** MCDM-methods and decision support systems in natural resource management,
- Establish** expert systems applications in forest management,
- Develop** wildfire management strategies incorporating ecological aspects, land use and land management,
- Design** wildlife management strategies incorporating ecological factors, anthropogenic influence.

Evaluation

- Evaluate** state of the art counter measures for object protection in mountainous countries,
- Compare** decision support and MCDM-methods in natural resource management,
- Evaluate** Artificial Intelligent Decision Support Systems,
- Evaluate** management strategies of terrestrial ecosystems using fire as a tool for ecological land use and management,
- Critical** assess existing wildlife management strategies and argue on possible solutions to ongoing problems.

Learning outcome elective courses Module - Forest Management for goods and environmental services (specialisation)

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Protection and mitigation measures against natural hazards	Recall various natural disasters, Identify mitigating measures for object protection	Associate natural disasters with mitigating measures for object protection	Develop active and passive countermeasures to natural disasters	Debate various active and passive countermeasures and their usability for individual natural disasters	Plan countermeasures against flood, torrential hazards, avalanches, and rock fall	Appraise state of the art counter measures for object protection in mountainous countries
Risk management and vulnerability assessment	Identify methods for risk analysis and assessment methods applied to natural hazards	Contrast risk assessment approaches related to other hazards	Apply risk analysis and assessment to example studies	Distinguish vulnerability, risk perception and evaluation, tolerable risk levels, concepts of mitigation measures, preparedness and disaster management	Design risk analysis and assessment for example studies	Evaluate outcome of risk analysis and assessment of example studies
Mountain hazard processes	Identify natural disasters in alpine regions, Outline hydrologic and geomorphologic processes in mountain catchments	Describe methods for the quantification of disaster processes, Explain the influence of forest and vegetation on disaster processes	Assess the potential impact zones of natural mountain disasters	Outline rainfall-runoff process and flood events, erosion, sediment transport, debris flows, shallow landslides, rock fall, and snow avalanches	Argue the importance of alpine natural hazards on landscape evolution	Describe risk assessment of certain natural mountain disaster processes
Decision Support Systems	Recall the conceptual foundations of decision support systems; List relevant DSS according to taxonomy.	Explain the specific problems of developing a DSS tool for a given decision problem.	Assess the purpose, relevance and applicability of existing DSS tools for a given decision problem.	Outline and examine information needs and requirements for DSS development and application	Design the conceptual framework for a DSS for a given decision problem;	Evaluate and justify the applicability of methods, tools and models for a given DSS tool.
Multiple criteria decision making in natural resource management	List multiple criteria planning methods (MCDM)	Discuss strengths and weaknesses of alternative MCDM-methods	Choose appropriate MCDM-methods in natural resource management	Compare MCDM-methods in natural resource management for training examples	Formulate MCDM-methods in natural resource management for training examples	Appraise MCDM-methods in natural resource management for given situations
Fire management in mountain forest ecosystem	Describe the dimension of forest fires worldwide and in mountain regions, Identify fire ecosystems and the adaptations of flora and fauna to periodic fires	Differentiate wild land fire types and fires at the urban-wild land interface, Discriminate co-evolution vs./plus anthropogenic inputs in fire-ecosystems, Distinguish fire behaviour, fighting, and management	Assess the use of fire for cultivation, protection, and control in Central Europe, Eurasia, Australia, North America and Africa, Assess land use and land management strategies according to their conflict potentials with wild fires	Contrast different methods to use fire for cultivation, protection, and control, Analyse the influence of fire comparing clear-cutting and wind throws, Appraise management strategies for wildfire to prevent conflicts with land use and management	Develop wildfire management strategies for a particular area incorporating ecological aspects, land use and land management	Appraise knowledge gaps in fire ecology and fire behaviour, Evaluate management strategies of terrestrial ecosystems using fire as a tool according to ecological, land use and management aspects

Adapting Forest Management to Climate Change	Recognise adaptive measures in forest management	Discuss approaches of adaptive management	Apply adaptive management processes and demonstrate for case study examples the design of adaptation strategies	Examine management strategies regarding to vulnerability of ecosystem services and analyse potential adaptive measures	Develop adaptive management strategies for multiple service situations	Evaluate different alternative adaptive options, propose action and justify your choice
Natural resources management in mountainous areas III - Wildlife problems	Recognise controversial valuation of bird and mammal wildlife in mountain regions, Identify influencing factors on wildlife abundance and survival	Discriminate factors effecting wildlife in natural ecosystems but also cultural landscapes with developmental intentions	Relate needs of wildlife to ecological factors and human attitudes and acceptance levels	Determine management strategies incorporating the ecological factors, anthropogenic influence and the needs of wildlife	Design management strategies incorporating the ecological factors, anthropogenic influence and the needs of wildlife	Critical assess existing wildlife management strategies and argue on possible solutions to ongoing problems

MODULE - Forest Engineering

Elective courses	Type	SWS	ECTS
Technology assessment	VS	2	3
CAD - Computer aided design	VU	1	1
Timber harvesting	EX	1	1

Learning outcome Module - Forest Engineering (specialisation):**Knowledge**

- Describe** methods and terms of technology assessment,
Recall harvesting machines used for forest timber harvesting,
Describe basic CAD practices for engineering design and drawing.

Comprehension

- Illustrate** multi-criteria decision-making processes and life cycle analysis,
Describe relations between silvicultural and harvesting systems,
Illustrate examples of forest engineering designs.

Application

- Employ** technologies with regard to methods of technology assessment
Create 2D sketches and parts using CAD software.

Analysis

- Analyse** impacts of new technologies on a economical, ecological and social scale,
Analyze and determine analogue and digital drawings.

Synthesis

- Develop** technology assessment and environmental impact assessment projects,
Identify harvesting technologies for use in mountain areas,
Devise drawings to foster forest management activities.

Evaluation

- Evaluate** harvesting technologies according to technology assessment methods,
Conclude possible adaptations of harvesting technologies to silvicultural systems in mountain areas,
Assess the quality and accuracy of analogue and digital drawings for further processing.

Learning outcome elective courses Module - Forest Engineering

courses	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
<i>Technology assessment</i>	Definition of the term technology assessment, Describe methods of Technology Assessment	Illustrate Multi-criteria decision-making processes, Explain Life Cycle Analysis	Employ project, technology and problem in a TA study, Discover and apply new technologies with regard to methods of technology assessment	Analyse impacts of the introduction of new technologies on a economical, ecological and social scale	Develop and present a technology assessment project, Design Environmental Impact assessments	Evaluate new technologies with regard to methods of technology assessment
<i>Timber harvesting</i>	Recall harvesting machines used for forest timber harvesting	Describe the relations between silvicultural systems and harvesting	Show how harvesting machines are used in various silvicultural systems	Appraise the use of harvesting machines in mountain areas	Design the use of harvesting technologies for different silvicultural systems used in mountain areas	Evaluate used harvesting technologies, Conclude on possible adaptations of harvesting technologies to different silvicultural systems used in mountain areas
<i>CAD - Computer aided design</i>	Describe the design process and basic CAD practices for engineering design and drawing	Solve examples of forest engineering designs	Create 2D sketches and parts using CAD software	Analyze and determine analogue and digital drawings	Devise drawings to foster forest management activities	Assess the quality and accuracy of analogue and digital drawings for further processing

§ 6 FREE ELECTIVES

Free electives worth a total of 10 ECTS credits are required to complete the master's programme. Free electives may be selected from all courses offered by all recognized universities in Austria and abroad. Free electives are intended to impart knowledge and skills in the student's own academic subject as well as in fields of general interest.

§ 7 MASTER'S THESIS

A master's thesis is a paper on a scientific topic, to be written as part of a master's degree programme (*for exceptions please see the By Laws (Satzung) of the University of Natural Resources and Life Sciences, Vienna, part III- Teaching, § 30[9]*). The thesis is worth a total of 30 ECTS credits. With their master's theses, students demonstrate their ability to independently address a scientific topic, both thematically and methodologically (§ 51 [8] UG 2002 BGBl. I no. 81/2009).

The topic of a master's thesis shall be chosen in such a way that it is reasonable to expect a student to be able to complete it within six months. Multiple students may jointly address a topic, provided that the performance of individual students can be assessed (§ 81 [2] UG 2002 BGBl. I no. 81/2009).

The master's thesis shall be written in English. Languages other than English are permissible only if approved and confirmed by the thesis supervisor. The thesis defence must be held in English.

§ 8 COMPLETION OF THE MASTER'S PROGRAMME

The Master's Programme in Mountain Forestry has been completed when the student has passed all required courses and received a positive grade on the master's thesis and defence examination.

§ 9 ACADEMIC DEGREE

Graduates of the Master's Programme in Mountain Forestry are awarded the academic title Master of Science, abbreviated as MSc or M.Sc. The academic title MSc (M.Sc), if used, shall follow the bearer's name (§ 88 [2] UG 2002 BGBl. I no. 81/2009).

§ 10 EXAMINATION REGULATIONS

(1) The Master's Programme in Mountain Forestry has been completed successfully when the following requirements (corresponds to components in [7] below) have been met:

- positive completion of the compulsory courses worth a total of 58 ECTS credits (§ 4),
- positive completion of elective courses worth a total of 20 ECTS credits (§ 5),
- positive completion of free electives worth a total of 10 ECTS credits (§ 6),
- positive completion of the master seminar (§ 4) of 2 ECTS credits,
- a positive grade on the master's thesis and the defence examination.

(2) Student evaluation takes the form of course and module examinations. Course examinations can be either written or oral, as determined by the course instructor, taking the ECTS credit value of the course into account. Any prerequisites for admission to examinations shall be listed in § 4 under the respective course/module.

(3) The choice of examination method shall be based on the type of course: Courses shall conclude with a written or oral examination, if continuous assessment of student performance is not applied. Seminars (SE) and project-based courses (PJ) can be evaluated based on independently written papers, length and contents of which are determined by the course instructor. For all other course types, the examination type is at the instructor's discretion.

(5) The topic of the master's thesis shall be selected from one of the subjects of the master's programme.

(6) After the successful completion of all the courses and examinations required in the Master's Programme, the completed master's thesis, after it has been given a positive evaluation by the thesis supervisor, shall be publically presented by the student and defended in the form of an academic discussion (defence examination). The examination committee shall consist of a committee chair, a first examiner and a second examiner. The student's total performance (thesis and defence examination) will be assigned a comprehensive grade. Both thesis and defence examination must receive a passing grade for the student to complete the programme. The written evaluations stating the rationale for the thesis grade and the defence examination grade are included in calculating the comprehensive grade and are documented separately.

The comprehensive grade is calculated as follows:

- Master's thesis: 70%
- Defence examination (incl. presentation): 30%

(7) A comprehensive evaluation of the student's performance on the entire programme shall be assigned. A comprehensive evaluation of "passed" means that each individual component of the programme was completed successfully. If individual components of the programme have not been successfully completed, the comprehensive evaluation is "failed". A comprehensive evaluation of "passed with honours" is granted if the student has received no grade worse than a 2 (good) on all individual components, and if at least 50% of the individual components were graded with 1 (excellent).

§ 11 TRANSITIONAL PROVISIONS

For students continuing their studies under the provisions of the previously valid curriculum, the list of equivalent courses (Äquivalenzliste) pursuant to a resolution of the Academic Programme Committee (Studienkommission) applies. This list includes all courses that correspond to courses offered in the previously valid curriculum.

For students who switch to the new master's programme curriculum, examinations for courses taken under the provisions of the previously valid curriculum shall be recognized towards the new programme under the provisions of this curriculum based on the list of equivalent courses.

§ 12 EFFECTIVE DATE

This curriculum shall take effect on 1.10.2013

ANNEX A TYPES OF COURSES

The following types of courses are available:

(Please only offer course types included in this list from now on.)

Lecture (VO)

Lectures are courses in which certain areas of a subject and the methods used in this area are imparted through didactic presentation.

Exercise course (UE)

Exercise courses are courses in which students are instructed in specific practical skills, based on theoretical knowledge.

Practical course (PR)

Practical courses are classes in which students deal with specific topics independently, based on previously acquired theoretical and practical knowledge.

Compulsory internship seminar (PP)

The compulsory internship seminar is a class in which students deal independently with topics related to their internship placements, based on previously acquired theoretical and practical knowledge.

Seminar (SE)

Seminars are courses in which students are required to work independently on the respective subject, deepen their knowledge of the topic and discuss relevant issues.

Field trips (EX)

Field trips are courses in which students have the opportunity to experience relevant fields of study in real-life practical application, to deepen their knowledge of the respective subject. Field trips can be taken to destinations both in Austria and abroad.

Master thesis seminar (MA)

Master thesis seminars are seminars intended to provide students with academic support during the thesis writing process.

Mixed-type courses:

Mixed-type courses combine the characteristics of the courses named above (with the exception of project-type courses). Integration of different course-type elements improved the didactic value of these courses.

Lecture and seminar (VS)

Lecture and exercise (VU)

Lecture and field trip (VX)

Project course (PJ)

Project courses are characterized by problem-based learning. Under instruction, students work - preferably in small groups - on case studies, applying appropriate scientific methods.

Seminar and field trip (SX)

Exercise and seminar (US)

Exercise and field trip (UX)