Universität für Bodenkultur Wien

University of Natural Resources and Life Sciences, Vienna

Curriculum

for the Master's Programme in

Mountain Forestry

Programme classification no. 066 429

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Contents

§ 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 in 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 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 are able to describe analytical tools for assessing and monitoring resources in mountain forests. 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 describe different management strategies and silvicultural measures applied in mountainous regions.	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 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 identify suitable methods for resource inventories and monitoring. 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 list and classify management strategies for mountain forests for the sustainable provision of ecosystem services leading to improved livelihood of forest users. Master's Programme in Mountain Forestry students are able to discuss management aspects supporting the income generation of land users in mountainous areas.	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 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 apply appropriate tools and methods to support decision making in natural resource management. 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 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 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 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 appraise the effects of management and conservation strategies on income of local land users.	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 integrate multiple stakeholder interests and develop suitable management strategies for improving the livelihood of forest users. 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 assess effects of management and conservation strategies on ecological and economical characteristics. 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 asses 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.

§ 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,
- Biometrics,
- 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 *(excl. Master seminar)*
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 <u>all compulsory courses of all 6 Modules</u> 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

<u>Learning outcome Module – Introduction to mountain forestry and scientific skills:</u>

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

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 Resource Economics	**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 form 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 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 us-ability 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 used 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 impor-	**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

		factors leading to forest health problems	tance of pests, pathogens and abiotic damaging factors in forest management and conservation			high altitudes and plantation forests

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	**Analyse** 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 t**he 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

MODULE - Economic and social dimensions in mountain forestry

Elective courses	Type	SWS	ECTS
Economics of multiple use forestry	VS	1	1,5
Innovations for SFM	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
Technology assessment	**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
Timber harvesting	**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
CAD - Computer aided design	**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 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 (the student's thesis supervisor) 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 (Annex B).

§ 12 EFFECTIVE DATE

This curriculum shall take effect on 1.10.2012

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)