Georg-August-Universität
Göttingen

Modulverzeichnis

Bachelor's degree programme "Molecular Ecosystem Sciences"

Module

Übersicht nach Modulgruppen

I. Bachelor's degree programme "Molecular Ecosystem Sciences"

To successfully complete the Bachelor's degree programme, a total of 180 C must be earned.

1. Compulsory Modules in the field of Molecular Ecosystem Sciences

The 18 following modules comprising 114 Credits must be successfully completed.

2. Professionalisation

A total of 54 C have to be earned according to the following regulations.

a. Key competencies

The 4 following modules comprising 24 C must be successfully completed.

b. Elective modules

A minumum of 5 modules mentioned below comprising at least 30 C must be successfully completed. Modules mentioned below may be substituted with alternative modules according to regulation 2 paragraph 4 of the examination regulations for this degree programme. Save sentence 2, one module may be substituted with any module regarding key competencies in the sense of Regulation 8 a of the General Examination Regulations comprising at least 6 C.

3. Bachelor's thesis

A total of 12 C are awarded for successfully completing the Bachelor's thesis.

Georg-August-Universität Göttingen **Module B.MES-SK.1105: Laboratory techniques**	6 C 4 WLH

Learning outcome, core skills: Students will train to work in a laboratory and they will learn the rules to assure personal and environmental safety. They will be introduced into basic and sophisticated methods in the fields of chemistry, biochemistry, soil science, microbiology and molecular biology. Students acquire knowledge in experimental planning, technical performance, data processing, calculation, data interpretation and documentation of practical scientific research. Writing of protocols will be practiced.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Organic trace analysis (Laboratory course, Exercises)	2 WLH
2. Inorganic analysis (Seminar, laboratory course, Exercises)	1 WLH
3. Microbiology and molecular biology (Laboratory course)	1 WLH
Examination: Protocol (max. 10 pages, 50%) and written exam (45 minutes, 50%) **Examination prerequisites:** Regular attendance and active participation	6 C

Examination requirements: Personal and environmental safety, handling and preparation of samples, calibration and use of standards, chromatographic methods, design, performance and documentation of chemical, microbial, and molecular experiments, assessment of results, team work to resolve experimental problems.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Stefan Schütz
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES-SK.1108: Computer science and mathematics**	6 C 4 WLH

Learning outcome, core skills: Understanding of basic notions and methods of computer science and mathematics, including: representation of information, databases, the World Wide Web, foundations of programming, simulation, visualization; notations from logic and set theory, relations, graphs, functions, differentiation, extreme values, integration; vectors, linear transformations, matrices, eigenvalues; scale levels of variables, measures of location, dispersion and correlation, linear regression, probability, sampling, confidence intervals, fundamentals about statistical testing.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Computer science and mathematics (Lecture, Exercise)	4 WLH
Examination: Written exam (90 minutes)	6 C

Examination requirements: Understanding of basic notions and methods of computer science and mathematics, including: databases, WWW, foundations of programming, simulation, visualization; graphs, functions, differentiation, extreme values, integration; vectors, linear algebra; descriptive statistics, linear regression, probability, sampling, simple tests.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES-SK.1115: Biostatistics**	6 C 4 WLH

Learning outcome, core skills: The module will provide the students with a basic understanding of descriptive, exploratory and confirmatory statistics to enable them to understand statistical details in scientific publications, apply statistical methods to their own data and to interpret results from statistical analyses. The lecture will cover descriptive and exploratory graphical tools and measures as well as the fundamental principles of confirmatory statistics (statistical point estimates, confidence intervals, statistical tests). Furthermore, it will briefly discuss the concepts of statistical predictions and model choice. In addition to the methodological concepts, the lecture will also comprise an introduction to the R language for statistical computing.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Introduction to biostatistics (Lecture)	2 WLH
2. Applied biostatistics with R (Exercise)	2 WLH
Examination: Term paper (max. 10 pages) **Examination prerequisites:** Regular and active participation during the exercise and regular submission (80%) of assignments (1 page each)	6 C

Examination requirements: The students demonstrate their ability to understand, apply and interpret statistical methodology in a statistical analysis. In the exercises, they will solve both theoretical and applied problems while for the term paper they will independently conduct their own statistical analysis and document the corresponding results.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Thomas Kneib
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1101: Plant physiology**	6 C 4 WLH

Learning outcome, core skills: In this course the students will learn how a plant functions at the cell, tissue and whole-plant level. The contents of the lectures encompass basic cell biology and plant physiology (nutrient uptake, and transport process, photosynthesis, respiration, plant hormones, development and stress adaptation). In the practical courses students will be trained at modern microscopes, will lean the basics of tissue culture, and will obtain practical expertise with the use of ecophysiological methods such as measurements of photosynthesis, fluorescence, water potentials etc.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Molecular plant physiology (Lecture)	2 WLH
2. Cell biology, tissue culture and stress responses (Practical course)	2 WLH
Examination: Written exam (120 minutes)	6 C

Examination requirements: Cell compartments and organelles, their structure and function, membrane transport, molecular principles of photosynthesis and respiration, molecular functioning of plant hormones in plant development and stress adaptation, tree biotechnology. Skills: solid theoretical foundation in plant physiology and practical skills in tree regeneration and working under sterile conditions.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in biology
Language: English	**Person responsible for module:** Prof. Dr. Andrea Polle
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1102: Chemical ecology**	6 C 4 WLH

Learning outcome, core skills: Students will learn to analyze the molecular basis of plant-insect interactions from the plant and from the insect point of view, based on plant volatiles associated to plant stress correlating with defence status and nutritional value of the plant. They learn how information gained by insect antennae is examined to understand the translation of this information into insect behaviour. Students will learn to assess how sensor-systems on the basis of insect olfaction can be utilized and how chemo-ecological findings can be extended into landscape by an integrative examination of biotic interactions from the molecular to the stand level. This will be the basis for understanding the role of semiochemical diversity in adaptation toward global change and for ecosystem functions and services.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Chemical ecology (Lecture)	1 WLH
2. Exercises in chemical ecology (Laboratory course, Seminar)	3 WLH
Examination: Oral examination (approx. 20 minutes)	6 C

Examination requirements: Biosynthesis of semiochemicals, signaling pathways, perception of semiochemicals, transduction pathways, physiological action and behavioural activity of semiochemicals, syn- and demecological aspects.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Stefan Schütz
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1103: Ecological genetics**	6 C 4 WLH

Learning outcome, core skills: Understanding of the importance of intraspecific (genetic) variation for ecosystem processes and functions, in particular • knowledge of modern methods to assess genetic diversity in diverse groups of organisms • understanding of the role of the evolutionary factors to shape genetic diversity with emphasis on selection • understanding of evolutionary processes including adaptation under natural conditions and in managed ecosystems • understanding of the impact of global change on genetic resources	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Ecological genetics (Lecture)	2 WLH
2. Assessment of genetic variation (Laboratory course, Workshops)	2 WLH
Examination: Oral examination (approx. 20 minutes)	

Examination requirements: Use of modern methods to assess genetic variation in diverse groups of organisms, evolutionary factors and how they shape genetic diversity, the role of adaptation under natural or managed conditions, impact of global change.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Konstantin V. Krutovsky
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1104: Biochemistry**	6 C 4 WLH

Learning outcome, core skills: The objective of this module is to introduce basic knowledge of different classes of biomolecules, including carbohydrates, lipids, proteins and nucleic acids. Students will learn to understand fundamental biochemical reactions as well as the application of biochemical methods. Students will be introduced to the basic in protein chemistry and genetics: DNA, RNA, enzymes, carbohydrates, lipids and cell membranes, metabolism bases and signal transduction. Applications and the context of key biochemical concepts will be introduced with examples from the areas of plant and soil biochemistry.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Soil biochemistry (Lecture, Seminar)	2 WLH
2. Plant biochemistry (Lecture, Seminar)	2 WLH

Examination: Written examination (90 minutes)	6 C

Examination requirements: Basic knowledge of different classes of biomolecules and their metabolism with examples from soil and plant biochemistry. Basic knowledge of biochemical methods and applications.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Oliver Gailing
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1106: Microbiology and molecular biology**	6 C 4 WLH

Learning outcome, core skills: Students will be introduced to molecular, biochemical and physiological aspects in microbiology and molecular biology which is important to Ecosystem Sciences. The acquired knowledge allows the students to address questions and problems in Ecology and Systems Biology on molecular levels and understand the background of modern molecular methods that can be applied to solve such topics.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Microbiology and biotechnology (Lecture)	2 WLH
2. Molecular biology (Lecture)	2 WLH
Examination: Oral examination (approx. 20 minutes)	6 C

Examination requirements: Basic knowledge on genetics, physiology, and ecology of microorganisms (bacteria and fungi), applications of microorganism in biotechnology generally and with specific focus on ecological tasks, structure and functions of DNA, RNA, proteins and exemplified metabolites, basic concepts and techniques in molecular biology, recombinant DNA technology, DNA transfer techniques, handling of GMOs.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Ursula Kües
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1107: Conservation of biodiversity**	6 C 4 WLH

Learning outcome, core skills: The use of molecular methods is commonplace in conservation at various levels of biological organization from genes to ecosystems. Students will examine the results of molecular approaches in biodiversity conservation based on selected projects and recent literature. Students will be able to critically evaluate benefits and limitations of molecular studies in a conservation context. Examples will be taken from different geographic and climatic regions.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Conservation of biodiversity based on molecular tools (Lecture)	1 WLH
2. Assessment of molecular diversity for conservation (Seminar, Workshop)	3 WLH
Examination: Presentation (approx. 15 minutes, 50%) with written outline (5 pages max., 50%)	6 C

Examination requirements: Effective comprehension of scientific literature with regard to conservation of biodiversity, different methods used for conservation of biodiversity and their specific applications, critical evaluation of molecular studies in a conservation context.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Konstantin V. Krutovsky
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1109: Plant ecology and diversity**	6 C 4 WLH

Learning outcome, core skills: Students are familiar with global to regional scale patterns of plant diversity, the distribution of major climatic and vegetation zones (ecozones, biomes), as well as their predominant land uses and anthropogenic impacts. Students are familiar with basic aut- and synecological concepts in plant and vegetation ecology from the level of the individual plant to plant communities. They have learned to distinguish different major plant communities in Central Europe and are familiar with their specific abiotic site conditions, and their conservation significance. Students are able to apply ecological field methods and to perform basic analyses of diversity and community structure.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Plant ecology and diversity (Lecture, Field studies)	4 WLH
Examination: Oral examination (approx. 20 minutes)	6 C

Examination requirements: Distribution and determinants of ecozones and biomes, local to global scale patterns of plant diversity, alpha-beta-gamma diversity, aut-and synecological concepts, plant communities and their relations with abiotic site conditions, basic knowledge about field and analysis methods.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Holger Kreft
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1111: Terrestrial biogeochemistry**	6 C 4 WLH

Learning outcome, core skills: The lecture part on terrestrial biogeochemistry will advance the knowledge of the students on the major biogeochemical processes of C, N and P cycles: the role of the pedosphere as the interface of biosphere, lithosphere, hydrosphere, and atmosphere on these major element cycles; major components of these element cycles in terrestrial ecosystems; anthropogenic influences on these element cycles; techniques of measurements of cycling rates applied in actual field conditions; and comparative biogeochemistry of contrasting ecosystems. The practical part on biogeochemical processes will bring hands-on experience of the students on in-situ measurements of these processes: land-use change effects on stocks of the different pools of C, N and exchangeable cations, asymbiotic N2 fixation in soil, soil greenhouse gas fluxes and their controlling factors. From the data of this field practical, the students will learn statistical analysis on land-use change effects, how to give an oral scientific presentation, and how to write a scientific report.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Terrestrial biogeochemistry (Lecture)	2 WLH
2. Biogeochemical processes (Field measurements and laboratory analysis)	2 WLH
Examination: Written examination (120 minutes, 50%) and term paper (10 pages max., 50%)	6 C

Examination requirements: C, N and P cycles of terrestrial ecosystems, tools for investigating biogeochemical cycling (process rates, element ratios and mass balance), soil biochemical reactions, comparative biogeochemistry, calculations of process rates and turnover time of specific pools of elements, and scientific interpretation of field-measured biogeochemical data.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Edzo Veldkamp
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1112: Wood biology and wood chemistry**	6 C 4 WLH

Learning outcome, core skills: In this module, the students will learn about the biological and chemical structures, modifications of as well as the biomaterials derived from majorly wood and minorly fiber plants. The lectures will be divided into following parts. The first part starts with the biosynthesis and basic structures of wood. Then, the physical, biological and chemical modifications of wood will be described. After that, the extraction of constituents from wood and their properties will be introduced. Finally, the potential applications using all these biomaterials will be described.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Wood biology (Lecture, Exercises, Excursion)	2 WLH
2. Wood chemistry (Lecture, Exercises, Laboratory visits, Excursion)	2 WLH
Examination: Oral examination (approx. 20 minutes)	6 C

Examination requirements: Detailed knowledge and understanding of biological and chemical structure of majorly wood and minorly fiber plants, the physical, biological and chemical modifications, as well as biomaterials derived from wood regarding their chemical and physical properties.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. rer. nat. Kai Zhang
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1113: Methods in systems biology**	6 C 4 WLH

Learning outcome, core skills: "Omics" techniques are the backbone of modern systems biology. This course comprises lectures and practicals in genomics, proteomics, transcriptomics and statistical computing. The students will learn the theory of these applications, and the functioning of the required hard- and software. The students will obtain practical training in selected methods. This involves lab work as well as computer applications. The learning outcome will be that the students are to apply "omics" methods to questions in ecology and systems biology.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Genomics (Lecture, Practicals)	1 WLH
2. Statistical computing and Transcriptomics (Lecture, Practicals)	2 WLH
3. Proteomics (Lecture, practicals)	1 WLH
Examination: Term paper (max. 20 pages)	6 C

Examination requirements: Detailed knowledge and understanding of methods to generate and analyse experiments involving approaches of modern systems biology. This includes a detailed understanding of basic statistical concepts to analyse "omics" data sets as well as skills in laboratory analyses and application of software for proteomic and transcriptomic data analysis. Skills: knowledge how to analyse plant tissues by application of molecular and statistical methods.	

Admission requirements: Successful examination in a minimum of 2 of the following courses: B.MES.1101: Plant physiology, B.MES.1103: Ecological genetics, B.MES.1106: Microbiology and molecular biology, B.MES-SK.1108: Computer science and mathematics.	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Andrea Polle
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1114: Forest Pathology**	6 C 4 WLH

Learning outcome, core skills: Recognition of forest damages and choosing the right control method are the basic skills of a forester. This course provides the student with an understanding of the most important fungal diseases and how they are controlled in forest ecosystem. After this course the student knows the most important abiotic environmental factors affecting forest systems, recognize the most important fungal diseases and understands their impact to forest trees, as well as understands the epidemiology of these diseases. The student also understands other than pathogenic interactions between fungi and forest trees. The course consists of lectures and lab practices.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Basics of forest pathology (Lecture, Lab course)	4 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** Regular submission (80%) of written laboratory reports (1 page)	6 C

Examination requirements: • Knowledge of the most important abiotic environmental factors affecting forest systems • recognize the most important fungal diseases • can choose right control method • understands how different damages affect to individual tree and to forest level • understands the epidemiology of different fungal diseases • understands other than pathogenic interactions between fungi and forest trees • can isolate pathogen from wood material in the laboratory • can use microscope to recognize root rot fungi	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Eeva Terhonen
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1116: Conservation and ecosystem management**	6 C 4 WLH

Learning outcome, core skills: The course imparts knowledge about the sustainable management of forest ecosystems and about nature conservation. Based on some fundamentals of forest ecology such as the impact of competitive interactions between trees, options of stand management are presented. Mixed stands and their management are of special importance. The course will provide information on how to analyze forest stands and how to derive appropriate silvicultural treatments in order to achieve the goals set by a given forest owner. The nature conservation part will introduce priority goals of conservation biology, the major threats to natural ecosystems and how they can be managed.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Forest ecosystem management (Lecture)	2 WLH
2. Nature conservation (Lecture)	2 WLH
Examination: Written exam (120 minutes)	6 C

Examination requirements: Competition in plant communities, plant – environment interactions, mixed stands, principles of stand management, silvicultural systems, human land-use, climate change, biodiversity, ecosystem functioning.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Peter Annighöfer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1117: Ecological climatology**	6 C 4 WLH

Learning outcome, core skills: In this course students will gain insights in the main atmospheric characteristics and how they influence ecosystem processes and fluxes between ecosystem compounds (e.g. air, plants, soil). They will also learn how ecosystems feed back to the atmosphere at local and global scale. This will form the basis for understanding the impact of climate change on ecosystem functions and services. The lecture course will give an overview on atmospheric variables such as radiation, humidity, temperature, and wind and their interactions with terrestrial ecosystems. In the seminar/exercise class, the understanding will be deepened by quantitative exercises. The students will be trained in quantitative and qualitative scientific methods to describe climate-dependent physical, chemical and biological processes in terrestrial ecosystems enabling them to understand and evaluate the current discussion on climate change and its impact on terrestrial ecosystems.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Ecological climatology (Lecture, Seminar, Exercise)	4 WLH
Examination: Written exam (120 minutes)	6 C

Examination requirements: Qualitative and quantitative description of radiation, humidity, temperature, wind, their interactions with terrestrial ecosystems, carbon and water cycle, atmospheric chemistry, climate change, climate modelling.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Alexander Knohl
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1118: Resource assessment in ecosystems**	6 C 4 WLH

Learning outcome, core skills: The students will be trained • to identify different types of resources in terrestrial ecosystems and forests in particular, • how to assess those resources (abundance, quality, etc.), • and how to design and conduct a scientifically sound study that aims at assessing an exemplary resource. The students will acquire knowledge in the fields of: • ecosystem assessment, resource identification • sampling approaches and measurement techniques • statistical analysis and scientific reporting of results	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Resource assessment in ecosystems (Lecture, Laboratory course) *Contents*: The lecture will introduce various types of resources and present differences in their provision by different terrestrial ecosystems. During the lab course the students will plan, conduct and evaluate the assessment of an exemplary resource in a nearby forest.	4 WLH
Examination: Written examination (120 minutes)	6 C

Examination requirements: Knowledge of resource types, definitions, basic statistics (mean, standard deviation, variance, coefficient of variation), sampling designs, data quality control, factors that need to be considered in study planning, basic principles of scientific reporting.	

Admission requirements: B.MES-SK.1105, B.MES-SK.1108	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Dominik Seidel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1119: Ecological modelling**	6 C 4 WLH

Learning outcome, core skills: Comprehensive knowledge of ecological models, theories and concepts. Development of interdisciplinary analytical thinking. Critical analysis and evaluation of the chances and limitations of different modelling approaches.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Ecological modelling (Lecture, Tutorial) *Contents*: Theoretical basics as well as classical and modern models of terrestrial ecology with special consideration of models in microbial ecology. Application and analysis of classic and modern ecological models and concepts.	4 WLH
Examination: Written examination (90 minutes)	6 C

Examination requirements: Comprehensive knowledge of ecological models, theories and concepts. Interdisciplinary analytical thinking skills. Ability to critically analyze and evaluate the chances and limitations of different modelling approaches.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Katrin Mareike Meyer
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1120: Current topics in molecular ecosystem sciences**	6 C 4 WLH

Learning outcome, core skills: The objective of the module is to introduce students to current topics in molecular ecosystem sciences and on-going research of the Faculty of Forest Sciences and Forest Ecology. The students will gain the ability to review actual research findings and learn how to present scientific data. Furthermore, they will practice to defend scientific results in an interdisciplinary discussion. Students will learn to question published research results critically and how to lead a constructive discussion in science. Thereby they practice the ability to discuss and take criticism in particular in interaction with other cultures. The aim is to strengthen analytical thinking and strategic project planning further.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Current topics in molecular ecosystem sciences (Lecture)	1 WLH
2. Literature seminar molecular ecosystem science (Seminar)	3 WLH
Examination: Presentation (approx. 20 minutes) **Examination prerequisites:** Regular and active participation in seminar discussions (80 %)	6 C

Examination requirements: Understanding and questioning of actual research results. The ability to present scientific results and outcomes. Active and critical participation in seminar discussions.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Oliver Gailing
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1121: Global change**	6 C 4 WLH

Learning outcome, core skills: At the end of this course the students are expected to • have insight in the major components of the earth system and how they are connected, • understand how environmental processes and biogeochemical cycles are regulated by biosphere-hydrosphere-atmosphere feedbacks and how they are affected by global chance through natural and anthropogenic processes, • are able to understand and evaluate simple biogeochemical models.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Global change (Lecture, Modelling exercises, Seminar)	4 WLH
Examination: Presentation (approx. 30 minutes, 50%) and written report (max. 10 pages 50%)	6 C

Examination requirements: Successful completion of assignments. After every lab students are given a mandatory homework assignment (though not graded).	

Admission requirements: none	**Recommended previous knowledge:** B.MES.1111, B.MES.1117
Language: English	**Person responsible for module:** Prof. Dr. Edzo Veldkamp
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 6
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1122: Scientific methods and project design**	12 C 8 WLH

Learning outcome, core skills: This B.Sc. preparatory module comprises the (1) acquisition of theoretical and conceptual skills to implement a B.Sc. thesis project and (2) practical training in laboratory or field work to collect and analyze data. Part (1) includes literature acquisition, use of libraries, developing research hypothesis, and presenting a research plan. The student lean how to strategically planning their B.Sc. project, starting from the selection of a topic and title to the development of an individual research proposal up to the critical discussion of actual scientific publications in related fields. Part (2) takes place in tight interaction with part 1. Here the students select their prospective supervisors and learn laboratory and field ecological methods that can be applied to their Bachelor work. The students usually work on a small project and receive hands-on training in modern ecological techniques.	**Workload:** Attendance time: 112 h Self-study time: 248 h

Courses:	
1. Theory and concepts (Lectures and Seminars)	2 WLH
2. Advanced methods (Project with practical training and theory)	6 WLH
Examination: Presentation (approx. 15 minutes, 25%) and 2. term paper (max. 15 pages, 75%)	12 C

Examination requirements: Presentation of the concept of the Bachelor thesis and 2. Application of this knowledge to a project. This requires knowledge on structural issues, literature acquisition, electronic literature sources and abilities to describe methods, report results, interpret results and correct citation.	

Admission requirements: none	**Recommended previous knowledge:** Successful completion of the study course recommended for MES semester 1, 2 and 3. Knowledge in statistics.
Language: English	**Person responsible for module:** Prof. Dr. Andrea Polle
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 6
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1201: Special topics in plant methods and ecological applications I**	6 C 4 WLH

Learning outcome, core skills: This elective module consists of a seminar and advanced method courses. In the seminar the students will be informed about recent development and new discoveries in forest botany, plant – microbial interactions, biotechnology, plant molecular genetics and practical applications. In the advanced method courses student undertake internships and/or field excursions to learn new methods and applications in plant physiology and ecology. The students will take responsibility in the organization of their study program.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Forest botany (Seminar)	2 WLH
2. Ecological applications / Field excursion (Lecture, practical)	2 WLH
Examination: Oral presentation (approx. 15 minutes) and written report (max. 10 pages)	6 C

Examination requirements: Discussion of scientific presentations, knowledge in recent problems in Forest Botany, application of advanced scientific methods to selected problems in plant science. Skills: knowledge in critical text analyses and presentation skills, knowledge in data base research, practical skills in handling modern equipment for plant analyses.	

Admission requirements: none	**Recommended previous knowledge:** In-depth knowledge in biology is required
Language: English	**Person responsible for module:** Prof. Dr. Andrea Polle
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module B.MES.1202: Special topics in plant methods and ecological applications II**	6 C 4 WLH

Learning outcome, core skills: This elective module consists of a seminar and an advanced method course. The seminar will be conducted as a journal club. The students will get lists of papers which they have to read and present during the semester. The topics will be chosen from recent literature. The goal is to become involved in research and to learn to understand how to structure research and to publish. In the advanced method courses, lectures and specialized techniques will be taught and practiced. The students will organize the journal club.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Advanced plant biochemistry and genetics / Journal club (Seminar)	2 WLH
2. Advanced methods (Lecture, practical)	2 WLH
Examination: Oral presentation (approx. 15 minutes) and written report (10 pages max.)	6 C

Examination requirements: Reading and analyzing scientific publications, in-depth understanding of scientific working methods in plant ecology and molecular biology. Skills: knowledge in critical text analyses and presentation skills, knowledge in research methods.	

Admission requirements: none	**Recommended previous knowledge:** In-depth knowledge in biology is required
Language: English	**Person responsible for module:** Prof. Dr. Andrea Polle
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module B.MES.1203: Semiochemical diversity**	6 C 4 WLH

Learning outcome, core skills: Students will learn to investigate the dynamics of semiochemical diversity in different types of ecosystems. This involves field sampling of important plants and animals, volatile extraction from different tissues, laboratory analyses of various types of volatile markers, data analyses and interpretation. Students will learn practical steps to assess semiochemical diversity, and will be able to evaluate the use of chemo-ecological methods for applications in plant protection, nature conservation, and ecosystem management.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Semiochemical diversity (Lecture)	1 WLH
2. Methods to study semiochemical diversity and biodiversity (Workshop, laboratory course)	3 WLH
Examination: Term paper (20 pages max.)	6 C

Examination requirements: Classification of semiochemicals, measures of chemical and biological diversity, analytical and determination methods, key species, key volatiles, key processes, semiochemicals in practical application.	

Admission requirements: B.MES.1102	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Stefan Schütz
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1204: Protection of renewable resources**	6 C 4 WLH

Learning outcome, core skills: The use of chemical methods is commonplace in protection measures at various levels of biological organization in forest protection, plant protection and stored product protection. Students will learn the results of chemo-ecological approaches in integrated pest management based on selected projects and recent literature. Students will be able to critically evaluate benefits and limitations of chemo-ecological approaches in a production and conservation context. Examples will be taken from different geographic and climatic regions.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Protection of renewable resources based on chemical and chemo-ecological methods (Lecture)	1 WLH
2. Assessment of protection measures for renewable resources (Seminar, Workshop)	3 WLH
Examination: Oral presentation (approx. 15 minutes) with written outline (max. 5 pages)	6 C

Examination requirements: Application of semiochemicals in different ecosystems, quality control, toxicology, integrated pest management, production of renewable resources, nature protection.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Stefan Schütz
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1205: Isotopes in ecosystem sciences**	6 C 4 WLH

Learning outcome, core skills: The course provides a very broad background for isotope applications in ecosystem compartments including soils, plants, atmosphere, and microorganisms. Overview of various tracer methods and isotope applications will be presented. The specifics of stable and radioactive isotopes for investigations of ecosystem processes from submolecular to global scale will give deep background for future isotope applications in Bachelor, Master and PhD theses.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Stable isotopes (Lecture, seminar with exercises)	2 WLH
2. Radioactive isotopes and labeling techniques (Lecture, seminar)	2 WLH
Examination: Written examination (90 minutes)	6 C

Examination requirements: Knowledge of specified teaching content, achievement of defined goals and proof of target competence.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Jens Dyckmans
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1206: Intraspecific diversity of plants**	6 C 4 WLH

Learning outcome, core skills: Students will learn to investigate the dynamics of intraspecific diversity in different types of ecosystems. This involves field sampling of important plants, DNA extraction from different tissues, laboratory analyses with various types of molecular markers, data analyses and interpretation. Students will learn practical steps to assess genetic diversity, and will be able to evaluate the use of DNA-based methods for applications in breeding, conservation, and ecosystem management.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Courses:	
1. Intraspecific diversity of plants (Lecture)	1 WLH
2. DNA based methods to study biodiversity (Workshops, laboratory exercise)	3 WLH
Examination: Term paper (20 pages max.)	6 C

Examination requirements: DNA markers and techniques, estimation of intraspecific diversity in different types of ecosystems, methods used for experimental sampling, DNA extraction from different tissues, laboratory techniques, data analyses and interpretation and application of results.	

Admission requirements: B.MES.1103, B.MES.1104	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Konstantin V. Krutovsky
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1207: Research practicum**	6 C 4 WLH

Learning outcome, core skills: Students have a possibility to participate in a research work at an institution of their choice (also abroad) to learn new scientific methods and get additional experiences about variety of research topics.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Research practicum (Laboratory courses/work, Seminar)	4 WLH
Examination: Term paper (max. 20 pages)	6 C

Examination requirements: Laboratory methods, analysis, interpretation and scientific presentation of research results. In case of abroad practicum: a confirmation letter from the supervisor with a grade (if possible, in the German grade system)	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Konstantin V. Krutovsky
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1208: Scientific project**	12 C 3 WLH

Learning outcome, core skills: Advanced knowledge of scientific methods and procedures, and practical skills acquired by active participation in a research project conducted under supervision of a lecturer of the programme at the University of Goettingen or a respective supervisor at a foreign institution. Ability to analyze, interpret and present relevant scientific data. Duration: 6 weeks.	**Workload:** Attendance time: 60 h Self-study time: 300 h

Course: Scientific project (Laboratory courses/work, Seminar)	3 WLH
Examination: Term paper (max. 30 pages)	12 C

Examination requirements: Scientific hypotheses, experimental design, laboratory techniques, analysis, interpretation and scientific presentation of research results. In case of abroad practicum: a confirmation letter from the supervisor with a grade (if possible, in the German grade system).	

Admission requirements: Conducted only together with the module B.MES.1209 "Practical training in laboratory techniques". Each student must get an approval from the MES programme's coordinator 3 months before the start of work.	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Konstantin V. Krutovsky
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.MES.1209: Practical training in laboratory techniques**	18 C 4 WLH

Learning outcome, core skills: Students learn about different research techniques, organization of work in a laboratory and an experiment planning by active participation in a research project conducted under supervision of a lecturer of the programme at the University of Goettingen or a respective supervisor at a foreign institution. Duration: 9 weeks.	**Workload:** Attendance time: 90 h Self-study time: 450 h

Course: Practical training in laboratory techniques (Laboratory courses/work, Seminar)	3 WLH
Examination: Laboratory protocol (10 pages max.), passed/failed. In case of abroad practicum: a confirmation letter from the supervisor with a result., not graded	18 C

Examination requirements: Experimental design, laboratory techniques, analysis and interpretation of research results. In case of abroad practicum: a confirmation letter from the supervisor with a result, not graded.	

Admission requirements: Conducted only together with the module B.MES.308 “Scientific project”. Each student must get an approval from the MES programme’s coordinator 3 months before the start of work.	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Konstantin V. Krutovsky
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module SK.FS.EN-FF-C1-1: Scientific Writing in English**	6 C 4 WLH

Learning outcome, core skills: Progression of pre-existing discursive skills and competences at a level above B2 according to the *Common European Framework of Reference for Languages*, which will enable the student to compose scientific texts in English, particularly in the area of molecular ecosystems sciences, e.g. • the skills needed to compose texts for scientific publications utilising specific language structures and conventions, • the acquisition of specific linguistic and stylistic structures in the English language as well as the development of a differentiated scientific vocabulary • the expansion of the operative intercultural knowledge about practices required to write a scientific paper with a focus on molecular ecosystems sciences in an academic context.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Scientific Writing in English (Course) Exam preparation: ungraded written work completed in class and outside of class.	4 WLH
Examination: Portfolio consisting of three tasks of max. 15 pages in total **Examination prerequisites:** regular active participation	6 C

Examination requirements: Proof of linguistic competence in an intercultural and scientific context. Demonstration of the ability to write scientific texts in the English language at a level above B2 according to the *Common European Framework of Reference for Languages*.	

Admission requirements: Module Mittelstufe II or placement test with a completed level B2 of the CEFR	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Heather Anne Kretschmer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: 16	

Additional notes and regulations: Applicable to: Bachelor’s Degree Programme “Molecular ecosystem sciences”