Georg-August-Universität
Göttingen

Modulverzeichnis

zu der Prüfungs- und Studienordnung für den Master-Studiengang "Sustainable Forest and Nature Management" (SUFONAMA) (Amtliche Mitteilungen I 36/2012 S. 1891, zuletzt geändert durch Amtliche Mitteilungen I Nr. 24/2024 S. 541)

Module

Übersicht nach Modulgruppen

I. Sustainable Forest and Nature Management (SUFONAMA)

1. Studies in Goettingen

To successfully complete the studies in Goettingen a total of 60 C must be earned.

a. Compulsory

The following four compulsory modules must be completed:

b. Restricted elective

From the following modules one module must be completed:

c. Master thesis

Completion of the Master thesis is worth 30 Credits.

Georg-August-Universität Göttingen **Module M.FES.113: Soil Hydrology**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
The course consists of three interconnected parts. The theoretical background (1) describes the fundamental static and dynamic principles of soil water, starting with the special physical properties of water molecules continuing with the basic static traits of soil water, e.g. water content and the energy state. The latter is important for the understanding and calculation of soil water flow under saturated and unsaturated conditions. The water balance of the soils will be completed by the potential sinks of soil water in ecosystems, like e.g. drainage, evaporation, root water uptake, and transpiration. The theoretical lectures will be accompanied by experimental exercises (2): lab measurements of bulk density, water content, water potential, conductivity, pF-curve are important parameters describing the state of soil water. Additionally, automated soil lysimeters with or without plants will be provided to the students for self-initiated experiments. The self-measured hydrological and meteorological time series data are the basis for the third part (3), the modelling of soil water cycles. Based on the learned experimental and theoretical skills, the basic principles of soil water modelling are explained and practiced.	Attendance time: 56 h Self-study time: 124 h

Course: Soil Hydrology (Lecture, Exercise, Practical course)	4 WLH
Examination: Term Paper (max. 20 pages)	6 C

Examination requirements:	
Theoretical and experimental skills of soil hydrology	

Admission requirements:	**Recommended previous knowledge:**
none	none
Language: English	**Person responsible for module:** Dr. Martin Jansen
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.114: Ecosystem - Atmosphere Processes**	6 C 4 WLH

Learning outcome, core skills: Understanding the carbon and water cycle of terrestrial ecosystems requires a solid understanding of biogeophysical and biogeochemical processes at the ecosystem – atmosphere interface. These processes are directly affected by human induced alterations of the climate system such as climate change and land use. In this course, the students will learn about ecosystem – atmosphere processes based on real datasets from forests and other terrestrial ecosystems. The student will be exposed to a quantitative analysis of the data and will gain basic insights into land surface modelling considering land use as well as climate change.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Ecosystem – Atmosphere Processes (Exercise)	2 WLH
Course: Ecosystem – Atmosphere Processes (Lecture, Seminar)	2 WLH
Examination: Presentation (approx. 20 minutes, 50%) and oral exam (approx. 20 minutes, 50%)	6 C

Examination requirements: The student will learn about biogeophysical and biogeochemical processes at the ecosystem – atmosphere interface. They will have the ability to formulate these processes in the programming language R and describe them quantitatively.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Alexander Nils Knohl
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.115: Statistical Data Analysis with R**	6 C 4 WLH

Learning outcome, core skills: Introduction to R as programming language for beginners, statistical data analysis including explorative data analysis, plotting, basic tests (t, F, non-parametric), ANOVA, simple linear regression, multiple regression, analysis of residuals, ANCOVA, non-linear regression, glms with focus on logistic regression, short introduction to tidyverse and ggplot; always including introduction to theory and to practical implementation in R.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Statistical Data Analysis with R (Lecture, Exercise)	4 WLH
Examination: Presentation (approx. 15 min.) with written outline (max. 10 pages)	6 C

Examination requirements:

- Import data into a statistics software and perform an explorative data analysis
- Display data graphically
- Select appropriate statistical approaches or models for data analysis
- Discuss the advantages and disadvantages of statistical approaches or models
- Apply statistical approaches or models to given data
- Explain and test assumptions of statistical approaches or models
- Interpret the results of the data analysis
- Suggest meaningful follow-up analyses
- Present and explain the procedures involved in a statistical data analysis

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:**
Maximum number of students: 30	

Additional notes and regulations:
30 students are only possible if a corresponding number of computers is available

Georg-August-Universität Göttingen **Module M.FES.312: International Forest Policy and Economics**	6 C 4 WLH

Learning outcome, core skills: **Global environmental and forest policy:** The objective is that students get basic knowledge of both the key policies related to forests and the application of the policy analysis on such issues. Students acquire comprehension about global forest related policy processes and factual knowledge about forest actors affecting the policy on a global level. The seminar combines a lead-in to global policy theory and its translation in practical, empirical knowledge about actors and processes of high importance in forestry. The different instruments for international policy formulation and implementation are discussed using case studies. **International forest economics:** The lecture is split in two main areas: 'International Wood Markets' and 'International Environmental and Forest Conservation'. The first part deals with the international trade with wood and wood products. International markets and the consequences of protectionism are analysed. Furthermore, aspects of international wood marketing are shown. In the second part, international environmental problems are described and possibilities as well as constraints for international co-operation are discussed. Finally, relations between environmental conservation and economic development are analysed.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Global environmental and forest policy (Seminar)	2 WLH
Examination: Written examination (60 minutes)	3 C

Course: International forest economics (Lecture)	2 WLH
Examination: Written examination (60 minutes)	3 C

Examination requirements: • Understanding of the theory in policy analysis and application to international cases • Knowledge of actors and instruments of international forest regimes • Familiarity with international wood markets and international trade with wood and wood products • Understanding of international wood marketing • Ability to analyse consequences of protectionism • Apply economic theory in order to analyse possible solutions towards international environmental problems • Sound understanding of the relations between forest conservation and economic development	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Carola Paul
Course frequency:	**Duration:**

each winter semester	1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.315: Monitoring of Forests and forrested Landscapes**	6 C 4 WLH

Learning outcome, core skills: Familiarize the students with the range of methods and techniques applied to forest monitoring in the preparation, planning, implementation and analysis phase. Objective is that the students are eventually in the position to carry out their own monitoring projects, and that they have the criteria to judge the quality of monitoring projects in general. Focus is on the target-oriented planning and the definition of the most appropriate sampling design and plot design that guarantees the generation of high-quality information for the decision makers in forestry. Remote sensing integration is addressed and is in more detail the subject of an other lecture module.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Monitoring of Forests and Landscapes (Lecture, Exercise) *Contents*: Forest monitoring is a forestry discipline that aims at the comprehensive and objective characterization of the forests as a production system and/or as an ecological system in a defined geographic area, in terms of status quo and changes. Forest inventories are the core element of monitoring and they generate data and information required by foresters, forest politicians and forest researchers to support decision making. The course module “Monitoring of forest resources” intends to familiarize the students with the range of methods and techniques applied to forest inventories in the preparation, planning, implementation and analysis phase. Objective is that the students are eventually in the position to carry out their own monitoring projects of forests and related resources, and that they know the criteria to judge the quality of monitoring projects in general. Focus is on the target-oriented planning and the definition of the most appropriate sampling design and plot design that guarantees the generation of high-quality information for the decision makers in forestry. An important focus is here the random error sources and approaches to limit their impact on the results. That includes comprehensive presentation of statistical sampling. Examples of small and large area inventories and monitoring are presented and critically analysed. The important remote sensing applications for forest monitoring are not dealt with in detail in this module, as this topic is covered in other modules; but the relevance of integrated inventories (combining field sampling and remote sensing) is addressed. The development of forest inventories towards integrated “landscape inventories”, “multi-resource inventories”, “tree inventories” is also addressed of this course. Prerequisites: Sound basic knowledge in the disciplines of "Forest Mensuration" and in "descriptive statistics".	4 WLH
Examination: Written exam (120 minutes)	6 C

Examination requirements: In the module „Monitoring of Forest Resources“, the students should know and be able to manage and understand all topics that were covered in the lectures and labs. This includes: • the relevance of data sources and data quality;	

- the relevance of methodological soundness in planning, implementing and analyzing forest inventory data;
- the basic principles of in planning, implementing and analyzing forest inventory data;
- important options of sampling and plot design and its characteristics (including application examples and calculation of estimates);
- the critical reading of forest inventory reports;
- the role of forest inventories when monitoring the “resource forest” and the “ecosystem forest“;
- the role of forest inventory and forest monitoring in decision processes at stand-, enterprise-, national and global level.

And, of course, calculation skills in producing sample based estimates are equally relevant.

Admission requirements: none	**Recommended previous knowledge:** Required is a good command of forest mensuration, descriptive statistics, basic sampling statistics and cartography (along what is commonly covered in Bachelor study programs).
Language: English	**Person responsible for module:** Prof. Dr. Christoph Kleinn
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.712: Bioclimatology and Global Change**	6 C (incl. key comp.: 6 C) 4 WLH

Learning outcome, core skills: Scientific basis of climate and climate change, trace gas budgets of soils and whole ecosystems and the potential to sequester carbon and nitrogen in managed and unmanaged terrestrial ecosystems.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Bioclimatology and Global Change (Lecture, Seminar) *Contents*: The module "Bioclimatology and Global Change" will introduce the students to the global climate system and its interaction with the biosphere. A lecture course will focus on the scientific basis of climate and climate change covering basic physical and chemical processes governing the climate system, climate zones, modelling as well as global and regional climate phenomena with a focus on tropical climates. A seminar course will highlight trace gas budgets of soils and whole ecosystems and their potential to sequester carbon and nitrogen in managed and unmanaged terrestrial ecosystems and their vulnerability to climate change. Using journal literature the students will work out oral presentations concerning current research topics concerning the global climate system and its interaction with the biosphere.	4 WLH
Examination: Oral exam (approx. 20 minutes, 50%) and oral presentation (approx. 20 minutes, 50%)	6 C

Examination requirements: Understanding the most relevant processes at the biosphere-atmosphere interface and of biogeochemical cycles. Being able to find, read, evaluate, and present scientific literature related to Global Change.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Alexander Nils Knohl
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.FES.719: Remote Sensing Image Processing with Open Source Software**	6 C 4 WLH

Learning outcome, core skills: This combined lecture and lab makes the student familiar with basic principles, techniques and applications of remote sensing. The students learn skills in digital image processing and information extraction using open source software on own laptops.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Remote sensing image processing with open source software (Lecture, Exercise) *Contents*: The course introduces the theories (via lectures and literature) and applications (including computer exercises) of remote sensing workflows. Remote sensing data from different sensors (cameras, LiDAR scanners, RADAR) and platforms (satellites, aircrafts and unmanned aerial systems (UAS)) are used to develop analysis workflows for forestry and environmental monitoring applications. Common steps and methods of remote sensing analysis such as preprocessing, image enhancement, sampling of reference data, automated classification and estimation and map validation are presented. In the practical labs, students deepen their knowledge and skills with small projects such as land cover classification, individual tree detection, biomass estimation and change detection using open source technologies.	4 WLH
Examination: Oral exam (approx. 15 minutes, 80%) and practical exam (approx. 15 minutes, 20%)	6 C

Examination requirements: The students should know and manage and understand and have insights into all topics that are covered in the module that consists of lectures and predominantly on labs where the students learn image analysis on their own notebooks: the exam requirements include: • Bases of electromagnetic radiation and its interactions with the atmosphere and terrestrial land cover types; • Basic techniques of remote sensing image acquisition, pre-processing, enhancement and classification – as covered in the lectures and labs; • Knowledge and skills regarding application of the software as used in the practical labs; • Options of remote sensing integration into forest monitoring regarding both mapping and estimation; • Assessing quality of remote sensing products, including accuracy analysis.	

Admission requirements: none	**Recommended previous knowledge:** Good command of forest mensuration and forest inventory, including calculation skills regarding analyses of inventory data.

Language: English	**Person responsible for module:** Prof. Dr. Christoph Kleinn
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.721: Ecological Functions of Wildlife: Implications for Conservation and Management**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Animals fulfill various ecological roles within ecosystems. For example, many vertebrate species act as ‘mobile links’ and transport genetic material or organic matter across large spatial extends. Similarly, the presence or absence of large carnivores, or the abundance of large herbivores in an ecosystem can substantially impact its properties. While the reciprocal relationships between animals and the environment have long been recognized in ecology, we are only now realizing how important anthropogenic activities are for the functions that animals have in ecosystems. The aim of the course is to provide students with an overview of the ecological functions of vertebrate animals and why considering human influences on vertebrate species can be crucial for ecosystem management and biodiversity conservation. In addition, the course will also provide students with a basic understanding on how to investigate these functions and their consequences for ecosystem functions and services	Attendance time: 56 h Self-study time: 124 h

Course: Ecological functions of wildlife: implications for conservation and management (Lecture, Seminar)	4 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination prerequisites:** Written exam (30 minutes)	6 C

Examination requirements: To successfully complete the course, students have to demonstrate a general understanding of 1. functions fulfilled by vertebrates within ecosystems; 2. human impacts on these ecosystem functions; 3. how to analyze animal-ecosystem relationships; 4. the implications of animal-ecosystem relationships for management and conservation The written exam (examination prerequisite) will take place in the first half of the semester.	

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

40	

Georg-August-Universität Göttingen **Module M.FES.736: Forest management in a changing climate**	6 C 4 WLH

Learning outcome, core skills: The course imparts knowledge about the sustainable management of forest ecosystems. Based on thefundamentals of forest ecology, such as the impact of competitive interactions between trees, different silvicultural systems and options of stand management are presented. Special attention is given to the structural and compositional dynamics of forest ecosystems and how they are impacted by forest management and silvicultural interventions. The course will provide information on how to analyze forest stands and how to develop appropriate silvicultural strategies in order to achieve the goals set by a given forest owner. Examples from temperate and tropical forest ecosystems will be given. An excursion illustrates the concept of continuous-cover-forestry for multiple uses which is presently the most important approach in Central European silviculture.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Forest Ecosystem management (Lecture)	2 WLH
Course: Management of Tropical and subtropical forests (Lecture)	1 WLH
Course: Continuous cover Forestry for multiple uses (Excursion)	1 WLH
Examination: Written examination (120 minutes)	6 C

Examination requirements: Knowledge of silvicultural measures such as tending, thinning and final harvest systems and understanding how these measures impact ecological and physiological processes (tree competition, biomass partitioning, etc.). Fundamentals of the continuous-cover-forestry.	

Admission requirements: none	**Recommended previous knowledge:** Basics in tree physiology and soil science
Language: English	**Person responsible for module:** Dr. Martin Ehbrecht
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.737: Forest health under climate change**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
This course addresses the complexity of assessing forest health and trains students in understanding and applying methods for surveying and interpreting data on forest condition, in and beyond Central Europe. It provides insights into the current state of knowledge on eco-physiological processes in trees, and how abiotic stresses drive interactions with abiotic agents and lead to tree mortality and forest decline. The course gives an overview on expected trends in forest condition, and presents scientific methods for assessing tree responses to climate extremes and for forecasting forest dynamics into an uncertain future climate. These methods cover the range of approaches, spanning from field measurements of fundamental tree physiology (photosynthesis, respiration, water transport etc.) and stand to landscape-scale assessment (terrestrial surveys, remote sensing etc.) of forest functions all the way to process-based modelling of forest dynamics. Topical sections: • From tree ecophysiology to forest health • Biotic interactions • Terrestrial and remote-sensing forest condition assessment • Forest dynamics modelling	Attendance time: 56 h Self-study time: 124 h

Course: Forest health under climate change (Exercise, Seminar)	
Examination: Written examination (90 minutes)	

Examination requirements:	
Understanding difficulties in defining forest health and usefulness of different proxies. Knowledge of key tree physiological processes and functions and how to measure them in the field. General understanding of the interactions between impacts of abiotic stress events on tree physiology and biotic agents like damaging insects or diseases. Knowledge of different assessment methods for forest condition, their strengths, weaknesses and usefulness. General understanding of forest ecosystem modelling and knowledge of current challenges in forecasting forest health.	

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

not limited	

Georg-August-Universität Göttingen **Module M.FES.738: Research Planning**	6 C

Learning outcome, core skills:	**Workload:**
The aim of the course is to provide tools for, and experience with, systematic design of research projects related with natural and social science aspects of natural resources management. An additional important aim is inculcation of the values of scholarship: inquiry, reflection, integrity, open mindedness, evidence-based thinking, and collegiality. Teaching and learning methods: The course is organised as a combination of lectures from different research groups, theoretical exercises, discussions and review of course paper drafts focusing on critical discussion of student presentations and development of constructive comments. Specific activities include: introduction to course; supervisor identification and consultations; presentation of research design principles; student presentation of draft parts of research design; review of peers' draft research design. After an overview of research activities of selected research groups, students will prepare a plan for a research study within natural resources management, e.g. a thesis. The plan must incorporate a literature review, a clear statement of hypotheses or questions to be addressed, an outline of the methods to be used and an assessment of any risks and ethical issues involved. Identification and assessment of risk and ethical issues is an essential feature designed to ensure that projects are carried out safely and with due regard to others and the environment. The review is expected to contain a critical appraisal of the assembled material and to be produced to journal standard.	Attendance time: 42 h Self-study time: 138 h

Course: Research planning (Course)	
Examination: Term Paper (max. 10 pages)	6 C

Examination requirements:	
Understanding of the quality parameters of research design. Ability to: 1. argue cogently and to think critically within the parameters of a particular academic discipline; 2. apply principles for good research design, including critical discussion of literature and problem identification, development of hypotheses and research questions, determination of data requirements, and selection of appropriate methods including statistical analyses; and 3. reflect on risks and ethical issues in relation to project implementation. Students should be able to: 1. demonstrate independent leraning skills necessary for the foundation of lifelong learning; 2. tackle scientific problems by collecting, analysing and evaluating appropriate qualitative and quantitative information and using it creatively; and 3. display the competencies, key skills, behaviour and attitudes in relation to individual and group work required in a professional working life.	

Admission requirements:	**Recommended previous knowledge:**
SUFONAMA student only	none

Language: English	**Person responsible for module:** Prof. Dr. Carola Paul
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	