MASTER OF SCIENCE M.Sc.
PHYSISCH GEOPGRAPHIE – LANDSCAPE SYSTEM SCIENCES

MODULHANDBUCH
Modul Number: GEO-75
Module Title: Spatial Pedology and Geomorphology
Compulsory/Elective: Compulsory

Module Coordinator: Scholten, Behrens
ECTS Credits: 6
Lecture Types (Contact Times): Lecture, course and tutorial
Cycle: every 2nd Semester

Module Content
This module will introduce students to advanced theories and concepts of spatial pedology and geomorphology. A range of soil and earth surface forming factors and processes will be introduced and studied. In addition, students will learn about the dynamics of landscapes, the role of humans in soil formation and in shaping the land surface. Main objectives of this module are:

- Examine processes of spatial pedology and geomorphology by reviewing literature from soil science and physical geography
- Introduce to self-reliant and independent research activities based on theoretic and applied scientific questions
- Handling of pedological and geomorphological aspects of specific regions
- Analysis and understanding of spatial and scale-dependent structures of the regolith
- Analysing of feedbacks in process systems

Learning Outcomes

- Ability to work precisely and specifically on current scientific questions
- Understanding of the scientific nature of pedology and geomorphology
- Ability to apply fundamental pedological and geomorphological theories and concepts to modern research questions
- Understanding of correlations of spatial phenomena and scale-dependent processes
- Ability to analyse complex spatial ecosystems as a specific qualification for the master in „Landscape System Sciences“
- Specialized skills in communication and presentation of scientific knowledge
- Skills of scientific reasoning
- Ability to work in a team and to take over responsibility
- Ability to plan and coordinate methodological procedures and work steps

Prerequisites
none

Exam
successful final test (70 %), practical home work (30 %)

Grade Factor
1

Semester
7. Semester (Winter)
Language
German/English
Teaching Methods
Individual tutorial by the lecturers, practical work in the computer pools

Lecturers
Geography

Work load total
180 h
Contact Time
15 -30 %
Preparation/Wrap-up Time
30-50 %
Exam Preparation
30-50 %
**Module Number**  
GEO-76

**Module Title**  
Pedological and Geoecological Field and Lab Tutorial

**Module Coordinator**  
Kühn

**ECTS Credits**  
6

**Lecture Types (Contact Times)**  
Field-course, lab-course and tutorial

**Cycle**  
every 2nd Semester

### Module Content

This module will introduce students to advanced techniques of pedological and geoecological field and laboratory analyses. A range of pedological and geoecological standard methods field be introduces, studied and trained. In addition, students will learn about the dynamics of landscapes, the role of humans in soil formation and in shaping the land surface. Main objectives of this module are:

- Students will learn how to carry out field and laboratory methods and analyses within a theoretical and practical framework
- Investigation and analysis on pedo- an geoecological aspects in selected landscapes with focus on the soil cover and the relief
- Self-reliant measurements of pedo- and geoecological parameters in the field and laboratory
- Examine pedo- and geo-ecological processes by interlocking aspects from selected landscapes
- Integrated interpretation of field and laboratory results
- Learn to apply the suitable method in the respective context

### Learning Outcomes

- Analytical and technical skills for the use of field and lab methods in integrated projects
- Specific knowledge about relevant field and lab methods as a base for further interdisciplinary project work
- Ability to apply of field and lab techniques in teamwork
- Advanced comprehension of relations and feedback processes crossing single subjects and scientific fields
- Ability of independent reception of Quaternary landscapes
- Ability to analyse and to understand complex spatial ecosystems as a specific qualification for the master in „Landscape System Sciences“
- Specialized skills in communication and presentation of scientific results from field and lab work
- Skills of scientific reasoning
- Ability to take over responsibility
- Ability to plan and coordinate methodological procedures and work steps

### Prerequisites

GEO-75 or comparable modules

### Exam

Successful field and lab report (70%), practical home work (30 %)

### Grade Factor

1

### Semester

7. Semester (Winter)

### Language

German/English

### Teaching Methods

Individual tutorial by the lecturers, field and lab exercises

### Lecturers

Geography

### Work load total

180 h

### Contact Time

30-50 %

### Preparation/Wrap-up Time

30-50 %

### Exam Preparation

30-50 %
## Module Number
GEO-73

## Module Title
Applied Geographical Information Systems

## Compulsory/Elective
Compulsory

<table>
<thead>
<tr>
<th>Module Coordinator</th>
<th>ECTS Credits</th>
<th>Lecture Types (Contact Times)</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hochschild</td>
<td>6</td>
<td>Lecture, course and tutorial</td>
<td>every 2nd Semester</td>
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</tbody>
</table>

## Module Content
The module “Applied GIS” imparts knowledge about actual state of the art methods in spatial information processing. It will cover subjects of Physical as well as Human Geography where Geographical Information Systems are used and will last from “Erosion and GIS” over “Network Analysis” to “Cyber City – GIS in Modern City Planning”. The students will have the opportunity to be guided through spatial analysis technology with the newest software available. Practical training in the computer pools is carried out within the tutorial with specific subjects like “Terrain Analysis” or “Urban GIS Applications”, etc., where the students could practice and apply their learned knowledge on day to day GIS tasks in order to get familiar with a structured GIS project management strategy.

## Learning Outcomes
- Analytical and technical skills for the use of Geographical Information Systems in applied geo scientific projects
- Specific knowledge about Integrated Data Analysis techniques as a base for further interdisciplinary project work
- Ability to analyse complex spatial ecosystems as a specific qualification for the master in „Physical Geography: Landscape System Sciences“
- Specialized skills in communication and presentation of scientific knowledge
- Skills of scientific reasoning
- Ability to work in a team and to take over responsibility
- Ability to plan and coordinate methodological procedures and work steps

## Prerequisites
none

## Semester
7. Semester (Winter)

## Language
German/English

## Teaching Methods
Individual tutorial by the lecturers, practical GIS work in the computer lab

## Lecturers
Geography

## Work load total
180 h

<table>
<thead>
<tr>
<th>Contact Time</th>
<th>Preparation /Wrap-up Time</th>
<th>Exam Preparation</th>
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</thead>
<tbody>
<tr>
<td>25 % (45 h)</td>
<td>67 % (105 h)</td>
<td>8 % (30 h)</td>
</tr>
</tbody>
</table>

## Exam
final test (70 %), practical home work (30 %)

## Grade Factor
1.0
Module Content
The module imparts examples from applied remote sensing. How is remote sensing used to solve geo-scientific problems? It consists of subjects like atmosphere, oceanography, geology/geomorphology, land use, vegetation, hydrology, snow/ice, natural hazards, urban geography and digital terrain models. The students will get an introduction on the use of different airborne and spaceborne sensor systems for the acquisition of actual areal parameters. Within the course, the students will deepen their knowledge through the individual presentation of literature studies.

Learning Outcomes
- Analytical and technical skills for the use of remote sensing sensor systems for the solution of geo-scientific problems
- Specific knowledge about the newest remote sensing sensor development and their potential for future geo-scientific applications
- Ability to provide actual, areal parameters derived from remote sensing data as a specific qualification for the master in ‘Landscape System Sciences’
- Specialized skills in communication and presentation of scientific knowledge
- Ability to work in a team and to take over responsibility
- Skills of scientific reasoning
- Ability to plan and coordinate methodological procedures and work steps

Prerequisites
none

Exam
final test (70 %), practical home work (30 %)

Grade Factor
1
Module Number: GEO-81
Module Title: Global Environmental Change

Module Coordinator: Scholten, Hochschild, Kinder, Rothfuß
ECTS Credits: 6
Lecture Types (Contact Times): Lecture, Seminar, Field-trip
Cycle: every 2nd Semester

Module Content
Students will be introduced to some of the globally most important environmental problems such as water and air pollution, sustainability, biodiversity, global warming and others. At the same time, this module is designed to familiarise students with the research process in the environmental and social sciences. Based on selected reading students will be challenged by the difficulty to assess the magnitude of environmental problems. Against this background, research ethics, the quality and reliability of scientific information, and the role of science in the public discourse will be discussed. Following the introduction of particular environmental problems by experts, students will work in groups to examine independently the extent of these problems in more depth and analyse the, sometimes contrasting, claims and arguments made by different scientists. These analyses will be presented to the whole group and an expert panel towards the end of the module. Module content can be listed as follows:

- Examine processes of environmental change by interlocking aspects from physical and human geography
- Review and examine the climate change debate and its scientific basis
- Regional case studies of environmental change
- Analysing feedbacks of environmental change to climate change, political ecologies, processes of sustainable development, use of geo resources, processes of globalisation, population development, regional development, migration
- research, analyse and presentation of environmental issues

Learning Outcomes

- Understanding of the basic principles concept of environmental processes and their impacts on different geographical aspects
- Application of fundamental geographical proceedings to examine and understand correlations of environmental change’s impacts
- Understanding of techniques of Physical and Human Geography to quantify and understand environmental changes
- Understand processes and mechanisms of palaeo-environmental and contemporary climate and environmental change and the their cohesion to different aspects of human geography and vice versa
- Ability to analyse potential impacts of environmental change on a range of sectors agriculture, forestry, water resources and human health
- Ability to formulate and understand procedures for potential mitigation and adaption options regarding changing processes
- Specialized skills in communication and presentation of scientific knowledge
- Ability to work in a team and to take over responsibility
- Skills of scientific reasoning
- Ability to plan and coordinate methodological procedures and work steps

Prerequisites
none

Exam
Oral presentation, essay, exercises

Grade Factor
1

Semester
Summer/Spring

Language
English/Deutsch

Teaching Methods
Lectures, Exercises, report of Field-trip

Lecturers
Human and Physical Geography

Work load total
180 h

Contact Time
15 -30 %

Preparation/Wrap-up Time
30-50 %

Exam Preparation
30-50 %
<table>
<thead>
<tr>
<th>Modul Number</th>
<th>Module Title</th>
<th>Compulsory/Elective</th>
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</thead>
<tbody>
<tr>
<td>GEO-86</td>
<td>Pedometrics and Landscape Modelling</td>
<td>Elective</td>
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<table>
<thead>
<tr>
<th>Module Coordinator</th>
<th>ECTS Credits</th>
<th>Lecture Types (Contact Times)</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholten, Behrens</td>
<td>6</td>
<td>Lecture, course and tutorial</td>
<td>every 2nd Semester</td>
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</tbody>
</table>

**Module Content**

The goal of this module is to explore various concepts and quantitative methods to model and understand the spatial distribution of soils as well as soil-landscape and soil-environmental relationships.

Topics include:
- Data mining
- Geostatistics
- Applied GIS-based pedometric and ecosystem modelling
- Technical approaches such as proximal soil sensing and precision agriculture,
- Geospatial data handling

**Learning Outcomes**

- Specific knowledge and experience in geographic information systems (GIS) and geospatial methods as applied to soil science issues.
- Specific knowledge and experience in using data analysis and modelling tools such as geo-statistics, machine learning and data mining.
- Specific knowledge and experience in advanced methods of proximal soil sensing and related techniques in precision agriculture.
- Skills of scientific reasoning
- Ability to plan and coordinate methodological procedures and work steps
- Skills in communication and presentation of scientific knowledge
- Ability to work in a team and to take over responsibility

**Prerequisites**

none

**Semester**

7. Semester (Winter)

**Language**

German/English

**Teaching Methods**

Individual tutorial by the lecturers, practical GIS work in the computer lab

**Lecturers**

Geography

**Work load total**

180 h

**Contact Time**

15-30 %

**Preparation/Wrap-up Time**

30-50 %

**Exam Preparation**

30-50 %

**Exam**

successful final test (70 %), practical home work (30 %)

**Grade Factor**

1
Modul Number | GEO-87
---|---
Module Title | Advanced Digital Image Processing
Compulsory/Elective | Elective

<table>
<thead>
<tr>
<th>Module Coordinator</th>
<th>ECTS Credits</th>
<th>Lecture Types (Contact Times)</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hochschild</td>
<td>6</td>
<td>Lecture, course and tutorial</td>
<td>every 2nd Semester</td>
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</tbody>
</table>

Module Content
The module imparts challenging knowledge of applied geographical remote sensing data evaluation with practical training with ERDAS Imagine, eCognition and other digital image processing software. Subjects are the theory and concepts of sophisticated image processing methods for image enhancement, rectification or classification procedures. This will be presented, exercised and trained by advanced applications in the fields of high resolution remote sensing (analogous and digital airborne data, QuickBird, TerraSAR-X data, etc.), microwave remote sensing (ENVISAT, ALOS, TerraSAR-X, Sentinel, etc.), hyperspectral remote sensing (airborne, ENMAP, etc.) as well as new methodological approaches (object oriented, etc.). It is suggested for students who will carry out a MSc thesis within the remote sensing science.

Learning Outcomes
- Specific knowledge on digital image processing techniques and their application potential
- Ability to turn remote sensing data into geo-scientific information
- Analytical and technical skills for scientific parameter derivation from remote sensing data
- Specialized skills in communication and presentation of remote sensing data
- Ability to work in a team and to take over responsibility
- Skills of scientific reasoning
- Ability to plan and coordinate digital imaging procedures and work steps

Prerequisites
GEO-77 or comparable modules

Exam
successful final test (70 %), practical home work (30 %)

Grade Factor
1

Semester
8. Semester (Summer)

Language
German/English

Teaching Methods
Individual tutorial by the lecturers, practical image processing work in the computer lab

Lecturers
Geography

Work load total
180 h

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<tr>
<th>Contact Time</th>
<th>Preparation /Wrap-up Time</th>
<th>Exam Preparation</th>
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<tr>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>25 % (45 h)</td>
<td>67 % (105 h)</td>
<td>8 % (30 h)</td>
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</tbody>
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**Module Number**
GEO-88

**Module Title**
Practical Internship

<table>
<thead>
<tr>
<th>Module Coordinator</th>
<th>ECTS Credits</th>
<th>Lecture Types (Contact Times)</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hochschild, Scholten</td>
<td>12</td>
<td>External internship</td>
<td>every semester</td>
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</table>

**Module Content**
The internship is part of the study programme and should be done between the second and third semester. The minimum duration of the internship is eight weeks. The internship supervisor at the placement confirms the successful completion of the internship by filling in a form. In addition the student is required to make an evaluation of the internship.

**Learning Outcomes**
- Get a first insight into potential employment sectors and an overview of the subject achieved by practical work
- Experience typical work processes and the human interactions in a company or research institute
- Get an idea of the daily work procedure at their workplace (‘everyday life experiences’)
- Become familiar with the structures within the institution, as well as the interconnections with external systems
- Intensify and apply expert knowledge in the course of the studies during the practical training

**Prerequisites**
none

**Exam**
Supervisor’s confirmation and student evaluation forms (100 %)

**Grade Factor**
one

**Semester**
7. and 8. semester (winter)

**Language**
German/English

**Teaching Methods**
Practical work

**Lecturers**
Geography

**Work load total**
360 h

<table>
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<th>Contact Time</th>
<th>Preparation/Wrap-up Time</th>
<th>Exam Preparation</th>
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<tbody>
<tr>
<td>100 %</td>
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<tr>
<td>Modul Number</td>
<td>Module Title</td>
<td>Compulsory/Elective</td>
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<tr>
<td>GEO-95</td>
<td>Ecosystem Analysis and Geoinformatics</td>
<td>Compulsory</td>
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</table>

**Module Coordinator**
Scholten, Hochschild

**ECTS Credits**
6

**Lecture Types (Contact Times)**
Lecture, course and tutorial

**Cycle**
every 2nd Semester

**Module Content**
The scope of this module is the development and application of geo-spatial data analysis methods. This forms the basis to enable the students to develop research and experimental designs as well as innovative environmental research projects. The module is based on current research activities at the institute.

Topics include:
- Statistical concepts of experimental design and analysis
- Sample design and sampling strategies
- Data interpretation
- Ecosystem modelling
- Geo-databases
- Geo-data infrastructures
- Concepts of (spatial) programming

**Learning Outcomes**
- Specific knowledge and experience in research and experimental design
- Specific knowledge and experience in developing and applying state-of-the-art geo-spatial data analysis methods
- Skills of scientific reasoning
- Ability to plan and coordinate methodological procedures and work steps
- Skills in communication and presentation of scientific knowledge
- Ability to work in a team and to take over responsibility

**Literature**

**Prerequisites**
none

**Semester**
9. Semester (Winter)

**Language**
German/English

**Teaching Methods**
Lectures, practical exercises, field and lab work, GIS work in the computer lab, tutorials, peer review

**Lecturers**
Geography

**Work load total**
180 h

**Contact Time**
30 - 50 %

**Preparation/Wrap-up Time**
30 - 40 %

**Exam Preparation**
20 - 40 %

**Exam**
final test (70 %), practical home work (30 %)
<table>
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<tr>
<th>Module Number</th>
<th>Module Title</th>
<th>Compulsory/Elective</th>
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<tbody>
<tr>
<td>GEO-91</td>
<td>Master Thesis</td>
<td>Compulsory</td>
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<tr>
<th>Module Coordinator</th>
<th>ECTS Credits</th>
<th>Lecture Types (Contact Times)</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervising scientist</td>
<td>30</td>
<td>Own scientific work with supervision</td>
<td>Each semester</td>
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</tbody>
</table>

**Module Content**
The master thesis is an original piece of scientific work prepared by each candidate individually under the supervision of a senior scientist. The thesis should be done during the third and forth semester. The supervisor accompanies the practical research and thesis writing thoroughly. In addition, the student has to report twice during the time of work about concept, hypothesis, material and methods, work flow, and first results of the experimental work.

- Own research in the field of Physical Geography
- Varying subject selection, in coincidence with supervisor
- Creation of an own scientific thesis. The written textbook should have 160 000 to 200 000 characters without supplements (60 to 80) pages in English or German language
- English and German summary of min. 2000 and max. 3000 characters
- Submission of the thesis in three printed versions and as digital version (.pdf)

**Learning Outcomes**

- Generation of research plan, literature search and critical evaluation
- Compilation of the research according to the scientific objectives
- Own scientific and methodological work on a complex physical geographical research question
- Capability of pursuing scientific work independently

**Prerequisites**
60 Credits

**Exam**
Review of MSc Thesis

**Grade Factor**
1

**Semester**
9th and 10th semester (winter and summer)

**Language**
German/English

**Teaching Methods**
Literature search, field work, theoretical-methodological research, generation of a scientific thesis

**Lecturers**
Geography

**Work load total**
900 h
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<tr>
<th>Modul Number</th>
<th>Module Title</th>
<th>Compulsory/Elective</th>
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<tbody>
<tr>
<td>GEO-99</td>
<td>Research and Presentation Tutorial</td>
<td>Compulsory</td>
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<th>ECTS Credits</th>
<th>Lecture Types (Contact Times)</th>
<th>Cycle</th>
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<tbody>
<tr>
<td>Hochschild, Scholten</td>
<td>6</td>
<td>Course</td>
<td>every 2nd Semester</td>
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</table>

**Module Content**

This module emphasizes on scientific working procedures. The students will learn how to formulate a scientific hypothesis, how they will acquire all necessary information through literature and media research to enable an individual and independent verbalisation of the scientific "state-of-the-art". As a derivation of that, the research deficit and the objectives of the suggested MSc-thesis will have to be fixed. The methodological approach will have to be presented in a written text as well as in time schedule for the intended scientific work. Finally the students will get support in discussing their results as well as in appropriate presentation techniques (i.e. PowerPoint presentation, web-site design, etc.).

Apart from these theoretical introductions, the students will have to prepare extended presentations on their MSc-thesis work and try to answer all scientific questions arising around their research approaches. Participants from all indentations of "Landscape System Sciences" will attend this course together, enabling interdisciplinary discussions and holistic approaches for the complex research questions.

**Learning Outcomes**

- Conceptual planning of successful MSc thesis project planning
- Analytical and technical skills for MSc thesis compilation
- Ability to independent scientific research, discussion of scientific problems and presentation of methodological approaches
- Specialized skills in communication and presentation of scientific results
- Skills of scientific reasoning

**Prerequisites**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Exam</th>
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<tbody>
<tr>
<td>90</td>
<td>Presentation (100 %)</td>
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**Semester**

<table>
<thead>
<tr>
<th>Language</th>
<th>Teaching Methods</th>
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</thead>
<tbody>
<tr>
<td>German/English</td>
<td>Introduction to theoretical background by lecturers, individual scientific discussions with lecturers and participants</td>
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</table>

**Lecturers**

Geography

**Work load total**

<table>
<thead>
<tr>
<th>Work load total</th>
<th>Contact Time</th>
<th>Preparation/Wrap-up Time</th>
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<tbody>
<tr>
<td>180 h</td>
<td>15 -30 %</td>
<td>30-50 %</td>
<td>30-50 %</td>
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