



UNIVERSITÄT  
HOHENHEIM

# Modulhandbuch

für den Studiengang  
Master of Science  
Earth and Climate  
System Science

Studienbeginn ab  
WiSe 21/22

Stand Oktober 2021

# Inhaltsverzeichnis

Modul: Agricultural and Forest Meteorology (1201-590)	3
Modul: Agricultural Production of Biobased Resources (3403-430)	6
Modul: Aktuelle Themen zur Biologie der Honigbienen (7301-420)	9
Modul: Astrobiology (1301-400)	11
Modul: Bioeconomy at European Level: EBU Label (3403-510)	15
Modul: Bodenwissenschaftliches Experiment (3102-420)	21
Modul: Chemistry of the Earth System & Pollution (1301-470)	23
Modul: Climate Basics: Massive Open Online Course on Climate Change, Risks and Challenges (1201-400)	26
Modul: Climate History and Evolution of the Earth System (1201-560)	28
Modul: Debate Seminar (1201-570)	30
Modul: Ecology and Agroecosystems (4906-410)	32
Modul: Economics and Environmental Policy (4902-440)	36
Modul: Economics and Management (5205-410)	40
Modul: Energy and Water Regime at the Land Surface (3103-500)	43
Modul: Environmental and Resource Economics (4101-410)	46
Modul: Environmental Microbiology (3102-410)	48
Modul: Ethical Reflection on Food and Agriculture (4302-420)	51
Modul: Experimentelle Arbeitsmethoden der organischen und bioorganischen Chemie (130b) (1302-400)	55
Modul: Forschungspraktikum Chemische Evolution (1301-430)	57
Modul: Global Agri-food Systems: Conventional, Organic, and Beyond (4302-460)	60
Modul: Global Change Issues (3202-420)	64
Modul: Introduction to Machine Learning in Python (4407-480)	70
Modul: Land Use Economics (4904-430)	72
Modul: Lecture Series Earth System Science (1201-550)	74
Modul: Massive Open Online Course on Climate Change, Risks and Challenges (1201-410)	76
Modul: Master-Thesis (1200-500)	79
Modul: Mathematics and Computational Sciences of the Earth System (1102-400)	80
Modul: Mathematics and Computational Sciences of the Earth System II (1102-410)	82
Modul: Measurement, Modeling and Data Assimilation I (1201-520)	84
Modul: Measurement, Modeling and Data Assimilation II (1201-530)	87
Modul: Microbiological Safety within the Feed and Food Production Chain (4605-430)	89
Modul: Natural Resource Use and Conservation in the Tropics and Subtropics (4907-410)	92
Modul: Plant and Crop Modeling (3103-410)	95
Modul: Plant Quality (3408-460)	98
Modul: Portfolio-Modul (Master) (3000-410)	101
Modul: Poverty and Development Strategies (4901-420)	108
Modul: Quantitative Methods in Economics (4901-470)	112
Modul: Remote Sensing of the Earth System (1201-500)	115
Modul: Special Topics of Earth System Science (1201-620)	117
Modul: UNlcert III English for Scientific Purposes (1000-040)	119
Modul: Weather and Climate Physics (1201-630)	122

## Modul: Agricultural and Forest Meteorology (1201-590)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	<p>Innerhalb des Studiengangs ECSS ist es empfehlenswert, wenn die Studierenden vor dem Belegen an den Pflichtmodulen "Weather and Climate Physics" und "Energy and Water Regimes at the Land Surface" teilgenommen haben.</p> <p>Das Modul ist auch für Studierende anderer Studiengängen offen, da es kein Bestandteil einer Profilrichtung oder speziellen Fachkombination ist.</p>
Teilnahmevoraussetzung	Basic understanding about atmospheric processes, basic modules of the first semester of the master course.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	<p>Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl</p> <p>Bioeconomy (Master, PO vom 01.10.2014) 1. Semester, Wahl</p> <p>Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Earth and Climate System Science (Master, PO vom 01.10.2017) 3. Semester, Wahl</p> <p>Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 1. Semester, Wahl</p> <p>Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl</p>
Prüfungsdauer (in Minuten)	120 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	56 h attendance + 124h independent study = 180 h
Lern- und Qualifikationsziele	The students develop a basic understanding for questions and methods used in agricultural and forest meteorology. They know the relationships between weather and climate on the one hand side and the different types of land surface on the other side and are capable to use this knowledge to solve interdisciplinary questions in applied meteorology.

	The students are capable to combine the competences learned in this module with their knowledge learned in the basis lectures of earth system sciences to work on interdisciplinary questions in agriculture and forestry.
empfohlene Vorkenntnisse	Interesse an der Meteorologie im Allgemeinen und den Beziehungen zwischen Meteorologie und Land- und Forstwirtschaft im Besonderen. Mathematische und physikalische Kenntnisse sind von Vorteil.
Anmerkungen	Maximum number of participants: 10
Modulprüfung und Gewichtung	Schriftlich, Klausur (100%), keine anderen Modulteile gehen in die Bewertung ein.
Studienleistung und Gewichtung	Active participation in both parts of the module
<b>Agricultural and Forest Meteorology, Lecture (1201-591)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Vorlesung
SWS	4
Inhalt	In the first part of the module, the basic understanding of atmospheric processes developed in earlier modules of the master course is briefly repeated and then complemented by details about the relationships between the atmosphere and the underlying land surface. Then the questions answered in agriculture and forest meteorology are presented to develop an understanding of the interrelation between weather and climate on the one side and agriculture, forests and forestry on the other side.
Literatur	-
Anmerkungen	-
<b>Agricultural and Forest Meteorology, Exercise and Practical (1201-592)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Übung mit Praktikum
SWS	2
Inhalt	The students solve exercises as preparation for the written examination as well as for deepening the material discussed in the lecture.  Furthermore, this part of the module contains practical work with tools used in Agriculture and Forest Meteorology to deepen the understanding of the applied methodologies.
Literatur	-

Anmerkungen	-
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## Modul: Agricultural Production of Biobased Resources (3403-430)

Modulverantwortung	Iris Lewandowski
Bezug zu anderen Modulen	This module provides the basic knowledge on agricultural production of biobased resources that is needed to accomplish the Master Programme in Bioeconomy.
Teilnahmevoraussetzung	See admission regulations for the Master Programme Bioeconomy.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 1. Semester, semi-elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 1. Semester, semi-elective Earth and Climate System Science (Master, since 01.10.2021), 1. Semester, compulsory
Prüfungsdauer (in Minuten)	60 minutes
Präsenzstudium (in Stunden)	52
Selbststudium (in Stunden)	128
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>Students have a sound knowledge of crop production in various agro-ecological zones and production systems. They are able to understand the conditions of agricultural production for biomass under different ecological and socio-economic settings. They investigate the natural resource base of agricultural production and have the skills to characterize material flows in agricultural systems, including agricultural products and their important links to livestock production. On this basis, they are able to develop concepts for the sustainable production of biomass for the biobased economy.</p> <p>Students are able to deal with complex natural systems. They understand the implications of this complexity on the agricultural production stage of biobased value chains. They gain the analytical skills</p>

	and practice the critical thinking necessary to engage in the discussion on sustainable land-use systems and the implications of competing uses of biomass on food security. They are able to explain the role of agricultural production in the bioeconomy. They also gain skills in oral presentation, scientific writing, team work and interdisciplinary collaboration.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 60. Priority will be given to students for whom the module is compulsory.
Modulprüfung und Gewichtung	50% written exam, 25% case study presentation including discussion, 25% case study written report
Studienleistung und Gewichtung	All students prepare a written report (25%), and prepare and hold a presentation (25%)
<b>Agricultural Production of Biobased Resources (3403-431)</b>	
Person(en) verantwortlich	Iris Lewandowski Regina Birner
Lehrform	Vorlesung
SWS	4
Inhalt	<p>The overall objective of the module is to provide fundamental knowledge on the functioning of agricultural systems in different climatic zones for the production of biobased resources for the bioeconomy.</p> <p>Contents of the module include:</p> <ul style="list-style-type: none"> <li>• <ul style="list-style-type: none"> <li>◦ Description, systematics and functioning of agro-ecosystems;</li> <li>◦ Provision of ecosystem services / hidden agricultural value chains;</li> <li>◦ Bio-physical principles of agricultural production;</li> <li>◦ Role of climate and climate change in agricultural production.</li> </ul> </li> <li>• <ul style="list-style-type: none"> <li>◦ Systematics, description and analysis of agricultural production systems in different agro-ecological regions;</li> <li>◦ Case studies in crop production;</li> <li>◦ In- and outputs and material flows in agricultural production systems;</li> <li>◦ Yields and quality of products from agricultural production;</li> <li>◦ Biomass supply systems;</li> <li>◦ Logistic aspects of biomass supply;</li> <li>◦ Biomass supply in the context of food security.</li> </ul> </li> </ul>

Literatur	<a href="https://link.springer.com/book/10.1007%2F978-3-319-68152-8">https://link.springer.com/ book/10.1007%2F978-3-319-68152-8</a>
Anmerkungen	-



## Modul: Aktuelle Themen zur Biologie der Honigbienen (7301-420)

Modulverantwortung	Ulrich Ernst
Bezug zu anderen Modulen	Das Modul ergänzt inhaltlich die Module „Bienenkunde und Imkerei“ und „Soziale Insekten.“
Teilnahmevoraussetzung	-
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Biologie, 3. Semester (Wahlpflicht) M.Ed. Biologie Lehramt, 3. Semester (Wahl) M.Ed. (Erw.) Biologie Lehramt, 3. Semester (Wahl) M.Sc. Agrarbiologie, 3. Semester (Wahl) M.Sc. Earth and Climate System Science, 3. Semester (Wahl) M.Sc. Molekulare Ernährungswissenschaft, 3. Semester (Wahl) M.Sc. Ernährungsmedizin, 3. Semester (Wahl)
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, Original- und Übersichtsarbeiten kritisch zu lesen und zu hinterfragen; ihre Meinung faktenbasiert und überzeugend darzulegen; andere Meinungen als Meinung zu akzeptieren, sie aber auf ihre Annahmen und Grundlagen zu überprüfen; einige der Verzerrungen und Tendenzen in der Wissenschaft zu erkennen und benennen zu können; Versuchsplanungen zu verbessern; klare Präsentationen zu erstellen; konstruktives Feedback zu geben und anzunehmen; kritische Fragen an Vortragende zu stellen; auf kritische oder unfaire Fragen souverän zu reagieren; über aktuelle Themen der Honigbienenbiologie fundiert zu diskutieren.
empfohlene Vorkenntnisse	Zur Vorbereitung auf das Modul empfiehlt es sich, das Modul „Bienenkunde und Imkerei“ oder „Soziale

	Insekten“ abgeschlossen zu haben oder sich selbständig Grundlagen zur Honigbienenbiologie angeeignet zu haben, z.B. aus Tautz, Jürgen (2007) Phänomen Honigbiene. Heidelberg; München, Spektrum Verlag
Anmerkungen	Anzahl Teilnehmerplätze: 15 Anmeldung zum Modul: via ILIAS Kriterien, nach denen Studienplätze vergeben werden: Reihenfolge der Anmeldung.
Modulprüfung und Gewichtung	Mitarbeit (50%), Protokoll (25%), Präsentation (25%)
Studienleistung und Gewichtung	-
<b>Aktuelle Themen zur Biologie der Honigbienen Veranstaltung (7301-421)</b>	
Person(en) verantwortlich	Ulrich Ernst Peter Rosenkranz
Lehrform	Seminar
SWS	4
Inhalt	Aktuelle Themen der Honigbienenbiologie, z.B. unter anderem  Schwarmverhalten, Kommunikation und Tänze, Alterung, Immunität, Schmerz bei Insekten, Verwandtschaftsselektion und Hamilton's Regel, Konflikte im Bienenvolk, Epigenetik und Imprinting, Klassiker der Bienenliteratur, Sinnesphysiologie, chemische Ökologie, Pheromone, aktuelle Themen der Imkerei. Die Themen werden in Absprache mit den Teilnehmenden ausgewählt.  Daneben soll Wissenschaftskultur kritisch beleuchtet werden und Umgang mit Kritik eingeübt werden.
Literatur	Aktuelle Übersichtsarbeiten, Originalartikel, Buchkapitel, Blogs (werden in der ersten Sitzung besprochen und nach Präferenz der Teilnehmenden ausgewählt)
Anmerkungen	Das Seminar lebt von der guten Vorbereitung der ausgewählten Texte zuhause und der aktiven Diskussion während der Sitzung.

## Modul: Astrobiology (1301-400)

Modulverantwortung	Henry Strasdeit
Bezug zu anderen Modulen	Nach Absprache mit dem Modulverantwortlichen kann das Modul Bestandteil der Spezialisierungsrichtung "Astrobiologie" sein (zusammen mit dem Forschungspraktikum Chemische Evolution und der Masterarbeit im Fachgebiet 130a).
Teilnahmevoraussetzung	Keine
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	90 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	56 h attendance + 124 h independent study = 180 h workload
Lern- und Qualifikationsziele	<p>After having completed the module, the students should be able to explain important concepts and cause-and-effect relations in astrobiology. They can determine the ideas behind astrobiological statements. The students know basic chemical aspects of astrobiology (e. g., chemical compounds, chemical analytical methods) and can recall relevant details. They can also recall details of astrobiologically important research activities (e. g., space missions). The students should be able to exemplify astrobiologically important classes of objects, processes and concepts (e. g., types of meteorites, mass extinctions, biosignatures, characteristic properties of life).</p> <p>The students understand how laboratory experiments, field studies, astronomical observations and space missions expand our knowledge about the origin and evolution of life. They realize that life on Earth is and always was strongly influenced by cosmic phenomena and that life itself could be a cosmic phenomenon, that is, life may also exists on</p>

	<p>other planets and moons. During an excursion, the students acquire practical skills in recognizing the traces of an ancient asteroid impact.</p> <p>Furthermore, students should be able to deal with highly interdisciplinary problems by combining the methods and ways of thinking of various scientific disciplines. They know how to access the diverse and scattered literature of an interdisciplinary field and to present and discuss results from relevant publications</p>
empfohlene Vorkenntnisse	Mindestens Grundkenntnisse in Biologie, Chemie und Physik, wie sie z.B. in den naturwissenschaftlichen Bachelorstudiengängen der Universität Hohenheim vermittelt werden. Interesse an Astronomie und Geologie ist hilfreich.
Anmerkungen	Places available: 14 Registration via ILIAS starting in January/February for the following summer semesterrn Places are assigned by the order of incoming registrations.
Modulprüfung und Gewichtung	Schriftliche Prüfung (Klausur) über den Stoff des gesamten Moduls.
Studienleistung und Gewichtung	participation at the excursion
<b>Introduction to Astrobiology (1301-401)</b>	
Person(en) verantwortlich	Henry Strasdeit
Lehrform	Übung mit Exkursion
SWS	2
Inhalt	<p>The lecture includes the following topics: astronomical basics, chemical evolution from the interstellar medium to planetary systems, the early Earth, asteroid impacts, primordial volcanic islands, black smokers, past and present environmental conditions on Mars, biosignatures, habitability, the search for life on Mars, the icy moons of Jupiter and Saturn, planetary field analogues, extremophiles, survival of microorganisms in space, lithopanspermia, the possible role of minerals and salts in the origin of life, protocells and protometabolism, origin of biological homochirality, oldest traces of life, mass extinctions, „rare Earth“, SETI.</p> <p>The excursion leads to an asteroid impact crater, either the Nördlinger Ries or the Steinheimer Becken. It includes a field trip and a visit to the respective museum.</p>

Literatur	<p>Plaxco, K. W., Gross, M.: Astrobiology - A Brief Introduction, 2nd edition, Johns Hopkins University Press, Baltimore, 2011.</p> <p>Rothery, D. A., Gilmour, I., Sephton, M. A. (eds.): An Introduction to Astrobiology, revised edition, Cambridge University Press, Cambridge, UK, 2011.</p> <p>Sullivan III, W. T., Baross, J. A. (eds.): Planets and Life - The Emerging Science of Astrobiology, Cambridge University Press, Cambridge, UK, 2007.</p> <p>Pösges, G., Schieber, M.: The Ries Crater Museum Nördlingen, 2nd edition, Pfeil, München, 2015.</p>
Anmerkungen	-
<b>Key Experiments in Astrobiology (1301-402)</b>	
Person(en) verantwortlich	Stefan Fox
Lehrform	Vorlesung
SWS	1
Inhalt	<p>This lecture gives an overview of seminal experiments in different fields of astrobiological research. Findings from laboratory and field studies, space missions, and astronomical and astrochemical observations will be presented. The focus will be on the practical aspects of simulation experiments, space missions, and chemical analyses. Some examples of the topics covered are (i) studies on the interstellar medium, exoplanets, and small celestial bodies (comets, asteroids, meteorites), (ii) experimental prebiotic chemistry: amino acids, Miller-type experiments, the formose reaction, protein and RNA world hypothesis, (iii) field studies at volcanic locations („hot-volcanic-coast scenario“), and (iv) analytical methods.</p>
Literatur	<p>Plaxco, K. W., Gross, M.: Astrobiology - A Brief Introduction, 2nd edition, Johns Hopkins University Press, Baltimore, 2011.</p> <p>Rothery, D. A., Gilmour, I., Sephton, M. A. (eds.): An Introduction to Astrobiology, revised edition, Cambridge University Press, Cambridge, UK, 2011.</p> <p>Sullivan III, W. T., Baross, J. A. (eds.): Planets and Life - The Emerging Science of Astrobiology, Cambridge University Press, Cambridge, UK, 2007.</p>
Anmerkungen	The topics covered in this lecture are partly aligned to the contents of the “Practical course in chemical evolution”.

<b>Seminar on Astrobiology (1301-403)</b>	
Person(en) verantwortlich	Henry Strasdeit
Lehrform	Seminar
SWS	1
Inhalt	In this seminar, each student selects an astrobiological topic and presents it in a talk of 15 to 20 minutes duration (e. g., as PowerPoint presentation). A list of topics to choose from will be provided. After each talk, one of the students will chair the following discussion. Topics for the seminar are, for example, the early Earth environment, the concept of habitability, extremophiles, earliest records of life, lithopanspermia, planetary protection, and terraforming.
Literatur	Journal articles and book chapters on which the seminar talks are based.
Anmerkungen	-

## Modul: Bioeconomy at European Level: EBU Label (3403-510)

Modulverantwortung	Iris Lewandowski
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	Beginn WS
Dauer des Moduls	1 semester
Studiengänge	Bioeconomy (Master) 3rd semester, elective Biobased Products and Bioenergy (Master) 3rd semester, elective Earth and Climate System Science (Master) 3rd semester, elective
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	60
Selbststudium (in Stunden)	120
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>By the end of the course, students will have acquired the main skills, competences and expertise to become an active change agent in the transformation towards a sustainable bioeconomy. Participants complete a series of activities to develop their profile within the field of the bioeconomy. This involves the acquisition of both bioeconomy-related academic knowledge as well as soft-skills in an international context. The EBU qualification supplement will encourage interdisciplinarity and collaboration by connecting students from different European universities. In addition, it will reward individual activities such as participation in optional soft skills trainings, summer schools, student challenges, entrepreneurial activities, etc. The EBU certificate thus promotes a form of study which views the bioeconomy from different perspectives and encourages thinking outside the (disciplinary) box.</p> <p>After successful completion of this module, students should be able to:</p> <ul style="list-style-type: none"> <li>• Work in international as well as inter- and transdisciplinary groups</li> </ul>

	<ul style="list-style-type: none"> <li>• Understand how the bioeconomy relates to specific fields of research</li> <li>• Demonstrate the skills and competences necessary to play an active role in the development of the bioeconomy</li> <li>• Serve as active members of the bioeconomy at European level</li> </ul>
empfohlene Vorkenntnisse	-
Anmerkungen	<p>The EBU has developed a common qualification supplement, the “EBU label”, that will be granted to master students on bioeconomy-relevant study programs offered at the six EBU partner universities. It aims to upgrade existing disciplinary university curricula at master level by incorporating inter- and transdisciplinarity, cross-sectoral collaboration and sustainability competences.</p> <p>For the EBU qualification supplement to be granted, the following criteria must be fulfilled:</p> <ol style="list-style-type: none"> <li>1. Enrolment in one of the following bioeconomy-relevant master programs: <ul style="list-style-type: none"> <li>• Bioeconomy</li> <li>• Biobased Products and Bioenergy</li> <li>• Earth and Climate System Science</li> </ul> </li> <li>2. Self-reflection report on the student's own T-shaped skills profile consisting of disciplinary and interdisciplinary expertise, hard and soft skills as well as sustainability competences.</li> <li>3. Completion of a master thesis with an explicit link to the bioeconomy through inclusion of a chapter describing the relevance of the thesis results to the bioeconomy. Ideally, supervisor(s) and co-supervisor(s) should be academics from two different EBU universities. Students should select their supervisors according to the topic of interest.</li> <li>4. Participation in the 'EBU Student Journey' or in an exchange semester at an EBU partner university:</li> </ol>



- Participation in the 'EBU student journey' must be combined with one of the additional activities listed in point 5. Students interested in participating in the journey must apply for it separately (for application rules, see elective course "EBU Student Journey"). Only 6 students will be selected per journey and year.
- An exchange semester at one of the partner universities must be combined with participation in the MOOC (see below) and in one of the other additional activities listed in point 5.

5. Additional activities:

- Participation in the MOOC "Concepts of sustainable bioeconomy" (see elective course "ABBEE MOOC: Concepts of Sustainable Bioeconomy"). This activity is mandatory for students choosing option b above (exchange semester);
- Participation in soft-skill trainings, including digital skills and lifelong learning programs;
  - Participation in events/competitions/workshops on the bioeconomy;
- Being proactive within the bioeconomy environment (entrepreneurship / activity in a bioeconomy student group / social media group).

After validation of the fulfilment of these criteria, students will receive certification of completion of the module.

Registration: Students must register for participation via ILIAS. In addition, participation in the courses "EBU Student Journey" and "MOOC: Concepts of Sustainable Bioeconomy" must be applied for separately.

Modulprüfung und Gewichtung	Examination interview
Studienleistung und Gewichtung	-
<b>EBU Student Journey (3403-511)</b>	
Person(en) verantwortlich	Iris Lewandowski
Lehrform	Seminar mit Exkursion
SWS	3

<p>Inhalt</p>	<p>Students work in teams, complete interactive online activities, follow online lectures and participate in an excursion (or on-site meeting, depending on location). During the excursion/on-site meeting, the students meet up for 5 days at one of the EBU partner universities and work in inter-disciplinary teams on a range of collaborative activities. These include a "bioeconomy challenge" on a cutting-edge bioeconomy-related topic. The focus differs every year depending on both the latest needs of the European bioeconomy and the scheduled visits to industry partners.</p> <p>Through these activities and depending on the year's focus, the EBU Student Journey will cover any number of the following skills:</p> <ul style="list-style-type: none"> <li>• Inter- and transdisciplinary skills based on a cross-sectorial mind-set</li> <li>• Sustainability competences including systems thinking, strategic competences, and normative competences</li> <li>• Personal and interpersonal skills including critical thinking, problem-solving, creativity, and others - International (digital) communication and collaboration skills</li> <li>• Management and entrepreneurial skills</li> </ul>
<p>Literatur</p>	<p>-</p>
<p>Anmerkungen</p>	<p>Only six students will be selected to participate in the EBU Student Journey per year. The other students will have the opportunity to follow the exchange semester (option b in the criteria of the module) to acquire the EBU qualification supplement.</p> <p>Application for the "EBU Student journey" will be possible for the whole month of February via ILIAS. Six participants from each EBU partner university will be selected per year (for selection criteria, see ILIAS).</p> <p>Preparatory online seminars and individual + group activities will be conducted before the on-site meeting. The exact dates of the on-site meeting will be announced prior to the application period.</p>

<b>MOOC: Concepts of Sustainable Bioeconomy (3403-512)</b>	
Person(en) verantwortlich	Iris Lewandowski
Lehrform	E-Learning
SWS	1
Inhalt	<p>This course describes the bioeconomy and its underlying concepts on a meta-level. The focus is on explaining the potential contribution of the bioeconomy to sustainability, including the role of innovation, governance and multi-stakeholder collaboration, as well as the importance of applying analytical methods to guide decision-making.</p> <p>This approach uses the concept of the biobased value chain as a transversal framework that combines biophysical, social, technological and economic elements. Special attention is given to the fundamentals of the bioeconomy such as systems thinking and inter- and transdisciplinarity.</p> <p>The course offers a space for reflection on the role of professionals in the bioeconomy. It serves as a baseline to enrich the bioeconomy dialogue, integrating a range of perspectives and dimensions. Given the plurality of bioeconomy perspectives, it is important to acknowledge that there is no 'one-size-fits-all' definition, and each interpretation is dependent on specific contexts.</p> <p>Against this background, the course explains different bioeconomy perspectives as well as the role of biobased resources and biological knowledge in shaping a sustainable bioeconomy.</p> <p>After completion of the course, students should be able to:</p> <ul style="list-style-type: none"> <li>• Recognize and understand diverse perspectives, underpinning concepts and principles of the bioeconomy and its potential to contribute to sustainability.</li> <li>• Explain the concept of the biobased value chain and the manifold sectors that are part of the bioeconomy.</li> <li>• Describe different holistic methods to measure sustainability in the bioeconomy.</li> <li>• Acknowledge the importance of innovation and inter-/transdisciplinary collaboration approaches for the transition towards a bioeconomy.</li> <li>• Discuss and interpret bioeconomy strategies and policies, identifying their components</li> </ul>

	<p>and governance mechanisms to foster the bioeconomy.</p> <ul style="list-style-type: none"> <li>• Identify stakeholders in the bioeconomy, their roles and influence in decision-making processes and the transition towards a sustainable bioeconomy.</li> </ul>
Literatur	<p>Lewandowski, I: Bioeconomy. Shaping the Transition to a Sustainable, Biobased Economy, Springer. <a href="https://doi.org/10.1007/978-3-319-68152-8">https://doi.org/10.1007/978-3-319-68152-8</a>, 2018</p>
Anmerkungen	<p>Places are limited and participation requires prior registration.</p> <p>This self-paced online course will be permanently available on iversity (iversity.org) where students should register, complete all videos, quizzes, reading activities and self-reflection exercises. To be awarded the credits, the students must register with the person responsible for the module via email (<a href="mailto:nicole.gaudet@uni-hohenheim.de">nicole.gaudet@uni-hohenheim.de</a>) to arrange a date for the exam.</p>

## Modul: Bodenwissenschaftliches Experiment (3102-420)

Modulverantwortung	Ellen Kandeler
Bezug zu anderen Modulen	Dieses Modul hilft Studierenden, das Interesse an Bodenkunde zu vertiefen und ein Themenauswahl für die Masterarbeit und / oder Promotion zu treffen.
Teilnahmevoraussetzung	Grundkenntnisse und fortgeschrittene Kenntnisse in Bodenwissenschaften
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	n. V.
Studiengänge	<p>Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl</p> <p>Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl</p> <p>Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 3. Semester, Wahlpflicht</p> <p>Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 2. Semester, Wahlpflicht</p> <p>Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 1. Semester, Wahlpflicht</p> <p>Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 2. Semester, Wahlpflicht</p> <p>Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahlpflicht</p> <p>Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahlpflicht</p>
Prüfungsdauer (in Minuten)	30 Minuten
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	<p>Nach erfolgreichem Abschluss dieses Moduls haben die Studierenden einen Einblick in die Themen der modernen Bodenwissenschaften. Sie können Böden analysieren und Ergebnisse mündlich präsentieren.</p> <p>Durch die Vorlesungsvor- und Nachbereitung sowie durch die Prüfungsvorbereitung erlernen und</p>

	trainieren die Studierenden selbstständiges Arbeiten und kritisches, analytisches Denken.
empfohlene Vorkenntnisse	-
Anmerkungen	Jeder Student kann wählen, ob er die Laborarbeit mit Bericht und den Vortrag auf englisch oder deutsch machen möchte.
Modulprüfung und Gewichtung	schriftliche Ausarbeitung in Form eines Laborprotokolls (75%) und Präsentation mit Diskussion (25%)
Studienleistung und Gewichtung	-
<b>Bodenwissenschaftliches Experiment (3102-421)</b>	
Person(en) verantwortlich	Ellen Kandeler Thilo Streck Thilo Rennert
Lehrform	Seminar
SWS	4
Inhalt	Entsprechend Ihres Interesses können Sie ein Projekt unter Anleitung von: Biogeophysik (Prof. Streck) Bodenchemie (Prof. Rennert) Bodenbiologie (Prof. Kandeler) durchführen. In Zusammenarbeit mit einem Post Doc oder einem Doktoranden beteiligen Sie sich aktiv an neuen Forschungsfragen. Sie analysieren Bodenproben, werten ihre Ergebnisse aus und präsentieren sie in einem Seminar. Für weitere Informationen bezüglich der Inhalte dieser Veranstaltung wenden Sie sich bitte an Prof. Kandeler: Tel. 0711/4592-4220.
Literatur	Der Betreuer stellt Ihnen aktuelle Literatur zu Ihrem gewählten Thema zur Verfügung.
Anmerkungen	Es handelt sich um ein Seminar mit Übungen! Das Projekt kann nach Absprache mit dem Betreuer jederzeit begonnen werden. Dauer: 2-3 Wochen im Institut nach Vereinbarung

## Modul: Chemistry of the Earth System & Pollution (1301-470)

Modulverantwortung	Henry Strasdeit
Bezug zu anderen Modulen	Nein
Teilnahmevoraussetzung	Keine
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Pflicht Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Pflicht
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>After having completed the module, the students know the most important substances (e. g., minerals) and compound classes of the Earth system and their relevant reactions. They can recall the relevant facts. The students understand the underlying chemical concepts and know how to apply them. They are able to perform calculations related to the properties of chemical substances in the Earth system (e. g., solubilities and redox potentials). The students comprehend the chemical aspects of the Earth system on a global scale as well as on the molecular level and acquire a differentiated view of anthropogenic impacts.</p> <p>The graduates of the module understand the basic physical and chemical processes in the tropo- and the stratosphere and in the earth system. The influence of air pollutants in the ambient air and on a global scale can be explained, which, in turn, allows classifying and assessing the air quality in a defined area.</p> <p>After having completed the module, the students know how to apply the scientific method to complex systems.</p>

empfohlene Vorkenntnisse	Grundkenntnisse in Chemie, wie sie z. B. in den naturwissenschaftlichen Bachelorstudiengängen der Universität Hohenheim vermittelt werden.
Anmerkungen	In person with the module coordinator (this only applies to students of Master's programmes other than ECSS)
Modulprüfung und Gewichtung	Schriftliche Prüfung (Klausur) aus zwei Teilen (Gewichtung in Prozent): a) anorganische und organische Chemie (je 25%), b) Atmosphärenchemie (50%).
Studienleistung und Gewichtung	Regelmäßige Teilnahme
<b>Organic Substances in the Earth System (1301-471)</b>	
Person(en) verantwortlich	Uwe Beifuß
Lehrform	Vorlesung
SWS	1
Inhalt	Initially, some important functional groups and reactions that are crucial for a proper understanding of organic chemistry will be repeated. This is followed by presentation and discussion of the most important classes of organic substances as well as selected compounds of the earth system. Their formation, properties, and (degradation) reactions will be discussed as far as they are relevant to the earth system.
Literatur	Hart, D.J., Hadad, C.M., Craine, L.E., Hart, H.: Organic Chemistry: A Short Course, Brooks/Cole, Belmont, 2012.  or any other textbook of organic chemistry.
Anmerkungen	-
<b>Inorganic Chemistry of the Earth's Surface (1301-472)</b>	
Person(en) verantwortlich	Henry Strasdeit
Lehrform	Vorlesung
SWS	1
Inhalt	The lecture is based on an integrative concept. The focus is on the chemical principles that can equally be applied to the description of the Earth's solid surface and the bodies of water. Key topics of the lecture are: general chemical description of the Earth's surface; mineral classes; rocks; weathering; solubility; mobilisation and immobilisation of metal ions; metal complex formation; ion exchange; adsorption; acid-base reactions; redox reactions; acidity; salt content; substances and their transport in the hydrosphere; anthropogenic impacts.



Literatur	<p>Duke, C.V.A., Williams, C.D.: Chemistry for Environmental and Earth Sciences, CRC, Boca Raton, 2008.</p> <p>Andrews, J.E., Brimblecombe, P., Jickells, T.D., Liss, P.S., Reid, B.J.: An Introduction to Environmental Chemistry, 2nd edition, Blackwell, Malden, 2004.</p> <p>vanLoon, G.W., Duffy, S.J.: Environmental Chemistry - A Global Perspective, 4th edition, Oxford University Press, Oxford, 2017.</p> <p>Textbooks of general and inorganic chemistry (the most recent editions).</p>
Anmerkungen	-
<b>Chemistry of the Atmosphere (1301-473)</b>	
Person(en) verantwortlich	Cosima Stubenrauch
Lehrform	Vorlesung
SWS	2
Inhalt	Structure of the atmosphere; radiation balance of the Earth; global balances of trace gases; chemical degradation mechanisms; stratospheric chemistry, ozone hole; tropospheric chemistry, photochemical smog; greenhouse effect, climate; spatial distribution of air pollutants in urban and rural areas; temporal variation and trends in air quality; meteorological influences.
Literatur	<p>Jacob, D.J.: Introduction to Atmospheric Chemistry, Princeton University Press, Princeton, 1999.</p> <p>Zellner, R.: Global Aspects of Atmospheric Chemistry, Steinkopff, Darmstadt, 1999.</p> <p>Warneck, P.: Chemistry of the Natural Atmosphere, 2nd edition, Academic Press, San Diego, 2000.</p> <p>Baumbach, G.: Air Quality Control, Springer, Berlin, 1996.</p>
Anmerkungen	The graduates of the module understand the basic physical and chemical processes in the tropo- and the stratosphere. The influence of air pollutants in the ambient air and on a global scale can be explained, which, in turn, allows classifying and assessing the air quality in a defined area.

## Modul: Climate Basics: Massive Open Online Course on Climate Change, Risks and Challenges (1201-400)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	None.
Teilnahmevoraussetzung	None.
Lehrsprache	englisch
ECTS	2
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Earth and Climate System Science (PO vom: 17.07.2013), (3. Semester, Wahl) M.Sc. Environmental Protection and Agricultural Food Production (PO vom: 12.02.2019), 3. Semester, Wahl sowie alle interessierten Studierenden aus den Masterstudiengängen der Fakultät N
Prüfungsdauer (in Minuten)	60 Minuten
Präsenzstudium (in Stunden)	37
Selbststudium (in Stunden)	23
Arbeitsaufwand (in Stunden)	36 h Online Seminar + 23 h Self Study + 1 h Oral Examination = 60 h Workload
Lern- und Qualifikationsziele	Students who complete this module will acquire a basic knowledge of  - the climate system  - climate models and scenarios  - climate history  - impacts of climate change  - climate change as a societal challenge  - climate change in politics and economy  - Transfer of knowledge in natural and applied sciences  - Teamwork and communication  - Critical and analytical thinking

	<p>- Interdisciplinary thinking and its applications to problems in earth sciences</p> <p>based on the performance of the online course with exercises.</p>
empfohlene Vorkenntnisse	None.
Anmerkungen	<p>Registration to the MOOC: <a href="https://www.oncampus.de/weiterbildung/moocs/climate-change-risks-and-challenges">https://www.oncampus.de/weiterbildung/moocs/climate-change-risks-and-challenges</a></p> <p>Ergänzendes Modul für ECSS und ESS Studierende mit Studienbeginn vor WS 2018/19.</p>
Modulprüfung und Gewichtung	Oral Examination (30 Minute Presentation + 30 Minute Discussion)
Studienleistung und Gewichtung	Provision of certificate of attendance to the Massive Open Online Course (MOOC)
<b>Climate Basics: MOOC on Climate Change, Risks and Challenges (1201-401)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	E-Learning
SWS	2
Inhalt	<p>This online course provides the basic knowledge in the functioning of the Earth's climate system. This information is providing by a series of interactive online lectures and exercises.</p> <p>The contents include the global energy and water cycle, ocean and weather circulation systems, and feedback processes in the climate system. The natural and the anthropogeneous changes are discussed and distinguished. The function of climate models is presented. Future emission scenarios and corresponding projections are introduced. Finally, mitigation and adaption to climate change are discussed.</p>
Literatur	<p>Intergovernmental Panel on Climate Change (IPCC)-Reports: <a href="http://www.ipcc.ch">www.ipcc.ch</a> and <a href="http://www.de-ipcc.de">www.de-ipcc.de</a></p> <ul style="list-style-type: none"> <li>• Assessment Report</li> <li>• 1.5 Degree Report</li> <li>• Land-Atmosphere Report</li> </ul>
Anmerkungen	-

## Modul: Climate History and Evolution of the Earth System (1201-560)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	Alle Pflichtmodule des ersten Semesters.
Teilnahmevoraussetzung	Keine.
Lehrsprache	englisch
ECTS	4
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Pflicht Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Pflicht
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	42
Selbststudium (in Stunden)	78
Arbeitsaufwand (in Stunden)	120
Lern- und Qualifikationsziele	The students learn to think in larger spatial and longer temporal scales and recognize evolution as a universal phenomenon. They understand how climate and chemistry of the Earth system developed over long time scales and that it will further change in the future. In addition, the students can distinguish between natural and anthropogenic influences on the Earth system.
empfohlene Vorkenntnisse	Kenntnisse von Pflichtmodulen des ersten Semesters.
Anmerkungen	Maximum number of participants: 15
Modulprüfung und Gewichtung	Klausur. 50% zum Thema 'Climate History', 50% zum Thema 'Evolution of the Climate System'.
Studienleistung und Gewichtung	Keine.
<b>Chemical Evolution (1201-561)</b>	
Person(en) verantwortlich	Henry Strasdeit
Lehrform	Vorlesung
SWS	1
Inhalt	The students are introduced to the chemical and biological evolution as well as its complexity and emergence. They learn how chemical aspects determined the development of our solar system and about the chemical and physical conditions on the young planet Earth. In addition, prebiotic

	chemistry and the theories for the development of life on the planet are introduced and the development of the Earth is explained from a chemical point of view. Finally, today's chemical industry and the anthropogenic chemical evolution are considered.
Literatur	H. Rauchfuß: "Chemische Evolution und der Ursprung des Le-bens", Springer, Berlin.
Anmerkungen	-
<b>Climate History (1201-562)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Vorlesung
SWS	1
Inhalt	The students perform a journey through the 4.5 billion years of Earth and climate History. They learn about the governing natural forcing mechanisms like the Milankovich cycles or the influence of plate tectonics and today's anthropogenic influences on the climate system. The development of the atmosphere and the sequence of cold and warm episodes is described in detail including the development of the biosphere and its influence on climate. Finally, the radiation balance, the greenhouse effect and future climate scenarios are discussed
Literatur	Publications of the International Geosphere Biosphere Program
Anmerkungen	-
<b>Climate History and Evolution of the Earth System (1201-563)</b>	
Person(en) verantwortlich	Volker Wulfmeyer Henry Strasdeit
Lehrform	Übung
SWS	1
Inhalt	Exercise to deepen the content of the lecture „Climate History“. The students select a subject and prepare a seminar talk. This talk is given to the whole group followed by a discussion.
Literatur	-
Anmerkungen	-

## Modul: Debate Seminar (1201-570)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	Alle Pflichtmodule des ersten Semesters.
Teilnahmevoraussetzung	Aktive Teilnahme an der Vorlesungen.
Lehrsprache	englisch
ECTS	2
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Pflicht Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Pflicht
Prüfungsdauer (in Minuten)	45
Präsenzstudium (in Stunden)	30
Selbststudium (in Stunden)	30
Arbeitsaufwand (in Stunden)	30 h attendance + 30 h independent study = 60 h workload
Lern- und Qualifikationsziele	The students learn the standard formats of debates such as the British and Open Parliamentary Styles. They elaborate their own speeches based on rhetorical tools. Standard knowledge about the structure of speeches is acquired as well. By practical debates, they examine their skills to appear convincingly in discussions about topics in Earth System Science such as global and climate change.
empfohlene Vorkenntnisse	Keine.
Anmerkungen	Maximum number of participants: 10 Registration via ILIAS. Registration is open from the end of the summer semester until the beginning of the winter semester.
Modulprüfung und Gewichtung	Vortrag geben.
Studienleistung und Gewichtung	Vorbereitung und Aufführung eine Debatten.
<b>Debate Seminar (1201-571)</b>	
Person(en) verantwortlich	
Lehrform	Seminar
SWS	2
Inhalt	In this seminar, the students learn to prepare and to perform a debate. Generally, the debate is performed based on the style of the "Open Parliamentary Debate".

	<p>After the definition of a debate, the main ingredients of a good speech are presented based on the well-known and still applicable introductions of Aristotle. Then, the preparation, organization, and performance of a high-quality speech is trained including a good behavior of the speaker.</p> <p>One week in advance, a topic of the debate is formulated by the students, which relates to the contents of this class and is matter of a controversial discussion among experts and/or in the public. By a draw it is selected whether the students belong to the government, the opposition or to the free speakers in the debate. These groups perform the final preparation of he debate together and independently, i.e., they allocate arguments and arrange their appearance in the debate. In the debate, the speakers of these parties present their arguments within a prescribed time schedule. The lecture is closed with an open discussion between the audience and all students.</p>
Literatur	The specific rules are handed out and explained to students in written form during a preliminary meeting.
Anmerkungen	-

## Modul: Ecology and Agroecosystems (4906-410)

Modulverantwortung	Ingo Graß
Bezug zu anderen Modulen	This module will link-up knowledge from different subject areas in order to enable students to interpret reactions within agroecosystems coherently.
Teilnahmevoraussetzung	Basic knowledge of farming and/or closely related topics. This module is designed to accommodate a range of experience and knowledge levels in both ecology and agriculture. Students with only basic knowledge in ecology and biology should enlarge them before starting in this module. To maintain the high quality of this module and due to time and space constraints in planned group work, seminar presentations, and excursions we only accept a maximum of 50 students. Access is on a "first come first serve" basis, allowing students for which the module is compulsory, semi-elective, and, thereafter, elective to enter the course.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	<p>Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 1. Semester, compulsory</p> <p>Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 1. Semester, compulsory</p> <p>Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective</p> <p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Landscape Ecology (Master, since 01.10.2014) 3. Semester, elective</p> <p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Organic Agriculture and Food Systems (Master, since 01.10.2014) 3. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 1. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 1. Semester, elective</p>



	<p>Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective</p> <p>Biobased Products and Bioenergy (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 1. Semester, semi-elective</p>
Prüfungsdauer (in Minuten)	120 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>After completion of the module, students are able to explain the principles of ecological agents that regulate the functioning of natural and agricultural ecosystems and to demonstrate the complex biotic interactions in natural landscapes and agro-ecosystems. Further, they are able to explain how to apply ecological concepts and principles to design and manage sustainable agro-ecosystems with improved long-term reliability in agricultural production.</p> <p>During preparation for the exam, while preparing and following up on lectures and while preparing the seminar, students practice self-reliance, time management, personal responsibility and cooperation. They hereby also adopt needful skills in fields, also including communication skills and (foreign) language proficiency. Students learn and practice both critical and analytical thinking and reading of scientific literature in the seminar and their ability to explore a scientific issue. Through the seminar presentation, students improve their oral articulateness and their ability to discuss scientific</p>

	matters. Finally, students acquire expertise to permit the competent application of technical knowledge and are of use in the solution of practical problems.
empfohlene Vorkenntnisse	-
Anmerkungen	Please register online via ILIAS as the module is restricted to 40 participants. The registration will be open until the end of the first week of the module. A waiting list will be maintained and implemented on the first day of the course. You will receive an electronic confirmation once you have been accepted into the module.
Modulprüfung und Gewichtung	Written exam (70 %)
Studienleistung und Gewichtung	Presentation in groups (20 %) with handout (5 %) and discussion (5 %)
<b>Ecology and Agroecosystems (4906-411)</b>	
Person(en) verantwortlich	Ingo Graß
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	<ul style="list-style-type: none"> <li>• Ecology - outline</li> <li>• Climatically caused diversity of tropical and subtropical ecozones</li> <li>• Agro-ecological zoning system</li> <li>• Plants and environmental factors</li> <li>• Interaction between agriculture and natural ecosystems</li> <li>• Principles of ecosystem functions</li> <li>• Interactions in agroecosystems: Species interactions</li> <li>• Agroecosystems of the tropics and subtropics</li> <li>• Wildlife and rangeland ecology</li> <li>• Practical methods in agroecology</li> </ul>
Literatur	<ul style="list-style-type: none"> <li>• Altieri, M.; 1995: Agroecology. Cambridge University Press, Cambridge.</li> <li>• Gliessmann, S.R.; 2000: Agroecology: Ecological processes in sustainable agriculture. CRC Press LLC, USA.</li> <li>• Gliessmann, S.R.; 2000: Field and laboratory investigations in Agroecology. CRC Press LLC, USA.</li> <li>• Krebs, Ch.J.; 2001: Ecology: The Experimental Analysis of Distribution and Abundance, Benjamin Cummings, San Francisco.</li> <li>• Martin, K. und J. Sauerborn; 2006: Agrarökologie, Verlag Eugen Ulmer, Stuttgart.</li> </ul>

	<ul style="list-style-type: none"> <li>• Ricklefs, R.E. and Miller, G.L.; 2000: Ecology. W.H. Freeman and Company, New York, USA.</li> </ul>
Anmerkungen	<ul style="list-style-type: none"> <li>• <ul style="list-style-type: none"> <li>◦ Lectures - to provide fundamental knowledge relevant to agro-ecosystems</li> <li>◦ Group assignment - to encourage broader interdisciplinary thinking and design in a group context</li> <li>◦ Examination - the final test of competency</li> </ul> </li> <li>• <ul style="list-style-type: none"> <li>◦ written exam 70%; seminar presentation 30%</li> </ul> </li> </ul>

## Modul: Economics and Environmental Policy (4902-440)

Modulverantwortung	Martina Brockmeier
Bezug zu anderen Modulen	Due to its introductory character, this module is a basis for more advanced economic modules such as "Microeconomics", "Agricultural and Food Policy" or "Environmental and Resource Economics".
Teilnahmevoraussetzung	This is an introductory module without any specific prerequisites.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 1. Semester, compulsory Organic Agriculture and Food Systems (Master, since 01.10.2014) 1. Semester, compulsory Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 1. Semester, compulsory Earth System Science (Master, since 01.10.2013) 3. Semester, elective Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 1. Semester, elective Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective
Prüfungsdauer (in Minuten)	120 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	After completing this module, students are able to explain basic principles and concepts of microeconomics, environmental economics and environmental policy. In addition, students are able to translate these concepts into complex real world situations (market imperfections, policy design, policy distortions, linkage between agriculture and the environment). Students can further

	<p>comparatively assess different policy options to address environmental problems/resource use. Finally, students are proficient in analysing the limits of economic concepts and their relevance in policy design.</p> <p>During preparation for the exam and while preparing and following up on lectures, students practice time management and self-reliance. They learn and practice critical and analytical thinking and learn to apply sound economic reasoning.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	Learning objectives are enhanced by the distribution of exercises and solutions, as well as a voluntary tutorial in order to support students in the application of economic concepts to real world problems.
Modulprüfung und Gewichtung	Written exam (100 %)
Studienleistung und Gewichtung	-
<b>Basic Microeconomics (4902-441)</b>	
Person(en) verantwortlich	Martina Brockmeier
Lehrform	Vorlesung
SWS	2
Inhalt	This lecture comprises the basic microeconomic concepts of household theory, theory of the firm, and the theory of markets under perfect and imperfect competition, as well as the economics of the public sector (public goods, externalities). These concepts are applied in many examples to the agricultural and food sector of developing and developed economies with a focus on interactions between agriculture and the environment. It will be shown how to apply microeconomic concepts to real world situations and policy challenges. This lecture is enhanced by the distribution of exercises and solutions, as well as a voluntary tutorial in order to support students in the application of microeconomic concepts.
Literatur	<p>The lecture is organized along the microeconomic part of "Principles of Economics" by Gregory Mankiw. The textbook "Economics" by Samuelson/Nordhaus has a similar content.</p> <p>The mathematical concepts used (differential and integral calculus) are well explained in "Fundamental Methods of Mathematical Economics" by Alpha C. Chiang.</p>
Anmerkungen	Basic microeconomics is implemented as in-class lectures or synchronous online lectures, depending on current regulations. ILIAS will be used as the

	<p>teaching platform. In the Basic Microeconomics section, you will find teaching material, a forum where questions are answered, and exercise sheets which will be discussed in the tutorial sessions. The lecture and the tutorial material will be updated on a weekly basis as the course proceeds. More information is given in the Syllabus that you can find under the tab „documents“.</p>
<b>Environmental Policy (4902-442)</b>	
Person(en) verantwortlich	Christian Lippert
Lehrform	Vorlesung
SWS	2
Inhalt	In the light of applied economic theory current resource use problems will be analysed. The lecture introduces to basic concepts of environmental and natural resource economics, cost-benefit analysis with respect to environmental resources, the concept of sustainable resource use, as well as to the theory of optimal resource extraction. Moreover, the most important environmental policy instruments will be presented and discussed.
Literatur	<ul style="list-style-type: none"> <li>Perman, R., Ma, Y., McGilvray, J., Maddison, D. and M. Common (2011): Natural Resource and Environmental Economics. 4th Edition, Pearson Education.</li> </ul>
Anmerkungen	This lecture takes place in the second half of the semester (4 hours per week). A voluntary tutorial is offered.
<b>Exercises to Basic Microeconomics (freiwillig) (4902-443)</b>	
Person(en) verantwortlich	Martina Brockmeier
Lehrform	Übung
SWS	1
Inhalt	.
Literatur	-
Anmerkungen	-
<b>Exercises to Environmental Policy (freiwillig) (4902-444)</b>	
Person(en) verantwortlich	Christian Lippert
Lehrform	Übung
SWS	1
Inhalt	.
Literatur	-

Anmerkungen	-
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## Modul: Economics and Management (5205-410)

Modulverantwortung	Franziska Schünemann
Bezug zu anderen Modulen	This module introduces to basic concepts used in Economics and Management required to accomplish the MSc Bioeconomy. It doing so, it (i) complements the semi-elective modules imparting basic knowledge in the agricultural and natural science, and (ii) forms the basis for the more advanced compulsory modules “Internal and External Costs & Benefits of Biobased Products” and “Markets, Innovation and Social Acceptance of Biobased Products”, and for elective modules from the fields of Economics and Management.
Teilnahmevoraussetzung	keine
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 1. Semester, Wahlpflicht Earth & Climate System Science (ab WS21/22) (Master, PO vom 17.07.2021), 1. Semester, Pflicht
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	56 h presence + 104 h preparation at home + exam = 160 h
Lern- und Qualifikationsziele	<p>Students have a sound knowledge of basic ideas and concepts of economics and corporate finance. They can communicate these ideas and concepts in interdisciplinary teams. They are able to employ methods used in economics and corporate finance to construct solutions to real-world problems that arise the context of organizing the biobased economy. On this basis, they are prepared to follow more advanced Economics and Management courses.</p> <p>Students are able to communicate and to work in interdisciplinary and international teams. They can think analytically and critically and employ quantitative methods to solve economic, business, and social issues. They are able to carve out important and to abstract from less important channels.</p>



empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (60 Minutes) and case study with oral presentation in class
Studienleistung und Gewichtung	-
<b>Basic Economic Concepts for Bioeconomists (5205-413)</b>	
Person(en) verantwortlich	Franziska Schünemann
Lehrform	Vorlesung mit Übung
SWS	2
Inhalt	This course enables students to understand the operations of value chains in the national and the global context. In order to make the interdependencies of value chains transparent, this course introduces students to the functioning of markets and the role of governments. While the economic concepts we deal with apply more generally, we have a special eye on applications to the bioeconomy. We will use quantitative methods, but economic math tends to be simpler than Math taught to undergraduates at universities. The course paves the ground for subsequent semi-elective Economics modules.
Literatur	To be announced in the lecture.
Anmerkungen	-
<b>Corporate Finance (5205-414)</b>	
Person(en) verantwortlich	Niklas Lampenius
Lehrform	Vorlesung
SWS	2
Inhalt	The overall objective of the module „Corporate Finance” is to provide a basic understanding of corporate finance and managerial responsibilities. The lectures cover qualitative as well as quantitative aspects of decision making with a focus on sustainability. Contents of the module include: <ul style="list-style-type: none"> <li>• Capital budgeting</li> <li>• Cash management</li> <li>• Performance management</li> <li>• Risk management (financial as well as operational risks)</li> <li>• Resulting consequences for managerial decision making</li> </ul>
Literatur	Stephen Ross, Randolph Westerfield, Jeffrey Jaffe (latest edition), Corporate Finance, Mcgraw-Hill/Irwin.

Anmerkungen

The lectures take place in the first half of the semester (4 hours per week).

## Modul: Energy and Water Regime at the Land Surface (3103-500)

Modulverantwortung	Thilo Streck
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Students should have completed the module Physics of the Earth System and the module Biology of the Earth System and Biodiversity.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 semester
Studiengänge	Earth System Science (Master, since 01.10.2013) 2. Semester, compulsory Earth and Climate System Science (Master, since 01.10.2017) 2. Semester, compulsory Biobased Products and Bioenergy (Master, since 01.04.2019) 2. Semester, elective Biobased Products and Bioenergy (Master, since 01.10.2019) 2. Semester, elective Biobased Products and Bioenergy (Master, since 01.10.2014) 2. Semester, semi-elective
Prüfungsdauer (in Minuten)	120 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>This interdisciplinary module gives insight into the fundamental properties of and processes at the land surface. This lays the foundation for successfully dealing with numerous problems from the local over the regional to the global scale. After completion of the module, the students have good knowledge of the basic processes in the soil-plant-atmosphere system, which control the water and energy exchange at the land surface, and their representation through the most important governing equations.</p> <p>Students learn to integrate new information with knowledge from the prior modules Physics and Biology of the Earth System. They learn how to apply problem solving strategies independently and in a different situation.</p>
empfohlene Vorkenntnisse	-

Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (100%)
Studienleistung und Gewichtung	-
<b>Energy and Water Regime at the Land Surface (3103-501)</b>	
Person(en) verantwortlich	Thilo Streck Joachim Ingwersen
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	<p>Lecture:</p> <ol style="list-style-type: none"> <li>1) Radiation processes at the land surface (long and shortwave radiation, albedo, photosynthetically active radiation)</li> <li>2) Energy partitioning at the land surface (fluxes of latent and sensible heat, ground heat flux, photosynthesis)</li> <li>3) Transport of energy and water in soil (1D, 3D; Fourier's law, Richards equation, material functions, infiltration)</li> <li>4) Landscape hydrology (processes at the watershed scale, linear models, lumped models, semi-distributed models, 3D models)</li> <li>5) Evapotranspiration (Penman equation)</li> <li>6) Land surface models (NOAH-MP)</li> <li>7) Crop models (assimilation, root growth, biological time, stress)</li> <li>8) Turbulent fluxes (basics, Monin-Obukov theory)</li> </ol> <p>Computer exercises:</p> <ul style="list-style-type: none"> <li>• Energy partitioning at the land surface</li> <li>• Physical interaction between atmosphere and radiation</li> <li>• Modeling thermal conduction in soil (with Berkeley Madonna)</li> <li>• Modeling water infiltration in soils with Hydrus 2D/3D (with case studies)</li> <li>• Land surface modeling with NOAH-MP</li> <li>• Turbulence and the eddy-covariance technique</li> <li>• Similarity relations including Monin-Obukov Theory</li> </ul>
Literatur	<ul style="list-style-type: none"> <li>• Bonan, G.B. Ecological Climatology: Concepts and Applications. Cambridge University Press, 2008.</li> <li>• Jury, W.A., Horton, R.H. Soil Physics. John Wiley &amp; Sons, 2004.</li> </ul>

	<ul style="list-style-type: none"><li>• Hillel, D. Introduction to Environmental Soil Physics: The State and the Transport of Matter and Energy in the Soil-Plant-Atmosphere Continuum. Academic Press, 2003.</li><li>• Campbell, G.S., Norman, J.M. An Introduction to Environmental Biophysics. Springer, 2000.</li></ul>
Anmerkungen	-

## Modul: Environmental and Resource Economics (4101-410)

Modulverantwortung	Christian Lippert
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Knowledge of basic concepts from economic theory (e.g. demand function and its determinants), from investment appraisal (e.g. calculating net present values) and from Environmental Economics (e.g. externalities) as taught in the module Economics and Environmental Policy (4201-440)
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 semester
Studiengänge	Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 2. Semester, compulsory Earth System Science (Master, since 01.10.2013) 2. Semester, elective Bioeconomy (Master, since 01.10.2014) 2. Semester, elective Earth and Climate System Science (Master, since 01.10.2017) 2. Semester, elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 2. Semester, elective
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	Applying the relevant microeconomic theory students should be enabled to analyse current problems of resource use and agricultural production.  Critical analytical thinking; communication and oral presentation; applying economic reasoning.
empfohlene Vorkenntnisse	-
Anmerkungen	Registration of module participants via the ILIAS website of this module ends on Wednesday, April 28th, 2021 at midnight! - Seminar and accompanying computer exercises; seminar papers by the students. – A reader and further material are available at ILIAS.
Modulprüfung und Gewichtung	Written exam (75%)
Studienleistung und Gewichtung	In-class presentation and short seminar paper (25%)
<b>Environmental and Resource Economics (4101-411)</b>	

Person(en) verantwortlich	Christian Lippert
Lehrform	Seminar
SWS	4
Inhalt	Fundamental concepts of Environmental and Natural Resource Economics are introduced and broadly discussed; In the light of applied microeconomic theory current problems of resource use and agricultural production will be analysed; special attention is given to combined economic and ecological models.
Literatur	Perman, R., Yue, M., Common, M., Maddison, D. and J. McGilvray (2011): Natural Resource and Environmental Economics, 4th Edition, Pearson Education.
Anmerkungen	Seminar and accompanying computer exercises; contributions by the students; lecture notes are available at the 'AStA Skriptenverkauf'. Further course material will be uploaded during the course to <a href="https://ilias.uni-hohenheim.de">https://ilias.uni-hohenheim.de</a> .

## Modul: Environmental Microbiology (3102-410)

Modulverantwortung	Ellen Kandeler
Bezug zu anderen Modulen	This module gives a basis for advanced studies in environmental microbiology and soil sciences (e.g. modul 3102-420 Project in Soil Science, Molecular Soil Ecology 3102-450)
Teilnahmevoraussetzung	Basics in microbiology, chemistry and biochemistry
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	<p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective</p> <p>Agricultural Sciences - Animal Sciences (Master, since 01.10.2015) 3. Semester, elective</p> <p>Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Agricultural Sciences - Animal Sciences (Master, since 01.04.2019) 3. Semester, elective</p> <p>Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, elective</p> <p>Agricultural Sciences - Soil Science (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p>
Prüfungsdauer (in Minuten)	90 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	After successfully completing the module, students generally have a better understanding for ecological systems and understand the role and function of microorganisms in different habitats in particular. Students can specify interactions of microorganisms



	<p>and soils, plants as well as animals. In addition, they are familiar with different aspects of biotechnology and ecotoxicology of microorganisms and can outline the rapid development of new methods in environmental microbiology (e.g. metagenomics and proteomics).</p> <p>While preparing and following up on lectures and while working on their seminar presentation including a written paper in the form of a review of a paper (extended abstract), students practice time management and enhance their self-reliance, organizational, cooperation and communication skills. They learn and practice both critical and analytical thinking and reading of scientific literature in the lecture and when preparing the seminar, while generally improving their ability of exploring a scientific subject. During preparation of the seminar, students improve their scientific articulateness, i.e. oral expression skills and presentation techniques. Students are prepared for compiling their own scientific work and for contributing to international conferences.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (50 %)
Studienleistung und Gewichtung	Presentation with discussion (40 %) and extended abstract (10 %)
<b>Environmental Microbiology (3102-411)</b>	
Person(en) verantwortlich	Ellen Kandeler Julia Fritz-Steuber Günter Neumann Jana Seifert
Lehrform	Vorlesung
SWS	2
Inhalt	Environmental microbiology of terrestrial ecosystems: Microbial degradation of organic pollutants in soils, soil microorganisms and heavy metals, overview of bacteria and fungi, regulation of metabolism, ecological functions of rhizodeposition, rumen microbiota, intestinal microbiota of pigs, microbial interactions in the gastrointestinal tract of animals and humans (metagenomics and metaproteomics)
Literatur	Madigan M.T., Martinko J.M. (2006) Brock Mikrobiologie. Pearson Studium, München. Paul E.A. et al. (2007) Soil Microbiology, Ecology, and Biochemistry. Third Edition. Elsevier, Oxford Hobson P. N., Stewart C. S. (1997) The rumen microbial ecosystem. Second edition, Chapman & Hall, London

Anmerkungen	-
<b>Seminar on Environmental Microbiology (3102-412)</b>	
Person(en) verantwortlich	Ellen Kandeler Günter Neumann Jana Seifert
Lehrform	Seminar
SWS	2
Inhalt	Students select topics for seminars based on recommendations of the lecturers. They can choose topics of microbiota living in different environment (e.g. soil, rhizosphere, rumen microbiota). One to two original papers give the basis for literature reserach of students. Students give presentations of 20 minutes followec by discussion (10 min). In addition, students prepare a extended abstract of four pages summing up the most important findings of the selected topic.
Literatur	The professor uploads one to two original papers for each topic that should be used as starting point for own literature research.
Anmerkungen	-

## Modul: Ethical Reflection on Food and Agriculture (4302-420)

Modulverantwortung	Claudia Bieling
Bezug zu anderen Modulen	Global Agri-food Systems (4302-460) and other modules that deal with interdisciplinary aspects of food and agriculture
Teilnahmevoraussetzung	<p>Since the number of participants is limited to 20, students are asked to submit a short letter of motivation to participate in the module. Applications for participation in WS 2021/22 should be submitted from October 4-17, 2021. Please send your letter of motivation to <a href="mailto:claudia.bieling@uni-hohenheim.de">claudia.bieling@uni-hohenheim.de</a> stating the following: 1. Your name 2. Your country of origin 3. Your study programme (and specialization, if applicable) 4. Study programme level (M.Sc./B.Sc./Ph.D.) 5. Statement of motivation: I want to take the course 'Ethical Reflection on Food and Agriculture' because... (around 150 words). The decision about participation will be communicated to applicants by October 18, 2021.</p> <p>We will give priority to students that take this module as part of their semi-elective programme and will prioritize Master level students. Criteria for the selection process will be the quality of the motivation letter and, in a second step, the order of submission.</p>
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	<p>Environmental Science - Soil, Water, and Biodiversity (Master) 3. Semester, semi-elective</p> <p>Agribusiness (Master) 3. Semester, elective</p> <p>Agricultural Sciences - Agricultural Economics (Master) 3. Semester, elective</p> <p>Agricultural Sciences - Animal Sciences (Master) 3. Semester, elective</p> <p>Agricultural Sciences - Major: Crop Production Systems (Master) 3. Semester, elective</p> <p>Agricultural Sciences - Soil Science (Master) 3. Semester, elective</p> <p>Agricultural Sciences in the Tropics and Subtropics (Master) 3. Semester, elective</p> <p>Biobased Products and Bioenergy (Master) 3. Semester, elective</p> <p>Bioeconomy (Master) 3. Semester, elective</p> <p>Crop Sciences - Plant Breeding and Seed Science (Master) 3. Semester, elective</p>

	<p>Crop Sciences - Plant Nutrition and Protection (Master) 3. Semester, elective</p> <p>Earth and Climate System Science (Master) 3. Semester, elective</p> <p>Earth System Science (Master) 3. Semester, elective</p> <p>Environmental Protection and Agricultural Food Production (Master) 3. Semester, elective</p> <p>Landscape Ecology (Master) 3. Semester, elective</p> <p>Organic Agriculture and Food Systems (Master) 3. Semester, elective</p>
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>After completing this module, students have basic knowledge of ethical theory and frameworks for ethical analysis, as well as of their application to the field of contemporary food and agricultural research and practice. Furthermore, course participants are familiar with identifying ethical issues and their underlying moral principles, and with ethical reasoning and evidence-based argumentation with respect to the multi-functionality of agriculture. Drawing on teaching methods that combine theory and on-the-ground experiences from lecturers and guest speakers, this module creates a space to critically discuss current ethical issues related to food and agriculture. Following an interactive didactic approach, students learn to identify the impact of concurrent global challenges on the different members of society (small and large scale farmers, consumers, civil society organizations, industry and retailers, the public sector, and scientists) and the environment, as well as define the roles and responsibilities of the various actors in meeting these challenges.</p> <p>Engaging participants in discussions with lecturers and guest speakers, and comprising a group work assignment that includes independent literature research, classification/prioritization of evidence and information, oral presentations and argumentation in plenary debates, as well as an individual journal exercise, this module enables students to further develop the following soft skills: - communication skills - logical and analytical abilities - critical and analytical reading of scientific literature - evidence-based argumentation - teamwork capacity</p>

	- intercultural competence - scientific journal-based literature research - scientific writing skills - (media-supported) presentation skills - organization and time management skills
empfohlene Vorkenntnisse	-
Anmerkungen	Please note that the number of participants is limited to 20. Therefore, students are asked to submit a short letter of motivation to participate in the module (see above). Applications can be submitted from October 4 to 17, 2021. Signing up in ILIAS will only be possible after the selection process. We will give priority to students that take this module as part of their semi-elective programme and will prioritize Master level students. Criteria for the selection process will be the quality of the motivation letter and, in a second step, the order of submission.
Modulprüfung und Gewichtung	Written paper in the form of an individual learner's journal (50 %)
Studienleistung und Gewichtung	Presentation in groups (40 %), participation in class (10 %)
<b>Ethical Reflection on Food and Agriculture (4302-421)</b>	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Seminar mit Übung
SWS	4
Inhalt	<p>The module is broadly structured in two parts:</p> <p>Part I is dedicated to the theoretical foundations of ethical thinking. Under the guidance of an ethicist from the International Center of Ethics in the Sciences and Humanities (IZEW, University of Tübingen), students will become acquainted with basic knowledge of ethical theory and tools for ethical analysis and argumentation, including:</p> <ul style="list-style-type: none"> <li>- prudence, justice and the good life as principles for ethical assessment</li> <li>- from fact to values and norms: how to build an argument</li> <li>- dealing with non-knowledge.</li> </ul> <p>In parallel to the lectures of the first part, students will practice the application of these theories and tools by elaborating case studies (group work) on an ethical issue of their choice (e.g. animal welfare, GMOs, biofuels).</p>

	<p>In Part II, students will further enhance their capacity to identify ethical issues related to the field of food and agriculture and critically reflect on them. For this, guest speakers are invited to share their experiences and perspectives, e.g. as an ethicist working in science or on providing food aid to developing countries. A particular emphasis will be on “solutions” or ways forward for reducing ethical problems and conflicts. As part of this, we will for instance explore the potential of taxation as a means for including ethical concerns in policy as well as alternative economic models that call for a more just economic order.</p>
Literatur	<p>Readings will be provided via ILIAS.</p>
Anmerkungen	<p>Please note that this module is limited to 20 students and can be taken only after applying with a motivation letter!</p> <p>Applications for participation in WS 2021/22 should be submitted from October 4-17, 2021. Please send your letter of motivation to <a href="mailto:claudia.bieling@uni-hohenheim.de">claudia.bieling@uni-hohenheim.de</a> stating the following:</p> <ol style="list-style-type: none"> <li>1. Your name</li> <li>2. Your country of origin</li> <li>3. Your study programme (and specialization, if applicable)</li> <li>4. Study programme level (M.Sc./B.Sc./Ph.D.)</li> <li>5. Statement of motivation: I want to take the course 'Ethical Reflection on Food and Agriculture' because... (around 150 words).</li> </ol> <p>The decision about participation will be communicated to applicants by Oct 18, 2021.</p> <p>We will give priority to students that take this module as part of their semi-elective programme and will prioritize Master level students. Criteria for the selection process will be the quality of the motivation letter and, in a second step, the order of submission.</p>

## Modul: Experimentelle Arbeitsmethoden der organischen und bioorganischen Chemie (130b) (1302-400)

Modulverantwortung	Uwe Beifuß
Bezug zu anderen Modulen	Dieses Modul dient als Vorbereitung für die Durchführung der experimentellen Master-Arbeit im Fachgebiet Bioorganische Chemie.
Teilnahmevoraussetzung	Grundkompetenzen in der Planung, Durchführung und Auswertung von Experimenten und Untersuchungen sowie in der Interpretation und Bewertung von erhaltenen Ergebnissen sowie Interesse an der wissenschaftlichen Bearbeitung einer Masterarbeit im Fachgebiet.
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Biologie, 3. Semester (Wahl) M.Sc. Agrarbiologie, 3. Semester (Wahl) M.Sc. Food Biotechnology, 3. Semester (Wahl) M.Sc. Food Science and Engineering, 3. Semester (Wahl) M.Sc. Lebensmittelchemie, 3. Semester (Wahl) M.Sc. Food Systems, 3. Semester (Wahl) M.Sc. Molekulare Ernährungswissenschaft, 3. Semester (Wahl) M.Sc. Ernährungsmedizin, 3. Semester (Wahl) M.Sc. Earth and Climate System Science, 3. Semester (Wahl)
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	112
Selbststudium (in Stunden)	113
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Im Rahmen von Projekten, die im Fachgebiet oder unter Beteiligung des Fachgebiets Bioorganische Chemie durchgeführt werden, lernen die Studierenden in der wissenschaftlichen Praxis relevante Arbeitsmethoden der organischen und bioorganischen Chemie kennen und anzuwenden.

	<p>Die Projekte sind thematisch in der Chemie angesiedelt und werden mit Hilfe der im Fachgebiet üblichen experimentellen Arbeitsmethoden bearbeitet. Dazu gehören u.a. präparative, analytische und spektroskopische Methoden sowie zusätzlich die Arbeit mit Datenbanken und wissenschaftlicher Literatur.</p> <p>Die Studierenden erwerben Kompetenzen in der Planung, Durchführung und Auswertung von Experimenten und Untersuchungen sowie in der Interpretation und Bewertung von erhaltenen Ergebnissen und deren Darstellung. Diese Kenntnisse sind Voraussetzung zur wissenschaftlichen Bearbeitung einer Masterarbeit im Fachgebiet.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	<p>Anzahl Teilnehmerplätze: 4   Bei diesem Modul handelt es sich um ein nicht-endnotenrelevantes Modul.</p> <p>Anmeldung zum Modul und Zeitraum: In persönlicher Absprache mit dem Dozenten</p> <p>Dieses Modul dient als Vorbereitung für die Durchführung der experimentellen Masterarbeit und kann daher nur in dem Fachgebiet absolviert werden, in dem auch die Abschlussarbeit geschrieben wird.</p>
Modulprüfung und Gewichtung	Protokoll
Studienleistung und Gewichtung	Laborbuch
<b>Experimentelle Arbeitsmethoden der organischen und bioorganischen Chemie (130b) (1302-401)</b>	
Person(en) verantwortlich	Uwe Beifuß
Lehrform	Projekt/Projektarbeit
SWS	8
Inhalt	Planung, Durchführung, Auswertung und Interpretation von wissenschaftlichen Experimenten in aktuellen Forschungsgebieten des Fachgebiets unter Anleitung eines erfahrenen Wissenschaftlers.
Literatur	Wird von der gewählten Einrichtung bereitgestellt.
Anmerkungen	-



## Modul: Forschungspraktikum Chemische Evolution (1301-430)

Modulverantwortung	Henry Strasdeit
Bezug zu anderen Modulen	Nach Absprache mit dem Modulverantwortlichen kann das Modul Bestandteil der Spezialisierungsrichtung "Astrobiologie" sein (zusammen mit dem Modul Astrobiology und der Masterarbeit im Fachgebiet 130a).
Teilnahmevoraussetzung	Chemiekenntnisse auf dem Niveau eines naturwissenschaftlichen Bachelor-Studiengangs.
Lehrsprache	deutsch/englisch
ECTS	6
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	geblockt (n. V.)
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 3. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	60 Minuten
Präsenzstudium (in Stunden)	98
Selbststudium (in Stunden)	82
Arbeitsaufwand (in Stunden)	98 h Präsenz + 82 h Eigenanteil = 180 h workload
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, grundlegende Prinzipien der chemischen Evolution (z. B. die abiotische Synthese organischer Stoffe) zu benennen und die zugehörigen Fakten zu reproduzieren. Sie können Wechselwirkungen zwischen organischen (z. B. Aminosäuren) und anorganischen Stoffen (z. B. Salzen) sowie organische Synthesen im Kontext der chemischen Evolution beschreiben. Sie sind in der Lage, die Reaktionsgleichungen zu den chemischen Umsetzungen zu erstellen. Die Studierenden können die potenzielle Bedeutung abiotischer Reaktionen für die chemische Evolution bewerten und Stoffe hinsichtlich ihrer relevanten Eigenschaften (z. B. Chiralität) vergleichen. Die Studierenden können wichtige instrumentell-analytische Verfahren der chemischen Evolutionsforschung erklären und die jeweilige praktische Vorgehensweise

	wiedergeben. Sie wissen außerdem, die Theorie und (Labor-)Praxis miteinander zu verknüpfen.
empfohlene Vorkenntnisse	Mindestens Grundkenntnisse der Chemie und der praktischen Laborarbeit, wie sie z.B. in den naturwissenschaftlichen Bachelorstudiengängen der Universität Hohenheim vermittelt werden. Interesse an der instrumentell-analytischen Chemie ist hilfreich.
Anmerkungen	Das Modul wird mehrfach im Jahr für jeweils max. 4 Studierende angeboten.  Anmeldung zur Teilnahme am Modul: Jederzeit persönlich bei Herrn Prof. Dr. Strasdeit oder Herrn Dr. Fox.  Kriterien, nach denen Studienplätze vergeben werden: nach Reihenfolge der Anmeldungen und nach terminlicher Verfügbarkeit
Modulprüfung und Gewichtung	Klausur
Studienleistung und Gewichtung	Teilnahme am Praktikum
<b>Forschungspraktikum Chemische Evolution (1301-431)</b>	
Person(en) verantwortlich	Henry Strasdeit Stefan Fox
Lehrform	Praktikum
SWS	7
Inhalt	Im Praktikum lernen die Studierenden, wie physikalische und chemische Aspekte des frühen Erdsystems in Laborexperimenten modelliert werden. Sie führen organisch-chemische Reaktionen durch, die unter den Bedingungen der frühen Erde plausibel sind. In den Experimenten wird insbesondere der Einfluss der anorganischen Umwelt berücksichtigt. Die Studierenden lernen in diesen Experimenten die Bedeutung von Atmosphäre, Mineralen, Gesteinen, Vulkanismus u. a. für die präbiotisch-chemische Evolution kennen. Sie setzen verschiedene Synthese-, Trenn- und Analyseverfahren kombiniert ein.  In der Übung werden relevante Grundlagen der chemischen Evolution besprochen. Es werden Aufgaben zu den Themen des Praktikums sowie die Auswertung und Diskussion der Versuchsergebnisse behandelt.
Literatur	-

Anmerkungen	-
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## Modul: Global Agri-food Systems: Conventional, Organic, and Beyond (4302-460)

Modulverantwortung	Claudia Bieling
Bezug zu anderen Modulen	This module is of particular interest for students who intend to choose the module "Ethical Reflection on Food and Agriculture" and other modules in the field of social sciences.
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	Organic Agriculture and Food Systems (Master) 1. Semester, compulsory Earth System Science (Master) 3. Semester, elective Earth and Climate System Science (Master) 3. Semester, elective Bioeconomy (Master) 3. Semester, elective
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	In this course, students are provided with the conceptual tools (most importantly: Food Regime Theory) to understand the sociological bases around which a future world of agriculture, food and broader land use will possibly take shape. After completing this course, students have a comprehensive understanding of agri-food systems and the paradigmatic shifts within. Students are in particular able to specify the diverse motivations and politics that have led farmers, consumers, and policy makers toward (or away from) more sustainable agri-food systems. They are familiar with the geographical, sociological, historical, political, legal, and economic aspects of how and why individuals, groups, and industries make (or are involved in) certain choices about food throughout the food chain (production, processing, trade, consumption). Finally, they are able to explain basic concepts and theories related to organic agriculture and sustainability and have an understanding for the complexity of agriculture and food as it relates –among others– to

	<p>the politics of resources, the environment and social justice. During preparation for the oral exam, while writing their essay (written paper) and preparing and following up on the seminar, students practice self-reliance, time management and team work. They learn and practice both critical and analytical thinking and reading of scientific literature. Writing the essay enhances their scientific articulateness. During discussions in class, students practice and improve their capability of exploring a scientific issue and of orally presenting an academic argument. With the help of dedicated tutorials, students are further supported with creating an essay plan and essay writing, quoting, referencing, and using academic and non-academic sources (therefore avoiding plagiarism).</p>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written paper (essay 100 %)
Studienleistung und Gewichtung	Attendance at group work is required for completion of the module.
<b>Global Challenges &amp; Local Answers – Approaches for Sustainable Human-Nature-Relations (4302-461)</b>	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Vorlesung
SWS	2
Inhalt	<p>Land Grabbing, soil desertification, precarization of rural livelihoods, and rising global inequality – these are just some examples that show the challenges of today's agriculture and food systems. In this module, we want to undertake a historical and geographical journey to learn more about the roots of these problematics and to discover some 'bright spots' in different regions that show that more sustainable forms of agriculture and land-use are possible.</p> <p>This module is divided into two sections:</p> <ul style="list-style-type: none"> <li>• Agriculture and Food as a System – Using systems thinking and bright spots to understand food challenges and solutions (this semester due to illness of the co-teacher: Global Challenges &amp; Local Answers – Approaches for Sustainable Human-Nature-Relations)</li> <li>• Past &amp; Future of Food Systems – Perspectives of Political Economy</li> </ul>

	<p>This first section of the module gives an introduction into the current debate on global challenges of sustainable development and crucial concepts (e.g. planetary boundaries) in this context. Approaches such as 'civic ecology' (offered by e-learning-units) provide students with an understanding for the socio-ecological and global-local interrelatedness of sustainable transformations and its relevance for issues of land-use, agriculture, and food systems. Students will reflect upon these questions in group work formats which are used as preparation for presenting their insights in the course of a debate club session (ungraded oral exam, requirement for participating in final graded exam).</p> <p>Parting from theoretical perspectives of Political Economy and Political Ecology, the second section offers a historical and global overview of the making of agri-food systems and the upcoming of social movements in the Global South and North that search for more sustainable and just proposals. Participants will acquire competencies in critical and systems thinking, ethical reflection, as well as conceptual knowledge on Food Regime Theory. The course is based on an interactive methodology that opens the space for critical reflections, active discussions and developing new thoughts and visions. For an active participation, students are required to prepare selected literature and write an essay that links Food Regime Theory with practical approaches of sustainable farming.</p>
Literatur	-
Anmerkungen	-
<b>Past and future of food systems: perspectives of political economy (4302-462)</b>	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Seminar
SWS	2
Inhalt	<p>This course has been designed to provide a comprehensive understanding of agri-food systems and make sense of paradigmatic shifts within.</p> <p>There are four main sections in this course:</p>

	<ul style="list-style-type: none"> <li>• Understanding the background</li> <li>• Understanding the contemporary paradigm</li> <li>• Understanding the emergence of alternatives</li> <li>• Adapting to transition</li> </ul> <p>These sections will unfold in order to make sense of the global agri-food systems and make sense of the social conditions that permitted the emergence of organic and sustainable agriculture, exploring the background and explaining the relationships between developed and developing countries, and conversely between global and local.</p> <p>Specific case studies relating to the course contents and from various geographic regions reinforce the learning process through enhanced discussions and critical reflection. Preparatory reading of selected literature and introduction to academic journal-based literature research and scientific writing complete the academic picture.</p>
Literatur	Course-relevant readings will be made available or uploaded in ILIAS if possible.
Anmerkungen	Because of limited space available (70 students), students must register via ILIAS. A waiting list will be available if the number of registrations will exceed expectations.
<b>Tutorial Global Agri-food Systems: Conventional, Organic, and Beyond (freiwillig) (4302-463)</b>	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Tutorium
SWS	2
Inhalt	-
Literatur	-
Anmerkungen	-

## Modul: Global Change Issues (3202-420)

Modulverantwortung	Andreas Schweiger
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	<p>Extremely important: you have to be present on the first day of the module in order to be enrolled for the module. This is mandatory because of organisational reasons. We will not accept any student for the module who is not present on the first day of the module.</p> <p>General requirements: Ability to think in an interdisciplinary way, background knowledge in natural sciences at least at Bachelor level, basic knowledge and interest in social sciences and economy, readiness for active contribution of knowledge from the students home countries.</p>
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 semester
Studiengänge	<p>Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective</p> <p>Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective</p> <p>Biobased Products and Bioenergy (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Bioeconomy (Master, since 01.10.2014) 3. Semester, elective</p> <p>Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective</p> <p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 1. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 1. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p>



	<p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Landscape Ecology (Master, since 01.10.2014) 3. Semester, elective</p>
Prüfungsdauer (in Minuten)	90 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>The aim of the module is to give a solid understanding of global change including global climate change, its impacts on species and ecosystems and ecological services, and the consequences for human society. This module has a natural science focus but covers societal and economic aspects of global change including mitigation and adaptation strategies as well as current approaches in international treaties.</p> <p>After completing the course the student will:</p> <ul style="list-style-type: none"> <li>• know the drivers of global change and global climate change and distinguish between natural and human impact</li> <li>• understand the perturbations of the global carbon, nitrogen, and water cycles</li> <li>• know and understand the major threats to ecosystems and ecological services and the potential impacts on the human society.</li> <li>• understand the effects of climate change on natural and anthropogenic (mainly agricultural) ecosystems including the most important feedbacks between ecosystem structure and processes and climatic conditions</li> <li>• be familiar with international treaties to combat climate change and understand</li> </ul>

	<p>mitigation and adaptation strategies to climate change</p> <ul style="list-style-type: none"> <li>• know methodological tools to investigate global change and its ecological impacts and feedbacks</li> </ul> <p>The student will be furthermore able to:</p> <ul style="list-style-type: none"> <li>• combine knowledge from different disciplines of natural science to analyze the extent and socio-ecological consequences of climate change</li> <li>• think across scales both in time and space to evaluate global change issues</li> <li>• judge about the severity of climate change and its effects compared to other drivers of ecosystem functionality</li> <li>• perform experimental research on ecological effects of climate change with a focus on plants</li> <li>• acquire, evaluate and summarize information from scientific literature and present this information in scientific presentations.</li> </ul> <p>The structure of the module provides the following competences:</p> <ul style="list-style-type: none"> <li>• The students will be able to discuss ecological, social, political and economic aspects of global change.</li> <li>• They are furthermore able to develop and communicate mitigation and adaptation strategies to combat the socio-ecological consequences global change and foster sustainable development.</li> <li>• The students will be able to co-operate and to work independently.</li> <li>• They will be able to evaluate critically data and model outputs on emissions, regulatory measures and treaties and suggest improvements.</li> <li>• The students will furthermore acquire intercultural competence by working in groups with international students.</li> </ul>
empfohlene Vorkenntnisse	-
Anmerkungen	The module consists of a lecture (Introduction to Global Change, 2SWS), a seminar (Emerging Topics in Global Change Research, 1 SWS) and a practical part (Experiments on Global Change, 1 SWS).

	The practical part will be conducted in Hohenheim according to the applicable safety regulations. The number of participants is limited to a maximum of 15. Participants will be selected with regard to the study program and the number of semesters. Enrolment will take place via ILIAS. Information on how to access the lectures/seminar will be provided via ILIAS in October.
Modulprüfung und Gewichtung	Written exam (70%)
Studienleistung und Gewichtung	Presentation with handout (15%)
	Exercise (15%)
<b>Global Change Issues (3202-421)</b>	
Person(en) verantwortlich	Andreas Fangmeier Petra Högy
Lehrform	Vorlesung mit Seminar und Praktikum
SWS	4
Inhalt	<p>Introduction to Global Change</p> <p>Introduction to Global Change is a lecture introducing to the students the most important knowledge and current research on global change with a special focus on global climate change.</p> <p>Contents of the lectures cover:</p> <ul style="list-style-type: none"> <li>• Human population and land-use change</li> <li>• Greenhouse gas emissions</li> <li>• The concept of radiative forcing and global warming</li> <li>• Sea level rise</li> <li>• Global carbon, water and nitrogen cycling and future projections</li> <li>• Effects on natural and seminatural ecosystems</li> <li>• Effects on agriculture</li> <li>• Health impacts</li> <li>• Mitigation options</li> <li>• International legislation</li> <li>• Emission trading</li> </ul> <p>Emerging Topics in Global Change Research</p> <p>This seminar is thought to complement the lecture "Introduction to Global Change" with some most recent findings from current publications in the scientific literature and will cover current challenges and emerging topics in global change research. The actual content will vary from year to year but</p>

	<p>may cover issues such as the latest findings on disturbance of the global carbon cycle and its implications for climate, ecological footprints, state of international negotiations, case studies on climate change effects on selected ecosystems, ecosystem services, habitats etc.</p> <p>The students will prepare a powerpoint presentation including a handout on a selected topic, they will present and discuss it and get feed-back not only on the scientific content but also on the didactics of their presentation.</p> <p>Experiments on Global Change</p> <p>In this practical part of the module the students will plan and conduct their own greenhouse experiment in which one of the most important resources to plant growth - water – will be manipulated. Water shortage is one of the major expected side effects of climate change and therefore represents a scientifically sound and relevant example on how to study climate change effects on plants. The students will analyze the response of C3 and C4 species to water shortage and learn about water cycling, water use efficiency and physiological adaptation of vegetation to resource deficiency. Furthermore, they will conduct ecophysiological investigations (leaf gas exchange measurements) with increasing atmospheric CO2 concentrations to evaluate primary plant responses to elevated CO2.</p> <p>The students will prepare a powerpoint presentation including a handout on the results of their experiments and discuss it and get feed-back not only on the scientific content but also on the didactics of their presentation</p>
Literatur	<p>Introduction to Global Change</p> <p>Literature on global change is numerous and almost immediately outdated when recommendations are written down somewhere. Nevertheless, as basic literature for understanding the current state of the art in science and recommendations to policy makers the latest reports of the IPCC are recommended (download at <a href="http://ipcc.ch/">http://ipcc.ch/</a>). Further literature is provided on the ILIAS e-learning platform</p> <p>Emerging Topics in Global Change Research</p>

	Ever changing and updated; students are assisted to find relevant literature and other sources; sources will be made available via the ILIAS e-learning platform.
Anmerkungen	-

## Modul: Introduction to Machine Learning in Python (4407-480)

Modulverantwortung	Christian Krupitzer Anthony Stein
Bezug zu anderen Modulen	The module provides basic knowledge in programming and machine learning required for participation in module 4407-440 "Introduction to Artificial Intelligence" or 4407-810 "Machine Learning Reading Club".
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	All Master's programs of the Faculty of Agricultural and Natural Sciences, 2. semester, elective
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	0
Selbststudium (in Stunden)	225
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	<p>After completing this module, students are able to critically assess the performance of different machine learning approaches and to choose the best approach for a specific use case. Therefore, this module will provide essential theoretical knowledge of the foundations of programming in Python and machine learning algorithms and approaches. Further, students acquire practically-applicable knowledge how to apply machine learning to solve real world problems.</p> <p>The online format, regular assignments as well as the self-study character of the module supports the students' organizational skills and trains their ability to work independently. Further, the module supports analytical thinking, i.e., how to structure a problem and find appropriate solutions to it by means of machine learning. Since the course materials and the teaching language are completely in English, the students further train their foreign language skills.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	The number of participants is limited to a semester-specific number that will be indicated in the corresponding course description in ILIAS and HohCampus.

Modulprüfung und Gewichtung	Computer-based online exam (50%)
Studienleistung und Gewichtung	Integrated online quizzes and programming assignments to be solved individually by the students (50%)
<b>Introduction to Machine Learning in Python (4407-481)</b>	
Person(en) verantwortlich	Anthony Stein Christian Krupitzer
Lehrform	E-Learning
SWS	5
Inhalt	-
Literatur	-
Anmerkungen	-

## Modul: Land Use Economics (4904-430)

Modulverantwortung	Thomas Berger
Bezug zu anderen Modulen	This module advances the knowledge in land-use economics and the essential steps required in the modeling process (conceptual modeling, model selection, parameterization and validation). Hands-on computer exercises address various aspects of agricultural land-use systems with emphasis on designing and analyzing simulation experiments for uncertainty and sensitivity assessments.
Teilnahmevoraussetzung	Basic knowledge of Mathematical Programming (Textbook: Ragsdale, C.T., 2004. Spreadsheet Modeling & Decision Analysis, Ch. 1-4)
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1. half of semester
Studiengänge	Earth System Science (Master, since 01.10.2013) 3. Semester, compulsory Bioeconomy (Master, since 01.10.2014) 3. Semester, elective Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 3. Semester, semi-elective
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	Students understand fundamental concepts of land use economics. They can model land use decision problems at various spatial scales. They have gained insights into advanced techniques such as bio-economic modeling and multi-agent systems. By developing their own simulation models, students apply analytical thinking and acquire various scientific skills (e.g., data handling, processing and analysis, oral presentation).
empfohlene Vorkenntnisse	Contents of Farm-System Modeling (4904-460)
Anmerkungen	Laptop required for computer exercises in class



Modulprüfung und Gewichtung	Written exam (100%)
Studienleistung und Gewichtung	-
<b>Land Use Economics (4904-431)</b>	
Person(en) verantwortlich	Thomas Berger
Lehrform	Vorlesung mit Übung
SWS	2
Inhalt	<ul style="list-style-type: none"> <li>• Land-use economics: basic concepts and research questions</li> <li>• Land-use modeling: model classes and cases of application</li> <li>• Irrigation as a special land-use problem</li> <li>• Land-use modeling at watershed level (case study)</li> <li>• Land-use modeling with CA and MAS</li> </ul>
Literatur	-
Anmerkungen	-
<b>Land Use Economics - Case Study (4904-432)</b>	
Person(en) verantwortlich	Thomas Berger
Lehrform	Praktikum
SWS	2
Inhalt	Cases of application for land-use modeling
Literatur	-
Anmerkungen	-

## Modul: Lecture Series Earth System Science (1201-550)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	Keine.
Teilnahmevoraussetzung	Keine.
Lehrsprache	englisch
ECTS	2
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Pflicht Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Pflicht
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	28
Selbststudium (in Stunden)	32
Arbeitsaufwand (in Stunden)	28 h attendance + 32 h independent study = 60 h workload
Lern- und Qualifikationsziele	<p>The students get a general idea of the key aspects of Earth System Science as well as the definition and the research approach of system science. The interaction of the compartments of the Earth system is demonstrated by a series of lectures focusing on different aspects such as climate change, land use, vegetation and biogeochemical cycles.</p> <p>The contents of the lecture series is set up in each semester according to brand-new topics, e.g. extracted from the media. The predictability of Earth system processes and the chaotic nature of weather and climate are discussed as well.</p>
empfohlene Vorkenntnisse	Keine.
Anmerkungen	-
Modulprüfung und Gewichtung	Klausur.
Studienleistung und Gewichtung	Keine.
<b>Lecture Series Earth System Science (1201-551)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Ringvorlesung
SWS	2
Inhalt	- Compartments of the Earth System

	<ul style="list-style-type: none"> <li>- Condition and interactions of components of the energy, water, and matter cycles across the compartments</li> <li>- Impact of human being to the Earth system, the anthroposphere</li> <li>- System theory</li> <li>- nonlinear coupled systems and chaotic systems</li> </ul> <p>Furthermore the students meet in person the representatives of the profession Earth System Science at the University of Hohenheim. The students meet the experts of different aspects in Earth System Science at the University.</p>
Literatur	-
Anmerkungen	Steffen et al.: "Global Change and the Earth System - A Planet under Pressure", Springer, ISBN 3-540-40800-2

## Modul: Massive Open Online Course on Climate Change, Risks and Challenges (1201-410)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	Keine
Teilnahmevoraussetzung	Mandatory modules of M.Sc. ECSS
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Earth and Climate System Science (PO vom: 17.07.2013) - Studienbeginn ab WiSe 2018/19; 3./4. Semester, Wahl M.Sc. Environmental Protection and Agricultural Food Production (Master, PO vom 01.10.2014) 3./4. Semester, Wahl sowie alle interessierten Studierenden aus den Masterstudiengängen der Fakultät N
Prüfungsdauer (in Minuten)	60 Minuten
Präsenzstudium (in Stunden)	54
Selbststudium (in Stunden)	126
Arbeitsaufwand (in Stunden)	54h Präsenz, 126h Eigenanteil = 180h Arbeitsaufwand
Lern- und Qualifikationsziele	Basic knowledge of: <ul style="list-style-type: none"> <li>- the climate system</li> <li>- climate models and scenarios</li> <li>- climate history</li> <li>- impacts of climate change</li> <li>- climate change as a societal challenge</li> <li>- climate change in politics and economy</li> </ul> Students acquire: <ul style="list-style-type: none"> <li>- Transfer of knowledge in natural and applied sciences</li> </ul>

	<ul style="list-style-type: none"> <li>- Teamwork and communication</li> <li>- Critical and analytical thinking</li> <li>- Interdisciplinary thinking and its applications to problems in earth sciences</li> </ul>
empfohlene Vorkenntnisse	Keine
Anmerkungen	<p>Number of participants: 6</p> <p>Application period: 4 weeks before start of lectures via ILIAS (first-come, first-serve)</p> <p>access to the online course per website:</p> <p><a href="https://www.oncampus.de/weiterbildung/moocs/climate-change-risks-and-challenges">https://www.oncampus.de/weiterbildung/moocs/climate-change-risks-and-challenges</a></p>
Modulprüfung und Gewichtung	<p>Mündliche Prüfung (Präsentation und Diskussion in Summe 60 Minuten)</p> <p>Hausarbeit (mind. 20 Seiten)</p>
Studienleistung und Gewichtung	Teilnahmezertifikat am MOOC
<b>MOOC Climate, Change, Risks and Challenges (1201-411)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	E-Learning mit Seminar
SWS	1
Inhalt	<p>This online course provides the basic knowledge in the functioning of the Earth's climate system. This information is providing by a series of interactive online lectures and exercises.</p> <p>The contents include the global energy and water cycle, ocean and weather circulation systems, and feedback processes in the climate system. The natural and the anthropogeneous changes are discussed and distinguished. The function of climate models is presented. Future emission scenarios and corresponding projections are introduced. Finally, mitigation and adaption to climate change are discussed.</p>
Literatur	<p>IPCC (see <a href="https://www.ipcc.ch">https://www.ipcc.ch</a>):</p> <p>- Assessment Report</p>

	- 1.5 Degree Report - Land-Atmosphere Report
Anmerkungen	-

## Modul: Master-Thesis (1200-500)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Successful completion of modules in the amount of 78 credits.
Lehrsprache	englisch
ECTS	30
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 4. Semester, Pflicht Earth and Climate System Science (Master, PO vom 01.10.2017) 4. Semester, Pflicht
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	900 h
Lern- und Qualifikationsziele	<p>After completion of the master thesis the students understand sub-components of the Earth system by inter- or transdisciplinary research, e.g., from atmospheric, agricultural, economic or social sciences. The studied interactions and feedbacks in these components either by measurements and their analyses, coupled modeling or data assimilation or combinations of these. They are able to understand the key processes in these systems and their interactions. They are able to present and to discuss their results at scientific conferences and in the public.</p> <ul style="list-style-type: none"> <li>- System analysis - System observations by synergies of instruments - System modeling</li> <li>- Competence to present their work in a comprehensive and concise manner.</li> </ul>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Master's thesis
Studienleistung und Gewichtung	-

## Modul: Mathematics and Computational Sciences of the Earth System (1102-400)

Modulverantwortung	Georg Zimmermann
Bezug zu anderen Modulen	Mathematical foundation for Module 1102-410.
Teilnahmevoraussetzung	Solid foundational knowledge of Maths, as used throughout the completion of a typical B.Sc. degree.
Lehrsprache	englisch
ECTS	4
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Pflicht Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	90 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	64
Arbeitsaufwand (in Stunden)	56 h Präsenzzeit, 64 h Eigenanteil, 120 h Arbeitsaufwand.
Lern- und Qualifikationsziele	Students who complete this module will obtain competency in the use of mathematical tools required for analysis and linear algebra, which are necessary to solve general and partial differential equations. Furthermore, students will be able to write simple computer programmes to solve related mathematical problems and be able to analyse data.
empfohlene Vorkenntnisse	Solid foundational knowledge of Maths, as used throughout the completion of a typical B.Sc. degree.
Anmerkungen	Teilnehmerzahl: Unbeschränkt.
Modulprüfung und Gewichtung	50% of the course credits will be determined by an exam.
Studienleistung und Gewichtung	50% of the course credits will be determined through self study exercises.
<b>Applied Mathematics for Earth and Climate System Science (1102-401)</b>	
Person(en) verantwortlich	Georg Zimmermann
Lehrform	Vorlesung
SWS	2
Inhalt	1) Complex numbers 2) Linear algebra:



	<p>matrices and linear mappings, eigenvalues and eigenvectors, quadratic forms and definiteness.</p> <p>3) Differentiation:</p> <p>ordinary and partial derivatives, gradient, divergence and curl, Laplacian operator.</p> <p>4) Integration:</p> <p>indefinite and definite integrals, curves and line integrals, conservative vector fields, surfaces and surface integrals, integral theorems by Gauß and Stokes.</p>
Literatur	Any standard book on mathematics for physicists or engineers. in English: basic (undergraduate level): M.L. Boas, Mathematical Methods in the Physical Sciences advanced (graduate level): G. B. Arfken, Mathematical Methods for Physicists in German: H. Fischer / H. Kaul, Mathematik für Physiker 1 & 2
Anmerkungen	-
<b>Computer Exercises for Earth and Climate System Science (1102-402)</b>	
Person(en) verantwortlich	Georg Zimmermann
Lehrform	Übung
SWS	2
Inhalt	Exercises to the topics of Applied Mathematics for Earth and Climate System Science using the programming environment Mathematica. Analysis and visualization of earth system observations and climate data using Mathematica.
Literatur	-
Anmerkungen	-

## Modul: Mathematics and Computational Sciences of the Earth System II (1102-410)

Modulverantwortung	Georg Zimmermann
Bezug zu anderen Modulen	Continuation from Module 1102-400.
Teilnahmevoraussetzung	Successful completion of module 1102-400.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	90 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	56 h Class Participation, 124 h Self Study, 180 h Total Workload.
Lern- und Qualifikationsziele	Ziel diese Modul ist es, dass die studentes gewöhnliche und partielle Differentialgleichungen als solche und auch einige spezielle Typen erkennen können. Sie wissen, wie bestimmte Typen von Differentialgleichungen gelöst werden können, einige explizit, andere numerisch. Sie können autonome Systeme erkennen, stationäre Lösungen finden und deren Stabilitätseigenschaften bestimmen. Ziel dieses Modul ist es, dass die studentes Differentialgleichungen verstehen können in dem Sinne, dass sie erkennen, welche Effekte durch die einzelnen Terme modelliert werden. Sie kennen Stabilitätseigenschaften und wie sie zu bestimmen sind.
empfohlene Vorkenntnisse	Erfolgreiche Teilnahme am Modul 1102-400
Anmerkungen	Teilnehmerzahl: Unbeschränkt. Anmeldung: Beim Dozenten zu Beginn des Semesters.
Modulprüfung und Gewichtung	Exam
Studienleistung und Gewichtung	50% of credits are determined by homework exercises
<b>Mathematics and Computational Sciences of the Earth System II (1102-411)</b>	
Person(en) verantwortlich	Georg Zimmermann

Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	<p>Ordinary differential equations: numerical methods, autonomous systems and the stability of their stationary solutions.</p> <p>Partial Differential equations: wave equation, heat equation, numerical methods</p>
Literatur	<p>Lecture notes provided by the lecturer.</p> <p>Additional, if so desired: Any standard book on mathematics for physicists or engineers. Examples:</p> <p>in English:</p> <p style="padding-left: 40px;">basic (undergraduate level): M.L. Boas, Mathematical Methods in the Physical Sciences</p> <p style="padding-left: 40px;">advanced (graduate level): G. B. Arfken, Mathematical Methods for Physicists</p> <p>in German:</p> <p style="padding-left: 40px;">H. Fischer / H. Kaul, Mathematik für Physiker 1 &amp; 2</p>
Anmerkungen	-

## Modul: Measurement, Modeling and Data Assimilation I (1201-520)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	Alle Pflichtmodule des ersten Semesters.
Teilnahmevoraussetzung	Recommended requirements: modules of the first semester, good computer skills, e.g. word processing and spreadsheets.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Pflicht Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Pflicht Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	120 Minuten
Präsenzstudium (in Stunden)	84
Selbststudium (in Stunden)	96
Arbeitsaufwand (in Stunden)	84 attendance + 96 h independent study = 180 h workload
Lern- und Qualifikationsziele	The students can install and operate observing systems in the field. They know how to archive, visualize and analyze the data and are aware of the importance of observations for driving, initialization, calibration and validation of numerical models. In addition, practical work with the Weather Research and Forecasting model (WRF) will be carried out and the students learn how to visualize, interpret and document their results.
empfohlene Vorkenntnisse	Keine.
Anmerkungen	Independent study consists of 2 hours of preparation and review for each session of the lecture, 1 hour review per session of the Exercise and 5 days for the independent composition of a written report on the field course.
Modulprüfung und Gewichtung	Written exam
Studienleistung und Gewichtung	Active participation in the practical parts of the module and the lectures.
<b>Measurement, Modeling and Data Assimilation I, Lecture (1201-521)</b>	

Person(en) verantwortlich	Volker Wulfmeyer Andreas Behrendt Hans-Dieter Wizemann
Lehrform	Vorlesung
SWS	2
Inhalt	<p>The lecture introduces several observing systems ranging from meteorological in-situ sensors for the different variables, instruments applied in soil sciences and biology, eddy-covariance measurements as well as remote sensing techniques. Apart from the description of the instruments itself, methods to analyze the collected data are introduced.</p> <p>Following the instrumental part, the meteorological workstation NinJo is introduced. It was developed to facilitate the work with huge data sets in operational meteorological forecasting. Then, the transfer to modeling is carried out with the introduction of data analysis techniques to convert point measurements to spatially resolved information.</p> <p>The third part of the lecture introduces the basic concept of modeling. What models are available? How important are observations for modeling? In which areas are models applied, what their performance is and what methods are applied to judge the model performance.</p>
Literatur	-
Anmerkungen	-
<b>Measurement, Modeling and Data Assimilation I, Exercise (1201-522)</b>	
Person(en) verantwortlich	Volker Wulfmeyer Andreas Behrendt Hans-Dieter Wizemann
Lehrform	Übung
SWS	2
Inhalt	In the exercise sessions, the students will solve problems adjusted to the subjects they learned in the lectures. These range from arithmetic problems to the analysis and visualization of observed data and model results.
Literatur	-
Anmerkungen	-
<b>Measurement, Modeling and Data Assimilation I, Practical (1201-523)</b>	
Person(en) verantwortlich	Volker Wulfmeyer Andreas Behrendt

	Maike Schumacher
Lehrform	Praktikum
SWS	2
Inhalt	<p>In the practical sessions, the students learn how to set up instruments in the field and how the observational data is gathered, archived and analyzed. Here, they work with data from different instruments introduced during the lecture.</p> <p>After the introduction of basic concepts of modeling, practical work is done to set up and run the Weather Research and Forecasting model (WRF) on a Linux PC including the analysis and visualization of the results.</p>
Literatur	-
Anmerkungen	-

## Modul: Measurement, Modeling and Data Assimilation II (1201-530)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	The modules "Mathematics and Computational Sciences" and "Weather and Climate Physics" in the first semester and "Measurements, Modelling and Data Assimilation I" in the second semester must have been accomplished. This module builds on part 1.
Teilnahmevoraussetzung	Recommended requirements: Participation in the first module "Measurement, Modeling, Data Assimilation I, Computer practice (e.g. word processing, spreadsheet, basic knowledge with Linux)
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	120 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	The students learn the basics of model development, programming and data assimilation. They will understand the fundamentals of microeconomics for the representation of production processes, are able to solve first practical decision problems with the aid of spreadsheet programs and solvers, and can discuss their results. In addition, they will deepen their knowledge about models for plant development, weather and climate and are able to critically judge their performances with the aid of observational data. Furthermore, a theoretical introduction into data assimilation techniques is given. With this knowledge, competence to estimate the future development of the earth system is developed. Furthermore, the students are capable to independently analyze and solve problems related to the earth system.
empfohlene Vorkenntnisse	In-depth knowledge of physics and mathematics, interest in simulating the atmosphere with numerical

	models on different scales. Familiarity with the Linux operating system and initial experience with programming languages.
Anmerkungen	Maximum number of participants: 10  Application to participate in the module: End of summer term until beginning of winter term using the ILIAS system.
Modulprüfung und Gewichtung	Written exam
Studienleistung und Gewichtung	Active participation in the practical parts of the module and the lectures
<b>Measurement, Modeling and Data Assimilation II (1201-531)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Vorlesung
SWS	2
Inhalt	The students learn the basics of model development, program-ming and data assimilation. They deepen their knowledge about models for plant development, weather and climate and are able to critically judge their performances with the aid of observational data. Furthermore, a theoretical introduction into data assimilation techniques is given.
Literatur	Kalnay, E.: Atmospheric Modeling, Data Assimilation and Predictability, Cambridge University Press, 2003. Evensen, G.: Data Assimilation, Springer, 2nd edition 2009
Anmerkungen	-
<b>Measurement, Modelling and Data Assimilation II, Exercise (1201-532)</b>	
Person(en) verantwortlich	Volker Wulfmeyer Andreas Behrendt
Lehrform	Übung
SWS	2
Inhalt	In the practical part, the students deepen their knowledge gained during the lecture with modeling and data assimilation exercises. As in the first part of the module, the Weather Research and Forecasting model (WRF) is applied.
Literatur	Kalnay, E.: Atmospheric Modeling, Data Assimilation and Predictability, Cambridge University Press, 2003.  Evensen, G.: Data Assimilation, Springer, 2nd edition 2009
Anmerkungen	-



## Modul: Microbiological Safety within the Feed and Food Production Chain (4605-430)

Modulverantwortung	Ludwig Hölzle
Bezug zu anderen Modulen	The knowledge gained by this basic module may be completed in several other more specific modules, especially 4602-430 "Project in advanced Environmental- and Animal Hygiene", 4602-440 "Laboratory Course in Advanced Environmental- and Animal Hygiene".
Teilnahmevoraussetzung	Students shall have basic knowledge in the biochemistry of carbohydrates, fats and proteins as well as in biology and genetics. For better preparation of the students, an introductory lecture is given for those participants who like to fresh up their knowledge before the module starts.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 1. Semester, compulsory Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 1. Semester, compulsory Earth System Science (Master, since 01.10.2013) 3. Semester, elective Landscape Ecology (Master, since 01.10.2014) 3. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 1. Semester, elective Agricultural Sciences - Animal Sciences (Master, since 01.10.2015) 3. Semester, elective Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 1. Semester, elective Agricultural Sciences - Animal Sciences (Master, since 01.04.2019) 3. Semester, elective

	Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, elective Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 3. Semester, elective
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>Students are able to understand and analyse the complex ecologic and microbial systems in soil, air and water as potential epidemiological niches for plant and animal pathogens and zoonotic agents. In addition, students are enabled to perform hygienic risk assessment during microbiocidal biotechnical processes, i.e. composting, anaerobic treatment and waste water treatment. In the group with international students they experience the cultural differences in risk assessment and can develop their intercultural competence in this module. Based on these skills and knowledge absolvents are capable to play an important role as advisors in international consultant teams regarding the hygiene of biotechnical processes.</p> <p>critical, analytical thinking , (foreign) language skills</p>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	oral exam (100 %)
Studienleistung und Gewichtung	-
<b>Microbiological Safety within the Feed and Food Production Chain (4605-431)</b>	
Person(en) verantwortlich	Wolfgang Beyer Ludwig Hölzle
Lehrform	Vorlesung
SWS	4
Inhalt	Principles of microbial morphology and physiology (bacteria, fungi, viruses), life cycles of parasites, microbiology and parasitology of vertebrates, plants, soils, water, and air; survival and inactivation of organisms; techniques for isolation and identification of organisms from soil, water and air.

	A set of questions will help in exam preparation.
Literatur	<ul style="list-style-type: none"> <li>• Brock : Biology of Microorganisms, Pearson Education International, Upper Saddle River,NJ07458</li> <li>• Hurst, Crawford, Knudsen, McInerney, Stetzenbach: Manual of Environmental Microbiology, ASM Press, Washington, DC</li> <li>• Bush, Fernandez, Esch, Seed: Parasitism, Cambridge University Press, Cambridge</li> </ul>
Anmerkungen	-

## Modul: Natural Resource Use and Conservation in the Tropics and Subtropics (4907-410)

Modulverantwortung	Folkard Asch
Bezug zu anderen Modulen	This module is directly linked to all other compulsory modules in AgriTropics.
Teilnahmevoraussetzung	.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	<p>Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 1. Semester, compulsory</p> <p>Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 1. Semester, compulsory</p> <p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Bioeconomy (Master, since 01.10.2014) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective</p> <p>Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, semi-elective</p>
Prüfungsdauer (in Minuten)	120 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>Students acquire basic knowledge on resource use, requirements, and conservation as linked to tropical agricultural production. They learn to define and evaluate the different abiotic and biotic resources and their relevance for sustainable agricultural production systems. They are able to recognize and define disciplinary and systemic interactions of resource use and conservation and can apply this knowledge in concepts of sustainable agricultural production.</p>

empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (100 %)
Studienleistung und Gewichtung	-
<b>Natural Resource Use and Conservation in the Tropics and Subtropics (4907-411)</b>	
Person(en) verantwortlich	Folkard Asch Uta Dickhöfer Bettina Haußmann
Lehrform	Vorlesung
SWS	4
Inhalt	<ol style="list-style-type: none"> <li>1) Introduction - module requirements - module links within the compulsory moduls - Ilias - exam mode and requirements - expectations</li> <li>2) Systems thinking - multidisciplinary approaches - Resources - functions - links between resources - concepts of use and conservation</li> <li>3) Weather - Climate - global circulation - wind systems - ocean currents - global energy distribution - precipitation patterns - agro-ecological zoning - agri-ecological zones -examples</li> <li>4) Precipitation patterns - agro-ecological zoning - agri-ecological zones -definitions- Length of growing period - Köppen-Geiger-vegetation zones -examples</li> <li>5) Global water cycle - precipitation - evaporation - transpiration - run-off - surface pools - kondensation - movement - immobilisation - water table recharge - drainage - percolation</li> <li>6) Water as a resource - global water issues- virtual water - Green -Blue -Grey - Water Concepts - rain water harvesting - field water management - water and soil -soil degradation and withering -tropical soils = problem soils</li> <li>7) General definitions, soil functions and global soil degradation</li> <li>8) Soil description and systematics</li> <li>9) Soil diversity at variable scales</li> <li>10) Problem soils and their management</li> <li>11) Exercise: Calculation of site characteristics</li> <li>12) Soil management in Sahelian subsistence farming systems</li> <li>13) Major land usetypes of the tropics and subtropics and ecosystems services</li> <li>14) Crop production systems, crop management and resource use in the tropics and subtropics: Potentials and constraints</li> <li>15) Land use change, LUC assesement: tools and approaches</li> </ol>

	<p>16) Matter flows in landscapes, interconnectivity of landscapes</p> <p>17) Land degradation: types, extent, human impact, consequences and mitigation options at landscape level</p> <p>18) Global diversity of vascular plants, Role of the tropics and subtopics: origin of most food crops, Agricultural threats to biodiversity</p> <p>19) Natural resource use in tropical livestock systems:  - System classifications - Resource use by livestock - efficiency of nutrient and water conversion - examples</p> <p>20) Tropical feed resources: - Feed evaluation systems  - Nutritional value of tropical feed resources</p> <p>21) Tropical feed resources: - Nutritional value of tropical feed resources (cont.) - Feed management and conservation - examples of livestock feeding in different production systems</p> <p>22) Grassland-based livestock production: - Grassland ecotypes - Spatio-temporal availability in resource availability - Pastoral livestock systems</p> <p>23) Grassland-based livestock production: - Grassland degradation processes -</p> <p>24) Grassland-based livestock production: Rangeland concepts - Management strategies</p> <p>25) Plant Genetic Resources (PGR), Roles and functions of crop and varietal diversity in the production system (including linkage with nutrition), PGR conservation (ex situ, in situ - farmer management of diversity), Use of PGR : legal framework (CBD, ITPGRFA, SMTA, benefit sharing)</p> <p>26) Use of PGR and crop improvement targeting sustainable production systems and sustainable use of natural resources (P, N efficiency)</p> <p>27) Use of PGR and crop improvement to cope with climate variability and change</p> <p>28) Use and breeding of minor crops</p>
Literatur	-
Anmerkungen	-

## Modul: Plant and Crop Modeling (3103-410)

Modulverantwortung	Thilo Streck
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Basic knowledge of mathematics will be helpful (esp. calculus; ordinary differential equations).
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	<p>Agricultural Sciences - Soil Science (Master, since 01.10.2014) 3. Semester, elective</p> <p>Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective</p> <p>Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective</p> <p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p> <p>Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, semi-elective</p>
Prüfungsdauer (in Minuten)	30 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>After successfully completing the module, students understand the important role of models of plant and crop growth in many disciplines (e.g. agricultural sciences, agricultural economics, bioeconomics, hydrology, earth system science, environmental physics and meteorology). They can specify the general concepts currently used in modelling the processes determining plant and crop growth. Students have a good understanding of the</p>

	<p>concepts and modelling approaches required for the development of crop growth models appropriate for various environmental situations from the local to the regional scale. They are finally able to work with and further develop basic plant growth models which integrate knowledge from different disciplines at the interface between biogeophysics, plant physiology and agricultural sciences, in particular models of phenological development, biological switches, light transmission in canopies, leaf gas exchange, photosynthesis, growth and respiration, transport processes and assimilate partitioning in plants and water and nutrient uptake by plants. Students are ultimately proficient in respective biochemical approaches and plant morphology.</p> <p>Students enhance their organizational skills, self-reliance, time management and team work abilities while preparing and following up on lectures and during the exercises and while preparing for the exam. They learn and practice critical and analytical thinking in the lectures and the exercises, improve their ability of integrating knowledge from different disciplines, and gain experience in approaching complex scientific subjects.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Oral exam (100 %)
Studienleistung und Gewichtung	-
<b>Plant and Crop Modeling (3103-411)</b>	
Person(en) verantwortlich	Thilo Streck
Lehrform	Vorlesung mit Übung
SWS	2
Inhalt	.
Literatur	-
Anmerkungen	-
<b>Computer Exercises in Plant and Crop Modeling (3103-412)</b>	
Person(en) verantwortlich	Thilo Streck Sebastian Gayler
Lehrform	Übung
SWS	2
Inhalt	



	-
Literatur	-
Anmerkungen	-

## Modul: Plant Quality (3408-460)

Modulverantwortung	Uwe Ludewig
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	<p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective</p> <p>Bioeconomy (Master, since 01.10.2014) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective</p>
Prüfungsdauer (in Minuten)	120 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>After successfully completing the module, students are able to describe the main requirements for the external appearance and physical composition of plant products (food, feed and other biobased products) from the perspective of the processor, marketer, consumer and legislator. They can specify means of influencing the quality by plant mineral nutrition (external quality, content and storage of value-adding ingredients; suppression of unwanted plant compounds) and can evaluate the possibilities of influencing the quality by mineral nutrition in comparison with other means, such as breeding (eg. genetically modified crops) and plant cultivation strategies. Students are familiar with quality concepts and the quality of the product beyond (eg. production quality). Students acquire these abilities in the lecture (2 SWS). In the accompanying seminar, students present and discuss original work from the literature and current aspects of plant quality in short lectures. A one-day excursion to LUFA Speyer gives an insight into the practice of the official quality control of agricultural products.</p>

	<p>During preparation for the exam, while preparing and following up on lectures and while preparing the seminar, students enhance their organizational skills, self-reliance, time management and team work. They learn and practice both critical and analytical thinking and reading of scientific literature in the seminar, while generally improving their ability of exploring a scientific subject. While preparing the seminar, students improve their scientific articulateness and further improve their oral communication skills, presentation techniques and discourse capacities through presenting their work.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (70 %)
Studienleistung und Gewichtung	Presentation (25 %) with extended abstract (5 %)
<b>Plant Quality (3408-461)</b>	
Person(en) verantwortlich	Uwe Ludewig Franz Wiesler Günter Neumann
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	<p>Structure</p> <ol style="list-style-type: none"> <li>1. Definition, evaluation and influence of plant quality</li> <li>2. The external quality of plants</li> <li>3. The material composition of plants <ol style="list-style-type: none"> <li>3.1 Inorganic constituents (ess. minerals, nitrate, heavy metals)</li> <li>3.2 Organic nitrogen compounds</li> <li>3.3 Carbohydrates</li> <li>3.4 Lipids</li> <li>3.5 Organic Acids</li> <li>3.6 Vitamins</li> <li>3.7 Bioactive Substances</li> <li>3.8 Residues and Contaminants</li> </ol> </li> </ol>

	<p>4. Specific quality issues</p> <p>4.1 Plant nutrition and quality of potato, sugar beet quality, quality of fruit, vegetable quality, wine quality</p> <p>4.2 Plant nutrition and quality of conventional, integrated or alternative crops</p> <p>5 Biotechnological methods to improve nutritional quality</p>
Literatur	<ul style="list-style-type: none"> <li>• Current literature</li> <li>• Marschner's Mineral Nutrition of Higher Plants (2011, Academic Press)</li> </ul>
Anmerkungen	-

## Modul: Portfolio-Modul (Master) (3000-410)

Modulverantwortung	Michael Kruse
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Pro Studiengang kann nur ein Portfolio Modul belegt werden.
Lehrsprache	deutsch/englisch
ECTS	1
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	n. V.
Studiengänge	<p>Agribusiness (bis Studienbeginn 2018) (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Agricultural Sciences in the Tropics and Subtropics (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Landscape Ecology (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Crop Sciences - Plant Nutrition and Protection (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Agrarwissenschaften - Agrartechnik (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahl</p> <p>Bioeconomy (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl</p> <p>Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl</p> <p>Agribusiness (bis Studienbeginn 2018) (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Agrarwissenschaften - Agrartechnik (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 2. Semester, Wahl</p> <p>Crop Sciences - Plant Breeding and Seed Science (Master, PO vom 01.10.2014) 2. Semester, Wahl</p>

Crop Sciences - Plant Nutrition and Protection (Master, PO vom 01.10.2014) 2. Semester, Wahl  
 Nachwachsende Rohstoffe und Bioenergie (Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 2. Semester, Wahl  
 Environmental Protection and Agricultural Food Production (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 2. Semester, Wahl  
 Organic Agriculture and Food Systems (Master, PO vom 01.10.2014) 2. Semester, Wahl  
 Agricultural Sciences in the Tropics and Subtropics (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 2. Semester, Wahl  
 Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 1. Semester, Wahl  
 Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Crop Sciences - Plant Breeding and Seed Science (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Crop Sciences - Plant Nutrition and Protection (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Environmental Protection and Agricultural Food Production (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Landscape Ecology (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Nachwachsende Rohstoffe und Bioenergie (Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Organic Agriculture and Food Systems (Master, PO vom 01.10.2014) 3. Semester, Wahl  
 Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 2. Semester, Wahl  
 Agrarwissenschaften - Pflanzenproduktionssysteme (Master, PO vom 01.10.2015) 3. Semester, Wahl  
 Agrarwissenschaften - Pflanzenproduktionssysteme (Master, PO vom 01.10.2015) 2. Semester, Wahl  
 Agrarwissenschaften - Tierwissenschaften (bis Studienbeginn WS 18/19) (Master, PO vom 01.10.2015) 3. Semester, Wahl  
 Agrarwissenschaften - Tierwissenschaften (bis Studienbeginn WS 18/19) (Master, PO vom 01.10.2015) 2. Semester, Wahl  
 Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl  
 Earth and Climate System Science (Master, PO vom 01.10.2017) 3. Semester, Wahl  
 Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 2. Semester, Wahl

Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl

Agribusiness (ab Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahl

Agribusiness (ab Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahl

Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 1. Semester, Wahl

Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahl

Nachwachsende Rohstoffe und Bioenergie (Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahl

Nachwachsende Rohstoffe und Bioenergie (Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahl

Agrarwissenschaften - Agrartechnik (ab Studienbeginn SS 19) (Master, PO vom 01.04.2019) 3. Semester, Wahl

Agrarwissenschaften - Agrartechnik (ab Studienbeginn SS 19) (Master, PO vom 01.04.2019) 2. Semester, Wahl

Agrarwissenschaften - Tierwissenschaften (ab Studienbeginn SS 19) (Master, PO vom 01.04.2019) 3. Semester, Wahl

Agrarwissenschaften - Tierwissenschaften (ab Studienbeginn SS 19) (Master, PO vom 01.04.2019) 2. Semester, Wahl

Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahl

Nachwachsende Rohstoffe und Bioenergie (ab Studienbeginn WS 19/20) (Master, PO vom 01.10.2019) 2. Semester, Wahl

Nachwachsende Rohstoffe und Bioenergie (ab Studienbeginn WS 19/20) (Master, PO vom 01.10.2019) 3. Semester, Wahl

Environmental Protection and Agricultural Food Production (ab WS 19/20) (Master, PO vom 01.10.2019) 2. Semester, Wahl

Environmental Protection and Agricultural Food Production (ab WS 19/20) (Master, PO vom 01.10.2019) 3. Semester, Wahl

Agricultural Sciences in the Tropics and Subtropics (ab Studienbeginn WS 2019/20) (Master, PO vom 01.10.2019) 3. Semester, Wahl

Agricultural Sciences in the Tropics and Subtropics (ab Studienbeginn WS 2019/20) (Master, PO vom 01.10.2019) 2. Semester, Wahl

Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	Es können zwischen 1,0 und 7,5 ECTS credits erworben werden. 1 ECTS credit = etwa 30 h.
Lern- und Qualifikationsziele	<p>Nach Abschluss des Moduls sind die Studierenden in der Lage,</p> <ul style="list-style-type: none"> <li>• die Grundlagen wissenschaftlichen Arbeitens zu benennen.</li> <li>• interdisziplinäre Schnittstellen bzgl. ihres Studiengangs zu identifizieren und zu beschreiben</li> <li>• eigene Wissenslücken zu erkennen und selbständig zu schließen.</li> <li>• unter Anleitung ein wissenschaftliches Projekt zu planen und durchzuführen.</li> <li>• Ergebnisse wissenschaftlichen Arbeitens schriftlich festzuhalten und diese im Rahmen einer Präsentation wiederzugeben.</li> </ul> <p>Das Modul vermittelt Schlüsselkompetenzen in unterschiedlichen Bereichen, je nach inhaltlicher Ausrichtung. Zu nennen sind vor allem: Die Befähigung zum selbständigen (wissenschaftlichen) Arbeiten und zur effektiven Informationsbeschaffung und Informationsanalyse durch das selbständige Erarbeiten eines Themas. Teamfähigkeit, Selbst- und Fremdorganisation und planerische Fähigkeiten durch die Arbeit in Gruppen, Forschungsteams, oder durch ein Praktikum in einem Betrieb, sowie durch die selbständige Organisation der Tätigkeiten in diesem Modul durch die Studierenden.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Es gibt in dem Modul nur unbenotete Studienleistungen, keine Prüfungsleistung. Eine Anmeldung zur Modulprüfung bei Prüfungsamt ist nicht erforderlich. Reichen Sie Ihre Bescheinigungen beim Modulverantwortlichen Prof. Dr. Michael Kruse ein und zwar erst dann, wenn Sie alle Bescheinigungen beisammen haben und das Modul abschließen möchten. (Das Modul kann mit 1 - 7,5 ECTS credits abgeschlossen und bestanden werden.) Senden Sie die Bescheinigungen als pdf-Datei per mail an michael.kruse@uni-hohenheim.de. Die ECTS werden durch den Modulverantwortlichen aufgrund der vorgelegten Bescheinigungen bzw. auf Empfehlung der betreuenden Hochschullehrer



	<p>an das Prüfungsamt gemeldet. Nach Verbuchung erscheinen die credits dann in HohCampus.</p>
<p>Studienleistung und Gewichtung</p>	<p>In dem Portfoliomodul können mit einer oder mehreren Studienleistungen insgesamt zwischen 1,0 und 7,5 ECTS credits erworben werden.  Als Studienleistungen werden mit ECTS credits anerkannt (Richtlinie 30 h = 1 ECTS credit):</p> <ul style="list-style-type: none"> <li>• ein Industrie-/Behörden-/Firmenpraktikum in vor- oder nachgelagerten Bereichen (einschließlich Werkstudierenden-Tätigkeit). Landwirtschaftliche Praktika selbst können im Master nur dann angerechnet werden, wenn kein agrarisch ausgerichteter Bachelor-Studiengang absolviert wurde. Hierbei ergeben 20 Arbeitstage mit 20 seitigem Bericht = 6 ECTS credits. Für andere credit Anzahlen wird linear angepasst (z.B. 10 Tage + 10 Seiten Bericht = 3 credits oder 25 Tage + 25 Seiten Bericht = 7,5 credits). Eine Genehmigung des Praktikums oder des Betriebes ist nicht erforderlich. Das Praktikum kann auch vor dem Studium abgelegt worden sein. Der Bericht samt Praktikumsbescheinigung ist bei einem Prüfungsberechtigten (i.d.R. Prof.) abzugeben. Dieser prüft den Bericht und bestätigt dem Modulverantwortlichen, dass der Bericht angenommen ist und schlägt die Anzahl der zu vergebenden ECTS Punkte vor. Seitens der Fakultät gibt es außer der Seitenzahl keine weiteren Vorgaben für den Bericht. Es ist ratsam, vor Erstellung des Berichts den Prüfungsberechtigten nach seinen Vorgaben zu fragen und diese zu berücksichtigen. Der Modulverantwortliche kann eine Bestätigung darüber ausstellen, dass das Praktikum als Studienleistung anerkannt wird. Das Praktikum kann maximal einmal geteilt werden.</li> <li>• Individuelles Forschungspraktikum (d.h. der/die Studierende wird z.B. in die Bearbeitung eines wissenschaftlichen Projekts in einem Institut bzw. einer Forschungseinrichtung integriert). Beispiel für 6 ECTS credits: 20 Arbeitstage mit 20 seitigem Bericht oder Arbeitstagebuch, Projektbeschreibung mit Fragestellungen, angewendete Methoden und ggf. Teilergebnisse. Der Bericht ist bei einem Prüfungsberechtigten (i.d.R. Prof.) abzugeben. Dieser prüft den Bericht und bestätigt dem Modulverantwortlichen, dass</li> </ul>

der Bericht angenommen ist und schlägt die Anzahl der zu vergebenden ECTS Punkte vor.

- Hausarbeit/Literaturarbeit über ein wissenschaftliches Thema (5 - 10 Seiten je ECTS credit). Hierfür ist zunächst ein Prüfungsberechtigter zu finden, der das Thema vergibt und später die Arbeit annimmt, prüft und dem Modulverantwortlichen bestätigt, dass der Bericht angenommen ist und die Anzahl der zu vergebenden ECTS Punkte vorschlägt.
- Summerschools für postgraduierte Studierende sowie Lehrveranstaltungen auf Master-Niveau, die zum Studiengang passen, nicht zu einer Modulprüfung gehören und die in Hohenheim oder an einer anderen Hochschule belegt wurden. Bitte beim Modulverantwortlichen eine Bescheinigung über die Teilnahme einreichen, die den Zeitumfang oder die Anzahl anrechenbarer Credits enthält.
- Selbst erstellte und auf Kongressen, Tagungen präsentierte Vorträge/Poster zu wiss. Forschungsprojekten (3 ECTS Punkte).
- Vortrag/Poster in einem Seminar außerhalb eines Moduls (1,5 ECTS Punkte)
- Sprachkurse (insges. max. 3 ECTS credits). Bitte beim Modulverantwortlichen eine Bescheinigung über die Teilnahme einreichen, die den Zeitumfang oder die Anzahl anrechenbarer Credits enthält.
- Fortbildungen im Bereich „Soft Skills“ mit erkennbarem Bezug für das gewählte Studienfach (insges. max. 3 ECTS credits). Auch on-line Kurse (learning paths) > 7h werden gemäß folgender Tabelle angerechnet. Ausgeschlossen sind Kurse zu Office-Software.

Stundenumfang Learning Path --> ECTS-Punkte

7 - 12 h --> 0,5

13 - 18 h --> 1

19 - 24 h --> 1,5

25 - 30 h --> 2

	<p>31 - 36 h --&gt; 2,5</p> <p>37 - 42 h --&gt; 3</p> <p>Bitte beim Modulverantwortlichen eine Bescheinigung über die Teilnahme einreichen, die den Zeitumfang oder die Anzahl anrechenbarer Credits enthält.</p> <ul style="list-style-type: none"> <li>• FIT-Tutorenausbildung (insges. max. 3 ECTS credits). Das Abhalten des Tutoriums kann nicht anerkannt werden, wenn es im Rahmen eines HiWi-Vertrags erfolgte. Bitte beim Modulverantwortlichen eine Bescheinigung über die Teilnahme einreichen, die den Zeitumfang oder die Anzahl anrechenbarer Credits enthält.</li> <li>• Kurse zu Statistischer Programmierung oder zu Statistikprogrammen (insges. max. 2 ECTS credits).</li> <li>• Leistungsscheine der Virtuellen Akademie Nachhaltigkeit (4302-480) werden mit den darin ausgewiesenen Credits anerkannt.</li> </ul> <p>Der Studiendekan ist bevollmächtigt, im Einzelfall und auf Antrag des/der Studierenden und ggf. mit Befürwortung eines betreuenden Hochschullehrers weitere Leistungen anzuerkennen. Tätigkeiten in Rahmen einer Beschäftigung (HiWi) an Forschungseinrichtungen der Universität Hohenheim, werden nicht als Studienleistung anerkannt. In Streitfällen bzgl. der Anerkennung von Studienleistungen entscheidet der Prüfungsausschuss.</p>
<b>Portfolio-Modul (Master) (3000-411)</b>	
Person(en) verantwortlich	Michael Kruse
Lehrform	Projekt/Projektarbeit
SWS	5
Inhalt	Für weitere Informationen siehe Modul: Portfolio-Modul (Master) (3000-410)
Literatur	-
Anmerkungen	Bei offenen Fragen senden Sie eine E-Mail <a href="mailto:anmichael.kruse@uni-hohenheim.de">anmichael.kruse@uni-hohenheim.de</a> oder kommen Sie in die offene Sprechstunde des Studiendekans montags 12:00 - 13:00 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links).

## Modul: Poverty and Development Strategies (4901-420)

Modulverantwortung	Manfred Zeller
Bezug zu anderen Modulen	Is complemented by module 4901-430 "Rural Development Policies and Institutions".
Teilnahmevoraussetzung	none
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	2. Semesterhälfte
Studiengänge	<p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Agribusiness (Master, since 01.10.2014) 3. Semester, elective</p> <p>Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective</p> <p>Agribusiness (Master, since 01.04.2019) 3. Semester, elective</p> <p>Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 1. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective</p> <p>Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective</p>
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	The students can describe issues and objectives of agricultural and rural development. They can provide an overview of the history of development strategies and theories, current approaches and their problems with special emphasis on economic distribution, poverty reduction and growth and their interdependencies.

	Independent work, critical and analytical thought, written and oral concise expression, team ability.
empfohlene Vorkenntnisse	-
Anmerkungen	Once not offered in WS 19/20. Please register online via ILIAS.
Modulprüfung und Gewichtung	written exam (100 %)
Studienleistung und Gewichtung	-
<b>Poverty and Development Strategies (4901-421)</b>	
Person(en) verantwortlich	Manfred Zeller
Lehrform	Vorlesung
SWS	4
Inhalt	<p>Students learn methods/indicators to measure development, with a specific focus on agriculture, economic growth, poverty, equality, and food security.</p> <p>This includes indicators of development, such as the Human Development Index, and development objectives and their relationships as well as conflicts between them. Data (mainly from World Bank and UN system) are presented on selected development indicators for all developing regions.</p> <p>This is followed by a review of development theories (classical, balanced/unbalanced growth models, modernization theory, basic needs approach, role of transaction costs and rural institutions) and related development strategies and by a discussion of the underlying factors of development (as derived by the development theories), such as the endowment with natural resources and land, labor and population growth, and human, financial and social capital. The contributions of agriculture for overall development are presented.</p> <p>Students learn also about the institutional setting of development aid. This concerns national and international development institutions including non-governmental organizations (NGOs) with their structures, roles and development approaches. Finally, students are introduced to several rural and agricultural development policies, with an emphasis on the role of the state for agricultural and rural development and sectoral policy instruments related to agricultural and food markets, land and rural</p>

	finance, agricultural extension, and social safety net / public works policies.
Literatur	<p>Major literature references for the module are:</p> <ul style="list-style-type: none"> <li>• TODARO, M.P. and S.C.Smith 2003. Economic Development. Harlow, UK: Pearson Education Ltd.</li> <li>• Chenery, H. and T.N. Srinivasan (eds.). 1989. Handbook of development economics. Amsterdam, NL: Elsevier Publishers.</li> <li>• World Bank. Annual issues of the World Development Report. New York, NY,</li> <li>• USA: Oxford University Press.- especially Attacking Poverty. World Development Report 2000/2001.</li> <li>• Eicher, C.K., and J.M. Staatz (eds.). 1998. International agricultural development. London, UK: Johns Hopkins University Press (especially articles 6, 7, 10, 11, 15, 17, 19, 20, 24, and 27)</li> <li>• UNDP. Annual issues of the Human Development Report. New York, NY, USA: United Nations Development Program (UNDP).</li> </ul>
Anmerkungen	<p>Lecture with discussion, work in small groups, study of literature, reader/script.</p> <p>The reader and powerpoint slides are available in the ASTA-Skriptenbüro.</p>
<b>Tutorial Poverty and Development Strategies (freiwillig) (not offered anymore) (4901-422)</b>	
Person(en) verantwortlich	Manfred Zeller
Lehrform	Tutorium
SWS	1
Inhalt	<p>The exercise will offer students to rehearse selected topics covered in the lecture for which students demand additional opportunity for learning and rehearsal. These topics include:</p> <ul style="list-style-type: none"> <li>• methods for measuring development in various dimensions (for example gross national product, income inequality, income poverty, purchasing power parity, human development index, food security, global hunger index);</li> <li>• analytical concepts used in various development theories; and exercises regarding price/market analysis and investments in agricultural research (e.g. total factor productivity analysis).</li> </ul>

Literatur	-
Anmerkungen	-

## Modul: Quantitative Methods in Economics (4901-470)

Modulverantwortung	Manfred Zeller
Bezug zu anderen Modulen	This module is considered as basic for all other modules offered to students in the Major of "Rural Development Economics" in the M.Sc. Agritropics.
Teilnahmevoraussetzung	Successfully completed courses in statistics at undergraduate level are assumed.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	2. Semesterhälfte
Studiengänge	<p>Earth System Science (Master, since 01.10.2013) 3. Semester, elective</p> <p>Organic Agriculture and Food Systems (Master, since 01.10.2014) 3. Semester, elective</p> <p>Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective</p> <p>Bioeconomy (Master, since 01.10.2014) 3. Semester, elective</p> <p>Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective</p> <p>Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective</p> <p>Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 3. Semester, elective</p> <p>Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 3. Semester, semi-elective</p>
Prüfungsdauer (in Minuten)	120 minutes
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	<p>After completing this module, students:</p> <ul style="list-style-type: none"> <li>• Know the steps of preparing a field research project</li> <li>• Comprehend the different methods of sampling commonly used in rural areas of developing countries</li> <li>• Are able to utilize about best practices in questionnaire design</li> </ul>



	<ul style="list-style-type: none"> <li>• Are proficient in various statistical tools to address research questions and to test research hypotheses</li> <li>• Can apply these tools using Stata, a comprehensive statistics software package</li> </ul> <p>During preparation for the exam, while preparing and following up on lectures and during the exercises, students practice self-reliance and time management. They learn and practice critical and analytical thinking when challenged with statistical analysis. In the exercises, students further practice team work by working in small groups. Skills in professional statistical software such as STATA are indispensable for further scientific work. The skills and competences gained in the course facilitate students to successfully conduct fieldwork activities in rural areas with the highest scientific standard.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	This module targets students from all master programs with a strong interest in empirical quantitative social science research. It is highly recommended to students in their 3rd semester who plan to conduct such research for their master thesis. A certain degree of overlap with module 4902-810 "Applied Econometrics" (compulsory for AgEcon students in their 1st semester) regarding linear regression is unavoidable because the module also targets students from other master programs who may not have chosen "Applied Econometrics" in their 1st semester. However, due to its much broader range of topics, "Quantitative Methods in Economics" is a highly recommended module also and especially for AgEcon students. Please register online via ILIAS. We only accept a maximum of 25 students.
Modulprüfung und Gewichtung	Written exam (100 %)
Studienleistung und Gewichtung	-
<b>Quantitative Methods in Economics (4901-471)</b>	
Person(en) verantwortlich	Manfred Zeller
Lehrform	Vorlesung mit Übung
SWS	3
Inhalt	This module consists of lectures and exercises in the computer lab. Its emphasis is on the design and execution of socio-economic research that investigates issues of rural or agricultural development in developing countries. The course mainly covers quantitative research methods that

	<p>are used in development economics and in applied socio-economic research in developing countries.</p> <p>The particular contents of the module are as follows:</p> <ol style="list-style-type: none"> <li>1) Quantitative research designs in the social sciences</li> <li>2) The sampling process (constructing sampling frames, sampling procedures, sample size)</li> <li>3) The measurement of variables and questionnaire design (with group assignment)</li> <li>4) Data entry and data cleaning (with computer exercises)</li> <li>5) Overview of statistical instruments</li> <li>6) Parametric and non-parametric tests (with computer exercises)</li> <li>7) Principal component analysis (with computer exercises)</li> <li>8) Linear regression (with computer exercises)</li> <li>9) Binary response models (with computer exercises)</li> <li>10) Two-stage Heckman procedure for correcting sample selection bias (with computer exercises)</li> </ol>
Literatur	<ul style="list-style-type: none"> <li>• Black, Thomas R. (1999) Doing quantitative research in the social sciences. An Integrated approach to research design, measurement and statistics. Sage Publications, London.</li> <li>• Field, Andy (2005) Discovering statistics using SPSS. Second Edition. Sage Publications, London.</li> <li>• Hill, R. Carter, Griffiths, William E., and Judge, George G. (2001) Undergraduate econometrics. Second Edition. John Wiley &amp; Sons, New York.</li> </ul>
Anmerkungen	-
<b>Exercises to Quantitative Methods in Economics (4901-472)</b>	
Person(en) verantwortlich	Manfred Zeller
Lehrform	Übung
SWS	1
Inhalt	Computer exercises to quantitative methods in economics used in socio-economic research to issues of rural or agricultural development in developing countries.
Literatur	-
Anmerkungen	-

## Modul: Remote Sensing of the Earth System (1201-500)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	An advisable complement is the module 3103-440 "Spatial data analysis with GIS"
Teilnahmevoraussetzung	Basic knowledge in mathematics and physics
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 2. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	56 h attendance + 124 h independent study = 180 h workload
Lern- und Qualifikationsziele	The students learn to think in larger spatial and longer temporal scales and recognize evolution as a universal phenomenon. They understand how climate and chemistry of the Earth system developed over long time scales and that it will further change in the future. In addition, the students can distinguish between natural and anthropogenic influences on the Earth system.
empfohlene Vorkenntnisse	Interest in the technical aspects, assumptions, limitations and uncertainties of state-of-the-art remote sensing methods. You need to bring basic skills and interest in physics and mathematics.
Anmerkungen	Maximum number of participants: 20
Modulprüfung und Gewichtung	The examination of the module is a 120-minute written test. Only the points achieved in this test are relevant for the grade.
Studienleistung und Gewichtung	Active participation in the exercises, solving the problems.
<b>Remote Sensing of the Earth System, Lecture (1201-501)</b>	
Person(en) verantwortlich	Volker Wulfmeyer Andreas Behrendt
Lehrform	Vorlesung

SWS	2
Inhalt	The observation of the Earth system using remote sensing has fundamental applications for everyday lives of mankind. The module introduces in the physical basis, the methods, and applications of remote sensing from ground-based, airborne, and space borne platforms. The module is equipped with brand-new examples such as hurri-cane watch, wild fire observations, and sea surface temperature measurements for weather forecasting. Please contact Dr. Behrendt (andreas.behrendt@uni-hohenheim.de) or Prof. Wulfmeyer (volker.wulfmeyer@uni-hohenheim.de) for further details.
Literatur	W.G. Rees, Physical Principles of Remote Sensing* C. Elachi, J. van Zyl, Introduction to the physics and techniques of remote sensing, Wiley & Sons, 2006* (some copies of both books are available in the central library of the university).
Anmerkungen	-
<b>Remote Sensing of the Earth System, Excercise (1201-502)</b>	
Person(en) verantwortlich	Volker Wulfmeyer Andreas Behrendt
Lehrform	Übung
SWS	2
Inhalt	Excercise of the content of the lectures with interesting applica-tions of remote sensing for studying variables of the atmosphere and the land surface.
Literatur	-
Anmerkungen	-

## Modul: Special Topics of Earth System Science (1201-620)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	All modules from the 1st semester
Teilnahmevoraussetzung	Successful completion of the 1st semester
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	60 Minuten
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	56 h attendance + 124 h independent study = 180 h workload
Lern- und Qualifikationsziele	<p>The Students are able to apply their knowledge from natural sciences and other applied sciences for understanding and analyses of interdisciplinary compelling topics of Earth System Science.</p> <p>Students learn...</p> <ul style="list-style-type: none"> <li>- Analysis problems from Earth System Science with respect to the interaction between physical, chemical, biological, and economic processes</li> <li>- Set up of corresponding Earth system models of moderate complexity</li> <li>- Analyze the output of the model with respect to input variables, error analyses</li> <li>- Interdisciplinary thinking</li> <li>- Competence to present the analysis of the problem in oral and written manner</li> </ul>
empfohlene Vorkenntnisse	Participation in the mandatory modules of the first semester.
Anmerkungen	Maximum number of participants: 15 Registration is open until March 2014. Ranking according to grades

	in first semester, priority set to students from Earth System Science but the module is also open for other curricula.
Modulprüfung und Gewichtung	presentation (100%)
Studienleistung und Gewichtung	Oral presentation and written report.

## Modul: UNIcert III English for Scientific Purposes (1000-040)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Scoring at least 85 points in the Language Center's entrance examination OR a UNIcert II certificate or equivalent proof of English language proficiency OR being enrolled in an English-language Master's program at the Faculty of Natural Sciences.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	2 Semester
Studiengänge	<p>Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl</p> <p>Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl</p> <p>Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Wahl</p> <p>Ernährungsmanagement und Diätetik (Bachelor, PO vom 01.04.2011) 5. Semester, Wahl</p> <p>Ernährungswissenschaft (Bachelor, PO vom 01.04.2011) 5. Semester, Wahl</p> <p>Lebensmittelwissenschaft und Biotechnologie (Bachelor, PO vom 01.04.2011) 5. Semester, Wahl</p> <p>Ernährungsmedizin (Master, PO vom 01.10.2010) 3. Semester, Wahl</p> <p>Molekulare Ernährungswissenschaft (Master, PO vom 01.10.2010) 3. Semester, Wahl</p> <p>Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 1. Semester, Wahl</p> <p>Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl</p> <p>Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl</p> <p>Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Wahl</p> <p>Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl</p> <p>Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl</p> <p>Lebensmittelchemie (Master, PO vom 01.10.2015) 3. Semester, Wahl</p> <p>Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl</p>

	<p>Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 2. Semester, Wahl</p> <p>Food Biotechnology (Master, PO vom 01.10.2016) 1. Semester, Wahl</p> <p>Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl</p> <p>Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl</p> <p>Ernährungsmanagement und Diätetik (Studienbeginn ab WS 2017/18) (Bachelor, PO vom 01.10.2017) 5. Semester, Wahl</p> <p>Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl</p> <p>Earth and Climate System Science (Master, PO vom 01.10.2017) 3. Semester, Wahl</p> <p>Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Wahl</p> <p>Biologie (Master, PO vom 01.10.2010) 2. Semester, Wahlpflicht</p> <p>Biologie (Master, PO vom 01.10.2010) 1. Semester, Wahlpflicht</p> <p>Biologie (Bachelor, PO vom 01.04.2011) 5. Semester, Wahlpflicht</p>
Prüfungsdauer (in Minuten)	240
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	<p>Upon successful completion of this module, the English language proficiency of the students corresponds to the level C1 of the Common European Framework of Reference for Languages.</p> <p>For details on the competencies you acquire beyond language proficiency, please read the individual course descriptions at <a href="https://spraz.uni-hohenheim.de/kurse?&amp;L=1">https://spraz.uni-hohenheim.de/kurse?&amp;L=1</a>.</p>
empfohlene Vorkenntnisse	-
Anmerkungen	<p>You need to register for the UNIcert III courses.</p> <p>Information on how to register is available at <a href="https://spraz.uni-hohenheim.de/anmeldung?&amp;L=1">https://spraz.uni-hohenheim.de/anmeldung?&amp;L=1</a></p>
Modulprüfung und Gewichtung	<p>UNIcert III examination (240 minutes total): 180 minutes written exam, 30 minutes listening comprehension, 30 minutes oral exam</p>



Studienleistung und Gewichtung	Regular attendance, active participation, other (see individual course descriptions at <a href="https://spraz.uni-hohenheim.de/kurse">https://spraz.uni-hohenheim.de/kurse</a> )
<b>UNiCert III English for Scientific Purposes (1000-041)</b>	
Person(en) verantwortlich	Lutz Fischer
Lehrform	Vorlesung
SWS	-
Inhalt	For details on the competencies you acquire beyond language proficiency, please read the individual course descriptions at <a href="https://spraz.uni-hohenheim.de/kurse?&amp;L=1">https://spraz.uni-hohenheim.de/kurse?&amp;L=1</a> .
Literatur	-
Anmerkungen	-

## Modul: Weather and Climate Physics (1201-630)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	Parallele Teilnahme des Moduls: Mathematics and Computational Sciences of the Earth System (1102-400).
Teilnahmevoraussetzung	Keine.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	<p>Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Pflicht</p> <p>Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Pflicht</p> <p>Nachwachsende Rohstoffe und Bioenergie (Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahl</p> <p>Nachwachsende Rohstoffe und Bioenergie (ab Studienbeginn WS 19/20) (Master, PO vom 01.10.2019) 3. Semester, Wahl</p> <p>Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 3. Semester, Wahlpflicht</p> <p>Nachwachsende Rohstoffe und Bioenergie (Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahlpflicht</p> <p>Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahlpflicht</p>
Prüfungsdauer (in Minuten)	120 Minuten
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	<p>Students who complete this module will obtain knowledge of the physical variables and processes related to the earth system and become familiar with the underlying mathematical equations and formulations.</p> <p>They will be able to independently apply these equations to solve physical problems.</p>
empfohlene Vorkenntnisse	Grundkenntnisse in Physik.
Anmerkungen	Maximum number of participants: 10

Modulprüfung und Gewichtung	Klausur.
Studienleistung und Gewichtung	None.
<b>Weather and Climate Physics, Lecture (1201-631)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Vorlesung
SWS	2
Inhalt	<p>The order of the topics relates to the chain of processes of the earth system: beginning with the sources of energy, followed by the transport of energy by radiation and ending with thermodynamic processes and thereby caused mass flows. The following topics will be discussed in detail:</p> <ul style="list-style-type: none"> <li>- Nuclear physics (equivalence of energy and mass; mass defect; nuclear fusion; radioactivity; isotopes; mass spectrometry) - Physics of atoms and molecules (emission and absorption of electromagnetic waves; spectra of atoms, molecules and solid bodies; spectrum analysis) - Radiation (Planck's law of radiation; transmission; scattering)</li> <li>- Thermodynamics (diffusion; heat transport processes; energetics of phase transitions of water; sensible und latent heat; enthalpy; entropy; thermodynamic equilibrium) - Mass flows (laminar and turbulent flow; Reynolds number; Navier-Stokes-equation; flow in a moving reference system; flow in porous matter)</li> </ul>
Literatur	-
Anmerkungen	-
<b>Weather and Climate Physics, Exercise (1201-632)</b>	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Übung
SWS	1
Inhalt	Solution of assigned physical problems related to the contents of the lecture.
Literatur	-
Anmerkungen	-