UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang Master of Science Earth and Climate System Science

Stand Oktober 2020

Inhaltsverzeichnis

Modul: Agricultural and Forest Meteorology (1201-590)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
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	▪ Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl ▪ Bioeconomy (Master, PO vom 01.10.2014) 1. Semester, Wahl ▪ Bioeconomy (Master, PO vom 01.10.2014) 3. 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) 1. Semester, Wahl ▪ Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl
Prüfungsdauer	120 Minuten
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	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.
Anmerkungen	Maximum number of participants: 10
Modulprüfung und Gewichtung	Written exam
Studienleistung und Gewichtung	Active participation in both parts of the module
Agricultural and Forest Meteorology, Lecture (1201-591)	
Person(en) verantwortlich	Volker Wulfmeyer

Lehrform	Vorlesung
SWS	2
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	-
Agricultural and Forest Meteorology, Exercise and Practical (1201-592)	
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	-

Modul: Aufbaumodul Sustainability (5206-270)

Modulverantwortung	Michael Ahlheim
Bezug zu anderen Modulen	AVWL1
Teilnahmevoraussetzung	(weitgehend) abgeschlossenes Grundstudium
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 Semester
Studiengänge	▪ Wirtschaftswiss. mit ökonom. Wahlprofil (Bachelor, PO vom 28.07.2010) 5. Semester, Pflicht ▪ Wirtschaftswissenschaften (Bachelor, PO vom 01.10.2015) 5. Semester, Pflicht ▪ Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Pflicht ▪ Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl
Prüfungsdauer	120 Minuten
Präsenzstudium	-
Selbststudium	-
Arbeitsaufwand	180 Stunden: 42 Stunden Präsenzstudium 136 Stunden Selbststudium / Vor- und Nachbereitung 2 Stunden Klausur
Lern- und Qualifikationsziele	Die Studierenden haben vertiefte Kenntnisse in den ökonomischen Instrumenten, die bei diversen Umweltschäden und umweltpolitischen Problemlagen Einsatz finden können. Sie kennen und verstehen neben dem Spektrum an umweltökonomischen Instrumenten zudem die theoretischen und praktischen Grundzüge verschiedenartiger Umweltbewertungsmethoden. Ferner besitzen die Studierenden Wissen über die Nutzung erneuerbarer und nicht-erneuerbarer Ressourcen. Sie sind in der Lage, umweltpolitische Instrumente, umweltökonomische Bewertungsmethoden und intertemporalen Ressourcenverbrauch aus der Perspektive verschiedener Nachhaltigkeitsansätze zu analysieren und zu bewerten. Vorlesung und Übung sind anwendungsorientierte Veranstaltungen, die im theoretischen Bereich vor allem auf ein mikroökonomisch-mathematisches Grundwissen zurück greifen und dieses bei den Studierenden weiter ausbauen.
Anmerkungen	-

Modulprüfung und Gewichtung	
Studienleistung und Gewichtung	Klausur
Sustainability and Environmental Economics (5206-272)	
Person(en) verantwortlich	Michael Ahlheim
Lehrform	Vorlesung mit Übung
SWS	3
Inhalt	In the first part of this lecture course different concepts of sustainability are introduced to students. The next part deals with government's responsibility for the environment and with optimal government policies to cope with market failure in the environmental sector of the economy. These policies focus on an overall efficient use of the scarce resources of an economy. The next part focusses on environmental cost-benefit analysis and different techniques of preference assessment. In the final part of this lecture course which focusses on the basic concepts of resource economics students learn about the optimal extraction of nonrenewable resources like crude oil or natural gas over time. The main topics of this lecture course are: ▪ The concept of sustainability and its different interpretations ▪ The responsibility of government for the environment ▪ Market failure and the economic causes of environmental problems ▪ Instruments of environmental policy ▪ The economic assessment of environmental values ▪ Basic concepts of resource economics
Literatur	Ahlheim, M. (1998), Measures of economic welfare, in: Barbera, S., Hammond, P. J., Seidl, C. (eds), Handbock of utility theory, Vol. 1: Principles, Kluwer Academic Publishers, Dordrecht, 483-568. Ahlheim, M., Ekasingh, B., Frör, 0 ., Kitchaicharoen, J., Neef, A. , Sangkapitux, C., Sinphurmsukskul, N. (2010), Better than their reputation: enhancing the validity of contingent valuation mail survey results through citizen expert groups. Journal of Environmental Planning and Management 53(2), 163-182. Ahlheim, M., Frör, 0 ., Sinphurmsukskul, N.(2006), Economic valuation of environmental benefits in developing and ernerging countries: theoretical

	considerations and practical evidence from Thailand and the Philippines, Quarterly Journal of International Agriculture 45 (4): 397-419.
Anmerkungen	-

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	▪ 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 ▪ Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 3. Semester, Wahlpflicht ▪ Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 2. Semester, Wahlpflicht ▪ Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 1. Semester, Wahlpflicht ▪ Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 2. Semester, Wahlpflicht ▪ Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahlpflicht ▪ Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahlpflicht
Prüfungsdauer	30 Minuten
Präsenzstudium	70 h
Selbststudium	155 h
Arbeitsaufwand	225 h Workload
Lern- und Qualifikationsziele	Nach erfolgreichem Abschluss dieses Moduls haben die Studierenden einen Einblick in die Themen der modernen Bodenwissenschaften. Sie können Böden analysieren und Ergebnisse mündlich präsentieren. Durch die Vorlesungsvor- und Nachbereitung sowie durch die Prüfungsvorbereitung erlernen und

	trainieren die Studierenden selbstständiges Arbeiten und kritisches, analytisches Denken.
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	-
Bodenwissenschaftliches Experiment (3102-421)	
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	-
Teilnahmevoraussetzung	-
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	120 Minuten
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. 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. After having completed the module, the students know how to apply the scientific method to complex systems.

Anmerkungen	In person with the module coordinator (this only applies to students of Master's programmes other than ECSS)
Modulprüfung und Gewichtung	Written examination
Studienleistung und Gewichtung	Regular attendance
Organic Substances in the Earth System (1301-471)	
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	-
Inorganic Chemistry of the Earth's Surface (1301-472)	
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	Duke, C.V.A., Williams, C.D.: Chemistry for Environmental and Earth Sciences, CRC, Boca Raton, 2008. Andrews, J.E., Brimblecombe, P., Jickells, T.D., Liss, P.S., Reid, B.J.: An Introduction to Environmental Chemistry, 2nd edition, Blackwell, Malden, 2004. vanLoon, G.W., Duffy, S.J.: Environmental Chemistry

	A Global Perspective, 4th edition, Oxford University Press, Oxford, 2017. Textbooks of general and inorganic chemistry (the most recent editions).
Anmerkungen	-
Chemistry of the Atmosphere (1301-473)	
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	▪ Jacob, D.J.: Introduction to Atmospheric Chemistry, Princeton University Press, Princeton, 1999. ▪ Zellner, R.: Global Aspects of Atmospheric Chemistry, Steinkopff, Darmstadt, 1999. ▪ Warneck, P.: Chemistry of the Natural Atmosphere, 2nd edition, Academic Press, San Diego, 2000. ▪ Baumbach, G.: Air Quality Control, Springer, Berlin, 1996.
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	-
Teilnahmevoraussetzung	-
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	60 Minuten
Präsenzstudium	36 h
Selbststudium	23 h
Arbeitsaufwand	60 h Arbeitsaufwand
Lern- und Qualifikationsziele	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 ▪ Interdisciplinary thinking and its applications to problems in earth sciences

	based on the performance of the online course with exercises.
Anmerkungen	Anmeldung zum MOOC über https://www.oncampus.de/weiterbildung/moocs/climate-change-risks-and-challenges Ergänzendes Modul für ECSS und ESS Studierende mit Studienbeginn vor WS 2018/19.
Modulprüfung und Gewichtung	Mündliche Prüfung (30 Minuten Präsentation + 30 Minuten Diskussion)
Studienleistung und Gewichtung	Einreichen der Teilnahmebescheinigung am MOOC
Climate Basics: MOOC on Climate Change, Risks and Challenges (1201-401)	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	E-Learning
SWS	2
Inhalt	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. 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 anthropgeneous 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.
Literatur	Intergovernmental Panel on Climate Change (IPCC)-Reports: www.ipcc.ch and www.de-ipcc.de ▪ Assessment Report ▪ 1.5 Degree Report ▪ Land-Atmosphere Report
Anmerkungen	-

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

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
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	-
Präsenzstudium	42 h
Selbststudium	78 h
Arbeitsaufwand	120 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.
Anmerkungen	Maximum number of participants: 15
Modulprüfung und Gewichtung	
Studienleistung und Gewichtung	-

Chemical Evolution (1201-561)

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	-
Climate History (1201-562)	
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	-
Climate History and Evolution of the Earth System (1201-563)	
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: Data Assimilation III (1201-540)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 Semester
Studiengänge	-
Prüfungsdauer	-
Präsenzstudium	-
Selbststudium	-
Arbeitsaufwand	
Lern- und Qualifikationsziele	-
Anmerkungen	-
Modulprüfung und Gewichtung	-
Studienleistung und Gewichtung	-

Modul: Debate Seminar (1201-570)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
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	-
Präsenzstudium	27 h
Selbststudium	25 h
Arbeitsaufwand	52 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.
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	Presentation
Studienleistung und Gewichtung	-

Debate Seminar (1201-571)

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 Parlamentary Debate". 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. 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.
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	▪ Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 1. Semester, compulsory ▪ Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 1. Semester, compulsory ▪ Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective ▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Landscape Ecology (Master, since 01.10.2014) 3. Semester, elective ▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Organic Agriculture and Food Systems (Master, since 01.10.2014) 3. Semester, elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (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 2019) (Master, since 01.04.2019) 1. Semester, elective

	▪ Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective ▪ Biobased Products and Bioenergy (Master, since 01.10.2014) 3. Semester, semi-elective ▪ Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-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 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 ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective ▪ Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 1. Semester, semi-elective
Prüfungsdauer	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	= 180 h workload
Lern- und Qualifikationsziele	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. 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 matters. Finally, students acquire expertise to permit the competent application of technical knowledge and are of use in the solution of practical problems.
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 %)
Ecology and Agroecosystems (4906-411)	
Person(en) verantwortlich	Ingo Graß
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	▪ Ecology - outline ▪ Climatically caused diversity of tropical and subtropical ecozones ▪ Agro-ecological zoning system ▪ Plants and environmental factors ▪ Interaction between agriculture and natural ecosystems ▪ Principles of ecosystem functions ▪ Interactions in agroecosystems: Species interactions ▪ Agroecosystems of the tropics and subtropics ▪ Wildlife and rangeland ecology ▪ Practical methods in agroecology
Literatur	▪ Altieri, M.; 1995: Agroecology. Cambridge University Press, Cambridge. ▪ Gliessmann, S.R.; 2000: Agroecology: Ecological processes in sustainable agriculture. CRC Press LLC, USA. ▪ Gliessmann, S.R.; 2000: Field and laboratory investigations in Agroecology. CRC Press LLC, USA. ▪ Krebs, Ch.J.; 2001: Ecology: The Experimental Analysis of Distribution and Abundance, Benjamin Cummings, San Francisco. ▪ Martin, K. und J. Sauerborn; 2006: Agrarökologie, Verlag Eugen Ulmer, Stuttgart. ▪ Ricklefs, R.E. and Miller, G.L.; 2000: Ecology. W.H. Freemann and Company, New York, USA.

Anmerkungen	▪ Lectures - to provide fundamental knowledge relevant to agro-ecosystems ▪ Group assignment - to encourage broader interdisciplinary thinking and design in a group context ▪ Examination - the final test of competency ▪ written exam 70%; seminar presentation 30%

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	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
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

	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. 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.
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	-
Basic Microeconomics (4902-441)	
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	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. The mathematical concepts used (differential and integral calculus) are well explained in "Fundamental Methods of Mathematical Economics" by Alpha C. Chiang.
Anmerkungen	This lecture is offered in the first half of the semester (4 hours per week). We offer an additional voluntary tutorial to support students in working on distributed exercises. This module is strongly recommended

	for first semester AgEcon students who find their background in economics weak.
Environmental Policy (4902-442)	
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	▪ Perman, R., Ma, Y., McGilvray, J. and ▪ Common (2007): Natural Resource and Environmental Economics. 3rd Edition, Pearson Education. ▪ Tietenberg, T. (2003): Environmental and Natural Resource Economics. 6th Edition. Addison Wesley. ▪ Tietenberg, T. (2007): Environmental economics and policy. 5th Edition. Addison Wesley.
Anmerkungen	This lecture takes place in the second half of the semester (4 hours per week). A voluntary tutorial is offered.
Exercises to Basic Microeconomics (freiwillig) (4902-443)	
Person(en) verantwortlich	Martina Brockmeier
Lehrform	Übung
SWS	1
Inhalt	.
Literatur	-
Anmerkungen	-
Exercises to Environmental Policy (freiwillig) (4902-444)	
Person(en) verantwortlich	Christian Lippert
Lehrform	Übung
SWS	1
Inhalt	.
Literatur	-

Anmerkungen	Second half of semester

Modul: Ecosystems and Biodiversity (2101-510)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Good knowledge of general biology, in particular of botany, at least high school level.
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	-
Präsenzstudium	56 h
Selbststudium	112 h
Arbeitsaufwand	168 h workload
Lern- und Qualifikationsziele	The students get an overall view of the earth's vegetation (zonobiomes, orobiomes, and pedobiomes) against the background of solar and climatic zones and basic soil properties. They get to know the basics and methods of biodiversity research and its applications as well as dendrochronological, palynological, and archaeobotanical work for reconstructions of historical climate, vegetational history, and archaeology.
Anmerkungen	-
Modulprüfung und Gewichtung	
Studienleistung und Gewichtung	-

Zonobiomes of the Earth and Plant Geography (wird nicht mehr angeboten) (2101-511)

Person(en) verantwortlich	Anke Steppuhn
Lehrform	Vorlesung
SWS	2
Inhalt	Presentation of earth vegetation in the interaction with the determining environmental factors their zonobiomes: tundra, taiga, deciduous mixed forest, evergreen sclerophyllous forest, steppe, semi-desert and desert, savannah, tropical rainforest, special

	type dry forest, mountain biomes (colline to alpine altitude), mountainous tundras, Páramo, pedobiomes ▪ Ecosystems and fundamental biogeochemical cycles ▪ Causes of Biodiversity ▪ Fire as global ecological factor
Literatur	➢ S-W. Breckle, Walter's Vegetation of the Earth: The Ecological Systems of the Geo-Biosphere. Springer, 2008 ➢ R. Pott & J. Hüppe, Spezielle Geobotanik: Pflanze -Klima - Boden. Springer, 2007
Anmerkungen	-
Exercise on Vegetation and Climate History (wird nicht mehr angeboten) (2101-512)	
Person(en) verantwortlich	Anke Steppuhn
Lehrform	Übung
SWS	2
Inhalt	▪ Learning the techniques in the areas of Tree-Ring Dating, Dendroecology, and Dendroclimatology ▪ Microscopic investigation of wood structure and on the identification of wood species ▪ Learning the working methods of archaeobotany ▪ Learning the measurement and working techniques of pollen analysis
Literatur	▪ H.-J. Beug, Leitfaden der Pollenbestimmung, Pfeil Verlag, München, 2004 ▪ E. R. Cook, Methods of Dendrochronology: Applications in the Environmental Sciences. Springer, 2010 ▪ S. Jacomet & A. Kreuz, Archäobotanik, Ulmer Verlag, Stuttgart, 1999 ▪ F. H. Schweingruber & H.C. Wolf, Tree Rings: Basics and Applications of Dendrochronology. Springer, 1991 ▪ D. Zohary & M. Hopf, Domestication of Plants in the Old World, Oxford University Press, Oxford, 2000
Anmerkungen	-
Agricultural Production of Biobased Resources (3403-431)	
Person(en) verantwortlich	➢ Iris Lewandowski ➢ Regina Birner ➢ Uta Dickhöfer
Lehrform	Vorlesung
SWS	4
Inhalt	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. Contents of the module include: ▪ Description, systematics and functioning of agro-ecosystems; ▪ Provision of ecosystem services; ▪ Bio-physical principles of agricultural production; ▪ Role of climate in agricultural production and impact of climate change. ▪ Systematics, description and analysis of agricultural production systems in different agro-ecological regions; ▪ Case studies in crop and animal production; ▪ In- and outputs and material flows in agricultural production systems; ▪ Yields and quality of products from agricultural production; ▪ Biomass supply systems; ▪ Logistic aspects of biomass supply; ▪ Biomass supply in the context of food security.
Literatur	to be announced
Anmerkungen	-

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	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. 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.
Anmerkungen	-

Modulprüfung und Gewichtung	Written exam (100%)
Studienleistung und Gewichtung	-
Energy and Water Regime at the Land Surface (3103-501)	
Person(en) verantwortlich	➢ Thilo Streck ➢ Joachim Ingwersen
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	Lecture: 1. Radiation processes at the land surface (long and shortwave radation, albedo, photosynthetically active radiation) 2. Energy partitioning at the land surface (fluxes of latent and sensible heat, ground heat flux, photosynthesis) 3. Transport of energy and water in soil (1D, 3D; Fourier's law, Richards equation, material functions, infiltration) 4. Landscape hydrology (processes at the watershed scale, linear models, lumped models, semi-distributed models, 3D models) 5. Evapotranspiration (Penman equation) 6. Land surface models (NOAH-MP) 7. Crop models (assimilation, root growth, biological time, stress) 8. Turbulent fluxes (basics, Monin-Obhukov theory) Computer exercises: ▪ Energy partitioning at the land surface ▪ Physical interaction between atmosphere and radiation ▪ Modeling thermal conduction in soil (with Berkeley Madonna) ▪ Modeling water infiltration in soils with Hydrus 2D/3D (with case studies) ▪ Land surface modeling with NOAH-MP ▪ Turbulence and the eddy-covariance technique ▪ Similarity relations including Monin-Obukov Theory
Literatur	▪ Bonan, G.B. Ecological Climatology: Concepts and Applications. Cambridge University Press, 2008. ▪ Jury, W.A., Horton, R.H. Soil Physics. John Wiley & Sons, 2004.

	▪ 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. ▪ Campbell, G.S., Norman, J.M. An Introduction to Environmental Biophysics. Springer, 2000.
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	-
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
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.
Anmerkungen	“Registration of module participants via the ILIAS website of this module ends on Sunday, May, 3rd 2020 at midnight! - Seminar and accompanying computer exercises; seminar papers by the students. – A reader and further material are available at ILIAS.”
Modulprüfung und Gewichtung	Wwritten (75%)
Studienleistung und Gewichtung	In-class presentation and short seminar paper (25%)
Environmental and Resource Economics (4101-411)	

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 https://ilias.uni-hohenheim.de.

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	▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences - Animal Sciences (Master, since 01.10.2015) 3. Semester, elective ▪ Environmental Protection and Agricultural Food Production (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 ▪ Agricultural Sciences - Animal Sciences (Master, since 01.04.2019) 3. Semester, elective ▪ Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, elective ▪ Agricultural Sciences - Soil Science (Master, since 01.10.2014) 3. Semester, semi-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	90 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
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 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). 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.
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (50 %)
Studienleistung und Gewichtung	Presentation with discussion (40 %) and extended abstract (10 %)
Environmental Microbiology (3102-411)	
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	-
Seminar on Environmental Microbiology (3102-412)	
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 environenment (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	Sustainability Discourses and Environmental Sociology; Global Agri-food Systems; Gender, Nutrition and Right to Food; and other modules that deal with interdisciplinary aspects of food and agriculture
Teilnahmevoraussetzung	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 2019/20 should be submitted from September 30 to October 13, 2019. Please send your letter of motivation to claudia.bieling@uni-hohenheim.de stating the following: 1. Your name 2. Your nationality 3. Your study programme 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... (max. 150 words) The decision about participation will be communicated to applicants by October 14, 2019.
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 Semester
Studiengänge	▪ Agribusiness (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 3. Semester, elective ▪ Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences - Major: Crop Production Systems (Master, since 01.10.2015) 3. Semester, elective ▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Organic Agriculture and Food Systems (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective

	▪ Bioeconomy (Master, since 01.10.2014) 3. Semester, elective ▪ Crop Sciences - Plant Breeding and Seed Science (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences - Soil Science (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences - Animal Sciences (Master, since 01.10.2015) 3. Semester, elective ▪ Biobased Products and Bioenergy (Master, since 01.10.2014) 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) 3. Semester, elective ▪ Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective ▪ Agribusiness (Master, since 01.04.2019) 3. Semester, elective ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective ▪ Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective ▪ Agricultural Sciences - Animal Sciences (Master, since 01.04.2019) 3. Semester, elective ▪ Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective ▪ Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, elective ▪ Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 3. Semester, elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective
Prüfungsdauer	-
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. 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 ▪ intercultural competence ▪ scientific journal-based literature research ▪ scientific writing skills ▪ (media-supported) presentation skills ▪ organization and time management skills
Anmerkungen	Please note that the number of participants is limited to 20 (we will give priority to Master level students). Therefore, students are asked to submit a short letter of motivation to participate in the module (see above). Applications can be submitted from September 30 to October 13, 2019. Registration in ILIAS will only be possible after the selection process.
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 %)
Ethical Reflection on Food and Agriculture (4302-421)	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Seminar mit Übung
SWS	4

Inhalt	The module is broadly structured in two parts: 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: ▪ prudence, justice and the good life as principles for ethical assessment ▪ from fact to values and norms: how to build an argument ▪ dealing with non-knowledge. 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). 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.
Literatur	Readings will be provided via ILIAS.
Anmerkungen	Please note that this module is limited to 20 students and can be taken only after applying with a motivation letter! See ILIAS for further information.

Modul: Forschungspraktikum Chemische Evolution (1301-430)

Modulverantwortung	Henry Strasdeit
Bezug zu anderen Modulen	-
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	60 Minuten
Präsenzstudium	98 h
Selbststudium	82 h
Arbeitsaufwand	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.
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
Forschungspraktikum Chemische Evolution (1301-431)	
Person(en) verantwortlich	
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	-

Modul: Gender, Nutrition, and Right to Food (4302-400)

Modulverantwortung	➢ Claudia Bieling ➢ Stefanie Lemke
Bezug zu anderen Modulen	This module links to other modules dealing with food and nutrition security at international or local level, rural development. Related modules that complement the topics addressed in this module are Global Nutrition, Social Conditions of Organic and Sustainable Agriculture, and Ethics of Food and Nutrition Security.
Teilnahmevoraussetzung	Acceptance into Environmental Protection and Agricultural Food Production or Agricultural Sciences in the Tropics and Subtropics
Lehrsprache	Englisch
ECTS	7,5
Angebotshäufigkeit	Alle 2 Jahre
Dauer des Moduls	4 weeks (block 4)
Studiengänge	▪ Environmental Protection and Agricultural Food Production (Regulations 2019) (Master, since 01.10.2019) 2. Semester, semi-elective ▪ Agricultural Sciences in the Tropics and Subtropics (Regulations 2019) (Master, since 01.10.2019) 2. Semester, elective
Prüfungsdauer	-
Präsenzstudium	35 h
Selbststudium	185 h
Arbeitsaufwand	225 h workload
Lern- und Qualifikationsziele	After completing this module, students have an understanding of gender concepts and the history and development of various UN Conventions in the context of Gender and the Right to Food. They are aware of women and girls facing specific gender-based risks and that they are especially vulnerable to food insecurity and hunger. Students gain insights into how gender, nutrition and the right to food are linked and have to be considered in a holistic way in order to address structural causes of food and nutrition insecurity. The research project "Gender, Nutrition and the Human Right to Adequate Food" that was carried out between 2011 and 2016, with participation of the UN-Special Rapporteur on the Right to Food, Prof. Dr. Olivier de Schutter, FoodFirst Information- and Action-Network (FIAN),

	members of CEDAW, ICESCR, and IBFAN/GIFA, as well as subsequent research and advocacy, is presented. Further, presenting on case studies based on research undertaken in various regions and by inviting guest speakers from international organisations working on the right to food and related issues, this module enables students to analyse the underlying social, political, economic and cultural conditions that pose gendered barriers to the Right to Food. Linkages are provided to related topics, i.e. sustainable agriculture, food and nutrition security, local food systems, sustainable diets, food sovereignty, sustainable development goals and climate change. Students are finally able to apply a Human Rights approach and rights-based methods in studies of food and nutrition. By engaging participants in discussions with lecturers and guest speakers, and through a comprehensive group work assignment that includes independent literature research, oral presentation and argumentation in plenary debates, this module further enhances students' communication skills, their intercultural competence, logical and analytical abilities, teamwork capacity, scientific journal-based literature research, (media-supported) presentation skills and organization and time management skills.
Anmerkungen	The module will take place in Summer Semester 2020 during Block 4: 6.7.2020 - 31.7.2020 The number of participants is limited to 20, so please only register if you are sure that you want to do the module. There will be a waiting list if the registration exceeds the number of spaces available. Both the written paper and the group presentation are connected to the same topic. Participation in both parts is therefore required. Students are required to participate in group work in order to sit for the exam.
Modulprüfung und Gewichtung	Written paper in publication format (70 %)
Studienleistung und Gewichtung	Presentation in groups with discussion (30%), compulsory attendance at exercises and seminar
Gender, Nutrition, and Right to Food (4302-401)	
Person(en) verantwortlich	➢ Stefanie Lemke

	➢ Claudia Bieling ➢ Julia Rietze
Lehrform	Vorlesung mit Übung
SWS	5
Inhalt	Worldwide hunger and malnutrition are largely caused by structural inequalities, characterized by chronic lack of access to adequate food. The majority of those affected are smallholder farmers, pastoralists, indigenous people, landless people, non-farm rural households and poor urban populations, with the women and girls among them being disproportionally affected. Our current food systems not only fail to address hunger, but at the same time encourage diets that are a source of overweight and obesity. This food system failure ultimately undermines the capacity of individuals and communities to be resilient in the face of environmental and social change, including climate change. Combatting hunger and malnutrition is in many countries a legally binding human rights obligation, with the right to food placing legal obligations on States to realize food security for all, also addressing States' obligations beyond their borders, including trade relations. In light of on-going conditions of rural, racial, gender, class and other structural power inequities a human rights framework can offer a more precise analysis of the root causes of these inequities, and provides an analytical tool for exploring the policy and practical dimensions of implementing the right to food. The purpose of this module is to introduce students to the history and development of various UN Conventions in the context of Gender and the Right to Food. Women and girls face specific gender-based risks and are especially vulnerable to food insecurity and hunger. Students will gain insights into how gender, nutrition and the right to food are linked and have to be considered in a holistic way in order to address structural causes of food and nutrition insecurity. Illustrated by case studies based on research undertaken in various regions, and inviting guest speakers from academia and international organizations working on the right to food, large-scale land acquisition, rural development, gender, climate change and related issues, this module will enable students to analyze the underlying social, political, economic and cultural conditions that pose gendered barriers to the Right to Food. Students will further be introduced to rights-based methods and approaches in research.

	1. Introduction to the concepts gender, nutrition and right to food, and linkages with other concepts: food and nutrition security, food sovereignty, local food systems, sustainable diets, sustainable development goals, climate change (among others) 2. The international human rights system; human rights conventions; human rights framework; human right to food and link with other rights 3. Women in agriculture; structural and gender-based violence; gender mainstreaming; empowerment; masculinities 4. Research approaches and methodological considerations in the context of gender, nutrition and right to food, with case studies from Ghana, Georgia, Sierra Leone, South Africa, Tanzania (among others) 5. Experience of NGOs, faith-based organizations and organizations working in development cooperation: applying concepts to practice (with participation of FIAN International, IFAD, Misereor, among others) 6. Bridging gaps and strengthening the science-policy interface in contributing to achieving sustainable and just food systems and livelihoods for all: examples from research and advocacy
Literatur	Preparatory reading of selected literature (mostly journal-based). The reading material will be available on Ilias before the start of the course.
Anmerkungen	▪ Lectures, involving invited guest speakers from academia and civil society organisations ▪ Engaging students in discussions with lecturers and guest speakers, group work, argumentation in plenary debates ▪ Comprehensive group work assignment (30% of exam grade) that includes independent scientific journal-based literature research and oral presentation

	▪ Case studies from various regions illustrating concepts discussed in class

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 modules "Ethical Reflection on Food and Agriculture" and "Gender, Nutrition and Right to Food".
Teilnahmevoraussetzung	Acceptance into the above programme or basic knowledge and/or strong interest in social sciences
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 Semester
Studiengänge	▪ Organic Agriculture and Food Systems (Master, since 01.10.2014) 1. Semester, compulsory ▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Bioeconomy (Master, since 01.10.2014) 3. Semester, elective ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective
Prüfungsdauer	20 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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). To make sense of global agri-food systems, students are introduced to a theoretical framework that helps understand changes in food provisioning: In the 19th century, the bases of contemporary agri-

	food systems were established, but it is in the 20th century that they changed again; agri-food systems underwent a further period of transformation as the industrial processing of food, the emergence of large food transnational corporations and the integration of ever widening portions of the globe into the world food system restructured world food relationships. These series of changes have had dramatic consequences on agriculture and land use; it is from this that alternative forms of agriculture emerged and the organic movement blossomed, for instance. Factoring in an increasing array of ecological shocks and threats like climate change and peak oil, and dramatically changing cultural and political dynamics around food, agriculture and land use, the next turn to "local" and "traditional" gives a perspective of the big changes food systems underwent. Students are hereafter aware of the possible outcomes of the current developments in organic and sustainable agriculture. In this course, students are provided with the conceptual tools to understand the sociological bases around which a future world of agriculture, food and land use will possibly take shape. Students have an insight into the political and social importance of food and agriculture and are able to identify different kinds of politics around agriculture and food production and 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 the politics of resources, the environment and social justice. During preparation for the 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).
Anmerkungen	The written paper (compulsory assignment) comprises an essay on topics related to course

	contents, to be submitted during the course. This course is taught by Dr. Cinzia Piatti.
Modulprüfung und Gewichtung	Oral exam (50 %)
Studienleistung und Gewichtung	Written paper (50 %)
Global Agri-food Systems: Conventional, Organic, and Beyond (4302-461)	
Person(en) verantwortlich	Claudia Bieling
Lehrform	Seminar
SWS	4
Inhalt	This course has been designed to provide a comprehensive understanding of agri-food systems and make sense of paradigmatic shifts within. There are four main sections in this course: ▪ Understanding the background ▪ Understanding the contemporary paradigm ▪ Understanding the emergence of alternatives ▪ Adapting to transition 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. 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.
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. This course is taught by Dr. Cinzia Piatti.

Tutorial Global Agri-food Systems: Conventional, Organic, and Beyond (freiwillig) (4302-462)	
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	Extremely important: you have to be present on the first day of the module (i.e. 18 October 2018 at 14:00 in lecture hall 20) in order to be enroled for the module. This is mandatory because of organisational reasons. We will not accept any student for the module who is not present on 18 October 2018. 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.
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 semester
Studiengänge	▪ Landscape Ecology (Master, since 01.10.2014) 3. Semester, elective ▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 1. Semester, elective ▪ Bioeconomy (Master, since 01.10.2014) 3. Semester, elective ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective ▪ Biobased Products and Bioenergy (Master, since 01.04.2019) 3. Semester, elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 1. Semester, elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, elective ▪ Biobased Products and Bioenergy (Master, since 01.10.2019) 3. Semester, elective ▪ Agricultural Biology - Landscape Ecology (Copy) (Master, since 00.00.0000) 3. Semester, semi-elective

	▪ Biobased Products and Bioenergy (Master, since 01.10.2014) 3. Semester, semi-elective ▪ Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-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 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 ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective ▪ Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, semi-elective
Prüfungsdauer	90 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. After completing the course the student will: ▪ know the drivers of global change and global climate change and distinguish between natural and human impact ▪ understand the perturbations of the global carbon, nitrogen, and water cycles ▪ know and understand the major threats to ecosystems and ecological services and the potential impacts on the human society. ▪ 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

	▪ be familiar with international treaties to combat climate change and understand mitigation and adaptation strategies to climate change ▪ know methodological tools to investigate global change and its ecological impacts and feedbacks The student will be furthermore able to: ▪ combine knowledge from different disciplines of natural science to analyze the extent and socio-ecological consequences of climate change ▪ think across scales both in time and space to evaluate global change issues ▪ judge about the severity of climate change and its effects compared to other drivers of ecosystem functionality ▪ perform experimental research on ecological effects of climate change with a focus on plants ▪ acquire, evaluate and summarize information from scientific literature and present this information in scientific presentations. The structure of the module provides the following competences: ▪ The students will be able to discuss ecological, social, political and economic aspects of global change. ▪ They are furthermore able to develop and communicate mitigation and adaptation strategies to combat the socio-ecological consequences global change and foster sustainable development. ▪ The students will be able to co-operate and to work independently. ▪ They will be able to evaluate critically data and model outputs on emissions, regulatory measures and treaties and suggest improvements. ▪ The students will furthermore acquire intercultural competence by working in groups with international students.
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 lecture and seminar take place online due to the current situation. The practical part will be conducted in Hohenheim according to meet the applicable safety regulations. The number of participants is limited to a maximum of 15. Participant will be selected following a first-come-first-serve principle. Enrolment will take place via ILIAS and will start on 20.10.2020. Information on how to access the online lectures/ seminar will be provided on ILIAS by end of October.
Modulprüfung und Gewichtung	Written exam (70%)
Studienleistung und Gewichtung	Presentation with handout (15%) Exercise (15%)
Global Change Issues (3202-421)	
Person(en) verantwortlich	➢ Andreas Fangmeier ➢ Petra Högy
Lehrform	Vorlesung mit Seminar und Praktikum
SWS	4
Inhalt	Introduction to Global Change 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. Contents of the lectures cover: ▪ Human population and land-use change ▪ Greenhouse gas emissions ▪ The concept of radiative forcing and global warming ▪ Sea level rise ▪ Global carbon, water and nitrogen cycling and future projections ▪ Effects on natural and seminatural ecosystems ▪ Effects on agriculture ▪ Health impacts ▪ Mitigation options ▪ International legislation ▪ Emission trading Emerging Topics in Global Change Research 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 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. 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. Experiments on Global Change 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. 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
Literatur	Introduction to Global Change 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 http://ipcc.ch/). Further literature is provided on the ILIAS e-learning platform Emerging Topics in Global Change Research 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	The lectures will take place online (via MS Teams) due to the current situation. The practical part of the module will be held in Hohenheim or digital based on the situation in winter semester. Information about the schedule and about how to access the online lectures and course material will be provided on the ILIAS e-learning platform by end of October.

Modul: Land Use Economics (4904-430)

Modulverantwortung	Thomas Berger
Bezug zu anderen Modulen	This module advances the knowledge in land-use modeling and especially multi-agent systems.
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	-
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
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 models and multi-agent systems. Analytical thinking, oral presentation, scientific reading, data handling, processing and analysis.
Anmerkungen	Laptop required for computer exercises in class
Modulprüfung und Gewichtung	Written (100%)
Studienleistung und Gewichtung	-
Land Use Economics (4904-431)	
Person(en) verantwortlich	Thomas Berger
Lehrform	Vorlesung mit Übung
SWS	2

Inhalt	▪ Land-use economics: basic concepts and research questions ▪ Land-use modeling: model classes and cases of application ▪ Irrigation as a special land-use problem ▪ Land-use modeling at watershed level (case study) ▪ Land-use modeling with CA and MAS
Literatur	-
Anmerkungen	-
Land Use Economics - Case Study (4904-432)	
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	-
Teilnahmevoraussetzung	-
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	-
Präsenzstudium	28 h
Selbststudium	28 h
Arbeitsaufwand	56 h workload
Lern- und Qualifikationsziele	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. 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 pro-cesses and the chaotic nature of weather and climate are dis-cussed as well.
Anmerkungen	-
Modulprüfung und Gewichtung	
Studienleistung und Gewichtung	-

Lecture Series Earth System Science (1201-551)

Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Ringvorlesung
SWS	2
Inhalt	▪ Compartments of the Earth System ▪ Condition and interactions of components of the energy, water, and matter cycles across the compartments

	▪ Impact of human being to the Earth system, the anthroposphere ▪ System theory ▪ nonlinear coupled systems and chaotic systems 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.
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	-
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	60 Minuten
Präsenzstudium	54 h
Selbststudium	126 h
Arbeitsaufwand	180h Arbeitsaufwand
Lern- und Qualifikationsziele	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 Students acquire: ▪ Transfer of knowledge in natural and applied sciences ▪ Teamwork and communication

	▪ Critical and analytical thinking ▪ Interdisciplinary thinking and its applications to problems in earth sciences
Anmerkungen	Number of participants: 6 Application period: 4 weeks before start of lectures via ILIAS (first-come, first-serve) access to the online course per website: https://www.oncampus.de/weiterbildung/moocs/climate-change-risks-and-challenges
Modulprüfung und Gewichtung	Mündliche Prüfung (Präsentation und Dikussion in Summe 60 Minuten) Hausarbeit (mind. 20 Seiten)
Studienleistung und Gewichtung	Teilnahmezertifikat am MOOC
MOOC Climate, Change, Risks and Challenges (1201-411)	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	E-Learning mit Seminar
SWS	1
Inhalt	This online course provides the basic knowledge in the functioning of the Earth's climate system. This information ist providing by a series of interactive online lectures and exercises. 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 anthropgeneous 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.
Literatur	IPCC (see https://www.ipcc.ch): ▪ Assessment Report ▪ 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	-
Präsenzstudium	-
Selbststudium	-
Arbeitsaufwand	900 h
Lern- und Qualifikationsziele	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. ▪ System analysis - System observations by synergies of instruments - System modeling ▪ Competence to present their work in a comprehensive and concise manner.
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	Mathematische Grundlagen für das Modul 1102-410.
Teilnahmevoraussetzung	Solide Grundkenntnisse in Mathematik wie sie in einem typischen B.Sc.-Programm behandelt werden.
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	90 Minuten
Präsenzstudium	56 h
Selbststudium	64 h
Arbeitsaufwand	120 h Arbeitsaufwand.
Lern- und Qualifikationsziele	Ziel diese Moduls ist es, dass die studentes die mathematischen Werkzeuge aus Analysis und Linearer Algebra beherrschen, die für gewöhnliche und partielle Differentialgleichungen benötigt werden. Darüberhinaus lernen sie, einfache Computerprogramme zu schreiben, um sowohl verwandte mathematische Probleme lösen als auch Daten analysieren zu können. Ziel diese Moduls ist es, dass die studentes genügend Routine in den oben genannten Bereichen erlangen, um sich bei der Lösung von Differentialgleichungen auf deren Methodik konzentrieren zu können. Darüberhinaus erlangen sie Grundfertigkeiten im Programmieren und in der Datenanalyse.
Anmerkungen	Teilnehmerzahl: Unbeschränkt.
Modulprüfung und Gewichtung	Klausur
Studienleistung und Gewichtung	50 % der Punkte von den Hausübungen
Applied Mathematics for Earth and Climate System Science (1102-401)	
Person(en) verantwortlich	Georg Zimmermann

Lehrform	Vorlesung
SWS	2
Inhalt	Linear algebra: matrices and linear mappings, eigenvalues and eigenvectors, quadratic forms and definiteness. Differentiation: ordinary and partial derivatives, gradient, divergence and curl, Laplacian operator. Integration: indefinite and definite integrals, curves and line integrals, conservative vector fields, surfaces and surface integrals, integral theorems by Gauß and Stokes.
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	-
Computer Exercises for Earth and Climate System Science (1102-402)	
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	Fortsetzung des Moduls 1102-400.
Teilnahmevoraussetzung	Erfolgreicher Abschluss des Moduls 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	90 Minuten
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h Arbeitsaufwand.
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.
Anmerkungen	Teilnehmerzahl: Unbeschränkt. Anmeldung: Beim Dozenten zu Beginn des Semesters.
Modulprüfung und Gewichtung	Klausur Klausur
Studienleistung und Gewichtung	50 % der Punkte von den Hausübungen
Mathematics and Computational Sciences of the Earth System II (1102-411)	

Person(en) verantwortlich	Georg Zimmermann
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	Ordinary differential equations: numerical methods, autonomous systems and the stability of their stationary solutions. Partial Differential equations: wave equation, heat equation, numerical methods
Literatur	Lecture notes provided by the lecturer. Additional, if so desired: Any standard book on mathematics for physicists or engineers. Examples: 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	-

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

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
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	120 Minuten
Präsenzstudium	84 h
Selbststudium	96 h
Arbeitsaufwand	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, ini-tialization, 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.
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.
Measurement, Modeling and Data Assimilation I, Lecture (1201-521)	
Person(en) verantwortlich	➢ Volker Wulfmeyer ➢ Andreas Behrendt

	➢ Hans-Dieter Wizemann
Lehrform	Vorlesung
SWS	2
Inhalt	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. 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. The third part of the lecture introduces the basic concept of modeling. What models are available. How important are observa-tions for modeling? In which areas are models applied, what their performance is and what methods are applied to judge the model performance.
Literatur	-
Anmerkungen	-
Measurement, Modeling and Data Assimilation I, Exercise (1201-522)	
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	-
Measurement, Modeling and Data Assimilation I, Practical (1201-523)	
Person(en) verantwortlich	➢ Volker Wulfmeyer ➢ Andreas Behrendt ➢ Maike Schumacher
Lehrform	Praktikum

SWS	2
Inhalt	In the practical sessions, the students learn how to set up instru-ments 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. After the introduction of basic concepts of modeling, practical work is done to set up and run the Weather Research and Fore-casting model (WRF) on a Linux PC including the analysis and visualization of the results.
Literatur	-
Anmerkungen	-

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

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
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 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	120 Minuten
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	The students learn the basics of model development, programming and data assimilation. They understand 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 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. Further-more, 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.
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

Measurement, Modeling and Data Assimilation II (1201-531)	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Vorlesung
SWS	1
Inhalt	The students learn the basics of model development, programming 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	-
Measurement, Modelling and Data Assimilation II, Exercise (1201-532)	
Person(en) verantwortlich	➢ Volker Wulfmeyer ➢ Andreas Behrendt
Lehrform	Übung
SWS	1
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	-
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. critical, analytical thinking , (foreign) language skills
Anmerkungen	-
Modulprüfung und Gewichtung	Oral exam (100 %)
Studienleistung und Gewichtung	-
Microbiological Safety within the Feed and Food Production Chain (4605-431)	
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	▪ Brock : Biology of Microorganisms, Pearson Education International, Upper Saddle River,NJ07458 ▪ Hurst, Crawford, Knudsen, McInerney, Stetzenbach: Manual of Environmental Microbiology, ASM Press, Washington, DC ▪ Bush, Fernandez, Esch, Seed: Parasitism, Cambridge University Press, Cambridge
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	▪ Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 1. Semester, compulsory ▪ Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 1. Semester, compulsory ▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Bioeconomy (Master, since 01.10.2014) 3. Semester, elective ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective ▪ Environmental Protection and Agricultural Food Production (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, semi-elective ▪ Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, semi-elective
Prüfungsdauer	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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.

	The 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.
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (100 %)
Studienleistung und Gewichtung	-
Natural Resource Use and Conservation in the Tropics and Subtropics (4907-411)	
Person(en) verantwortlich	➢ Folkard Asch ➢ Uta Dickhöfer ➢ Bettina Haußmann
Lehrform	Vorlesung
SWS	4
Inhalt	1. Introduction, module requirements, module links within the compulsory moduls, Ilias, exam mode and requirements, expectations 2. Systems thinking, multidisciplinary approaches, Resources, functions, links between resources, concepts of use and conservation 3. Weather, Climate, global circulation - wind systems - ocean currents - global energy distribution - precipitation patterns - agro-ecolgical zoning - agri-ecological zones - examples 4. Precipitation patterns - agro-ecological zoning, agri-ecological zones -definitions- Length of growing period - Köppen-Geiger-vegetation zones, examples 5. Global water cycle - precipitation - evaporation - transpiration - run-off - surface pools - kondesation 6. movement - immobilisation - water table recharge 7. drainage - percolation 8. 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 9. General definitions, soil functions and global soil degradation 10. Soil description and systematics 11. Soil diversity at variable scales 12. Problem soils and their management 13. Exercise: Calculation of site characteristics 14. Soil management in Sahelian subsistence farming systems 15. Major land usetypes of the tropics and subtropics and ecosystems services 16. Crop production systems, crop management and resource use in the tropics and subtopics: Potentials and constriants

	15. Land use change, LUC assessement: tools and approaches 16. Matter flows in landscapes, interconnectivity of landscapes 17. Land degradation: types, extent, human impact, consequences and mitigation options at landscape level 18. Global diversity of vascular plants, Role of the tropics and subtopics: origin of most food crops, Agricultural threats to biodiversity 19. Natural resource use in tropical livestock systems: - System classifications - Resource use by livestock - efficiency of nutrient and water conversion - examples 20. Tropical feed resources: - Feed evaluation systems - Nutritional value of tropical feed resource 21. Tropical feed resources: - Nutritional value of tropical feed resources (cont.) - Feed management and conservation - examples of livestock feeding in different production systems 22. Grassland-based livestock production: - Grasslandbecotypes - Spatio-temporal availability in resource availability - Pastoral livestock systems 23. Grassland-based livestock production: - Grasslandbdegradation processes - 24. Grassland-based livestock production: Rangelandbconcepts - Management strategies 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) 26. Use of PGR and crop improvement targeting sustainable production systems and sustainable use of natural resources (P, N efficiency) 27. Use of PGR and crop improvement to cope with climate variability and change 28. Use and breeding of minor crops
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	▪ Agricultural Sciences - Soil Science (Master, since 01.10.2014) 3. Semester, elective ▪ Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective ▪ Earth System Science (Master, since 01.10.2013) 3. 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 Protection and Agricultural Food Production (until WS 2018/19) (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 ▪ Environmental Protection and Agricultural Food Production (from WS 19/20) (Master, since 01.10.2019) 3. Semester, semi-elective
Prüfungsdauer	30 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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 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. 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.
Anmerkungen	-
Modulprüfung und Gewichtung	Oral exam (100 %)
Studienleistung und Gewichtung	-
Plant and Crop Modeling (3103-411)	
Person(en) verantwortlich	Thilo Streck
Lehrform	Vorlesung mit Übung
SWS	2
Inhalt	.
Literatur	-
Anmerkungen	-
Computer Exercises in Plant and Crop Modeling (3103-412)	
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	▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Crop Sciences - Plant Nutrition and Protection (Master, since 01.10.2014) 3. Semester, elective Bioeconomy (Master, since 01.10.2014) 3. Semester, elective ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective
Prüfungsdauer	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. 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.
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (70 %)
Studienleistung und Gewichtung	Presentation (25 %) with extended abstract (5 %)
Plant Quality (3408-461)	
Person(en) verantwortlich	➢ Uwe Ludewig ➢ Franz Wiesler ➢ Günter Neumann
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	Structure 1. Definition, evaluation and influence of plant quality 2. The external quality of plants 3. The material composition of plants 3.1 Inorganic constituents (ess. minerals, nitrate, heavy metals) 3.2 Organic nitrogen compounds 3.3 Carbohydrates 3.4 Lipids 3.5 Organic Acids 3.6 Vitamins 3.7 Bioactive Substances

	3.8 Residues and Contaminants 4. Specific quality issues 4.1 Plant nutrition and quality of potato, sugar beet quality, quality of fruit, vegetable quality, wine quality 4.2 Plant nutrition and quality of conventional, integrated or alternative crops 5. Biotechnological methods to improve nutritional quality
Literatur	▪ Current literature ▪ Marschner's Mineral Nutrition of Higher Plants (2011, Academic Press)
Anmerkungen	-

Modul: Population and Quantitative Genetics (3502-450)

Modulverantwortung	Karl Schmid
Bezug zu anderen Modulen	None
Teilnahmevoraussetzung	Basic understanding of genetics: Structure and function of DNA, RNA and proteins; Mendelian inheritance; Genetic recombination; Principles of statistics: Normal distribution, hypothesis testing, mean and variances;
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 Semester
Studiengänge	▪ Crop Sciences - Plant Breeding and Seed Science (Master, since 01.10.2014) 1. Semester, compulsory ▪ 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 ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 1. Semester, elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 3. Semester, semi-elective ▪ Agricultural Sciences - Major: Crop Production Systems (Master, since 01.10.2015) 3. Semester, semi-elective ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 3. Semester, semi-elective
Prüfungsdauer	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	After successfully completing the module, students can describe the genetic structure and dynamics of populations in dependence of evolutionary factors and effects of breeding. They are familiar with the genetic basis of quantitative trait variation and are able to model and interpret patterns of variation relevant for breeding.

	During preparation for the exams, while preparing and following up on lectures and during the exercises, students enhance their organizational skills, self-reliance, time management communication and cooperation skills. They learn and practice critical and analytical thinking in the exercises, while also being challenged with independently solving mathematical exercises.
Anmerkungen	The first exam (compulsory assignment) takes place midterm, the exact date is announced at the beginning of the lecture.
Modulprüfung und Gewichtung	Written exam (50 %)
Studienleistung und Gewichtung	Written exam (50 %)
Population and Quantitative Genetics (3502-451)	
Person(en) verantwortlich	Karl Schmid
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	The nature of genetic variation; genetic structure of populations under random mating (Hardy Weinberg Equilibrium, Gametic linkage disequilibrium), Inbreeding (Selfing, matings of siblings, backcrossing) and outcrossing; changes of gene frequencies by selection and mutation in natural and breeding populations; Molecular population genetics and molecular evolution; The basic model of quantitative genetics; Effect of genotype and environment on phenotypic traits; Models for genotypic traits; Components of genotypic variation; Similarity among relatives; Structure of variation among units important for breeding; Prediction of selection gain; Evolutionary quantitative genetics; Methods of genetic mapping.
Literatur	▪ Hartl, D.L., and A.G. Clark. (2006): Principles of Population Genetics (4. ed.). Sinauer Ass., Inc., Sunderland. ▪ Hedrick, P.W. (2005): Genetics of Populations (3. ed.). Jones and Bartlett Publishers, Boston. ▪ Falconer, D.S., and T.F.C. Mackay (1996): Introduction to Quantitative Genetics (4. ed.). Longman Group Ltd., Essex.

	▪ Lynch, M., and B. Walsh. (1998): Genetics and Analysis of Quantitative Traits. Sinauer Ass., Inc., Sunderland.
Anmerkungen	Presentation of the content with a script and slides; exercises are used to improve the understanding of the material; computer labs are used to introduce students to computer programs for population genetic analysis.

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	▪ Agribusiness (bis Studienbeginn 2018) (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Agricultural Sciences in the Tropics and Subtropics (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Landscape Ecology (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Crop Sciences - Plant Nutrition and Protection (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Agrarwissenschaften - Agrartechnik (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Bioeconomy (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl ▪ Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl ▪ Agribusiness (bis Studienbeginn 2018) (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Agrarwissenschaften - Bodenwissenschaften (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Agrarwissenschaften - Agrartechnik (bis Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Agrarwissenschaften - Agricultural Economics (Master, PO vom 01.10.2014) 2. Semester, Wahl ▪ Crop Sciences - Plant Breeding and Seed Science (Master, PO vom 01.10.2014) 2. Semester, Wahl

- 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) Semester, Wahl ▪ Agrarwissenschaften - Tierwissenschaften (ab Studienbeginn SS 19) (Master, PO vom 01.04.2019) 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	-
Präsenzstudium	-
Selbststudium	-
Arbeitsaufwand	Es können zwischen 1,0 und 7,5 ECTS credits erworben werden. 30 h = 1 ECTS credit.
Lern- und Qualifikationsziele	Nach Abschluss des Moduls sind die Studierenden in der Lage, ▪ die Grundlagen wissenschaftlichen Arbeitens zu benennen. ▪ interdisziplinäre Schnittstellen bzgl. ihres Studiengangs zu identifizieren und zu beschreiben ▪ eigene Wissenslücken zu erkennen und selbständig zu schließen. ▪ unter Anleitung ein wissenschaftliches Projekt zu planen und durchzuführen. ▪ Ergebnisse wissenschaftlichen Arbeitens schriftlich festzuhalten und diese im Rahmen einer Präsentation wiederzugeben. 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 selbstständige 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 selbstständige Organisation der Tätigkeiten in diesem Modul durch die Studierenden.
Anmerkungen	Das Modul ist unbenotet. Es bleibt daher bei der Bildung des Notendurchschnitts unberücksichtigt. Eine Anmeldung zur Prüfung dieses Moduls im Prüfungsamt ist nicht erforderlich. Die vom Studiendekan ausgestellte Bescheinigung wird nach Abschluss des Moduls im Prüfungsamt abgegeben. Bei offenen Fragen kommen Sie in die offene Sprechstunde des Studiendekans montags 12:00 - 13:00 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links). Schreiben Sie bitte keine e-Mails direkt an den Studiendekan!
Modulprüfung und Gewichtung	keine Die ECTS werden durch den zuständigen Studiendekan Prof. Dr. Michael Kruse aufgrund der vorgelegten Bescheinigungen bzw. auf Empfehlung der betreuenden Hochschullehrer vergeben. Bitte kommen Sie hierzu in die Sprechstunde, Mo. 12 - 13 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links) und bringen Ihre Bescheinigungen

	mit. Die dort erhaltene Bescheinigung über die anerkannten Leistungen geben Sie dann beim Prüfungsamt ab. Das Modul kann mit 1 - 7,5 ECTS credits abgeschlossen und bestanden werden. Das Modul ist unbenotet.
Studienleistung und Gewichtung	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): ▪ ein Industrie-/Behörden-/Firmenpraktikum in vor-und nachgelagerten Bereichen (einschließlich Werkstudierenden-Tätigkeit). ▪ 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 Studiendekan, 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 Studiendekan kann eine Bestätigung darüber ausstellen, dass das Praktikum als Studienleistung anerkannt wird. ▪ Das Praktikum kann maximal einmal geteilt werden. Landwirtschaftliche Praktika selbst können im Master nicht angerechnet werden. ▪ 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 Studiendekan, dass 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).

- Summerschools für postgraduierte Studierende.
  (ECTS nach Absprache mit einem Hochschullehrer)

- Fortbildungsveranstaltungen wissenschaftlicher Gesellschaften für postgraduierte Studierende.
  (ECTS nach Absprache mit einem Hochschullehrer)

- Fachspezifische Sprachkurse (insges. max. 2 ECTS credits).

- Fortbildungen im Bereich „Soft Skills“ mit erkennbarem Bezug für das gewählte Studienfach
  (insges. max. 2 ECTS credits).

- FIT-Tutorenausbildung (insges. max. 3 ECTS credits). Das Abhalten des Tutoriums kann nicht anerkannt werden, wenn es im Rahmen eines HiWi-Vertrags erfolgte.

- Kurse zu Statistischer Programmierung oder zu Statistikprogrammen (insges. max. 2 ECTS credits).

- Leistungsscheine der Virtuellen Akademie Nachhaltigkeit (4302-480) werden mit den darin ausgewiesen Credits anerkannt. Die Leistungsscheine werden durch eine elektronische Klausur in Hohenheim oder einer anderen Partner-Hochschule des Projektes erworben: https://www.va-bne.de/index.php/de/studierende/beteiligte-hochschulen-2 und durch Prof. Bieling bestätigt.
  (Derzeit ausgesetzt)

Der Studiendekan ist bevollmächtigt, im Einzelfall und auf Antrag des/der Studierenden und mit Befürwortung eines Hochschullehrers, weitere Leistungen anzuerkennen.

- Tätigkeiten in Rahmen einer Beschäftigung (HiWi) an Forschungseinrichtungen der Universität Hohenheim, werden nicht als Studienleistungen anerkannt.

- In Streitfällen bzgl. der Anerkennung von Studienleistungen entscheidet der Prüfungsausschuss.

Portfolio-Modul (Master) (3000-411)	
Person(en) verantwortlich	Michael Kruse
Lehrform	Projekt/Projektarbeit
SWS	5
Inhalt	In dem Portfoliomodul können mit einer oder mehreren Studienleistungen insgesamt zwischen 1,0 und 7,5 ECTS credit erworben werden. Als Studienleistungen werden mit ECTS credits anerkannt (Richtlinie 25 - 30 h = 1 ECTS credit): ▪ ein Industrie-/Behörden-/Firmenpraktikum in vor- und nachgelagerten Bereichen (einschließlich Werkstudierenden-Tätigkeit). ▪ Individuelles Forschungspraktikum (d.h. der/ die Studierende wird z.B. in die Bearbeitung eines wissenschaftlichen Projekts in einem Institut bzw. einer Forschungseinrichtung integriert). ▪ Hausarbeit/Literaturarbeit über ein wissenschaftliches Thema (5 - 10 Seiten je ECTS credit). ▪ Summerschools für postgraduierte Studierende. (ECTS nach Absprache mit einem Hochschullehrer) ▪ Fortbildungsveranstaltungen wissenschaftlicher Gesellschaften für postgraduierte Studierende. (ECTS nach Absprache mit einem Hochschullehrer) ▪ Fachspezifische Sprachkurse (insges. max. 2 ECTS credits). ▪ Fortbildungen im Bereich „Soft Skills“ mit erkennbarem Bezug für das gewählte Studienfach (insges. max. 2 ECTS credits). ▪ FIT-Tutorenausbildung (insges. max. 3 ECTS credits). Das Abhalten des Tutoriums kann nicht anerkannt werden, wenn es im Rahmen eines HiWi-Vertrags erfolgte. ▪ Kurse zu Statistischer Programmierung oder zu Statistikprogrammen (insges. max. 2 ECTS credits). ▪ Leistungsscheine der Virtuellen Akademie Nachhaltigkeit werden mit den darin ausgewiesen Credits anerkannt. Die Leistungsscheine werden durch eine elektronische Klausur in Hohenheim oder einer anderen Partner-Hochschule des Projektes erworben: www.va-bne.de/index.php/de/ studierende/beteiligte-hochschulen-2 und durch Prof. Bieling bestätigt.

	Der Studiendekan ist bevollmächtigt, im Einzelfall und auf Antrag des/der Studierenden und mit Befürwortung eines Hochschullehrers, weitere Leistungen anzuerkennen. Die ECTS werden durch den zuständigen Studiendekan Prof. Dr. Michael Kruse aufgrund der vorgelegten Bescheinigungen bzw. auf Empfehlung der betreuenden Hochschullehrer vergeben. Bitte kommen Sie hierzu in die Sprechstunde, Mo. 12 - 13 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links) und bringen Ihre Bescheinigungen mit. Die dort erhaltene Bescheinigung über die anerkannten Leistungen geben Sie dann beim Prüfungsamt ab. Das Modul kann mit 1 - 7,5 ECTS credits abgeschlossen und bestanden werden. Das Modul ist unbenotet. Für weitere Informationen siehe Modul: Portfolio-Modul (Master) (3000-410)
Literatur	-
Anmerkungen	Bei offenen Fragen kommen Sie in die offene Sprechstunde des Studiendekans montags 12:00 - 13:00 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links). Schreiben Sie bitte keine e-Mails direkt an den Studiendekan!

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	▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Agribusiness (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective ▪ Agribusiness (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 ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 1. Semester, semi-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	-
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
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.
Anmerkungen	Once not offered in WS 19/20. Please register online via ILIAS.
Modulprüfung und Gewichtung	written exam (100 %)
Studienleistung und Gewichtung	-
Poverty and Development Strategies (4901-421)	
Person(en) verantwortlich	➢ Manfred Zeller ➢ Orkhan Sariyev
Lehrform	Vorlesung
SWS	4
Inhalt	Students learn methods/indicators to measure development, with a specific focus on agriculture, economic growth, poverty, equality, and food security. 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. 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. 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 finance, agricultural extension, and social safety net / public works policies.

Literatur	Major literature references for the module are: ▪ TODARO, M.P. and S.C.Smith 2003. Economic Development. Harlow, UK: Pearson Education Ltd. ▪ Chenery, H. and T.N. Srinivasan (eds.). 1989. Handbook of development economics. Amsterdam, NL: Elsevier Publishers. ▪ World Bank. Annual issues of the World Development Report. New York, NY, ▪ USA: Oxford University Press.- especially Attacking Poverty. World Development Report 2000/2001. ▪ 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) ▪ UNDP. Annual issues of the Human Development Report. New York, NY, USA: United Nations Development Program (UNDP).
Anmerkungen	Lecture with discussion, work in small groups, study of literature, reader/script. The reader and powerpoint slides are available in the ASTA-Skriptenbüro.
Tutorial Poverty and Development Strategies (freiwillig) (4901-422)	
Person(en) verantwortlich	Manfred Zeller
Lehrform	Tutorium
SWS	1
Inhalt	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: ▪ 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); ▪ analytical concepts used in various development theories; and exercises regarding price/market analysis and investments in agricultural research (e.g. total factor productivity analysis).
Literatur	-
Anmerkungen	-

Modul: Quantitative Methods in Biosciences (3402-420)

Modulverantwortung	Hans-Peter Piepho
Bezug zu anderen Modulen	The methods covered by this module enable you to make an informed choice anong different statistical methods, when it comes to the design and analysis of your own survey or experiment. Notice: compulsory for the specifications "Plant" and "Animal"
Teilnahmevoraussetzung	A first course in statistics
Lehrsprache	Englisch
ECTS	6
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	1 Semester
Studiengänge	▪ Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, compulsory ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2014) (Master, since 01.10.2014) 1. Semester, compulsory ▪ Environmental Science - Soil, Water, and Biodiversity (Regulations 2019) (Master, since 01.04.2019) 1. Semester, compulsory ▪ Crop Sciences - Plant Breeding and Seed Science (Master, since 01.10.2014) 1. Semester, elective Crop Sciences - Plant ▪ Nutrition and Protection (Master, since 01.10.2014) 1. Semester, elective Organic ▪ Agriculture and Food Systems (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 3. Semester, elective
Prüfungsdauer	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	After successfully completing this module, participants have a profound knowledge of basic statistical methods and concepts. They can apply advanced quantitative methods as used in either the biosciences or in economy. They are able to make informed use of up-to-date computing tools.

	During preparation for the exam, while preparing and following up on lectures and while participating in the laboratory, participants practice self-reliance and time management. The successful participant is able to identify and apply suitable basic statistical methods for his or her own survey and experiment. Key concepts are understood so that the participant is well equipped to professionally communicate with a statistician about his/her planned experiment or survey both at the design stage and the analysis stage.
Anmerkungen	It is necessary to register per ILIAS for the participation in this module.
Modulprüfung und Gewichtung	Written exam (100 %)
Studienleistung und Gewichtung	-
Quantitative Methods in Biosciences (3402-421)	
Person(en) verantwortlich	Hans-Peter Piepho
Lehrform	Vorlesung mit Laborübungen
SWS	4
Inhalt	Descriptive statistics, survey sampling, simple tests, Type I and Type II errors, confidence intervals, linear regression and correlation, residuals, analysis of variance, c2-tests, factorial analysis of variance, multiple linear regression, polynomial regression, nonlinear regression. Lecture. Lab work will be done using a pocket calculator and the SAS statistical package.
Literatur	▪ Lecture notes. ▪ Mead, R., Curnow, R. N., Hasted. A. M. 1993. Statistical methods in agriculture and experimental biology. 2nd edition. Chapman & Hall, London. ▪ Rees, D.G. 1985. Essential statistics. Chapman and Hall, London.
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	▪ Earth System Science (Master, since 01.10.2013) 3. Semester, elective ▪ Organic Agriculture and Food Systems (Master, since 01.10.2014) 3. Semester, elective ▪ Agricultural Sciences in the Tropics and Subtropics (until WS 2018/19) (Master, since 01.10.2014) 3. Semester, elective ▪ Bioeconomy (Master, since 01.10.2014) 3. Semester, elective ▪ Earth and Climate System Science (Master, since 01.10.2017) 3. Semester, elective ▪ Bioeconomy (starting WS 16/17) (Master, since 01.04.2017) 3. Semester, elective ▪ Agricultural Sciences in the Tropics and Subtropics (from WS 2019/20 on) (Master, since 01.10.2019) 3. Semester, elective ▪ Agricultural Sciences - Agricultural Economics (Master, since 01.10.2014) 3. Semester, semi-elective
Prüfungsdauer	120 minutes
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	After completing this module, students: ▪ Know the steps of preparing a field research project ▪ Comprehend the different methods of sampling commonly used in rural areas of developing countries ▪ Are able to utilize about best practices in questionnaire design

	▪ Are proficient in various statistical tools to address research questions and to test research hypotheses ▪ Can apply these tools using Stata, a comprehensive statistics software package 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.
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	-
Quantitative Methods in Economics (4901-471)	
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 are used in development economics and in applied socio-economic research in developing countries.

	The particular contents of the module are as follows: 1. Quantitative research designs in the social sciences 2. The sampling process (constructing sampling frames, sampling procedures, sample size) 3. The measurement of variables and questionnaire design (with group assignment) 4. Data entry and data cleaning (with computer exercises) 5. Overview of statistical instruments 6. Parametric and non-parametric tests (with computer exercises) 7. Principal component analysis (with computer exercises) 8. Linear regression (with computer exercises) 9. Binary response models (with computer exercises) 10. Two-stage Heckman procedure for correcting sample selection bias (with computer exercises)
Literatur	▪ Black, Thomas R. (1999) Doing quantitative research in the social sciences. An Integrated approach to research design, measurement and statistics. Sage Publications, London. ▪ Field, Andy (2005) Discovering statistics using SPSS. Second Edition. Sage Publications, London. ▪ Hill, R. Carter, Griffiths, William E., and Judge, George G. (2001) Undergraduate econometrics. Second Edition. John Wiley & Sons, New York.
Anmerkungen	-
Exercises to Quantitative Methods in Economics (4901-472)	
Person(en) verantwortlich	➢ Manfred Zeller ➢ Tim Loos
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	120 Minuten
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	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.
Anmerkungen	Maximum number of participants: 20
Modulprüfung und Gewichtung	Written exam
Studienleistung und Gewichtung	-

Remote Sensing of the Earth System, Lecture (1201-501)

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 appli-cations 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	-
Remote Sensing of the Earth System, Excercise (1201-502)	
Person(en) verantwortlich	➢ Volker Wulfmeyer ➢ Andreas Behrendt
Lehrform	Übung
SWS	2
Inhalt	Exercise 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	60 Minuten
Präsenzstudium	56 h
Selbststudium	124 h
Arbeitsaufwand	180 h workload
Lern- und Qualifikationsziele	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. Students learn... ▪ Analysis problems from Earth System Science with respect to the interaction between physical, chemical, biological, and economic processes ▪ Set up of corresponding Earth system models of moderate complexity ▪ Analyze the output of the model with respect to input variables, error analyses ▪ Interdisciplinary thinking ▪ Competence to present the analysis of the problem in oral and written manner
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	-

Modul: Spring School "Extreme Environments" (1301-410)

Modulverantwortung	Stefan Fox
Bezug zu anderen Modulen	Astrobiology (1301-400)rnPractical Course Chemical Evolution (1301-431) Selbstorganisation und Musterbildung in biologischen Systemen mit dem Schwerpunkt Membranen (2302-400)
Teilnahmevoraussetzung	Bachelor degree in einer technischen, naturwissenschaftlichen oder agrarwissenschaftlichen Disziplin sowie sehr gutes Grundwissen in Physik, Chemie und Biologie
Lehrsprache	Englisch
ECTS	7,5
Angebotshäufigkeit	Jedes WS
Dauer des Moduls	Geblockt
Studiengänge	▪ Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl ▪ Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Wahl ▪ Earth and Climate System Science (Master, PO vom 01.10.2017) 3. Semester, Wahl ▪ Biologie (Master, PO vom 01.10.2010) 3. Semester, Wahl ▪ Crop Sciences - Plant Nutrition and Protection (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Biologie (Master, PO vom 01.10.2010) 1. Semester, Wahl ▪ Crop Sciences - Plant Nutrition and Protection (Master, PO vom 01.10.2014) 3. Semester, Wahl ▪ Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Wahl
Prüfungsdauer	90 Minuten
Präsenzstudium	72 h
Selbststudium	116 h
Arbeitsaufwand	188 h workload
Lern- und Qualifikationsziele	The students understand how studies such as laboratory experiments, astronomical observations and space missions contribute to our knowledge about chemical evolution in extreme environments that probably led to the origin of life. They realize that life on Earth is and always was strongly influenced by cosmic phenomena. The students gain an overview about abiotic (prebiotic) chemical reactions in extreme environments and how traces of extinct and extant life can be detected on Earth and possibly on

	other planets (e.g. Mars) and moons (e.g. Europa, Enceladus). Extreme environments on other bodies of the Solar System are discussed as possible habitats for extraterrestrial life forms. During an excursion, the students acquire skills in recognizing the traces of an ancient asteroid impact. Students understand the technical and scientific prerequisites to study living systems under space conditions. The students know how gravity perception in general is organized in living systems. After having completed the module, the students should be able to deal with highly interdisciplinary problems by combining the methods and ways of thinking of various scientific disciplines. They should be able to understand the extended technical needs in the presented field of science. The students are able to convert newly gained theoretical knowledge into own experimental research. In a small experiment, students gain the ability to formulate scientific hypotheses, the design of experimental setups and the practical realization of experiments and data management and interpretation.
Anmerkungen	Anzahl Studien-/Teilnehmerplätze: 12 Anmeldung zur Teilnahme: über ILIAS ab Oktober Das Modul findet in der vorlesungsfreien Zeit vor Beginn des Sommersemesters statt.
Modulprüfung und Gewichtung	Klausur
Studienleistung und Gewichtung	regular attendance, participation in three excursions
Spring School "Extreme Environments" (1301-411)	
Person(en) verantwortlich	
Lehrform	Vorlesung
SWS	1
Inhalt	-
Literatur	-
Anmerkungen	-

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	▪ Earth System Science (Master, PO vom 01.10.2013) 2. Semester, Wahl ▪ Earth System Science (Master, PO vom 01.10.2013) 3. Semester, Wahl ▪ Earth System Science (Master, PO vom 01.10.2013) 1. Semester, Wahl ▪ Ernährungsmanagement und Diätetik (Bachelor, PO vom 01.04.2011) 5. Semester, Wahl ▪ Ernährungswissenschaft (Bachelor, PO vom 01.04.2011) 5. Semester, Wahl ▪ Lebensmittelwissenschaft und Biotechnologie (Bachelor, PO vom 01.04.2011) 5. Semester, Wahl ▪ Ernährungsmedizin (Master, PO vom 01.10.2010) 3. Semester, Wahl ▪ Molekulare Ernährungswissenschaft (Master, PO vom 01.10.2010) 3. Semester, Wahl ▪ Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 1. Semester, Wahl ▪ Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl ▪ Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl ▪ Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Wahl ▪ Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl ▪ Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl ▪ Lebensmittelchemie (Master, PO vom 01.10.2015) 3. Semester, Wahl ▪ Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl

	▪ Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 2. Semester, Wahl ▪ Food Biotechnology (Master, PO vom 01.10.2016) 1. Semester, Wahl ▪ Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl ▪ Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl ▪ Ernährungsmanagement und Diätetik (Studienbeginn ab WS 2017/18) (Bachelor, PO vom 01.10.2017) 5. 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 ▪ Earth and Climate System Science (Master, PO vom 01.10.2017) 1. Semester, Wahl ▪ Biologie (Master, PO vom 01.10.2010) 2. Semester, Wahlpflicht ▪ Biologie (Master, PO vom 01.10.2010) 1. Semester, Wahlpflicht ▪ Biologie (Bachelor, PO vom 01.04.2011) 5. Semester, Wahlpflicht
Prüfungsdauer	-
Präsenzstudium	-
Selbststudium	-
Arbeitsaufwand	225 h
Lern- und Qualifikationsziele	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. For details on the competencies you acquire beyond language proficiency, please read the individual course descriptions at https://spraz.uni-hohenheim.de/kurse?&L=1.
Anmerkungen	You need to register for the UNIcert III courses. Information on how to register is available at https://spraz.uni-hohenheim.de/anmeldung?&L=1.
Modulprüfung und Gewichtung	UNIcert III examination (240 minutes total): 180 minutes written exam, 30 minutes listening comprehension, 30 minutes oral exam
Studienleistung und Gewichtung	Regular attendance, active participation, other (see individual course descriptions at https://spraz.uni-hohenheim.de/kurse)

Modul: Weather and Climate Physics (1201-630)

Modulverantwortung	Volker Wulfmeyer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	Englisch
ECTS	6
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 ▪ Nachwachsende Rohstoffe und Bioenergie (Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahl ▪ Nachwachsende Rohstoffe und Bioenergie (ab Studienbeginn WS 19/20) (Master, PO vom 01.10.2019) 3. Semester, Wahl ▪ Environmental Science - Soil, Water, and Biodiversity (PO 2014) (Master, PO vom 01.10.2014) 3. Semester, Wahlpflicht ▪ Nachwachsende Rohstoffe und Bioenergie (Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 3. Semester, Wahlpflicht ▪ Environmental Science - Soil, Water, and Biodiversity (PO 2019) (Master, PO vom 01.04.2019) 3. Semester, Wahlpflicht
Prüfungsdauer	120 Minuten
Präsenzstudium	56 h
Selbststudium	112 h
Arbeitsaufwand	168 h workload
Lern- und Qualifikationsziele	The students have knowledge of the physical variables and pro-cesses related to the earth system and are familiar with the underlying mathematical equations and formulations. They are able independently to apply these equations in order to solve physical problems. They know the principles of physical modeling and understand the content of complex equations. The students have the physical understanding required to specify the state and the ongoing processes of the earth system. They have the expertise of analytical thinking and are able to quantitatively solve problems in natural science.

Anmerkungen	Maximum number of participants: 10
Modulprüfung und Gewichtung	Written examination
Studienleistung und Gewichtung	-
Weather and Climate Physics, Lecture (1201-631)	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Vorlesung
SWS	2
Inhalt	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 thermody-namic processes and thereby caused mass flows. The following topics will be discussed in detail: ▪ 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) ▪ Thermodynamics (diffusion; heat transport processes; energet-ics of phase transitions of water; sensible und latent heat; enthal-py; entropy; thermodynamic equilibrium) - Mass flows (laminar and turbulent flow; Reynolds number; Navier-Stokes-equation; flow in a moving reference system; flow in porous matter)
Literatur	-
Anmerkungen	-
Weather and Climate Physics, Exercise (1201-632)	
Person(en) verantwortlich	Volker Wulfmeyer
Lehrform	Übung
SWS	1
Inhalt	Solution of assigned physical problems related to the contents of the lecture.
Literatur	-
Anmerkungen	-