

# **Modulhandbuch**

## **Course Book**

### **M.Sc. Agricultural Science and Resource Mangement in the Tropics and Subtropics (ARTS)**

**Studienbeginn vor WS 2020/2021**

**Beginning of studies before WS 2020/2021**



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## Abkürzungen/Abbreviations:

### Häufigkeit/Course cycle

SS=Sommersemester/Summer semester

WS=Wintersemester/Winter semester

### Verwendbarkeit des Moduls/Study program allocation

P/C=Pflichtmodul/Compulsory

WP/E=Wahlpflichtmodul/Elective

fWP/O=freies Wahlpflichtmodul/Optional

PM=Projektmodul/Project module

### Lehr- und Lernformen/Teaching and learning methodes

V/L=Vorlesung/Lecture

Ü/T=Übung/Tutorial

S=Seminar

P=Praktikum/Practical training

E=Exkursion/Excursion

prÜ/pT=praktische Übung/ Practical course

PS=Projektseminar/Project seminar

T/sT=Tutorium/Student tutorial

K/C=Kolloquium/Colloquium

AG/SG=Arbeitsgemeinschaft/Study group

B-Arb/BT=Bachelorarbeit/Bachelorthesis

M-Arb/MT=Masterarbeit/Masterthesis

Mit Asterisk (\*) gekennzeichnet: Lehrveranstaltungen, für die gemäß § 13 Abs. 6 der POO als Voraussetzung für die Teilnahme an Modulprüfungen die verpflichtende Teilnahme festgelegt ist. Die Pflicht zur Teilnahme besteht dann zusätzlich zu etwaigen sonstigen aufgeführten Studienleistungen.

Marked with an asterisk (\*): Courses for which, in accordance with § 13 Paragraph 6 of the POO, compulsory attendance is specified as a prerequisite for taking module examinations. The compulsory attendance then exists in addition to any other listed academic achievements.

## **Compulsory modules of the first semester (ARTS-A,WS)**

**24 ECTS-CP must be completed.**

<b>Ecological Conditions and Climate Change</b>					
Code: ARTS-A1 POS: 748101010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker; Prof. Dr. Karl-Heinz Südekum; Dr. Stefan Pätzold; Dr. Thomas Gaiser				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	1.
Learning objectives	Students acquire the know how about and a quantitative understanding of the structure and use of resources (soil, water, plant, animal, genes, ecosystem) for agricultural production within their changing biophysical environment, including the effects of agriculture on and the contributions to desertification and climate change.				
Key competences	Technical knowledge and methods for site-and system-specific targeting of production strategies and to assess effects, contributing factors and impact of climate change on tropical agriculture				
Learning content	<p>Ecological conditions essential for (sub)tropical agriculture</p> <ul style="list-style-type: none"> <li>- Ecology of the earth, landscape formation, biodiversity</li> <li>- Climate, agroecological zones, definitions and descriptions</li> <li>- Soil formation in relation to landscape and climatic factors</li> <li>- Water resources, management and use in relation to climatic zones</li> <li>- Land use systems in major climatic zones.</li> </ul> <p>Causes and consequences of global climate change</p> <ul style="list-style-type: none"> <li>- Trends and scenarios of future climate and ist impact on agriculture</li> <li>- Sources and sinks of greenhouse gases</li> <li>- Political frameworks to combat climate change</li> <li>- Strategies to reduce emissions from agriculture (mitigation)</li> <li>- Strategies to cope with climate change phenomena (adaptation)</li> <li>- Scenarios of future climate and ist impact on agriculture</li> <li>- Trade-offs of major mitigation / adaptation scenarios</li> </ul>				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked) T (blocked)	Ecological conditions and principles of climate change Climate change scenarios	40 40	2,0 2,0	120 60
Examination(s)	Code	Type of examination	Duration of examination		
	748101017	Written exam	120 min		graded
Academic Achievements					not graded
Other	4-week block course in October (afternoons); Regular participation in exercises and presence at seminar presentations				

<b>Genes, Seeds and Biodiversity</b>					
Code: ARTS-A2 POS: 748101020		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	PD Dr. Ali Ahmad Naz				
Lecturers	PD Dr. Ali Ahmad Naz; PD Dr. Dessie Salilew Wondim				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	1.
Learning objectives	Students acquire knowledge about the issues related to agrobiodiversity, seed management applied crop and animal genetics, seed management, and recent developments in crop and animal biotechnology				
Key competences	Understanding of basic scientific principles and approaches Training of presentation skills Shaping of interdisciplinary thinking				
Learning content	Biodiversity and genetic resources management - Biodiversity: Origin of species, hot spots of biodiversity - The importance of agrobiodiversity - Genetic principles and methods - Plant genetics: Basics, use and conservation - Animal genetics: Basics, use and conservation - Markers, QTLs, gene expression analysis Seed Science and Seed Health - morphology of seeds, - physiology of germination, - seed distribution: mechanisms and risks				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked) T (blocked)	Genes, Seeds and Biodiversity Genes, Seeds and Biodiversity	40 40	3,0 1,0	140 40
Examination(s)	Code	Type of examination	Duration of examination		
	748101029	Written exam	60 min		graded
Academic Achievements					not graded
Other	4-week block course in November (afternoons); Regular attendance of exercises				

<b>Agricultural Production Systems in the Tropics</b>					
Code: ARTS-A3 POS: 748101030		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker; Prof. Dr. Ralf Pude; Prof. Dr. Karl-Heinz Südekum; Prof. Dr. Eike Lüdeling; Prof. Dr. Florian Grundler; Prof. Dr. Bernt Guldbbrandsen; Prof. Dr. Wolfgang Büscher				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	1.
Learning objectives	Students acquire the know-how about the structure, use and effects of current plant and animal production systems in different environments of the (sub)tropics.				
Key competences	Basic understanding of the diverse existing production systems in tropical regions and their constraints and challenges				
Learning content	(Sub)tropical plant production General overview of production systems in different climatic zones and socioeconomic environments, including: production of field crops, vegetables, fruits, agro-forestry; - plant diseases and protection; - plant nutritional disorders and nutrient management; - energy value and use of plants; and - management of plant production systems Animal Production Systems Animal Production systems in different climatic zones and socio-economic environments including: - Breeding, Nutrition, Animal Health, Mechanization, differentiation and integration of production goals				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Crops	40	2,0	90
	L (blocked)	Animals	40	2,0	90
Examination(s)	Code	Type of examination	Duration of examination		
	748101039	Written exam	120 min		graded
Academic Achievements					not graded
Other	4-week block course in December (afternoons)				



<b>Rural Development</b>					
Code: ARTS-A4 POS: 748101050		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Jan Börner				
Lecturers	Dr. Emmanuel Nshakira Rukundo				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E C	1./3. 1.
Learning objectives	Students will be familiar with the theoretical and methodological basics of Rural Development. They gain knowledge on phenomena and strategies at the micro and the macro level, the structure, function and change of rural development and an understanding of the process of change in the agricultural sector and in rural areas of developing countries; they obtain the ability to define needs of rural development and related strategies.				
Key competences	Interpretation and Evaluation of English text material; Visualization in brainstorming and mind mapping-procedures				
Learning content	Fields of research, concepts and indicators of rural development processes, stakeholder analysis and participation, phenomena of rural development (networks, globalization, migration, poverty, urbanization). Theory of rural development, prerequisites and difficulties, analysis of stakeholders, social structures of farming systems, social security systems, cooperatives, farmers associations and MFIs in developing countries, agricultural reforms in selected countries.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Agricultural and Food Economics Agricultural and Food Economics	25 25	1,3 2,7	60 120
Examination(s)	Code	Type of examination	Duration of examination		
	748101059	Written exam	100 min		graded
Academic Achievements					not graded
Other					

## **Elective modules of the first semester (ARTS-A,WS)**

**6 ECTS-CP must be completed.**

<b>Crop Ecology</b>				
Code: ARTS-AS5 POS: 748122010	Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Thomas Döring			
Lecturers	Prof. Dr. Thomas Döring; Prof. Dr. Mathias Becker; Dr. Thomas Gaiser			
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften			
Usability	Course program	Mode	Study semester	
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)	E	1.	
	M.Sc. Crop Sciences	C	1.	
	M.Ed. Agricultural Science (Teacher's Training)	E Focus Crop Science	1.	
Learning objectives	Die Studierenden verfügen über die Fähigkeit, die Produktionsprozesse in agrarischen Systemen im Kontext der physikalischen und chemischen Umwelt und unter besonderer Berücksichtigung der natürlichen Ressourcen in ihrer Komplexität zu erklären.			
Key competences	Grundverständnis von den biologischen, chemischen und physikalischen Vorgängen in der belebten Umwelt; Grundkenntnisse des Stoffwechsels, des Nährstoffhaushalts und der Ertragsbildung von landwirtschaftlichen Kulturpflanzen sowie den Eigenschaften ihrer Produktionsstandorte			
Learning content	<ul style="list-style-type: none"> <li>- Vorstellung landwirtschaftlicher Produktionssysteme der gemäßigten Breiten sowie der Tropen und Subtropen; Typologie der Produktionssysteme; Nachhaltigkeitsprinzip; Bedarf und Verwertung pflanzlicher Stoffe; inhaltliche Abgrenzung zu fachnahen Modulen</li> <li>- Primärprozesse der Stoffbildung und des Stofftransports auf Wurzel-, Blatt- und Bestandesebene (Photosynthese, Respiration) und ihre Abhängigkeit vom Angebot ausgewählter Nährstoffe; Wechselwirkung mit dem Wasserangebot; Einfluss von Boden-Substrateigenschaften sowie Bedeutung von Rhizobien und arbuskulärer Mykorrhiza</li> <li>- Einfluss des Angebots von Strahlung, Wasser, CO<sub>2</sub> und Temperatur auf die Stoffbildung in Pflanzenbeständen einschl. ihrer Wechselwirkungen; Bedeutung der Bestandesstruktur und des Mikroklimas während der phänologischen Entwicklung bei annuellen und perennierenden Nutzpflanzenbeständen; intra- und interspezifische Konkurrenz und ihr Einfluss auf die Produktivität</li> <li>- Stoffkreisläufe in Pflanzenbeständen; Quellen und Senken; ökologische Bewertung im Hinblick auf Nutzungseffizienz und Emissionen; Beeinflussung durch die Fruchtfolge; Bedeutung der organischen Substanz</li> <li>- genetische Ressourcen und züchterischer Fortschritt; Assoziation von Merkmalen und Genregionen (QTL/AM-Methoden) auf Adaptation, Ertragsbildungs- und Qualitätsmerkmalen; Allelmining</li> <li>- Pflanzenschutz: Bewertung von Befall, Schädigung und Schaden, Bedeutung verschiedener Schadorganismen, Befalls-Verlust-Beziehungen, Komponenten des Integrierten Pflanzenschutzes, Einfluss von Sortenwahl, Mikroklima; Fruchtfolge, Düngung und Produktionssystem, Fallbeispiele zum Integrierten Pflanzenschutz in ausgewählten Kulturen</li> <li>- Management der natürlichen Ressourcen in pflanzlichen Produktionssystemen – Integration der Teilprozesse der Ertrags- und Qualitätsbildung von Pflanzenbeständen anhand von Fallbeispielen;</li> <li>- Probleme, Perspektiven und Herausforderungen an die moderne pflanzliche Produktion</li> </ul>			
Language	English			
Recommended knowledge	none			
Prerequisites	none			
Maximum number of students				

<b>Crop Ecology</b>					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Crop Ecology		4,0	180
Examination(s)	Code	Type of examination	Duration of examination		
	748122019	eKlausur	120 min		graded
Academic Achievements					not graded
Other	Kurs wird in englischer Sprache angeboten; bei Teilnahme ausschließlich deutschsprachiger Studierender kann er in deutscher Sprache abgehalten werden Erfolgreicher Abschluss des BSc Agrar bzw. Zulassung zum Studiengang ARTS oder NaLa				

<b>Molecular Crop Science</b>					
Code: ARTS-AM5 POS: 748112010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Claudia Knief				
Lecturers	Prof. Dr. Claudia Knief; Dr. Caroline Marcon; Prof. Dr. Heiko Schoof; Prof. Dr. Andreas Meyer; Prof. Dr. Florian Grundler				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	1.
	M.Sc. Crop Sciences			C	1.
	M.Sc. Plant Sciences			O	
Learning objectives	Understanding of the basic concepts in molecular crop sciences and introduction into the key research areas of molecular crop science within the faculty of agronomy.				
Key competences	Understanding and communication of scientific texts in English. Discussion of scientific contents using the terminology of molecular crop science.				
Learning content	Introduction to basic molecular concepts and ongoing research related to crop functional genomics, crop bioinformatics, chemical signaling, molecular biology of the rhizosphere and molecular phytomedicine				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Molecular Crop Science Research in Bonn	40	2,0	90
	S (blocked)	Basic concepts in molecular crop science	40	2,0	90
Examination(s)	Code	Type of examination	Duration of examination		
	748112019	Report (presentation)	30 min during the semester		graded
Academic Achievements					not graded
Other	Relevant literature will be distributed prior to the course				

<b>Economics on Sustainability</b>					
Code: ARTS-AE5 POS: 748132010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Karin Holm-Müller				
Lecturers	Dr. Tsegaye Tagesse Gatiso				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics			E	1.
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	1.
	M.Sc. Nature Conservation and Landscape Ecology			E Block A	1.
	M.Ed. Agricultural Science (Teacher's Training)			E Focus Economics	1.
M.Ed. Nutrition Science and Home Economics (Teacher's Training)			E	1.	
Learning objectives	Students will obtain a good knowledge about the theoretical approaches of environmental and ecological economics and can apply them to problems related to sustainability.				
Key competences	Enhance capability to reflect and discuss complex problems from different perspectives				
Learning content	Basic approaches of ecological and environmental economics; The environmental Kuznets curve and the Pollution haven hypothesis; intertemporal allocation of renewable and non-renewable approaches Definition and Indicators for sustainability (Genuine savings); monetary valuation of environmental impacts; Life-cycle-analysis and communication of environmental achievements; food consumption and sustainability				
Language	English				
Recommended knowledge	Solid knowledge at bachelor level of microeconomics and welfare theory are recommended for this module.				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Economics on Sustainability Economics on Sustainability	40 40	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748132019	Written exam	120 min		graded
Academic Achievements					not graded
Other					

<b>Microeconomics</b>					
Code: ARTS-AE6 POS: 748132020		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Thomas Heckelei				
Lecturers	An N.Q. Cao				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C E	1. 1.
Learning objectives	At the end of the course students will have acquired theoretical and applied competence in the neoclassical theory of supply, demand and markets at a formal mathematical level. Specifically, the students are able to formulate and solve unconstrained and constrained optimization problems and made first steps towards quantitative economic analysis.				
Key competences	Analytical thinking, use of spreadsheet tools for modelling				
Learning content	Choice and demand: utility maximization, expenditure minimization, Slutsky equation, market demand Supply and factor demand: Production functions, cost minimization, profit maximization Coordination of supply and demand through competitive markets Strategic behavior (game theory), monopoly, imperfect competition Labour markets, enterprise-household models Capital investment Land market, land heterogeneity				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Microeconomics Microeconomics	50 50	3,0 1,0	120 60
Examination(s)	Code	Type of examination	Duration of examination		
	748132029 748132028	Written exam [50%] Assignments [50%]	120 min during the semester		graded graded
Academic Achievements					not graded
Other					

## **Elective modules of the focus "System approaches" (ARTS-BS,SS)**

**30 ECTS-CP must be completed from the elective modules of the chosen specialization.**

**A maximum of 12 ECTS-CP can be completed from free elective modules.**



<b>Tropical crop production systems</b>					
Code: ARTS-BS2 POS: 748222020		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker; Jun.-Prof. Dr. Lisa Biber-Freudenberger; Prof. Dr. Jan Börner				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
Learning objectives	Acquire knowledge about major crop production systems as well as aspects of restoration ecology, including land use and planning tools				
Key competences	Students get an overview of major crop production systems and will acquire detailed knowledge on approaches use in restoration ecology, land use planning, ecosystem health and technical engineering				
Learning content	Principles of restoration ecology of crop lands are presented. Principles of tropical agroforestry and major agroforestry systems are introduced using case studies. Crop uses on degraded and marginal lands and their effects on systems sustainability are discussed and land use planning tools are presented				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L+E (blocked)	Restoration ecology	15	2,0	90
	L+E (blocked)	Agroforestry systems	15	2,0	90
Examination(s)	Code	Type of examination	Duration of examination		
	748222027	Written exam			graded
Academic Achievements					not graded
Other					

<b>Soil Resources of the World</b>					
Code: ARTS-BS1 POS: 748222010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Dr. Sara Bauke				
Lecturers	Prof. Dr. Wulf Amelung; Dr. Sara Bauke; Ramona Mörchen				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	2.
Learning objectives	To become acquainted with the major soils of the world, their classification, genesis, land-use options, and associated risks				
Key competences	Understanding of the major soil properties and classification of soil types occurring around the globe				
Learning content	<p>The course is structured in</p> <ul style="list-style-type: none"> <li>- Lecture + seminar (2 SWS) on major soil types according to World Reference Base of Soil Resources (WRB) classification, principles of their genesis, major properties and land-use options. The course is spinned up with some advanced knowledge on specific processes associated with different soils relevant for e.g. global element cycles or food security.</li> <li>- Practices: Here the student learns how to classify soils according to WRB and Soil Taxonomy on the basis of analytical data sheets, photographs and/or archived soil monoliths</li> <li>- Excursions: In one-day excursions the students will visit the World Soil Museum and/or field sites in Western Germany with relicts of tropical soils</li> </ul>				
Language	English				
Recommended knowledge	Basic knowledge: Principles of Soil Science (e.g. Allgemeine Boden- und Standortkunde)				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Soils of the world	24	1,5	90
	S*	Soil classification (includes practices on soil classification)		0,5	30
E	Soil formation under topical conditions	24	2,0	60	
Examination(s)	Code	Type of examination	Duration of examination		
	748222017	Written exam  Prerequisites for admission to the exam: presentation, regular participation	120 min		graded
Academic Achievements					not graded
Other					

<b>Animal production systems in the tropics</b>					
Code: ARTS-BS3 POS: 748222030		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Karl-Heinz Südekum				
Lecturers	Prof. Dr. Karl-Heinz Südekum; Dr. José María Arroyo Martínez; PD Dr. Dessie Salilew Wondim				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Animal Science			O	2.
Learning objectives	Acquire knowledge about major animals and production systems as well as about the social-ecological interactions for their use and management				
Key competences	Students get an overview of animal production systems and will acquire detailed knowledge on physiological basics of livestock performance, preventive medicine and safety of food (animal origin), technical engineering in animal production systems, farm animal husbandry and animal nutrition with their relations to product quality and environmental aspects.				
Learning content	<ul style="list-style-type: none"> <li>- Physiology of growth, reproduction and lactation,</li> <li>- Mechanisms of adaptation and defense against microbes</li> <li>- Diagnostic tools to evaluate herd health</li> <li>- Nutrition needs and feed stuffs</li> <li>- Process engineering in animal production</li> <li>- Forage harvest and conservation technology</li> <li>- Husbandry systems and product quality assessment</li> </ul>				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L PS*	Animal production systems in the tropics Animal production systems in the tropics	15 15	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748222037	Report (presentation)  Prerequisites for admission to the exam: regular attendance	during the semester		graded
Academic Achievements					not graded
Other					

<b>Element cycles in tropical agro-ecosystems</b>					
Code: ARTS-BS4 POS: 748222040		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker; Prof. Dr. Nicolas Brüggemann				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	2.
Learning objectives	Students get acquainted with the principles and processes of element transformation in (sub)tropical environments, including the management of organic waste and other secondary raw materials. They will be able to assess and analyze the availability of major (nutrient)elements in a range of environments and to determine the quantity and quality of organic matter and various secondary raw materials. Finally the students will be able to apply their knowledge to plan intervention strategies for improved crop plant nutrition in environments with variable ecological conditions.				
Key competences	Team-oriented work, holistic thinking and comprehension of abstract relationships and complex interactions				
Learning content	Pools, fluxes and transformation processes of major elements (water, C, N, P, S) in tropical environments. Ecological conditions and organic matter management and its implications for the nutrition of tropical crops. Waste treatment and treatment technologies (composting, anaerobic digestion) and use of organic waste as fertilizer. Use of staple isotopes.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Element cycles (lecture)	20	2,0	120
	E (blocked)	Waste management (excursion)	20	1,0	30
	P (blocked)	Staple isotopes (exercises)	20	1,0	30
Examination(s)	Code	Type of examination	Duration of examination		
	748222047	Report (presentation)	during the semester		graded
Academic Achievements					not graded
Other	The course is offered in English language by Mathias Becker (Nutrient elements), Nicolas Brüggemann (water, soils and isotopes) and Achim Clemens (Waste)				

<b>Organic Agriculture in the tropics and subtropics</b>					
Code: ARTS-BS5 POS: 748222050		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Dr. Daniel Neuhoff				
Lecturers	Prof. Dr. Thomas Döring; Dr. Daniel Neuhoff				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	3.
Learning objectives	After completing this module, students will have acquired detailed knowledge on organic agricultural systems and techniques suitable to optimize Organic Agriculture in the tropics and subtropics. They will learn to analyse cropping systems from an integrated agronomic perspective.				
Key competences	In the seminar students will learn to present a scientific work/ research paper.				
Learning content	Methodical approaches in Organic Agriculture research; development and assessment of sustainable production systems; ecological effects of inappropriate land use; agronomic strategies in dryland and irrigated areas; soil fertility management; rotation design, performance of leguminous crops and BNF, agroforestry, alley cropping, eco-balances (LCA), environmental impact categories; selected examples of organic crop production techniques: paddy rice, sugar cane, cotton, coffee, cocoa, citrus, vegetables and fruits				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Organic Agriculture in the tropics and subtropics	15	2,0	90
	S (blocked)	Selected chapters of tropical organic agriculture	15	2,0	90
Examination(s)	Code	Type of examination	Duration of examination		
	748222057	Written exam	60 min		graded
Academic Achievements					not graded
Other					

<b>Ecological conditions of tropical crop nutrition and bioclimatology</b>					
Code: ARTS-BS6 POS: 748222060		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker; PD Dr. Jürgen Burkhardt; PD Dr. Luna Bharati				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	2.
Learning objectives	Students acquire in-depth knowledge on the botany and production methods of major (sub)tropical crops and on interactions with climate and management factors. The understanding of processes will enable the students to analyze the implications of changing environmental conditions on crop production. In addition, they will be able to apply agro-metereological methods to determine crop responses and to define social-ecological niche environments for major crop nutrition strategies				
Key competences	Diversity , botany and uses of major crop categories, principles and key methods in bioclimatology, holistic thinking and comprehension of abstract relationships and complex interactions between biophysical parameters and farming systems attributes				
Learning content	Methods & application of climatology in agro-ecosystems; Effects of temperature, precipitation, humidity, radiation, daylength and wind on microclimates of non-uniform terrain, nutrient availability and translocation, and crop responses; Botany uses and adaptation strategies to changing ecological conditions of major (sub)tropical crops, Ecological interactions between crops, soils, microorganisms and environmental health; Case study examples (shifting cultivation, lowland rice)				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Ecological conditions and Bioclimatology	20	3,0	135
	S (blocked)	Ecological conditions of tropical crop nutrition and bioclimatology	20	1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748222069	Report (presentation)	15 min during the semester		graded
Academic Achievements					not graded
Other	The course is offered in English language by Mathias Becker (Ecological interactions), Bodo Möseler (major crops) and Jürgen Burkhardt (Bioclimatology)				

<b>Plant Protection in the Tropics and Subtropics</b>					
Code: ARTS-BS7 POS: 748222070		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Florian Grundler				
Lecturers	Prof. Dr. Florian Grundler; PD Dr. Erich-Christian Oerke				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	2.
Learning objectives	The students will be introduced to the principles and methods of plant protection in the tropics and subtropics				
Key competences	Aquisition of insights into current research; application of scientific methods; self reliant preparation of oral presentations of scientific literature in English				
Learning content	Introduction to pests and pathogens of important tropical and subtropical crops, principles and methods of measures of pest and pathogen control				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Introduction to the subject	20	1,0	30
	S*	Selected current topics	20	3,0	120
	sT	Plant Protection in the Tropics and Subtropics	20	1,0	30
Examination(s)	Code	Type of examination	Duration of examination		
	748222077	Report (presentation)  Prerequisites for admission to the exam: regular participation	during the semester		graded
Academic Achievements					not graded
Other					

<b>Crop and Ecosystem Analysis and Modelling</b>					
Code: ARTS-BS8 POS: 748222080		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Dr. Thomas Gaiser				
Lecturers	Dr. Thomas Gaiser; Dr. Hella Ellen Ahrends; Dr. Sabine Seidel; Gunther Krauss				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Nature Conservation and Landscape Ecology			C	2.
	M.Sc. Crop Sciences			E	2.
Learning objectives	Students learn to analyse and model crops and ecosystems. Important relationships determining crop and ecosystem responses to environmental conditions and how these can be modeled will be understood. Students obtain basic knowledge in mathematical (mainly numerical) modelling and apply these to develop models for selected crop and ecosystem processes. They also learn to apply models to solve practical problems				
Key competences	Students obtain knowledge about the principles of systems analysis and numerical modelling. They are introduced to programming and to running simulation models using graphical user interfaces (SIMILE). They are able to develop and evaluate system models about simple relationships between system components. Students learn how to process data with common software products (MS-Excel, R)				
Learning content	<ul style="list-style-type: none"> <li>- Systems theory and methods of systems analysis</li> <li>- Types of models</li> <li>- Conceptualizing of crops or ecosystems systems</li> <li>- Mathematical formulation of relationships (including practical exercises)</li> <li>- Implementation of mathematical algorithms (including practical exercises)</li> <li>- Processing and presentation of data including geo data (including practical exercises)</li> <li>- Methods of model calibration and parameterisation</li> <li>- Sensitivity and uncertainty analysis</li> <li>- Model verification, validation and evaluation</li> </ul>				
Language	English				
Recommended knowledge	Basic knowledge in mathematics and data management				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L+T L+T	Analysis of crop and ecosystem processes Modelling of crop and ecosystem processes	24 24	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748222087	Report (presentation)	during the semester		graded
Academic Achievements					not graded
Other	The module will be taught in english.				



<b>Land use and land degradation</b>					
Code: ARTS-BS9 POS: 748222090		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
Learning objectives	Participate to excursions, learning to recognize key indicator species and processes of land degradation. Independent literature review and data summary on a selected topic. Project-related research work				
Key competences	Geo-botanical indicators and human-induced land degradation				
Learning content	Excursion to a representative major environment with both agricultural land use and elements of nature protection. Recognize key indicator species. Quantify main geo-botanical formations. Learn about processes and effects of human-induced soil degradation and main remediation strategies in tropical environments				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Soil degradation	15	1,0	45
	E* (blocked)	Geo-botany	15	2,0	90
	E* (blocked)	Human-induced land degradation	15	1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748222097	Report (presentation)  Prerequisites for admission to the exam: regular attendance	during the semester		graded
Academic Achievements					not graded
Other					

<b>Natural resource use and management in plant production</b>					
Code: ARTS-BS10 POS: 748222100		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Thomas Döring				
Lecturers	Prof. Dr. Thomas Döring; Dr. Hubert Hüging; Dr. Thomas Gaiser; Dr. Hella Ellen Ahrends; Dr. Miriam Athmann				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			E	2.
	M.Ed. Agricultural Science (Teacher's Training)			E Focus Crop Science	2.
Learning objectives	Nach erfolgreichem Abschluss des Moduls verfügen die Studierenden über vertiefte Kenntnisse zu Qualität und Quantität sowie über Art und Effizienz der Nutzung von natürlichen Ressourcen in der pflanzlichen Produktion in Abhängigkeit vom Management.				
Key competences	Teamorientiertes Arbeiten, Argumentationssicherheit, Denken in abstrakten Zusammenhängen, vernetzendes Lernen, eigenständige Vertiefung der Thematik, Recherchefähigkeit, Analyse von komplexen Funktionen				
Learning content	<ul style="list-style-type: none"> <li>- Art, Vorkommen und Eigenschaften der natürlichen Ressourcen (Nährstoffe, Wasser, Kohlenstoff, solare Strahlung) für die pflanzliche Produktion</li> <li>- Definition der Nutzungseffizienz von Ressourcen, Optimierung des Ressourceneinsatzes</li> <li>- Möglichkeiten und Grenzen der Ressourcennutzung im Hinblick auf die Nachhaltigkeit der Nutzung</li> <li>- Bedeutung der Ressourcen für die Ertrags- und Qualitätsbildung in Abhängigkeit von Angebot, Transport und Verteilung im Kontinuum Boden/Pflanze/Atmosphäre.</li> <li>- Ressourcennutzung auf verschiedenen Skalen (Organ, Pflanzenbestand, Betrieb, Region, global) sowie Wechselwirkungen zwischen den Skalen</li> <li>- Verfahren zur Bewertung der Nachhaltigkeit in der Ressourcennutzung</li> <li>- Forschungsfragen und methodische Ansätze zu deren Lösung</li> </ul>				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L S	Natural Resource Use Natural Resource Use	20 20	1,0 5,0	30 150
Examination(s)	Code	Type of examination	Duration of examination		
	748222109	Report (presentation)	during the semester		graded
Academic Achievements					not graded
Other	Der Kurs wird in englischer Sprache angeboten; bei ausschließlicher Teilnahme von Studierenden mit deutscher Muttersprache kann er in deutscher Sprache abgehalten werden!				

<b>Crop and ecosystem analysis and modelling - data processing and visualization</b>					
Code: ARTS-BS11 POS: 748222110		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Dr. Thomas Gaiser				
Lecturers	Dr. Thomas Gaiser; Dr. Hella Ellen Ahrends; Gunther Krauss; Andreas Enders				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	1./3.
	M.Sc. Crop Sciences			O	1./3.
Learning objectives	The course seeks to provide students with comprehensive knowledge on methods and tools to analyze, process and visualize spatial data used by crop and ecosystem models; students will be enabled to manage their own GIS project independently				
Key competences	Students learn to analyze, compare, process and visualize spatial data used in crop and ecosystem models as input or output. They are able to perform basic operations by using Geographical Information Systems (GIS). They develop own data sets needed in current research projects, which requires collaboration, team work and basic skills in project planning.				
Learning content	<ul style="list-style-type: none"> <li>- Introduction into crop and ecosystem modelling</li> <li>- Introduction into Geographical Information Systems (GIS)</li> <li>- Introduction into database development and management</li> <li>- Training on open-access GIS software</li> <li>- Georeferencing of data (maps, survey data)</li> <li>- Type of spatial data and methods used for conversion between different data types (interpolation, aggregation, classification, up- and downscaling)</li> <li>- Introduction into Geostatistics</li> <li>- Visualization of spatial data</li> <li>- Validation and comparison of spatial data sets</li> </ul>				
Language	German				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Data processing and GIS	10	1,0	30
	S	Data processing and GIS	10	5,0	150
Examination(s)	Code	Type of examination	Duration of examination		
	748222119	Report (presentation)	during the semester		graded
Academic Achievements					not graded
Other					

## **Elective modules of the focus "Molecular approaches" (ARTS-BM,SS)**

**30 ECTS-CP must be completed from the elective modules of the chosen specialization.**

**A maximum of 12 ECTS-CP can be completed from free elective modules.**

<b>Animal breeding and genetics</b>					
Code: ARTS-BM5 POS: 748212050		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	PD Dr. Dessie Salilew Wondim				
Lecturers	PD Dr. Dessie Salilew Wondim; NN; NN; NN				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
Learning objectives	Acquire knowledge and understand up to date methods of animal breeding				
Key competences	To safely do labwork, to improve practical skills, to interpret and process scientific texts				
Learning content	1) - Breeding systems, pure breeding, cross breeding, breeding goals, - Identification and measuring of relevant traits for selection, development of breeding programmes, implementation of breeding techniques, genetic improvement of local breeds, cattle reproductive technologies - Animal genetic resources 2) -Methods of conservation, practical methods of bio- and gene technology, molecular animal breeding				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked) PS (blocked)	Principles of animal breeding in the (sub)tropics Practical methods of bio and gene technology	25	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748212059	Written exam	60 min		graded
Academic Achievements					not graded
Other					

<b>Crop abiotic stresses</b>					
Code: ARTS-BM2 POS: 748212020		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	NN				
Lecturers	Prof. Dr. Mathias Becker				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	2.
Learning objectives	Students get acquainted with crop responses to abiotic stresses. Experimental planning, plant sampling, and data analysis are practiced and will help the student to understand the mechanisms involved in stress-tolerant and stress-sensitive genotypes and to apply methods required in stress-response trials and to assess the stress responses of rice. Project-related independent research work.				
Key competences	Comprehension of abstract relationships and complex interactions; practical experience in experimental layout, sampling and laboratory chemical analyses; analysis and presentation of experiment observations and data.				
Learning content	Physiology and effects on crop performance parameters of drought, submergence, salinity, ozone stress, element toxicity (Al, Fe) and deficiencies (N, P, K) and their relationship to environmental conditions. Hands-on exercises using pH-, EC-, SPAD-, and leaf area meter, pressure bomb, and canopy analyzer in the greenhouse and pressure digestion and photometry in the laboratory. In-depth studies in groups involving literature survey, data collection and observations, and oral presentation of key findings.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked) PS (blocked)	Abiotic stresses  Rice under stress	12  12	2,0  2,0	90  90
Examination(s)	Code	Type of examination	Duration of examination		
	748212027	Presentation	15 min during the semester		graded
Academic Achievements					not graded
Other	The course is offered in English language by Mathias Becker (element toxicities), Tom Eichert (plant-water relationships), Moni Wimmer (oxidative and temperature stress) and Christine Kreye (Project seminar in greenhouse and laboratory) Regular active participation at practices and the project seminar in the greenhouse and laboratory				

<b>Projects in phytomedicine</b>					
Code: ARTS-BM3 POS: 748212030		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Florian Grundler				
Lecturers	Prof. Dr. Florian Grundler; Dr. Sylvia Schleker; Clarissa Hiltl; Dr. Badou Mendy; Dr. Shamim Hasan				
Teaching unit(s)					
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			O	2.
	M.Sc. Plant Sciences			O	
Learning objectives	The students will be introduced to basic and applied aspects of topical phytomedicine				
Key competences	Aquisition of insights into current research; application of scientific methods; self-reliant preparation of oral presentations of scientific literature in English.				
Learning content	Introduction to principles in phytomedicine, lab and greenhouse experiments will be planned, performed, and evaluated in Molecular Phytomedicine, Nematology and Biological Control				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Introduction to the subject	8	1,0	30
	PS*	Selected projects in tropical phytomedicine	8	3,0	120
	S	Projects in phytomedicine	8	1,0	30
Examination(s)	Code	Type of examination	Duration of examination		
	748212037	Report (presentation)  Prerequisites for admission to the exam: regular participation	during the semester		graded
Academic Achievements					not graded
Other					

<b>Genome Analysis in Plant Breeding</b>					
Code: ARTS-BM1 POS: 748212010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Jens Léon				
Lecturers	Prof. Dr. Jens Léon; PD Dr. Ali Ahmad Naz				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			E	3.
	M.Sc. Plant Sciences			O	2.
Learning objectives	The students will be introduced to theoretical and practical aspects of the analysis of plant genomes which are relevant to plant breeding.				
Key competences	Independent literature review, Lab work, Team work				
Learning content	<p>The genome analysis in plant breeding is focused on the molecular analysis of inheritable traits in crop plants. The field is located at the junction between classical plant breeding and the relatively recent field of molecular biology. The aims are to improve varieties by means of molecular marker techniques. DNA markers are short DNA sequences, which are inheritable and can be characterized in the laboratory. DNA markers are inherited like Mendelian factors and enable the breeders to understand the genetic architecture of each individual in a segregating population. Applications of DNA markers in plant breeding are numerous. During the course of the lecture following topics will be presented:</p> <p>(1) the genome analysis using DNA markers and next generation sequencing techniques,            (2) the generation of linkage maps,            (3) the detection and selection of favorable genes for monogenic and polygenic, i.e. quantitative traits: single gene and QTL mapping,            (4) the marker-assisted selection of favorable genotypes,            (5) the identification and differentiation of varieties and            (6) the isolation and utilization of new genes in plant breeding, e.g for pathogen resistance.</p> <p>During the practical course the relevant methods will be introduced.</p>				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked) pT* (blocked)	Genome analysis in crops  Lab: practical work in course	70  15	2,0  2,0	90  90
Examination(s)	Code	Type of examination	Duration of examination		
	748212019	Written exam  Prerequisites for admission to the exam: Successful participation in the practical course	60 min		graded
Academic Achievements					not graded
Other					



<b>Microbiology of the soil and rhizosphere</b>					
Code: ARTS-BM6 POS: 748212060		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Claudia Knief				
Lecturers	Prof. Dr. Claudia Knief; Dr. Katharina Frindte				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2.
	M.Sc. Crop Sciences			E	2.
Learning objectives	Advanced knowledge about microbial activities and functions in the soil and rhizosphere. Knowledge about the molecular basis of plant-microbe interactions.				
Key competences	Reading, understanding and evaluating literature (english); oral presentation skills (english)				
Learning content	<p>Lecture, Physiology of soil microorganisms: The students obtain detailed knowledge about metabolic activities of soil inhabiting microorganisms that are involved in the oxidation and reduction of diverse carbon, nitrogen, sulfur and iron compounds. Moreover, adaptation strategies and responses to changing environmental conditions are subject of this lecture.</p> <p>Lecture, Rhizosphere microbiology: The rhizosphere as a particular habitat for microorganisms is introduced and life of microorganisms in this habitat. Beneficial as well as harmful plant-microbe associations are presented and the molecular basis of such interactions explained.</p> <p>In the seminar, the content of the lecture 'Rhizosphere microbiology' is expanded by presenting and discussing recent literature reports.</p>				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Physiology of soil microorganisms	14	1,0	45
	L	Rhizosphere microbiology		2,0	90
	S	Rhizosphere microbiology		1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748212069	Report (presentation)	30 min during the semester		graded
Academic Achievements					not graded
Other					

<b>Agricultural Entomology and Nematology</b>					
Code: MA-E,M,P-23-FW POS: 748212070		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Florian Grundler				
Lecturers	Prof. Dr. Florian Grundler; Dr. Ralf Nauen				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E	2./4.
	M.Sc. Crop Sciences			O	2./4.
Learning objectives	In depth knowledge of the biology and control of plant parasitic insects, mites and nematodes, and on agriculturally beneficial arthropods and nematodes				
Key competences	Knowledge of the scientific functions and methods, and their applications				
Learning content	<p>Basic biology of insects and mites, insect neuroscience, development and energy metabolism, insects and mites as global crop pests, insecticide and acaricide mode of action, insecticide resistance I (metabolic mechanisms), insecticide resistance II (target-site mutations), insect biocontrol, integrated insect and mite management, bee pollinator safety</p> <p>Arthropod antagonists of pests</p> <p>Basic nematode biology, nematode taxonomy, plant-nematode interactions, nematicides, integrated nematode control, antagonists of nematodes and biological control</p> <p>Nematode antagonists of pests</p>				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Agricultural Entomology and Nematology	20	2,0	90
	T	Agricultural Entomology and Nematology		1,0	45
	S	Agricultural Entomology and Nematology		1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748212079	Report (presentation)	during the semester		graded
Academic Achievements					not graded
Other					

## **Elective modules of the focus "Economic approaches" (ARTS-BE,SS)**

**30 ECTS-CP must be completed from the elective modules of the chosen specialization.**

**A maximum of 12 ECTS-CP can be completed from free elective modules.**

<b>Impact evaluation of conservation &amp; development projects and environmental policies</b>					
Code: ENV-130 POS: 749222040		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Jan Börner				
Lecturers	Prof. Dr. Jan Börner				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E E	2. 2.
Learning objectives	The course will introduce concepts and quantitative techniques to evaluate impacts of conservation measures, such as payments for environmental services, integrated conservation and development projects, and the enforcement of regulatory policies.				
Key competences	<ul style="list-style-type: none"> <li>- Understanding the differences between state-of-the-art evaluation methods</li> <li>- Ability to interpret results in diverse intervention contexts with a focus on tropical country environments.</li> </ul>				
Learning content	Role of impact evaluation in guiding the design of conservation measures, i.e., in the context of international mechanisms for climate change mitigation (REDD+); Overview of methods and related debates: black-box versus theory-based impact evaluation; Counterfactual analysis, experimental versus non-experimental design, selection bias, impact heterogeneity, and estimation methods; Case studies of conservation initiatives; Application of key methods to selected cases.				
Language	English				
Recommended knowledge	Basic knowledge of microeconomics and statistics				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Resource and Environmental Economics Resource and Environmental Economics	15 15	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	749222047	Assignments	during the semester		graded
Academic Achievements					not graded
Other					

<b>Environmental Economics and Policies</b>					
Code: ARTS-BE3 POS: 748232030		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Dr. Tsegaye Tagesse Gatiso				
Lecturers	Dr. Tsegaye Tagesse Gatiso				
Teaching unit(s)					
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E E	2. 2.
Learning objectives	Students will be able to use neoclassical and institutional economics to analyze the impacts of environmental policy design				
Key competences	Rigorous theoretical analysis of policy measures; Enhanced capability of discussing complex matters grounded in economic theory				
Learning content	General environmental policy: Public goods, Common pool resources and institutions, Theoretically optimal policy instruments (Coase, Pigou); pragmatic policy instruments (with real world examples): environmental liability, command and control approaches, taxes, subsidies, emission trading; Asymmetric information and incentive compatible instruments; eco-tax and double dividend; Agricultural environmental policy: Property rights, taxes and agri-environmental measures (AEM), performance based AEM, auctions in AEM; influences from other sectors on agri-environmental policy implications.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Environmental Economics and Policies Environmental Economics and Policies	40 40	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748232039	Written exam	120 min		graded
Academic Achievements					not graded
Other					

<b>Applied Trade Theory and Policy</b>					
Code: ARTS-BE4 POS: 748232040		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Thomas Heckelei				
Lecturers	Prof. Dr. Thomas Heckelei; Dr. Yaghoob Jafari				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E E	3. 3.
Learning objectives	Students will gain an overview on classical and new economic theories of international trade explaining trade patterns between countries. Exercises and discussion of applications with emphasis in agricultural and food products will allow students to apply the theories and understand their limitations. Students will learn to work with academic trade literature and to assess the trade and welfare impacts of trade policies independently in the context of exercises.				
Key competences	Use and assessment of academic literature. Use of spreadsheet tools for quantitative modelling.				
Learning content	1) Why do we observe trade? Technological differences (Ricardian model), differences in factor endowments (Heckscher-Ohlin Model), increasing returns to scale 2) Who gains and who loses from trade? Gains from trade: the country perspective, gains from trade: the "within country" or agent perspective, deviations from the perfect market assumption 3) What are the trade and welfare impacts of specific policies? Import tariffs, import quotas, export subsidies, non-tariff measures 4) What are the gains of trade agreements? Multilateral trade agreements (WTO), regional trade agreements, regional versus multilateral agreements 5) How do multinational firms affect trade?				
Language	English				
Recommended knowledge	Module Microeconomics or similar knowledge in microeconomics at master level				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Applied Trade Theory and Policy Applied Trade Theory and Policy	20 20	3,0 1,0	120 60
Examination(s)	Code	Type of examination	Duration of examination		
	748232047	Assignments	during the semester		graded
Academic Achievements					not graded
Other					

<b>Development Economics</b>					
Code: ARTS-BE5 POS: 748232050		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Joachim von Braun				
Lecturers	Prof. Dr. Joachim von Braun; Dr. Alisher Mirzabaev; Dr. Agr. Lukas Kornher; Dr. Zaneta Kubik; Dr. Agr. Oliver Kirui				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E E	2. 2.
Learning objectives	With the successful completion of the course, students will have an overview on essential theories of economic development and understand their practical relevance for developing countries. Moreover, students will become familiar with the complex and multidimensional concepts of underdevelopment and poverty. They will learn to understand different development policies and evaluate them using a variety of quantitative economic techniques.				
Key competences	Case study approach to analysis				
Learning content	1) Economic Development: Definitions and measurement concepts 2) Partial theories of economic development (Historical School, The Stages of Economic Growth (Rostow), Theory of structural change and Two sector models (Lewis) 3) Complex theories of economic development (Neoclassical growth theory, Endogeneous growth theory: the role of social capital and new knowledge for the growth process, New institutional economics: the value- and rules based system of a society as an explanatory factor for economic development, 4) Political-economic explanatory approaches: The role of the state and the role of interest groups in the development process 5) From theory to its practical use; case studies 6) Quantitative Analysis of Development Policy				
Language	English				
Recommended knowledge	Module Microeconomics or similar knowledge				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Development Economics Development Economics	20 20	2,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748232059	Written exam	120 min		graded
Academic Achievements					not graded
Other					

## **Compulsory modules of the third semester (ARTS-C,WS)**

**30 ECTS-CP must be completed.**



<b>Lecture series on current issues</b>					
Code: ARTS-C1 POS: 748301010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS/SS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker; Prof. Dr. Jakob Rhyner				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	1.-3.
Learning objectives	Learn about national and international research and development organizations. Get in touch with responsible actors in view of future internships or possible employments.				
Key competences	Critically assess visions and missions of diverse research and development organizations; Acquire social competences				
Learning content	Presentation by major research and development organizations, mainly those operating from Bonn (ZEZ, DIE, UN, Fair Trade, IFOAM, etc.). Participation to excursions to EU parliament, and other development policy organizations. Participation at Tropentag conference. Self presentation of a topic on research management from the candidates home country				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Organizations	30	2,0	90
	E	Organizations	30	1,0	45
	S*	Resource issues, Conference: Tropentag	30	1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748301019	Report (presentation)  Prerequisites for admission to the exam: Attendance of >20 lecture presentations and the conference; Active participation at excursions, discussions	during the semester		graded
Academic Achievements					not graded
Other					

<b>Scientific Communication</b>					
Code: ARTS-C2 POS: 748301020		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	3.
	M.Sc. Crop Sciences			O	3.
Learning objectives	Students acquire technical skills to effectively communicate with other scientists (writing of research papers and theses, preparing posters, oral presentations)				
Key competences	Technical skills and reinsurance in communicating effectively research findings				
Learning content	Avenues of communication; English writing; Elements of research papers; Analyses of publications; Thesis structure and formatting; Posters, Oral presentation, Discussion strategies.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Do's and don't's	25	2,0	90
	T (blocked)	Posters, references, literature analysis	25	1,0	45
	S (blocked)	Presentation skills	25	1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748301029	Written exam			graded
Academic Achievements					not graded
Other	regular participation in exercises and at seminar presentation				

<b>Project planning and research management</b>					
Code: ARTS-C4 POS: 748301040		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Prof. Dr. Mathias Becker				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	3.
Learning objectives	Be able to conceive, plan and execute a research / development project				
Key competences	Know about project planning strategies, Do's and don't's in proposal writing and acquire basic understanding in team work and project management				
Learning content	Discussion strategies (Brainstorm, Meta-plan, Mind-map) Project planning strategies (Break-down structure, Log-frame) Proposal elements (Structure, timeplan, workplan, budget) Additional elements (Consortium, donors, ethics, conflict management) Develop a proposal Peer review of other proposals Proposal presentation and defense				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L (blocked)	Project planning and research management	30	1,0	45
	T (blocked)	Project planning and research management	30	2,0	90
	S (blocked)	Project planning and research management	30	1,0	45
Examination(s)	Code	Type of examination	Duration of examination		
	748301049	Report (presentation)	during the semester		graded
Academic Achievements					not graded
Other					

<b>Methods of agricultural research data</b>					
Code: ARTS-C5 POS: 748301050		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Prof. Dr. Heiko Schoof				
Lecturers	Prof. Dr. Heiko Schoof; Dr. Thomas Gaiser; Dr. Hubert Hüging; Dr. Beate Doerffel; Florian Boecker; Gunther Krauss				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften; Mathematik				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	3.
	M.Sc. Crop Sciences			C	1./3.
Learning objectives	Understand and apply methods for analysis and display of agricultural data. Basic R-skills. Characterization of agricultural systems, experiment design, selection of suitable analyzing methods, usage of scientific electronic media, scientific publication rules, introduction to mathematical and statistical models				
Key competences	Analytical thinking, basic computer skills, competence in electronic media, basic statistical analysis, presentation and publication, critical assessment of methods				
Learning content	Electronic databases for agricultural sciences, scientific publication rules, introduction to statistical software „R“, exploratory data analysis and visualization of data, hypothesis testing, analysis of variance, planning of field experiments and their analysis, introduction to system theory and mathematical models, introduction to statistical models for complex data sets, introduction to system analysis and modelling.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Methods of agricultural research data Computer exercises for the lecture topics	60 20	3,0 2,0	90 90
Examination(s)	Code	Type of examination	Duration of examination		
	748301059	Assignments	during the semester		graded
Academic Achievements					not graded
Other	Literature: Gomez&Gomez: Statistical Procedures for Agricultural Research; J. Wiley&Sons, 1984 Sokal, Rohlf: Biometry – The Principles and Practice of Statistics in Biological Research; Freeman and Company, 1995				

<b>Sustainability and risk</b>					
Code: ARTS-C03 POS: 780764260		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Dr. Kathleen Jacobs				
Lecturers	Prof. Dr. Jakob Rhyner; Dr. Kathleen Jacobs				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program	Mode	Study semester		
	M.Sc. Agricultural and Food Economics	E	3.		
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)	C	3.		
	M.Sc. Crop Sciences	E Focus PERC	3.		
Learning objectives					
Key competences					
Learning content	<p>Knowledge about sustainability and risk is key to understanding the societal challenges of global change and to considering them in one's own field of action. Starting from the current state of global sustainability problems, this interdisciplinary and multi-perspective course first illustrates the fundamentals of the terms 'sustainability' and 'risk'. Building on this, particular attention is paid to the 2030 Agenda for Sustainable Development by critically discussing aspects such as implementation and measurement of the Sustainable Development Goals (SDGs). As the course has thus focused on the political perspective, pertinent economic concepts as well as the role of businesses are subsequently examined. In addition to imparting knowledge about the basics and critical aspects of economic growth, alternative growth models (e.g. degrowth, green growth) are presented and discussed. Furthermore, various economic systems towards sustainability (e.g. bio-based economy, circular economy) are introduced and differentiated from each other. When looking at the sustainability management of businesses, the following key topics are elaborated:</p> <ul style="list-style-type: none"> <li>- Implementation strategies,</li> <li>- Sustainability management standards,</li> <li>- Sustainable business models, and</li> <li>- Sustainable supply chain management.</li> </ul> <p>After an exploration of the principles of sustainability assessment and, in particular, the tool of life cycle assessment, the course finally focuses on the role of the individual in the sustainability and risk debate. This is done by providing insights into the field of sustainable consumption, such as:</p> <ul style="list-style-type: none"> <li>- Psychology of sustainability and risk,</li> <li>- Characteristics of sustainable consumers,</li> <li>- Models of sustainable consumer behaviour, and</li> <li>- Promotion of sustainable consumption.</li> </ul> <p>The examples used during the course often refer to agriculture and the food industry, but are intentionally not limited to them. Besides the continuous use of built-in short exercises, interactive teaching formats (e.g. case studies, simulation game), thematic excursions (e.g. COVID-19 crisis, Fair Trade) and guest lectures are also integral components of the curriculum.</p>				
Language					
Recommended knowledge					
Prerequisites					
Maximum number of students					

<b>Sustainability and risk</b>					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L		80	4,0	180
Examination(s)	Code	Type of examination	Duration of examination		
	780764269	Written exam	90 min		graded
Academic Achievements					not graded
Other	- Additional guest lecturers from the UN and other organisations				

## **Free elective modules**

**A maximum of 12 ECTS-CP.**

<b>Project on recent Advances in Terrestrial Biogeochemistry and Soil Conservation</b>					
Code: MA-E,M,P-15-FW POS: 746104040		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS/SS
Coordinator	Prof. Dr. Wulf Amelung				
Lecturers	Prof. Dr. Wulf Amelung; Dr. Melanie Braun				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			O	3.
	M.Sc. Crop Sciences			O	3.
Learning objectives	To deepen the knowledge on project management, scientific writing and advanced research in the field of soil ecology, terrestrial biogeochemistry and soil conservation				
Key competences	Project management and planning, scientific literature research and writing, advanced laboratory skills				
Learning content	This module will be individually adapted to the skills of a small group of students (usually max. 4 people). The students are involved in an ongoing research project of their interest or may design an own small project after consultation of the lecturers. The practices involve training in advanced theoretical and/or analytical skills, scientific writing, quality control, and scientific project planning.				
Language	English				
Recommended knowledge	none				
Prerequisites	At least 2 M.Sc. courses in INRES soil science				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	T (blocked)	Research at the frontiers of soil ecology, terrestrial biogeochemistry and soil conservation	4	4,0	180
Examination(s)	Code	Type of examination	Duration of examination		
	746104049	Report ()	during the semester		graded
Academic Achievements					not graded
Other					



<b>Applied Planning Methods in Agribusiness</b>					
Code: ABS-120 POS: 749112010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term WS
Coordinator	Dr. Carolin Kamrath				
Lecturers	Dr. Carolin Kamrath; Lora Tsvetanova; Dr. Débora Monteiro Moretti; Philipp Baaden				
Teaching unit(s)					
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E O	3. 3.
Learning objectives	Students will be able to identify and analyze business planning-related problems by using suitable qualitative and quantitative techniques. They will also be able to apply the relevant techniques to selected business problems and identify problem solutions through these approaches.				
Key competences	Knowledge of advanced qualitative and quantitative techniques, related software programmes, potential data sources and their application to specific problem solving in the agri-food sector				
Learning content	Planning processes and planning problems; understanding future scenarios (strategic foresight); group concept mapping (GCM) and survey design to explore public understanding; case studies; design of discrete choice experiments to explore consumer demand; use of mediation and moderation analysis to explore causal relationships; social network analyses (Ucinet) applied to different units of analysis: products, processes, company-level and/or entire supply chains in the larger setting of the agribusiness. Students will become acquainted with relevant software programs and databases to conduct own studies and present them to fellow students.				
Language	English				
Recommended knowledge	none				
Prerequisites	none				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L	Applied Planning Methods in Agribusiness	25	4,0	180
Examination(s)	Code	Type of examination	Duration of examination		
	749112018 749112017	Oral exam [50%] Assignments [50%]	60 min during the semester		graded graded
Academic Achievements					not graded
Other					

<b>Advanced Applied Econometrics</b>					
Code: APO-230 POS: 749242010		Workload (h) 180	Credits (LP) 6,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Thomas Heckelei				
Lecturers	Prof. Dr. Thomas Heckelei; Prof. Dr. Silke Hüttel				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural and Food Economics M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			E O	2. 2.
Learning objectives	Students will acquire competence in selecting and applying econometric methods to estimate quantitative economic models derived from economic theory. In addition they will learn to use and interpret outputs from econometric software packages.				
Key competences	Quantitative analysis; Competence in software use for quantitative analysis;				
Learning content	1) Review General Linear Model and OLS 2) Model specification (functional form and variable choice) 3) Seemingly Unrelated Regression, system estimation 4) Endogenous regressors (instrumental variable estimation, Generalised Method of Moments) 5) Panel data analysis 6) Limited dependent variable models (Maximum Likelihood) 7) Using prior information in estimation (Bayesian estimation)				
Language	English				
Recommended knowledge	none				
Prerequisites	Passed exam in module BAS-110				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	L T	Advanced Applied Econometrics Advanced Applied Econometrics	20 20	3,0 1,0	120 60
Examination(s)	Code	Type of examination	Duration of examination		
	749242019	Assignments	during the semester		graded
Academic Achievements					not graded
Other					

## **Masterthesis and Colloquium**

**The masterthesis credits 20 ECTS-CP and the colloquium 10 ECTS-CP.**

<b>Masterthesis</b>					
Code: ARTS-D1 POS: 8900		Workload (h) 600	Credits (LP) 20,0	Duration (Semester) 1	Term WS/SS
Coordinator	NN				
Lecturers	Alle Lehrenden der Lehrinheit				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	4.
Learning objectives	Conceptualisation, planning, implementation and analysis of a complex scientific task over a period of at least two months and no more than six months.				
Key competences	Project work, presentation skills				
Learning content	Task of Masterthesis				
Language	English				
Recommended knowledge	none				
Prerequisites	all ARTS-A-modules, >50CP out of ARTS-B and ARTS-C-modules				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	MT	Masterthesis			600
Examination(s)	Code	Type of examination	Duration of examination		
	8900	Masterthesis	2 - 6 Months		graded
Academic Achievements					not graded
Other					

<b>Colloquium</b>					
Code: ARTS-D2 POS: 748401020		Workload (h) 300	Credits (LP) 10,0	Duration (Semester) 1	Term SS
Coordinator	Prof. Dr. Mathias Becker				
Lecturers	Alle Lehrenden der Lehrereinheit				
Teaching unit(s)	Agrar-, Forst- und Ernährungswissenschaften				
Usability	Course program			Mode	Study semester
	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics (ARTS)			C	4.
Learning objectives	Presentation of main research results in public Colloquium				
Key competences	presentation skills, application of scientific methods; self-reliant preparation of oral presentations of scientific literature in English				
Learning content	Task of Masterthesis				
Language	English				
Recommended knowledge	none				
Prerequisites	90CP out of: all ARTS-A and ARTS-C-modules, min 5 ARTS-B-modules				
Maximum number of students					
Course(s)	Teaching method	Topic	Class size	Contact time per week	Workload [h]
	C*	Colloquium			300
Examination(s)	Code	Type of examination	Duration of examination		
	748401029 748401028	Report (presentation) [50%] Oral exam [50%]	during the semester 45 min		graded graded
Academic Achievements					not graded
Other					