# Modulhandbuch Course Book

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

Studienbeginn ab WS 2020/2021

Beginning of studies from 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)**

24 ECTS-CP must be completed.



Module	Module Title: Ecological conditions and climate change									
Module I	<b>D/Code:</b> AR	TS-/	401 [780750010]							
1. Contei	nt and inte	nde	ed learning outcomes							
Learning content:	Students a water, plar including tl interdiscipl explaining 1. Interdisc	quir t, a ne e inai pos iplii	e the know-how about and a quantita nimal, genes, ecosystem) for agricultu ffects of agriculture on and the contr y lecture is structured into three com sible implications: nary lecture on ecological conditions f	ative unders ural product ributions to ponents air for agricultu	standing of the ion within the desertification med at acquirin and production	structure a ir changing and climat ng knowled , including	ind use biophy e chan ge, inte geodyr	e of resour rsical envir ge. The erpreting t namics, cli	ces (soil, ronment, rends and mate	
<ul> <li>Climate, agroecological zones, definitions and descriptions; - Soil formation in relation to landscape and climatic factors; - Water resources, management and use in relation to climatic zones; - Land use systems in major climatic zones.);</li> <li>2. Lecture and case study examples of observations, trends and processes of climate change and their implications and trade-offs for crop and animal production systems (- Trends and scenarios of future climate and its impact on agriculture; - Sources and sinks of greenhouse gases; - Political frameworks to combat climate change; - Strategies to reduce emissions from agriculture (mitigation); - Strategies to cope with climate change phenomena (adaptation); - Scenarios of future climate and its impact on agriculture climate and its impact on agriculture - Trade-offs of major mitigation / adaptation scenarios);</li> </ul>										
	3. Seminar	pre	sentation on a selected climate chang	ge-related is	sue					
Learning	outcomes									
- understa - are able	to classify, i	ipie gni: nter synl	ze ecological processes and interactio prete, compare and critically assess c ain observations, using a case study e	ons for agrico limate obse	ultural produc rvations and t	tion. rends.				
2 Prereo	misites	-701				ountry.				
obligatory	/									
recomme	nded									
Maximum of studen	n number 2 ts	:5 st	tudents							
3. Study	program a	loc	ation							
Study pro	gram					Compulso	ory/ Ele	ctive	Semester	
M.Sc. Agri (ARTS)	icultural Scie	nce	e and Resource Management in the Tr	ropics and S	ubtropics		С		1.	
4. Teachi	ng and lea	rnir	ng methodes			1	1			
Type of	Interval		Торіс		Language of	Group	SWS	Work	load [h]	
course					instruction	size		Contact time	Self- study	
L (blocked)	afternoon block	oon Ecological principles			English	25	1,5	20,0	30,0	
T (blocked)	afternoon block	on Observation in climate change English			English	25	1,5	20,0	30,0	
S (blocked)	afternoon block		Case study presentationEnglish251,020,060,0							
5. Course	e cycle			6. Worklo	ad [h]	7. Durati	on	8. Credi	ts (ECTS)	
WS	180 1 6,0									



Module Title: Ec	ological conditions and climate change			
Module ID/Code: AR	TS-A01 [780750010]			
9. Requirements for	r the rewarding of credits (ECTS)			
Types of Assessment	Prerequisites for admission to the Assessment	Graded yes/no	Language (exam)	Weighting factor
Written exam [780750019]		graded	English	75%
Report (presentation) [780750018]		graded	English	25%
Academic Achieveme	nts			
10. Module coordin	ation			
Module coordinator				
Dr. Janina Dierks				
Teaching person				
The teaching persons https://basis.uni-bonr	in the current semester can be found in basis: n.de/			
Institute/ Departmen	t			
Agrar-, Forst- und Erna	ährungswissenschaften			
11. Further informa	tion			



	Title: F	ood	security and sustainable food	systems							
1 Conto	of and int	anda	d learning outcomes								
1. Conter	Students y		eu learning outcomes	an through a	food syste	- mc	long and u	ndorct	and cur	orgio	
content:	tradeoffs	NIII IE botw	earn to look at agriculture and nutritic	Ith goals. Co	ncents and	ems em		t of for	anu syn M socu	ergie	s driu lietary
content.	quality ar	nd th	e triple burden of malputrition as we	III as related	nolicy inte	rve	ntions will	he disc	nissed	links	iletary
	between a	agrici	ulture biodiversity climate change d	liets nutritic	on and hea	alth	will be ana	lvzed fi	om a g	lobal	
	perspectiv	/e an	d with empirical examples from low	middle-, an	d high-inco	ome	countries.	Case s	tudies v	vill b	e used to
	evaluate s	peci	fic food systems topics from a compre	ehensive sus	tainable de	evel	opment pe	erspecti	ve. Cas	e stu	dies will
	include to	pics	such as organic farming, GMOs, meat	consumptio	on, palm oil	l, nu	itrition-ser	sitive a	gricultu	ire, a	nd the
	supermar	ket ro	evolution, among others.	•	· •				0		
Learning o	outcomes										
After a su	ccessful co	mple	tion of the course, the students								
- are able	to define k	ey te	erms related to food security and sust	ainable diets	S.						
- can expla	ain how foo	od sy	stems relate to the various sustainabl	le developm	ent goals (	SDG	is).				
- can iden	tify policy r	need	s and analyze the sustainability implic	ations of spe	ecific interv	vent	tions.				
- can evalu	uate the ar	gume	ents in the public debate around susta	ainable agric	culture and	nut	trition.				
- can cons	truct and u	ise di	ietary surveys and nutrition assessme	nt tools.							
2. Prereq	uisites										
obligatory											
recomme	nded										
Maximum of studen	n number ts										
3. Study	program a	alloc	ation								
Study pro	gram						Compulso	ory/ Ele	ctive	Se	mester
M.Sc. Agri	cultural an	d Fo	od Economics					E			3.
M.Sc. Agri (ARTS)	cultural Sci	ience	e and Resource Management in the Tr	ropics and Su	ubtropics			E			3.
M.Sc. Nut	rition Scien	ce						E			3.
M.Sc. Mol	ecular Foo	d Teo	chnology					Е			3.
4. Teachi	ng and lea	arnir	ng methodes								
Type of	Interval		Торіс		Language	of	Group	SWS	Wo	orklo	ad [h]
course					instructio	n	size		Conta	ict	Self-
									time	e	study
L	during the	<u>)</u>			English		120	4,0	56,0	)	124,0
5 Course	semester			6 Worklo	ad [b]		7 Durati		8 Cro	dite	(FCTS)
	cycle			190	սս լոյ		1		6.0	uits	
9 Requir	ements fo	or th	e rewarding of credits (FCTS)	100			1		0,0		
Types of /	Seasement		erequisites for admission to the Asse	ssmant		Gr	hahe	Langu	200	Wai	ahtina
Types of P	33C35mem			351110110		ve	s/no	(exam	uge 1)	fact	or
Written ex	kam					gra	nded	Englis	, h		
[78076326	59]										
Academic	Achievem	ents				I		1		1	



Module Title: Food security and sustainable food systems
Module ID/Code: ARTS-A06 [780763260]
10. Module coordination
Module coordinator
Prof. Dr. Matin Qaim
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module	Title: C	ons	ervation and use of genetic res	ources						
Module I	<b>D/Code</b> : A	RTS-/	A03 [780750020]							
1. Conter	nt and int	ende	ed learning outcomes							
Learning	Genetic re	esour	rces form an important basis of crop a	nd livestock	production	n. In this mod	ule, stu	dents a	are	
content:	familiarize	ed wi	ith the importance of genetic resource	es for agricul	ture, and w	vith methods	and ap	proach	es to	conserve
	and utilize	e the	m. This includes insights into seed scie	ences, gene l	bank mana	gement, mole	ecular g	enetics	in pl	ants and
	animals, a	nd m	nodern biotechnological approaches t	o characteriz	ze, utilize a	nd maniputat	e genes	s and g	enom	es. The
	module ir	clud	es a seminar, in which students prese	nt non-grade	ed talks rela	ated to the co	urse to	pic. Pa	rticip	ation in
	the semin	ar is	a prerequisite for participation in the	exam.						
Learning o	outcomes									
After a suc	ccessful co	mple	etion of the course, the students							
- will knov	the basic	s of p	plant and animal genetics as relevant	for agricultur	re.					
- will knov	current n	hetho	ods of conserving and using genetic di	versity for a	griculture.					
- will know	v state-of t	he ar	rt biotechnological approaches used in	n agiculture.						
- will be al	ole to critic	ally j	Judge, compare and justify different b	iotechnologi	cal approa	ches and their	r applic	ation ir	n agri	culture.
- WIII be al	Die to integ	rate	their knowledge of different genetic	and blotechr	nological ap	proaches to o	levelop	strate	gies d	DT
preserving	g and using	g gen	ietic resources.							
2. Prereq	uisites									
rocommo	ndod	Knov	wlodge of fundamental plant and anin	nal hiology						
recomme	ideu	KIIU		nai biology						
Maximum	number	40 st	tudents							
of student	ts									
3. Study	program	alloc	cation			<u> </u>		- 1		
Study pro	gram					Compulse	ory/ Ele	ective	Se	mester
M.Sc. Agri (ARTS)	cultural Sc	ience	e and Resource Management in the Tr	ropics and Su	ubtropics		С			1.
4. Teachi	ng and le	arnir	ng methodes							
Type of	Interval		Торіс		Language	of Group	SWS	W	orklo	ad [h]
course					instructio	n size		Contact		Self-
								tim	e	study
L	afternoor				English	40	3,0	40,	0	80,0
(blocked)	block									
S*	afternoor				English	40	1,0	20,	0	40,0
(blocked)	block									
5. Course	e cycle			6. Workloa	ad [h]	7. Durati	on	8. Cre	edits	(ECTS)
WS				180		1		6,0		
9. Requir	ements f	or th	ne rewarding of credits (ECTS)							
Types of A	ssessmen	t Pro	erequisites for admission to the Asse	ssment		Graded	Langu	age	We	ighting
						yes/no	(exan	1)	fact	or
Presentati [78075002	on 291					not graded	Englis	h	0%	
	- 1									
Written ex	kam	Ра	articipation in the seminar			graded	Englis	h	100	%
[78075002	28]		•							
Academic	Achievem	ents								



Module Title: Conservation and use of genetic resources
Module ID/Code: ARTS-A03 [780750020]
10. Module coordination
Module coordinator
Dr. Mariana Báez
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module	<u>Title:</u> A	gricultural produc	tion systems							
Module I	/Code: Al	RTS-A04 [780750030]								
1. Conter	nt and inte	ended learning outo	omes							
Learning content:	Students a in differen	quire the know-how a t environments of the	about the structure, e (sub)tropics.	use and effe	ects of curre	nt plant and	animal	product	tion s	systems
	1. (sub)tro	pical plant productior	1					_		
	Overview	of production systems	s in different climation	c zones inclu	iding: field c	rops, vegetal	bles, fru	iits, agro	o-tor	estry; -
	plants; and	d - management of pla	ant production syste	ems; moelling	g of agricult	ural producti	on syst	ems.	iu us	eor
	2. (sub)tro	pical animal production	on systems	es and socio	-economic e	nvironment	sinclud	ing.		
	- breeding	, nutrition, animal hea	alth, mechanization,	differentiati	ion and inte	gration of pr	oductio	n goals.		
Learning o	outcomes					· ·				
After a suc	cessful cor	npletion of the course	e, the students							
- recognize	e different	types of production sy	/stems.							
- understa	nd interact	ions between system	components.							
2. Prereq	uisites									
obligatory	'									
recomme	nded									
Maximum of student	number s	25 students								
3. Study	orogram a	llocation								
Study pro	gram					Compuls	ory/ Ele	ective	Se	mester
M.Sc. Agri (ARTS)	cultural Sci	ence and Resource M	anagement in the Ti	ropics and Su	ubtropics		С			1.
4. Teachi	ng and lea	rning methodes								
Type of	Interval	Торіс			Language o	of Group	SWS	Wo	rklo	ad [h]
course					instruction	size		Conta	ct	Self-
L (blocked)	afternoon	Crop production	systems		English	25	2,0	30,0	)	60,0
L (blocked)	afternoon	Animal productio	on systems		English	25	2,0	30,0	)	60,0
5. Course	cycle			6. Worklo	ad [h]	7. Durati	ion	8. Cre	dits	(ECTS)
WS	•			180		1		6,0		. ,
9. Requir	ements fo	or the rewarding of	credits (ECTS)			•				
Types of A	ssessment	Prerequisites for ad	Imission to the Asse	essment	(	Graded yes/no	Langu (exarr	age 1)	Wei fact	ghting or
Written ex [78075003	am 99]				1	graded	Englis	h		
Academic	Achievem	ents								



### 



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

Two modules (6 ECTS-CP) must be completed.



Module	Title: Cr	op Physiolog	gy									
Module I	<b>D/Code:</b> AR	TS-AM05a [780	0800050]									
1. Conter	nt and inter	nded learning	g outcomes									
LearningPlant physiology is the analysis and causal explanation of live processes. The course will provide an update on the basics of plant physiology with an emphasis on physiological processes important for determination of crop yield. Specifically, this will include topics related to consumable parts of the plant and also physiological adaptations to stress situations. Through description of recent findings of new pathways and metabolic functions the course will emphasize that Crop Physiology integrates cell biology. biochemistry and molecular biology.												
Learning	outcomes	that crop Filys	sology integrate		gy, biochein	istry and h	noie		gy.			
After a su	ccessful com	nletion of the	course the stur	lents								
- are able	to describe l	kev metabolic i	pathways.									
- are able	to explain he	ow plants aqui	re ressources fro	om the env	vironment.							
- are able	to describe a	and explain ph	ysiological adap	tations und	derlying the o	developme	ent d	of consuma	able pa	rts.		
2. Prereq	uisites											
obligatory	/											
recomme	nded											
Maximum of student	number ts											
3. Study	program al	location										
Study pro	gram							Compulso	ory/ Ele	ctive	Ser	nester
M.Sc. Agri (ARTS)	cultural Scie	nce and Resou	irce Managemei	nt in the Tr	opics and Su	btropics			E			1.
M.Sc. Cro	o Sciences								С			1.
M.Ed. Agr	icultural Scie	ence (Teacher's	s Training)						E			1.
4. Teachi	ng and leai	ning method	les									
Type of	Interval	Topic				Language	of	Group	SWS	Wo	orkloa	ad [h]
course						instructio	n	size		Conta	ict	Self-
L	during the	Crop Physic	ology			English		120	2.0	30.0	e )	study 60.0
	semester	. ,	07			0			,	,		,
5. Course	e cycle				6. Workloa	id [h]		7. Duratio	on	8. Cre	dits	(ECTS)
WS					90			1		3,0		
9. Requir	ements for	the rewardi	ng of credits (I	ECTS)								
Types of A	Assessment	Prerequisites	for admission t	o the Asse	ssment		Gra yes	ided /no	Langu (exam	age )	Weig facto	ghting or
eKlausur 4	15 min						gra	ded	Englis	h		
[78080005	59]											
Academic	Achieveme	nts							l			
10. Modu	ule coordin	ation										
Module co	oordinator											
Prof. Dr. A	ndreas Mey	er										
Teaching	person											
The teach	ing persons	in the current s	semester can be	found in b	asis:							
https://ba	isis.uni-bonn	.de/										
Institute/	Departmen	t										
Agrar-, Fo	rst- und Ernä	ährungswissen	schaften									
11. Furth	er informa	tion										



Module	Title: C	rop	Breeding Research									
Module ID	<b>D/Code:</b> A	RTS-	-AM05b [780800060]									
1. Conter	nt and inte	end	ed learning outcomes									
Learning content:	content: variety of methods, many based on knowledge from genetics and genomics. This lecture presents highlights from classical research and current topics and approaches. Topics include domestication, genetic variation, crop evolution, quantitative traits, phenotyping, molecular breeding tools, population genetics, genetic resources and the concept of germplasm, information management, mapping, QTL analysis, marker assisted selection, introgression, genotype-by-environment interactions, gene transfer, breeding informatics.											
Learning	outcomes	by-C	environment interactions, gene transit	i, breeding	mormatic	5.						
After a suc - are able - are able - are able - are able	ccessful cor to explain t to discuss t to explain a to discuss t	mple the g the r and the i	etion of the course, the students genetic basis of crop genetic resources relevance of crop traits in breeding pro differentiate methods for breeding. impact of modern approaches on bree	s. ograms. ding.								
2. Prereq	luisites											
obligatory	/											
recomme	nded	Mo	dule "Plant breeding" (B.Sc. Agrarwisse	enschaften)								
Maximum of student	n number ts											
3. Study	program a	allo	cation									
Study pro	gram						Compulso	ory/ Ele	ctive	Sei	nester	
M.Sc. Agri (ARTS)	icultural Sci	ienc	e and Resource Management in the Tr	opics and Su	ubtropics			E			1.	
M.Sc. Crop	p Sciences							С			1.	
M.Ed. Agr	icultural Sc	ienc	ce (Teacher's Training)					E			1.	
4. Teachi	ing and lea	arni	ng methodes									
Type of	Interval		Торіс		Language	of	Group	SWS	W	orkloa	ad [h]	
course					instructio	n	size		Conta	act	Self-	
L	during the semester	2	Crop Genetics and Breeding		English		120	2,0	30,0	0	60,0	
5. Course	e cycle			6. Workloa	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)	
WS				90			1		3,0			
9. Requir	rements fo	or th	ne rewarding of credits (ECTS)									
Types of A	Assessment	t Pr	rerequisites for admission to the Asse	ssment		Gra yes	aded s/no	Langu (exam	age I)	Weig facte	ghting or	
Written ex [78080006	xam 69]					gra	ded	Englis	h			
Angela	A ak!											
Academic	Achievem	ents	5									
10 Modu	ula coordi	nati	ion									
Module co	oordinator	IIati										
Prof Dr A		1250	n									
Teaching	nerson	1030										
The teach	ing persons	s in t	the current semester can be found in b	basis:								
https://ba	isis.uni-bon	nn.de	e/									
Institute/	Departme	nt										
Agrar-, Fo	rst- und Eri	nähr	rungswissenschaften									
11. Furth	er inform	atio	on									



Module	Title: Pr	oduction ecology									
Module I	<b>D/Code:</b> AF	TS-AS05a [780800040]									
1. Contei	nt and inte	nded learning outcomes									
Learning content:	This modul deals with symbiotic r design of s such as in o ecosystem	e focuses on the ecology of c biotic interactions e.g. compe- elationships, and allelopathy ustainable cropping systems crop diversification, evolution services	rops and croppin etition, compensa . The second part and concentrates hary plant breedir	g syster ation, fa : builds s on app ng, optir	ms and is d acilitation, o on the und olications o mal foragin	ivided into t complement lerstanding f ecological g theory in	wo main ation, pa of these theory ir grassland	i parts. arasitisr interact i croppi ds, and j	The fi n, he ions ng sy provis	rst part rbivory, for the stems, sion of	
Learning	outcomes	50111005.									
After a sur - reproduc - understa - analyse a resources - design a	ccessful con ce the main and the com and evaluate diversified o	npletion of the course, the str aspects of biotic interactions ponents and complexity of ec e the potential of a diversified cropping system based on eco	udents and their underly cological interacti d cropping system plogical theories.	ying me ions in a ı - e.g. a	echanisms i cropping sy as describe	n cropping s rstems with d in a scient	ystems. regard to ific articl	o biotic e - to pi	intera rotec	actions. t	
2. Prereq	uisites										
obligatory	/										
recomme	nded										
Maximum	number										
of studen	ts										
3. Study	program a	llocation					/ =1			<u> </u>	
Study pro	gram					Compu	sory/ El	ective	Se	mester	
M.Sc. Agri (ARTS)	cultural Scie	ence and Resource Managem	ent in the Tropics	s and Su	lbtropics		E			1.	
M.Sc. Cro	o Sciences						С			1.	
M.Ed. Agr	icultural Sci	ence (Teacher's Training)					E			1.	
4. Teachi	ng and lea	rning methodes									
Type of	Interval	Торіс			Language	of Group	SWS	Workloa		oad [h]	
course					instructio	n size		Conta	act	Self-	
1	during the	Crop Ecology			Fnglish	120	15	22 tim	e 0	45.0	
L	semester	crop ecology			LIIGIISII	120	1,5	22,	0	43,0	
Т	during the	Cropping System Design	II		English	30	0,5	8,0	)	15,0	
5. Course			6.14	Vorklo	ad [h]	7. Dura	tion	8. Cre	dits	(ECTS)	
WS	. cycle		90			1		3.0	and	(2010)	
9. Requir	ements fo	r the rewarding of credits	(ECTS)								
Types of A	ssessment	Prerequisites for admission	to the Assessme	ent		Graded ves/no	Langu (exan	uage n)	Wei fact	ghting or	
eKlausur [78080004	17]					graded	Germ Englis	an and sh	75%		
Project wo [78080004	Project work     graded     English     25%       [780800048]										
Academic	Achieveme	nts									



# Module Title: Production ecology Module ID/Code: ARTS-AS05a [780800040] 10. Module coordination Module coordinator Prof. Dr. Thomas Döring Prof. Dr. Thomas Döring Teaching person The teaching persons in the current semester can be found in basis: https://basis.uni-bonn.de/ Institute/ Department Agrar-, Forst- und Ernährungswissenschaften 11. Further information Module Information



Module Title	: Reso	ource conservation							
Module ID/Cod	le: ARTS	-AS05b [780800030]							
1. Content and	d intend	led learning outcomes							
Learning This content: first the u mod e.g. 1	module f part deal inderstar ule conce through i	ocuses on the resource conservation i with abiotic interactions (e.g. with re- nding of these interactions for the des entrates on various applications for re rrigation, tillage, rotation design etc.	in cropping sy gard to water ign of sustair source conse	ystems and r, crop nutr nable cropp rvation nar	is divided in ients, and CO ing systems. nd the provis	to two r D2), the In the s ion of e	nain pa second econd p cosyste	rts. W part   art, t n ser	/hile the builds on he vices,
Learning outco	mes								
After a successf - reproduce the - understand th - analyse and ev - design a susta	ul compl main asp e compo valuate th inable cro	etion of the course, the students pects of abiotic interactions and their nents and complexity of abiotic intera ne potential of a cropping system - e.g opping system based on knowledge or	underlying m ctions in crop as describe n resource co	echanisms oping syste d in a scien nservation	in cropping ms. tific article -	systems to prote	ct resou	irces.	
2. Prerequisite	es								
obligatory									
recommended									
Maximum num	ber								
of students									
3. Study prog	ram allo	cation							
Study program		Compulsory/ Elective Semester							
M.Sc. Agricultur (ARTS)	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics E 1. (ARTS)								
M.Sc. Crop Scie	nces					С			1.
M.Ed. Agricultu	ral Sciend	ce (Teacher's Training)				E			1.
4. Teaching ar	nd learn	ing methodes				-	1		
Type of Inter	rval	Торіс		Language	of Group	SWS	W	orkloa	ad [h]
course				instructio	n size		Conta	act	Self-
L durir	ng the	Resource conservation		English	120	1,5	22,0	)	45,0
T durir	ng the ester	Cropping system design I		English	30	0,5	8,0		15,0
5. Course cycl	e		6. Workloa	ad [h]	7. Durat	ion	8. Cre	dits	(ECTS)
WS			90		1		3,0		•
9. Requireme	nts for t	he rewarding of credits (ECTS)			÷				
Types of Assess	sment P	nent Prerequisites for admission to the Assessment Graded Languages (exam)				iage n)	Weig facto	ghting or	
eKlausur [780800037]		graded German and 75% English							
Project work [780800038]					graded	Englis	h	25%	
Academic Achie	evement	S						<u> </u>	



Module Title: R	Resource conservation
Module ID/Code: A	\RTS-AS05b [780800030]
10. Module coordi	ination
Module coordinator	r
Prof. Dr. Thomas Dö	ring
Teaching person	
The teaching person	s in the current semester can be found in basis:
https://basis.uni-bor	nn.de/
Institute/ Departme	ent
Agrar-, Forst- und Er	nährungswissenschaften
11. Further inform	nation



# Elective modules of the second and third semester (ARTS-B) - System approaches

You can choose 18-30 ECTS-CP from the elective modules. The specialisation System approaches is only awarded if 24 ECTS-CP from this specialisation are completed.



Module	Module Title: Soil resources of the world											
Module II	<b>D/Code:</b> AR	TS-BS01 [780790230]										
1. Conte	nt and inte	nded learning outcom	ies									
1. Content Learning content: Learning After a su - can desc - can com	In this cour options, an The course - Lecture + principles of specific pro - Practical of analytical d relicts of tro outcomes ccessful com ribe the maj pare soils ac	se students will be introd associated risks. is structured in seminar on major soil ty f their genesis, major pr cesses associated with d ourses: Here the studen ata sheets, photographs opical soils pletion of the course, th or soil properties and cla cording to their potentia	duced to the maj opes according to operties and land different soils rele its learn how to c and/or archived ne students assification of soi al use for agricult	World Refer d-use option evant for glo classify soils a soil monolit	ne world, th rence Base is. The cour ibal elemer according t ths and/or ring around	of S rse p nt cy o W field	classificati coil Resour provides ac cles or foc RB and So I sites in W	on, ger ces (W dvance od secu il Taxol /estern	nesis, la RB) clas d know rity. nomy o Germa	nd-u ledg n the	se ation, e on e basis of <i>i</i> ith	
- can iden	tity risks asso	classification procedure	pes of land-use	on these soi	ils.							
2 Proroc	uisites	classification procedure	es for the major r	elerence gro	Jups.							
obligatory	/											
recommo	y APTS A01 A02 A02 A04 ASOEs and ASOEb											
recomme	ARTS-AUI, AUZ, AU3, AU4, ASUSA and ASUSD											
Maximum number     25 students       of students												
3. Study program allocation												
Study pro	udy program Compulsory/ Elective Semeste							mester				
M.Sc. Agri (ARTS)	cultural Scie	nce and Resource Mana	gement in the Tr	opics and Su	ubtropics			E			2.	
M.Sc. Nat	ure Conserva	ation and Landscape Eco	ology					E			2.	
M.Sc. Cro	o Sciences						E Foc	us PER	C		2.	
4. Teach	ng and lea	ning methodes			r							
Type of course	Interval	Торіс			Language instruction	of n	Group size	SWS	Wo Conta	orklo act	ad [h] Self-	
L	during the semester	Soils of the world			English		25	1,5	15,0	)	45,0	
S*	during the semester	Soil management arc	ound the world		English		25	1,0	10,0	)	40,0	
P* (blocked)	full-day blo	ck Soil classification			English		25	2,0	30,0	)	40,0	
5. Course	e cycle			6. Workloa	ad [h]		7. Duratio	on	8. Cre	dits	(ECTS)	
SS				180			1		6,0			
9. Requi	ements for	the rewarding of cre	dits (ECTS)									
Types of A	Assessment	Prerequisites for admis	ssion to the Asse	ssment		Gra yes	ded /no	Langu (exam	age 1)	Weighting factor		
Written e [7807902]	kam 39]	Presentation in the sem	ninar, regular atte	endance		graded English						
Academic	Achieveme	nts										



### Module Title: Soil resources of the world

Module ID/Code: ARTS-BS01 [780790230]

### 10. Module coordination

Module coordinator

Dr. Sara Bauke

**Teaching person** 

The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

Institute/ Department

Agrar-, Forst- und Ernährungswissenschaften

**11. Further information** 

Zech, W., Hintermeier-Erhard, G., Schad P (eds). 2020. Soils of the world. Springer- Verlag, 190 pages



Module Title: Crop ecology, water management and bioclimatology								
ARTS	BS02 [780800210]							
intend	ed learning outcomes							
LearningStudents acquire in-depth knowledge on crop interactions of corps with climate and waterThe understanding ofcontent:processes will enable them to analyze the implications of changing environmental conditions on water managementand production. In addition, they will be able to apply agro-meteorological methods to determine crop responses.Finally, botanical and ecological attributes of corps with major economic importance will be discussed, allowingstudents to define social-ecological niche environments for major crop production and water managementstrategies.								
Strategies and implications of water management incl. model applications; Methods & application of climatology in agro-ecosystems; Botany and ecological requirements of major crop types and species; Effects of temperature, precipitation, humidity, radiation, day length and wind on microclimates of non-uniform terrain, and crop responses; Crop adaptation strategies to changing ecological conditions;								
es								
After a successful completion of the course, the students - understand key concepts and implications of bioclimatology. - can apply concepts of water management. - have aquired the skills to use water models to analyze water demand. - can relate botanical attributes to ecological requirements of crops.								
eraction	is between climate, management attr	ibules and i	and use system	115.				
ART	S-A01, A02, A03, A04, AS05a and AS0	5b						
<b>er</b> 25 s	tudents							
m allo	cation							
				Compulso	ory/ Ele	ctive	Semester	
Scienc	e and Resource Management in the Tr	ropics and Si	ubtropics		E		2.	
es				E Foc	us PER(	2	2.	
learni	ng methodes			1				
al	Торіс		Language of	Group	SWS	Worl	doad [h]	
			instruction	size		Contact time	Self- study	
oon	n Bioclimatology English 25 1,3 15,0 45,							
oon	onWater management and model applicationsEnglish251,315,045,0							
oon	n Crop botany and ecological adaptation English 25 1,3 15,0 45,0						45,0	
	·	6. Worklo	ad [h]	7. Duratio	on	8. Credi	ts (ECTS)	
		180		1		6,0		
	Crop Crop intend ints acquisses will oductic , botanin ints to de gies. Ints com gies and ods & ap y and ed of tem and c daptati tudy ex. es I comple concep pts of w e skills t nical att eraction m allou I Science I learni al oon oon oon	Crop ecology, water management a         ARTS-BS02 [780800210]         intended learning outcomes         Intended learning outcomes	Crop ecology, water management and bioclim         : ARTS-BS02 [780800210]         intended learning outcomes         hts acquire in-depth knowledge on crop interactions of coses will enable them to analyze the implications of chang oduction. In addition, they will be able to apply agro-met i, botanical and ecological attributes of corps with major ero is to define social-ecological niche environments for majigies.         hts comprise:         gies and implications of water management incl. model apods & application of climatology in agro-ecosystems; y and ecological requirements of major crop types and spis of temperature, precipitation, humidity, radiation, day lead aptation strategies to changing ecological conditions; tudy examples         es         I completion of the course, the students         concepts and implications of bioclimatology.         pts of water management.         e skills to use water models to analyze water demand.         incla attributes to ecological requirements of crops.         eractions between climate, management attributes and lead         mallocation         I Science and Resource Management in the Tropics and Spices         es         I Science and Resource Management and model applications         oon       Bioclimatology         oon       Bioclimatology         oon       Crop botany and ecological adaptation	Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]         intended learning outcomes         ths acquire in-depth knowledge on crop interactions of corps with clima isses will enable them to analyze the implications of changing environme oduction. In addition, they will be able to apply agro-meteorological mice botanical and ecological attributes of corps with major economic imports to define social-ecological niche environments for major crop produc gies.         its comprise:         gies and implications of water management incl. model applications; da & application of climatology in agro-ecosystems; y and ecological requirements of major crop types and species; of temperature, precipitation, humidity, radiation, day length and wind h, and crop responses; daptation strategies to changing ecological conditions; tudy examples         es         Icompletion of the course, the students concepts and implications of bioclimatology. pts of water management. e skills to use water models to analyze water demand. hical attributes to ecological requirements of crops. eractions between climate, management attributes and land use system to any and ecological requirements of crops.         eractions       Isoience and Resource Management in the Tropics and Subtropics         res       Ianguage of instruction         completion       Bioclimatology       English         oon       Bioclimatology       English         oon       Water management and model applications       English         oon       Crop botany and ecological adaptation <t< td=""><td>Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]         intended learning outcomes         its acquire in-depth knowledge on crop interactions of corps with climate and water sess will enable them to analyze the implications of changing environmental condit oduction. In addition, they will be able to apply agro-meteorological methods to d , botanical and ecological attributes of corps with major economic importance will ts to define social-ecological nethods for major crop production and w gies.         its comprise:       gies and implications of water management incl. model applications; and ecological requirements of major crop types and species; and implication of climatology in agro-ecosystems; and ecological requirements of bioclimatology.         is of temperature, precipitation, humidity, radiation, day length and wind on microor, and crop responses;         is of temperature, precipitation, humidity, radiation, day length and wind on microor, and crop responses;         is of temperature, precipitation, folicilimatology.         pts of water management.         es         icompletion of the course, the students         completion of the course, the students         completion setween climate, management attributes and land use systems.         is of water management.         es skills to use water models to analyze water demand.         incal attributes to ecological requirements of crops.         eractions between climate, management attributes and land use systems.         ita</td><td>Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]       intended learning outcomes         ists acquire in-depth knowledge on crop interactions of corps with climate and water. The isses will enable them to analyze the implications of changing environmental conditions on oduction. In addition, they will be able to apply agro-meteorological methods to determine, botanical and ecological attributes of corps with major economic importance will be disc.         is comprise:       gies and implications of water management incl. model applications;         ids &amp; application of climatology in agro-ecosystems;       y and ecological requirements of major crop types and species;         is of temperature, precipitation, humidity, radiation, day length and wind on microclimates       i, and crop responses;         daptation of the course, the students       concepts and implications of bioclimatology.         pts of water management.       e skills to use water models to analyze water demand.         incla attributes to ecological requirements of crops.       eractions between climate, management attributes and land use systems.         ical attributes to ecological requirements of crops.       eraction structure         aRTS-A01, A02, A03, A04, AS05a and AS05b       E         erg       2 students       E         isses       E Focus PER         else       E Focus PER         isses       E Focus PER         isses       E Focus PER</td><td>Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]       intended learning outcomes         intended learning outcomes       intended learning outcomes of corps with climate and water. The understates will enable them to analyze the implications of changing environmental conditions on water managemet ises.         is acquire in-depth knowledge on crop interactions of corps with major economic importance will be discussed, all to define social-ecological attributes of corps with major economic importance will be discussed, all ts to define social-ecological inche environments for major crop production and water management ises.         is comprise:       gies and implications of water management incl. model applications; ids &amp; application of climatology in agro-ecosystems; y and ecological requirements of major crop types and species;       on on microclimates of non-u, and crop responses;         y and ecological requirements of major crop types and species;       of temperature, precipitation, humidity, radiation, day length and wind on microclimates of non-u, and crop responses;         datation strategies to changing ecological conditions;       to specify the students         completion of the course, the students       completion of the course, the students         concepts and implications of bioclimatology.       pts of water management.         e skills to use water models to analyze water demand.       completion between climate, management attributes and land use systems.         ical attributes to ecological requirements of crops.       eractions       E     </td></t<>	Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]         intended learning outcomes         its acquire in-depth knowledge on crop interactions of corps with climate and water sess will enable them to analyze the implications of changing environmental condit oduction. In addition, they will be able to apply agro-meteorological methods to d , botanical and ecological attributes of corps with major economic importance will ts to define social-ecological nethods for major crop production and w gies.         its comprise:       gies and implications of water management incl. model applications; and ecological requirements of major crop types and species; and implication of climatology in agro-ecosystems; and ecological requirements of bioclimatology.         is of temperature, precipitation, humidity, radiation, day length and wind on microor, and crop responses;         is of temperature, precipitation, humidity, radiation, day length and wind on microor, and crop responses;         is of temperature, precipitation, folicilimatology.         pts of water management.         es         icompletion of the course, the students         completion of the course, the students         completion setween climate, management attributes and land use systems.         is of water management.         es skills to use water models to analyze water demand.         incal attributes to ecological requirements of crops.         eractions between climate, management attributes and land use systems.         ita	Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]       intended learning outcomes         ists acquire in-depth knowledge on crop interactions of corps with climate and water. The isses will enable them to analyze the implications of changing environmental conditions on oduction. In addition, they will be able to apply agro-meteorological methods to determine, botanical and ecological attributes of corps with major economic importance will be disc.         is comprise:       gies and implications of water management incl. model applications;         ids & application of climatology in agro-ecosystems;       y and ecological requirements of major crop types and species;         is of temperature, precipitation, humidity, radiation, day length and wind on microclimates       i, and crop responses;         daptation of the course, the students       concepts and implications of bioclimatology.         pts of water management.       e skills to use water models to analyze water demand.         incla attributes to ecological requirements of crops.       eractions between climate, management attributes and land use systems.         ical attributes to ecological requirements of crops.       eraction structure         aRTS-A01, A02, A03, A04, AS05a and AS05b       E         erg       2 students       E         isses       E Focus PER         else       E Focus PER         isses       E Focus PER         isses       E Focus PER	Crop ecology, water management and bioclimatology         : ARTS-BS02 [780800210]       intended learning outcomes         intended learning outcomes       intended learning outcomes of corps with climate and water. The understates will enable them to analyze the implications of changing environmental conditions on water managemet ises.         is acquire in-depth knowledge on crop interactions of corps with major economic importance will be discussed, all to define social-ecological attributes of corps with major economic importance will be discussed, all ts to define social-ecological inche environments for major crop production and water management ises.         is comprise:       gies and implications of water management incl. model applications; ids & application of climatology in agro-ecosystems; y and ecological requirements of major crop types and species;       on on microclimates of non-u, and crop responses;         y and ecological requirements of major crop types and species;       of temperature, precipitation, humidity, radiation, day length and wind on microclimates of non-u, and crop responses;         datation strategies to changing ecological conditions;       to specify the students         completion of the course, the students       completion of the course, the students         concepts and implications of bioclimatology.       pts of water management.         e skills to use water models to analyze water demand.       completion between climate, management attributes and land use systems.         ical attributes to ecological requirements of crops.       eractions       E	



Module Title: Cr	op ecology, water management and bioclimat	tology								
Module ID/Code: AR	TS-BS02 [780800210]									
9. Requirements for the rewarding of credits (ECTS)										
Types of Assessment	Prerequisites for admission to the Assessment	Graded yes/no	Graded Language We yes/no (exam) fac							
Term paper [780800219]		graded	English	70%						
Presentation [780800218]		graded	English	30%						
Academic Achieveme	nts	I								
10. Module coordin	ation									
Module coordinator										
Prof. Dr. Ana Meijide										
Teaching person										
The teaching persons	in the current semester can be found in basis:									
https://basis.uni-bonr	n.de/									
Institute/ Departmen	t									
Agrar-, Forst- und Erna	ährungswissenschaften									
11. Further informa	tion									



Module	Title: L	and u	use systems in the tropics and	subtropic	S							
Module I	<b>/Code:</b> A	RTS-B	S03 [780750040]									
1. Conter	nt and int	endeo	d learning outcomes									
<ol> <li>Conter</li> <li>Learning content:</li> <li>Content:</li> <li>Learning c</li> <li>After a suc - understa</li> <li>understa</li> <li>can apply</li> <li>are sensi</li> </ol>	t and int Acquire ki Understar Contents: - Diversity - Ecosyste - Species i - Attribute - Human o Seminar p their sust outcomes ccessful co nd implica nd key attr / concepts // concepts // ze produc	endec nowled nd the y of lar em servinterac es and develo present ainabil mpleti tions of ributes of ecc ction an	d learning outcomes dge about land use systems and imp attributes and functioning of major add use systems vices, threats to biodiversity and con- ctions and adaptation stragegies in d managment in dryland, wetland and pment and environment policy effec- tations of case studies and of innova lity are elaborated and presented by ion of the course, the students of land use on ecosystem services and s of major production system types a psystem services and adapted land u ind land use systems for developing s independetly develop sustainable al	lications of o tropical pro- servation pr lifferent land d forest use s cts on land u tive interver students an ad threats to and their interse se practices sustainable a ternatives to	different la duction sys ractices d uses systems se ntions in tra- id findings biodiversit eractions w to case stu alternatives o traditiona	nd uses on items and s aditional la are discuss :y. vith manage idy example is to current al land use i	ecosyster ocial-ecol nd-use sy ed ement. es. land use. n the trop	n service ogical in stems to	es. htera o imp sub-	ctions. prove		
- can apply	/ concepts	of cor	nservation agriculture or restoration	ecology to c	ase study e	examples.						
2. Prereq	uisites		-									
obligatory	,											
recomme	nded	ARTS-A01, A02, A03, A04, AM05a and AM05b										
Maximum of student	number s	r 25 students										
3. Study	orogram a	alloca	tion			Comm			6-			
M Sc. Agri	gram	ionco	and Posourco Management in the Tr	onics and Su	ubtropics	Compt		ective	se	niester		
(ARTS)				opics and sc	abtropics		L			۷.		
4. Teachi	ng and le	arning	g methodes									
Type of	Interval	Т	оріс		Language	of Grou	p SWS	Wo	orklo	(load [h]		
course					instructio	n size		Conta time	Contact S			
L (blocked)	afternoon block	ו L	and use and production systems		English	25	2,0	20,0	)	40,0		
T (blocked)	afternoon block	n C	Concepts of conservation / restoratio	on and	English	25	1,5	20,0	)	40,0		
S (blocked)	afternoon block	n S s	ynthesize knowledge on special lanc ystems	l use	English	25	0,5	5,0		55,0		
5. Course	cycle			6. Workloa	ad [h]	7. Dur	ation	8. Cre	dits	(ECTS)		
SS				180		1		6,0				
9. Requir	ements fo	or the	e rewarding of credits (ECTS)									
Types of A	ssessmen	t Pre	requisites for admission to the Asse	ssment		Graded	Langu	lage	Wei	ghting		
Term pape [78075004	paper graded English				i <b>n)</b> ih	factor 70%						
Presentati [78075004	on 18]					graded	Englis	h	30%	)		
Academic	Achievem	ents					<u> </u>					



Module Title: Land use systems in the tropics and subtropics
Module ID/Code: ARTS-BS03 [780750040]
10. Module coordination
Module coordinator
Prof. Dr. Mathias Becker
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
11. Further information



Module	Title: A	nin	nal production systems in the t	ropics								
Module I	<b>D/Code:</b> A	RTS-	BS04 [780810170]									
1. Conter	1. Content and intended learning outcomes											
Learning content:	Learning       The students will be provided with lectures on         content:       - animal (Cattle, sheep, goat, bufallo and poultry) production systems in trpical climate         - association between production system, species distribution and climate zones         - challenges of animal production system in various climatic zones											
Learning outcomes												
After a successful completion of the course, the students												
- can classify and understand animal production systems in the tropics and subtropics.												
- are able to characterize challenges of animal production systems in tropical climate.												
2. Prereq	Prerequisites											
obligatory	/											
recomme	nded	ART	S-A01, A02, A03, A04, AM05a and AM	105b								
Maximum of student	n number ts	25 s	tudents									
3. Study	program	alloo	cation									
Study pro	gram					Co	mpulso	ory/ Ele	ctive	Se	mester	
M.Sc. Agri (ARTS)	cultural Sc	ienc	e and Resource Management in the T	ropics and Su	ubtropics			E			2.	
M.Sc. Anir	nal Science	è	F 2.									
4. Teaching and learning methodes												
Type of	e of Interval Topic Language of Group SWS Workload [h]											
course					instructio	n	size C		Conta	ontact Self- time study		
L (blocked)	afternoor block	1	Animal production systems in the tro	opics	English		25	2,0	30,0	,0 60,0		
5. Course				6. Worklo	ad [h]	7.1	Durati	on	8. Cre	dits	(FCTS)	
SS	. cycic			180	aa [11]	1	1 60				(2010)	
9. Requir	ements f	or th	ne rewarding of credits (ECTS)	100		1-			0,0			
Types of A	Assessmen	t Pr	rereguisites for admission to the Asse	essment		Grade	d	Langu	age	We	ighting	
			•			yes/no	0	(exam	ı)	fact	factor	
Written ex	xam					gradeo	ł	Englis	h			
[78081017	79]											
Academic	Achievem	ents	<b>i</b>									
10. Modu	ule coordi	nati	ion									
Module co	oordinator											
Dr. Reinha	ard Puntiga	m										
Teaching	person											
The teach	ing person	s in t	the current semester can be found in l	basis:								
https://ba	isis.uni-boi	nn.de	e/									
Agrar- Fo	rst- und Er	nähr	ungswissenschaften									
11 Furth	er inform	atio	n									
11.1010												



Module	Title: E	ement cycles in tropical	agroecos	ystems							
Module II	D/Code: Al	RTS-BS05 [780800180]									
1. Contei	nt and inte	ended learning outcomes									
Learning content:	<ul> <li>including the management of organic waste and other secondary raw materials. Students are exposed to project-related research work, team-oriented work, holistic thinking and the comprehension of abstract relationships and complex interactions. Contents include:</li> <li>Pools, fluxes and transformation processes of major elements (water, C, N, P, S) in tropical environments.</li> <li>Ecological conditions and implications for the nutrition of tropical crops.</li> <li>Waste treatment and treatment technologies (composting, anaerobic digestion) and use of organic waste as fertilizer. Use and potential of staple isotopes.</li> <li>He 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</li> </ul>										
	be able to apply their knowledge to plan intervention strategies for improved crop plant nutrition in environments with variable ecological conditions.										
Learning o	outcomes								-		
After a successful completion of the course, the students - are able to assess and analyze the availability of major (nutrient)elements in a range of environments. - are able to determine the quantity and quality of organic matter and various secondary raw materials. - are able to plan intervention strategies for improved crop plant nutrition in environments with variable ecological conditions. - are able to synthesize secondary information on topics related to element cycles in the form of a seminar presentation. <b>2. Prerequisites</b>											
obligatory	tory										
recomme	nded	ARTS-A01, A02, A03, A04, AS05a and AS05b									
Maximum	number	25 students									
of studen	ts										
3. Study	program a	llocation									
Study pro	gram						Compulso	ory/ Ele	ctive	Se	mester
M.Sc. Agri (ARTS)	cultural Sci	ence and Resource Managem	ent in the Ti	ropics and Su	ubtropics			E			2.
M.Sc. Cro	o Sciences						E Foc	us PER	2		2.
4. Teachi	ng and lea	rning methodes									
Type of	Interval	Торіс			Language	of	Group	SWS W		orkload [h]	
course					instructio	n	size		Conta time	et e	Self- study
L (blocked)	afternoon block	Element cycle lectures			English		25	2,5	40,0	)	50,0
S (blocked)	afternoon block	Case studies		1	English		25	1,5	10,0	)	80,0
5. Course	cycle			6. Workloa	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)
SS				180			1		6,0		
9. Requir	ements fo	or the rewarding of credits	(ECTS)								
Types of A	ssessment	ment Prerequisites for admission to the Assessment Graded yes/no				aded s/no	Language (exam)		Weighting factor		
Report (presentat [78080018	eport graded English presentation) 780800189]										
Academic	Achievem	ents									



Module Title: Element cycles in tropical agroecosystems
Module ID/Code: ARTS-BS05 [780800180]
10. Module coordination
Module coordinator
Prof. Dr. Mathias Becker
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module	Title: Or	ganic Agriculture in the Tro	pics a	nd Subtro	pics						
Module I	O/Code: AR	TS-BS06 [780800130]									
1. Conter	nt and inter	nded learning outcomes									
Learning content:	The module important p Approaches ecological e crops and B world nutri sugar cane,	e gives an insight in organic farmin permanent cash crops. Contents in a in Organic Agriculture research; of ffects of inappropriate land use; s NF, agroforestry, alley cropping, of tion; a focus of the module lies on cotton, coffee, cocoa, citrus, vego	ng syter nclude: develop soil fert ecologio n croppi etables	ms mainly u pment and a ility manage cal challeng ing systems and fruits.	nder tropic assessment ement; rota es in tropica and techni	al c of s ation al a que	onditions v sustainable n design, p griculture; s of import	vith a sprodu erforma organic cant cro	ction sy ance of agricu ps such	ocus vstem legu lture n as r	on ns; minous and ice,
Learning o	outcomes										
After a suc - have ext - understa - are able - are able	ccessful com ensive know nd the prine to give a scie to analysise	pletion of the course, the student legde on challenges of tropical ag ciples of field trial design and man entific presentation in english lang cropping systems from an agrono	ts ricultur nageme guage. omic ano	re. :nt. d ecological	perspectiv	e.					
2. Prereg	uisites				· · ·						
obligatory	······································										
recomme	nmenaea										
Maximum of student	Maximum number of students										
3. Study	program al	location									
Study pro	gram						Compulso	ory/ Ele	ctive	Se	mester
M.Sc. Agri (ARTS)	cultural Scie	nce and Resource Management ir	n the Tr	ropics and S	ubtropics			E			3.
M.Sc. Cro	o Sciences						E Foc	us PER	2		3.
4. Teachi	ng and lear	ning methodes				_	[	r			
Type of course	Interval	Торіс			Language instructio	of n	Group size	SWS	Wo Conta time	orklo act	ad [h] Self- study
L	during the semester	Organic Agriculture in the Trop Subtropics	pics and	d	English		80	2,0	30,0	)	60,0
S	during the semester	Selected aspects of tropical or	ganic a	griculture	English		20	2,0	30,0	)	60,0
5. Course	cycle			6. Worklo	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)
WS				180			1		6,0		
9. Requir	ements for	the rewarding of credits (ECT	'S)					-			
Types of A	ssessment	Prerequisites for admission to th	ne Asse	ssment		Gr ye	aded s/no	Langu (exam	age I)	Weighting factor	
Written ex [78080013	kam 89]					gra	aded	Englis	h		
Academic	Achieveme	nts									



Module Title: Organic Agriculture in the Tropics and Subtropics
Module ID/Code: ARTS-BS06 [780800130]
10. Module coordination
Module coordinator
Dr. Daniel Neuhoff
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
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Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module Title: Crop and Ecosystem Analysis and Modelling										
Module II	<b>D/Code</b> : A	RTS-	BS07 [780790290]							
1. Conte	nt and int	end	ed learning outcomes							
Learning content:	Learning       The content of the module can be summarized by the following headings         content:       Systems theory and methods of systems analysis         Types of models       Conceptualizing of crops or ecosystems systems         Mathematical formulation of relationships (including practical exercises)         Implementation of mathematical algorithms (including practical exercises)         Methods of model calibration and parameterisation         Sensitivity and uncertainty analysis         Model verification, validation and evaluation         Students learn to analyse and model crops and ecosystems. Important relationships determining crop and								nts	
	obtain ba	asic knowledge in mathematical (mainly numerical) modeling and apply these to develop models for								
	selected crop and ecosystem processes. They also learn to apply models to solve practical problems.									
Learning	outcomes									
After a successful completion of the course, the students - can distinguish different types of systems and models and can give examples. - are able to construct simple models of cropping systems based on defined assumptions. - are able to apply dynamic simulation models. - understand the principles of dynamic modelling.										
2 Prerequisites										
obligatory										
recommended N			odul "Pflanzenbau" (B.Sc. Agrarwissenschaften)							
Maximum number 30 students										
3. Study program allocation										
Study program Compulsory/ Elective Semester							nester			
M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics E 22 (ARTS)						2.				
M.Sc. Nature Conservation and Landscape Ecology					E 2.			2.		
M.Sc. Crop Sciences E Focus PERC					2.					
4. Teaching and learning methodes										
Type of Interval			Торіс		Language of	Group	SWS	Wo	Workload	
course					instruction			Conta	act Self-	
during th					English	30	2.0	2.0 30.0 F		<b>study</b>
semester		-			LIIGIISII			50,0		
рТ	during the semester	ing the nester			English	30	2,0	30,0	)	60,0
5. Course cycle 6. Workload [h] 7. Duration 8. Credits (ECTS							(ECTS)			
SS				180	1 6,0					



Module Title: Cr	op and Ecosystem Analysis and Modelling						
Module ID/Code: ARTS-BS07 [780790290]							
9. Requirements for the rewarding of credits (ECTS)							
Types of Assessment	Prerequisites for admission to the Assessment	Graded	Language	Weighting			
		yes/no	(exam)	factor			
Presentation		graded	English	50%			
[780790299]							
Report		graded	English	50%			
[780790298]		0					
Academic Achievements							
10. Module coordination							
Module coordinator							
Dr. Thomas Gaiser							
Teaching person							
The teaching persons in the current semester can be found in basis:							
https://basis.uni-bonn.de/							
Institute/ Departmen	t						
11. Further information							



Module Title: Horticultural Production and Research											
Module ID/C	ode: AR	TS-BS08 [780800120]									
1. Content a	and inter	nded learning outcomes									
Learning       - Overview of major horticultural production systems, in regional and global contexts         content:       - Overview of horticultural value chains         - In-depth discussion of selected critical issues in horticultural production         - Horticultural approaches to agricultural development         - Sustainability concerns in horticulture											
<ul> <li>Climate change and its impacts on horticulture</li> <li>Horticultural modeling</li> <li>Critical discussion of horticultural literature</li> <li>Literature search, scientific writing and presenting</li> </ul>											
Learning outcomes											
After a successful completion of the course, the students - will be able to critically interpret horticultural literature. - will be able to explain how major horticultural commodities are produced and provide examples of various production systems. - will be able to analyze horticultural production systems and identify strengths and weaknesses.											
- will be able	to assess	horticultural literature and provide a ba	lanced and l	ogically rigor	ous evaluati	ion.					
- will be able	to compo	ose a scientifically rigorous paper on sele	ected topics,	based on exte	ensive analy	/sis of p	ublishe	d sou	irces.		
2. Prerequisites obligatory											
recommende	ed N	1odul "Gartenbauliche Kulturen" (B.Sc. A	grarwissens	chaften)							
Maximum number     50 students											
3. Study pro	ogram al	location									
Study progra	im				Compulse	orv/Ele	ctive	Ser	nester		
M.Sc. Agricult (ARTS)	nce and Resource Management in the T	ropics and Su	ubtropics		E			3.			
M.Sc. Crop Sc	ciences				E Focus PER		С 3		3.		
M.Ed. Agricul	ltural Scie	ence (Teacher's Training)			E		3.		3.		
4. Teaching	and lear	ning methodes									
Type of Int course	terval	Торіс		Language of instruction	Group size	SWS	Wo Conta	orkload [h] act Self-			
L du	uring the	Horticultural Production and Researc	ch	English	50	1,0	15,0	)	20,0		
S du	uring the mester	Horticultural literature study		English	10	3,0	45,0	)	100,0		
5. Course cy	/cle		6. Workloa	ad [h]	7. Duration		8. Credits (ECTS)				
WS			180		1	1			6,0		
9. Requirem	nents for	the rewarding of credits (ECTS)					•				
Types of Assessmen		Prerequisites for admission to the Asse	essment	G ye	raded es/no	Langu (exam	Language (exam)		Weighting factor		
Presentation [780800129]					aded	English		20%			
Term paper [780800128]					aded Englis		h	ı 40%			
Assignment [780800127]					;raded Er		English		40%		
Academic Ac	hievemei	nts									



### Module Title: Horticultural Production and Research

Module ID/Code: ARTS-BS08 [780800120]

### **10. Module coordination**

### Module coordinator

Prof. Dr. Eike Lüdeling

### **Teaching person**

The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

### Institute/ Department

Agrar-, Forst- und Ernährungswissenschaften

### 11. Further information

Baudoin et al., 2013: Good Agricultural Practices for greenhouse vegetable crops - Principles for Mediterranean climate areas. FAO (http://www.fao.org/3/a-i3284e.pdf)

Baudoin et al., 2017: Good Agricultural Practices for greenhouse vegetable production in the South East European countries. FAO (http://www.fao.org/3/a-i6787e.pdf)

Dixon & Aldous, 2014: Horticulture: Plants for People and Places (Vol. 1-3). Springer

Marcelis & Heuvelink, 2019: Achieving sustainable greenhouse cultivation. Burleigh Dodds

Taiz & Zeiger, 2006: Plant Physiology, das Original mit Übersetzungshilfen, Spektrum Akademischer Verlag

Tromp et al. (Eds.), 2005: Fundamentals of Temperate Zone Tree Fruit Production. Backhuys Publishers

von Zabeltitz, 2011. Integrated Greenhouse Systems for Mild Climates. Springer


Module Title: Irrigation agriculture												
Module II	Module ID/Code: ARTS-BS09 [780790430]											
1. Conte	1. Content and intended learning outcomes											
Learning	In this cou	urse s	tudents will be introduced to agricult	ural irrigatio	on in Germa	ny and world	wide. T	he cou	rse is	5		
content:	structure	d in le	ectures, practical courses in the fields	and the lab	oratories at	the Campus	Poppels	sdorf ar	nd or	ne		
	excursion	of ha	If a day to a farm or company irrigati	ng crops.								
	The lectur	res pr	ovide advanced knowledge on (i) the	extent and	significance	of irrigation	in agric	ulture,	(ii) v	/hen		
	crops hav	e to b	be irrigated and how to estimate the i	irrigation wa	iter demand	l, and (iii) wh	ich tech	nical de	evice	es are		
	supportiv	e for i	irrigation.									
	In the pra	ctical	courses the students learn how relev	vant measur	ement devi	ces work (e.g	. to me	asure so	oil w	ater		
Learning	content o	r stor	natal conductance) and how to use t	hem.								
Learning outcomes After a successful completion of the course, the students												
After a successful completion of the course, the students												
- can describe the importance of irrigated agriculture around the globe.												
- can estir	- can estimate the irrigation water demand for agricultural production.											
2 Prorec		i use	several devices that anow measuring		Mant Waters	5.6105.						
obligator												
Jungatory												
recomme	ended	d Production ecology; Resource conservation; Crop Physiology; Crop ecology, water management and										
Maximum	Dioclimatology											
of studen	naximum number   20 students											
of students 3. Study program allocation												
Study program Compulsory/Elective Semester												
Study pro	in the second					Compuis	Dry/ Ele	ective	36	mester		
MI.SC. Agri (ARTS)	icultural Sc	ience	and Resource Management in the Ti	ropics and Si	ubtropics		E			2.		
M.Sc. Nat	ure Conser	vatio	n and Landscape Ecology				0			2.		
M.Sc. Cro	p Sciences					E Foo	us PER	С		2.		
4. Teach	ing and le	arnin	ıg methodes			1						
Type of	Interval	ŀ	Торіс		Language of	of Group	SWS W		Vorkload [h]			
course					instruction	size		Conta	Contact Se			
								time		study		
L	during the	e	lecture on irrigation agriculture		English	20	1,0	15,0	)	35,0		
	semester											
рТ	during the	9	usage of measurement devices		English	20	0,7	10,0	)	25,0		
	semester				En ell' l		0.2			1.0		
E	during the	9	half-day excursion to a farm or irrigat	tion	English	20	0,3	4,0		1,0		
E Course	semester		company	6 Worklo	ad [b]	7 Durati	0n	9 Cro	dita			
S. Course	e cycle				au [ii]			<b>o.</b> Cre	uits			
33 0 Boguin	romonto f	ar th	a rowarding of cradits (ECTS)	90		1		3,0				
9. Requi			e rewarding of credits (ECTS)		I.	Cuadad	Langu		14/0	iahtina		
Types of A	Assessmen		erequisites for admission to the Asse	ssment		Graueu vos/no	Langu	age	fact	or		
Oral evan	<u></u>					graded	Englic	<u>יי</u> h	iau	.01		
[7807904]	7807904391					Biuucu	LIGIS	••				
	1											
Academic	Achievem	ents			I				•			



## Module Title: Irrigation agriculture Module ID/Code: ARTS-BS09 [780790430] 10. Module coordination Module coordinator Dr. Sabine Seidel Teaching person The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

Institute/ Department

Agrar-, Forst- und Ernährungswissenschaften

11. Further information



Module	Title: S	imulation of Ag	ricultural and Biolo	ogical Syste	ems						
Module ID/Code: ARTS-BS10 [780750090]											
1. Conte	nt and int	ended learning o	utcomes								
Learning content:	The cours models). The course named SII basis for co effects of uncertain SIMPLE n with Dyna	e focuses on the pr The course begins b e, and statistical no MPLE) is presented liscussing some bas CO2 level. Then ty and sensitivity ar nodel, programmed mic Crop Models",	inciples, tools and prac by teaching two basic to tions for system model in detail and discussed sic processes of plant g three essential method halysis, model calibrat I in R, will be used a of which D. Wallach is	tice of work bols; the R pr ling. Also a si I. This illustra growth and ds of working ion and mo is an examp first author.	ing with cro rogramming imple crop r ates the nati developmen g with dynar del evaluat le and for	p models (an language, w nodel from th ure of dynam nt. Importan nic models a ion. Through exercises. Th	d more hich wil ne litera ic syste tly, the re consi nout th ne text	genera Il be use ature (a m mode idered i e cours book is	lly sy ed th ppro els, a l incl n det se, th s "W	rstem roughout priately nd is the udes tail; ne orking	
Learning	outcomes										
- will be a - will be c - will be c <b>2. Prerec</b>	ble to unde apable of c apable of e	alibrating crop mod valuating crop mod	p models g sensitivity analysis for lel performance	r crop model	s						
obligator	y										
recomme	ended	d Module "Crop and Ecosystem analysis and Modelling"									
Maximun of studen	n number Its	20 students									
3. Study	program a	allocation					/ =1				
Study pro	ogram					Compulse	ory/ Ele	ective	Se	mester	
M.Sc. Agr (ARTS)	icultural Sc	ence and Resource	e Management in the T	ropics and Si	ubtropics		E			3.	
M.Sc. Cro	p Sciences					E Foo	us PER	C		3.	
4. Teach	ing and le	arning methodes			I		1	1			
Type of course	Interval	Торіс			Language of instruction	of Group size	sws	Wo Conta	orklo Inct	ad [h] Self-	
L	during the	e Dynamic syste	em models, principles a	ind	English	20	2,0	30,0	)	60,0	
Т	during the	Application of	methods using R		English	20	2,0	30,0	)	60,0	
5. Cours	e cycle			6. Worklo	ad [h]	7. Durati	on	8. Cre	dits	(ECTS)	
WS	•			180		1		6,0			
9. Requi	rements f	or the rewarding	of credits (ECTS)			•					
Types of A	Assessmen	Prerequisites for	r admission to the Asse	essment		Graded yes/no	Langu (exam	iage 1)	Wei fact	ghting or	
Written e [7807500	exam 199]					graded	Englis	h			
Academic	c Achievem	ents					1		I		



Module Title: Simulation of Agricultural and Biological Systems
Module ID/Code: ARTS-BS10 [780750090]
10. Module coordination
Module coordinator
Dr. Sabine Seidel
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
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11. Further information



Module Title: Cropping system simulation for climate risk assessments										
Module ID/Cod	<b>de:</b> NPW-	057 [780800570]								
1. Content an	d intend	ed learning outcomes								
Learning Stud content: adap ferti requ mod grou The - Clir - Brid limit - Ob - Mo Adva - Pra	lents recei otation str lizer, crop uirements, lels and th ups for mo content o mate risk o ef overvie cations, in served da odel calibro anced Cro	ive an overview of climate risk in cropp rategies and impact risk assessments the diversification, cultivar selection, and sources and quality for model input, of the implications of model scalability of in del applications for different case study f the module can be summarized in the definitions, environmental factors affe w on types of crop models (e.g. statist put and output data for upscaling. ta collection for model use: sources, q ation and validation using SIMPLACE (S p and Ecosystem management). rrises for model calibration and mode	ping systems hat can be e land suitabi calibration a nput and ou dies. e following: ecting crop p cical, mechar quality and lin Scientific Im	s, mechanist xplored with lity. Studen nd validatio tput data. T roduction. histic), availa mitations. pact assessions for climat	tic models an n such model ts will unders n. Students w he course ind able modellin ment and Mo	d their s, such tand di vill lear cludes p g fram delling	applicat as, irriga fferent o n to app practical eworks, Platforn	tion f atior data bly cr exer crop n for	for op rcises in o model	
- Practical exercises for model calibration and model applications for climate impacts, adaptation and risk.										
After a success - gain understa - are able to us - are able to us	ful comple nding on t e dynamic e dynamic	etion of the course, the students the potential uses of agroecosystem m c crop simulation models to simulate c c crop models as tool for cropping syst	nodels for cli rop growth. em analysis	mate risk as and impacts	ssestments in s of climate ro	crop p elated r	roductic <sup>.</sup> isk.	on.		
2. Prerequisit	es									
obligatory	gatory Crop and ecosystem analysis and modelling (NaLa-029)									
recommended	ecommended Einführung in den Pflanzenbau (BSc Agricultural Science)									
Maximum num of students	nber 20 s	tudents								
3. Study prog	ram alloo	cation								
Study program					Compulse	ory/ Ele	ective	Se	mester	
M.Sc. Agricultu (ARTS)	ral Science	e and Resource Management in the Tr	ropics and Su	ubtropics		E			3.	
M.Sc. Crop Scio						<u>с</u>			з. э	
		we weath a data				E			5.	
4. Teaching a		Topic		Language	of Group	514/5	Wo	rklo	ad [b]	
course	i vai	торе		instruction	size	3003	Conta time	ct	Self- study	
L durit sem	ng the ester			English	20	1,0	15,0	)	30,0	
pT durin sem	ng the ester			English	20	1,0	15,0	)	30,0	
5. Course cycl	le		6. Workloa	ad [h]	7. Durati	on	8. Cree	dits	(ECTS)	
WS			90		1		3,0			
9. Requireme	nts for th	ne rewarding of credits (ECTS)								
Types of Assess	sment   Pr	rerequisites for admission to the Asse	ssment		Graded	Langu	age	Wei	ghting or	
Presentation [780800579]					graded	English		50%		
Report [780800578]					graded	Englis	h	50%		
Academic Achi	evements									



Module Title: Cropping system simulation for climate risk assessments									
Module ID/Code: NPW-057 [780800570]									
10. Module coordination									
Module coordinator									
Dr. Ixchel M. Hernandez-Ochoa									
Teaching person									
The teaching persons in the current semester can be found in basis:									
https://basis.uni-bonn.de/									
Institute/ Department									
Agrar-, Forst- und Ernährungswissenschaften									
11. Further information									



Module	Module Title: Ecological modeling for natural resource science and management										
Module I	Module ID/Code: NPW-056 [780800560]										
1. Content and intended learning outcomes											
Learning content:	Students and mana generalize learn to a	will u gem ed lin oply	understand the procedure of ecologica ent. They learn to analyze ecological lear models, generalized additive mod models to solve practical problems or	al model buil data using Pr lels, and mix n personal la	lding and inter rogram R, part red-effects mo ptops.	rpretation f icularly foc dels throug	or natu using o hout t	ural res n linea he coui	ource r mo rse. T	e science dels, They also	
	The content of the module is summarized as followings - Scientific methods and types of research designs (e.g., hypothetico-deductive methods, observation/experiment) - Types of statistical distributions/models and their assumptions (e.g., normal, Poisson, and binomial distributions) - Implementation of models using Programming software R - Model diagnosis (e.g., residual plot and goodness-of-fit test) - Null significance hypothesis testing (e.g., a null hypothesis, an alternative hypothesis, Type I and Type II errors, and P-values) - Information-theoretic approach using the Akaike Information Criterion (AIC) - Model interpretation (e.g., understanding intercept and coefficients and visualizing model output)										
Learning o	outcomes										
After a successful completion of the course, the students - describe the procedure of scientific methods and relate it to ecological data analysis with specific examples. - organize ecological data analyses using program R from preprocessing raw data through building models to visualizing model outputs. - classify types of statistical distributions to select appropriate models depending on the characteristics of ecological data. - recognize assumptions for types of statistical models and describe the potential violation for specific cases in natural resource science and management. - check research methods and statistical results of both own research and published articles to critically evaluate the model interpretation											
2. Prereg	uisites										
obligatory		non	e								
recomme	nded	Basi	c knowledge of t-test, chi-square test	, and ANOVA	is desirable						
Maximum of studen	n number ts	15 s	tudents								
3. Study	program a	alloc	ation								
Study pro	gram					Compulso	ry/ Ele	ctive	Se	mester	
M.Sc. Agri (ARTS)	icultural Sc	ience	e and Resource Management in the Ti	ropics and Su	ubtropics		E			1./3.	
M.Sc. Nat	ure Conser	vatic	on and Landscape Ecology				E			1./3.	
M.Sc. Cro	p Sciences					E Foci	us PER	С		1./3.	
4. Teachi	ing and lea	arni	ng methodes								
Type of	Interval		Торіс		Language of	Group	SWS	W	orklo	ad [h]	
course					instruction	size		Conta	act	Self-	
L	during the	è	Principles of ecological model buildin	g	English	15	1,0	14,0	0	34,0	
S*	during the	5	Discussions on cientific publications		English	15	1,0	14,0	0	45,0	
pT*	during the	g the Practicals related to the course English				15	2,0	28,	0	45,0	
5. Course	e cycle			6. Workloa	ad [h]	7. Duratio	on	8. Cre	dits	(ECTS)	
WS	•			180		1		6,0			



Module Title: Ec	ological modeling for natural resource science ar	nd managem	ent							
Module ID/Code: NF	PW-056 [780800560]									
9. Requirements for the rewarding of credits (ECTS)										
<b>Types of Assessment</b>	Prerequisites for admission to the Assessment	Graded	Language	Weighting						
		yes/no	(exam)	factor						
Assignment	Participation in practical courses	graded	English	50%						
[780800569]										
Presentation	Participation in paper discussion and its presentation,	graded	English	50%						
[780800568]	Regular class attendance									
Academic Achieveme	ints									
10. Module coordir	nation									
Module coordinator										
Dr. Ryo Ogawa										
Teaching person										
The teaching persons	in the current semester can be found in basis:									
https://basis.uni-boni	n.de/									
Institute/ Departmen	t									
Agrar-, Forst- und Ern	ährungswissenschaften									
11. Further informa	ition									
Sources of module co	ntents (not required to purchase):									
A primar on natural re	esource science (Guthery 2010; https://www.tamupress.com	n/book/978160	3440257/a-prin	ner-on-natural-						
resource-science/)										
Mixed effects models	and extentions in Ecology with R (Zuur et al., 2009; https://	link.springer.co	m/book/10.100	7/978-0-387-						
87458-6)										



Module	Title: S	pati	al ecology and conservation bi	ology						
Module II	D <b>/Code</b> : N	IPW-	055 [780800550]							
1. Conte	nt and int	ende	ed learning outcomes							
Learning content:	LearningStudents will learn the basic principles of conservation biology, with a special focus on applications related to spatial ecology and management of natural resources (including those in agroecosystems). The course will cover the goals of conservation, elaborating on the main current threats to biodiversity (e.g. land-use change, habitat loss, climate change, invasive species, etc.), the units of conservation (e.g. genes, populations, species, habitats, ecosystem 									
After a su	ccessful co	mple	tion of the course, the students							
<ul> <li>learn key</li> <li>learn on</li> <li>understation</li> <li>apply bation</li> <li>present</li> </ul>	y concepts the differe and the bas and how to sic (spatial) and critical	in co ent ur sic pr eval ) eco lly dis	nservation biology and current pressi nits of conservation, and different spa inciples of spatial ecology and the fea uate the effectiveness of conservation logy concepts to propose solutions to scuss recent published articles in the f	ng threats to itial scales at tures of spain n measures. practical co field of conso	o biodiversity. t which conser tial data. nservation pro ervation biolog	rvation mea oblems. gy and spat	isures a	ogy.		
2. Prerequisites										
Obligator	y 					• • •				
recomme	nded	Basi	c knowledge of spatial data/softwares	s (e.g. ArcGI	S, QGIS) is des	irable.				
Maximun	n number	20 s <sup>.</sup>	tudents							
of studen	ts	- 11								
3. Study	program a	alloc	ation			Compulse			6.	mastar
Study pro	igram					Compuise		ective	e Semester	
(ARTS)		ience	e and Resource Management in the Tr	opics and Si	ubtropics		C			1./3.
M.Sc. Nat	ure Conser	vatic	on and Landscape Ecology				E			1./3.
M.Sc. Cro	p Sciences					E Foc	us PER	с		1./3.
4. Teach	ing and lea	arniı	ng methodes							·
Type of	Interval		Торіс		Language of	Group	SWS	Wo	rklo	ad [h]
course			•		instruction	size		Conta	ct	Self-
								time		study
L	during the	e	Theory of spatial ecology and conserved	vation	English	20	1,0	14,0		20,0
	semester		biology							
S*	during the semester	ne Presentation and discussion of journal articles r			English	20	1,0	14,0		40,0
pT* during the Practical exercise with laptop semester						20	2,0	28,0		64,0
5. Course	e cycle			6. Worklo	ad [h]	7. Durati	on	8. Cred	lits	(ECTS)
WS				180		1		6,0		



Module Title: Spatial ecology and conservation biology										
Module ID/Code: NP	W-055 [780800550]									
9. Requirements fo	r the rewarding of credits (ECTS)									
Types of Assessment	Prerequisites for admission to the Assessment	Graded	Language	Weighting						
		yes/no	(exam)	factor						
Colloquium [780800559]	Participation in journal club and group discussion	not graded	English	30%						
Project work	Participation in practical exercise	not graded	English	30%						
[780800558]										
Assignment		graded	English	40%						
[780800557]										
Academic Achieveme	nts									
10. Module coordin	ation									
Module coordinator										
Stephanie Roilo										
Teaching person										
The teaching persons	in the current semester can be found in basis:									
https://basis.uni-bonr	n.de/									
Institute/ Departmen	t									
Agrar-, Forst- und Ern	ährungswissenschaften									
11. Further informa	tion									
Spatial Ecology and Co	onservation Modelling - Springer (https://link.springer.co	m/book/10.1007/97	8-3-030-0198	9-1)						
Conservation Biology	<ul> <li>Springer (https://link.springer.com/book/10.1007/978-</li> </ul>	3-030-39534-6)								



Module	Title: Cli	mate-Smart Ecosystem M	anagen	nent						
Module II	<b>D/Code:</b> NP	W-059 [780800590]								
1. Conte	nt and inte	nded learning outcomes								
Learning content:	Learning In this course, students will gain insights into Climate-Smart Ecosystem Management (CSEM), focusing on key concepts and strategies for effectively managing diverse ecosystems in a changing climate. Lectures will cover climate change patterns and trends, and its impacts on agriculture, forestry, and peatlands. Students will learn about techniques for measuring greenhouse gas (GHG) and water fluxes from various ecosystems (e.g., chambers, eddy covariance, and remote sensing), including a visit to a GHG measurement station. The course will also address the effects of management practices across these ecosystems as tools to mitigate climatic impacts, with a focus on reducing GHG emissions and increasing soil organic carbon sequestration. International agreements and policies related to climate change mitigation will be presented, alongside emission inventories. Students will become familiar with strategies for climate change adaptation and mitigation, including climate-smart integrated production systems (e.g., agroforestry, etc.). The seminars will include lectures by stakeholders working in CSEM and presentations of case studies by students in groups. This module will equip students with the knowledge and skills to devise innovative solutions for mitigating climatic impacts from diverse ecosystems and building climate-resilient ecosystems.									
Learning	outcomes									
<ul> <li>outline t</li> <li>climate ch</li> <li>describe</li> <li>know ab</li> <li>acquire l</li> <li>identify</li> <li>interpret</li> <li>availabilit</li> <li>identify</li> <li>analyse f</li> <li>and impro</li> <li>2. Prerec</li> <li>obligatory</li> </ul>	<ul> <li>- outline the core concepts and practices of CSEM, identify examples from different ecosystems, and describe their impact on climate change mitigation and adaptation.</li> <li>- describe the mechanisms responsible for GHG production and consumption in ecosystems.</li> <li>- know about water and energy fluxes in various ecosystems and the microclimatic effects of ecosystem management practices.</li> <li>- acquire basic knowledge of measurement techniques for GHG and water fluxes from agriculture, forest and peatlands.</li> <li>- identify international organizations and relevant actors in climate mitigation and adaptation.</li> <li>- interpret climate change patterns and trends, and discuss their implications on crop yields, forest productivity, water availability, and other relevant factors.</li> <li>- identify key practices for mitigating GHG emissions and increasing soil organic carbon storage.</li> <li>- analyse the effectiveness of different climate-smart ecosystem management plans and strategies, and propose modifications and improvements.</li> </ul>									
recomme	nded									
Maximum		1 students								
of studen	ts	4 students								
3. Study	program al	location								
Study pro	gram					Compulso	ory/ Ele	ective	Se	mester
M.Sc. Agri (ARTS)	icultural Scie	nce and Resource Management	in the T	ropics and Su	ubtropics		E			1./3.
M.Sc. Nat	ure Conserv	ation and Landscape Ecology					E			1./3.
M.Sc. Cro	p Sciences						E			1./3.
4. Teachi	ing and lea	rning methodes								
Type of	Interval	Торіс			Language of	Group	SWS	Wo	orklo	ad [h]
course					instruction	size		Conta	act	Self-
L	during the CSEM Lectures			English	24	2,0	<b>tim</b> 30,0	e D	<b>study</b> 60,0	
S*	during the Case studies and stakeholders English semester					24	2,0 30,0		C	60,0
5. Course	e cycle			6. Workloa	ad [h]	7. Durati	on	8. Cre	dits	(ECTS)
WS				180		1		6,0		



Module Title: Cli	mate-Smart Ecosystem Management									
Module ID/Code: NP	W-059 [780800590]									
9. Requirements for the rewarding of credits (ECTS)										
Types of Assessment	Prerequisites for admission to the Assessment	Graded	Language	Weighting						
		yes/no	(exam)	factor						
Presentation [780800599]	Participation in project work	graded	English	30%						
Report (presentation) [780800598]	Report in form of a poster - doing a presentation is a prerequisite	graded	English	30%						
Oral exam [780800597]		graded	English	40%						
Academic Achieveme	nts									
10. Module coordin	ation									
Module coordinator										
Prof. Dr. Ana Meijide										
Teaching person										
The teaching persons	in the current semester can be found in basis:									
https://basis.uni-bonr	n.de/									
Institute/ Departmen	t									
Agrar-, Forst- und Erna	ährungswissenschaften									
11. Further informa	tion									
Guest lectures from ke	ey stakeholders and experts in the field (N.N.), including rep	resentatives fro	m private comp	banies and						
international organiza	tions									



Module	Title: E	colo	ogical climatology								
Module I	Module ID/Code: NPW-060 [780800600]										
1. Contei	1. Content and intended learning outcomes										
Learning content:	Students v ecosystem to the atm on ecosys temperate understar	will le n pro nosp tems ure, a iding	earn about the atmospheric processes ocesses and fluxes in the plant-soil-air here at local and global scales. This wi s. The lectures will give an overview or and wind and their interactions with to g will be deepened by quantitative exe	s responsible interface. Th Il set the bas n atmospher errestrial ec rcises and g	e of local and g ney will also un sis for underst ric variables su osystems. In t roup presenta	global clima nderstand h anding the uch as radia he seminar, tions. The s	tes and now eco impact tion, ho /exerci student	d how the osystems t of clima umidity, se class, t ts will be	ey influence feed back te change the trained in		
	quantitative and qualitative scientific methods to describe and study climate-dependent physical, chemical and biological processes in terrestrial ecosystems enabling them to understand and evaluate the current discussion on climate change and its impact on terrestrial ecosystems.										
Learning	outcomes	ang									
After a sur- identify t - recall the - explain h - compreh change. - illustrate - assess ho regional su - evaluate - recognisu <b>2. Prereq</b> <b>obligatory</b> <b>recomme</b> <b>Maximum</b> <b>of studen</b>	After a successful completion of the course, the students         - identify the key components of cycles of earth systems and climate.         - recall the most important climatological and hydrological variables and what governs them at different scales.         - explain how climate controls the functioning and distribution of plants in different terrestrial environments.         - comprehend how interactions between climate and terrestrial ecosystems function and how these may feed back into climate change.         - illustrate the climatological, hydrological and nutrient conditions in different terrestrial environments.         - assess how changes in land cover or land use impact the climatological, hydrological and nutrient conditions at local and regional scales.         - evaluate how changes in climate reflect on different terrestrial ecosystems.         - recognise suitable approaches and methods to study interactions between climate and terrestrial ecosystems.         2. Prerequisites         obligatory       none         recommended         Maximum number       24 students										
3. Study	program a	alloc	ation								
Study pro	gram					Compulso	ry/ Ele	ctive	Semester		
M.Sc. Agri (ARTS)	icultural Sci	ience	e and Resource Management in the Tr	opics and Su	ubtropics		E		1./3.		
M.Sc. Nat	ure Conser	vatic	on and Landscape Ecology				0		1./3.		
M.Sc. Cro	p Sciences						E		1./3.		
4. Teachi	ing and lea	arni	ng methodes				-				
Type of	Interval		Торіс		Language of	Group	SWS	Wor	kload [h]		
course					instruction	size		Contac	t Self-		
L	during the semester	g the Basics of ecological climatology		English	24	2,0	30,0	60,0			
S*	during the semester	the Practical exercises related to the course English ter			English	24	2,0	30,0	60,0		
5. Course	e cycle			6. Workloa	ad [h]	7. Duratio	on	8. Cred	its (ECTS)		
WS											



Module Title: Ec	ological climatology			
Module ID/Code: NP	W-060 [780800600]			
9. Requirements for	r the rewarding of credits (ECTS)			
Types of Assessment	Prerequisites for admission to the Assessment	Graded yes/no	Language (exam)	Weighting factor
Oral exam [780800609]		graded	English	50%
Presentation [780800608]	participation in project work and its presentations	graded	English	50%
Academic Achieveme	nts			
10. Module coordin	ation			
Module coordinator				
Prof. Dr. Ana Meijide				
Teaching person				
The teaching persons https://basis.uni-bonr	in the current semester can be found in basis: n.de/			
Institute/ Departmen	t			
Agrar-, Forst- und Erna	ährungswissenschaften			
11. Further informa	tion			
We will partially follow Gordon.	w the structure and use some of the material form the boo	ok "Ecological Clim	natology" 2016,	by Bonan



Module	Title: I	ntro	duction to Tropical Forestry						
Module II	Ile ID/Code: ARTS-BS11 [780750110]								
1. Conte	nt and int	end	ed learning outcomes						
1. Conter Learning content:	nt and int Tropical f erosion co tropical for remaining previous f The modu across the For each f sustainab conservat products) plantation resilient a consolida Students moderate	end orest oprest g fores fores le ma cion-(c , woo n fore and s ted i have e the	ed learning outcomes ts harbor vast biodiversity and provide ol. However, climate change, deforesta ecosystems, creating the need for for est resources. This is an introductory r try knowledge is required. ves an overview of global forest resou- pics, covering the moist to dry tropics t type, importance and key functions, anagement strategies are discussed. T priented close-to-nature forestry with od production-oriented management estry, which will also be discussed in t ustainable landscapes. The acquired k n field trips to nearby forest stands. t o give a 10 min oral presentation on presentation of one colleague. At the	e essential ed ation and un rest restorati nodule for st urces, dynam and azonal f managemen 'he module o extensive re in (near) nat he context o nowledge ou a forestry-re end of the v	cosystem func isustainable la ion and smart tudents with a nics and threat forest types su nt-relevant ch covers forest r esource exploi tural and seco of community f n sustainable f elated topic (3 vinter semest	tions such a nd use prac and sustair an interest i is. It classifi uch as mour aracteristic: nanagemen tation (e.g. ndary tropi forestry app forest mana 80% of the g er, there is a	as wate tices the able m n tropi- es impo- ntain for s and e of appro- of non cal fore proache gemer	er regulati nreaten m nanageme cal forest ortant for orests or n xamples o oaches su -timber fo ests, agrof es and the ot will be or this mo en exam (	on and any nt of ry. No est types nangroves. of ch as orest orest orestry and e design of dule) and 70% of the
	grade). Note: The module 'Introduction to Tropical Forestry' (winter semester, 2 SWS, 3 credits) combines well will the module 'Basics of Central European Forestry' (summer semester, 2 SWS, 3 credits). For students with an interest in forestry, it is recommended to take both these modules.								
Learning	outcomes								
<ul> <li>After a su</li> <li>have acc</li> <li>have obt</li> <li>can appl</li> <li>can appl</li> <li>can give</li> <li>presentat</li> </ul>	ccessful co juired knov ained knov y acquired y obtained and mode ion).	wled wled knov knov rate	ge on important tropical forest types, ge on sustainable forest management wledge on tropical forests to identify p wledge on sustainable forest manager a scientific presentation on a selected	their distribu principles. potential ma nent to critic forest ecosy	ution and defi ngement opti- cally assess lan ystem to fellow	ning charac ons for a giv nd-use prac w students	teristic ven tro tices ad (manda	s. pical regio cross the atory stud	on. tropics. ent
2. Prerec	luisites								
obligatory	1								
recomme	nded	inte	rest in forest ecology and/or forest m	anagement					
Maximum of studen	n number ts								
3. Study	Study program allocation								
Study pro	dy program Compulsory/ Elective Semester								
M.Sc. Agri (ARTS)	icultural Sc	ienco	e and Resource Management in the Tr	ropics and Su	ubtropics		E		1./3.
M.Sc. Nat	ure Conser	vatio	on and Landscape Ecology				E		1./3.
4. Teachi	ing and le	arni	ng methodes		-	I		-	
Type of course	Interval		Торіс		Language of instruction	Group size	SWS	Work Contact time	Self- study
S	during the semester	е	tropical forestry		English	30	2,0	30,0	60,0
5. Course	e cycle			6. Workloa	ad [h]	7. Duratio	on	8. Credi	ts (ECTS)
WS				90		1		3,0	



Module Title: In	troduction to Tropical Forestry			
Module ID/Code: AR	TS-BS11 [780750110]			
9. Requirements for	r the rewarding of credits (ECTS)			
Types of Assessment	Prerequisites for admission to the Assessment	Graded	Language (exam)	Weighting
Written exam [780750119]		graded	English	70%
Presentation [780750118]		graded	English	30%
Academic Achieveme	nts	Ι		1
10. Module coordin	ation			
Module coordinator				
Dr. Alexander Röll				
Teaching person				
The teaching persons https://basis.uni-bonr	in the current semester can be found in basis: n.de/			
Institute/ Departmen	t			
Agrar-, Forst- und Erna	ährungswissenschaften			
11. Further informa	tion			



Module	Title: B	asic	s of Central European Forestry	,					
Module I	D <b>/Code</b> : A	RTS-	BS12 [780750120]						
1. Conter	ent and intended learning outcomes								
Learning content:	Forests ha control. C need for r introducto knowledg The modu	arbor limat esilie ory n e is r ile 'B	vast biodiversity and provide essenti te change and unsustainable land-use ent and sustainable restoration and m nodule for students with an interest in equired. asics of Central European Forestry' co	al ecosystem practices ar anagement forest ecolo overs the hist	n functions suc e a threat to r of the remain ogy and forest tory, ecology a	ch as water nany forest ing forest re manageme and sustain	regula ecosys esource ent. No able ma	tion and stems, c es. This previou	d erosion reating the is an us forestry ent of forests
	in Central oriented of which will place in th context, s summer s	Euro close also ne fie tude eme	ope and particularly in Germany. This to-nature forestry, wood production be discussed in the context of resilier eld as exercises related to forest inven nts have to give a 10 min poster prese ster, there is a written exam (70% of t	includes fore -oriented ma nt and sustai tory, vegeta entation (309 .he grade).	est manageme anagement, ag inable landsca tion ecology, % of the grade	ent approac groforestry pe design. I pedology ar e for this mo	hes suc and pla Part of nd silvio odule).	ch as co antation the mo culture. At the e	nservation- forestry, dule will take In this end of the
	Note: The module 'Basics of Central European Forestry' (summer semester, 2 SWS, 3 credits) combines well will the module 'Introduction to Tropical Forestry' (winter semester, 2 SWS, 3 credits). For students with an interest in forestry, it is recommended to take both these modules.								
Learning o	outcomes								
<ul> <li>have acq</li> <li>have obt</li> <li>can apply</li> <li>can apply</li> <li>can give</li> <li>presentati</li> </ul>	quired knov tained knov y acquired y obtained a scientific ion).	vledg vledg silvid knov post	ge on important Central European for ge on sustainable forest management cultural knowledge to identify potenti- wledge on sustainable forest manager cer presentation on a selected silvicult	est types, the principles. al mangeme nent to critic cural methoc	eir distribution nt options for cally assess lan t to fellow stu	n and defini a given for nd-use prac dents (man	ing cha est stai tices a datory	racteris nd. cross Ce student	tics. entral Europe. t
2. Prereg	quisites								
obligatory	y								
recomme	nded	inte	rest in forest ecology and/or forest ma	anagement					
Maximum of student	n number ts								
3. Study	program a	alloc	ation			1			
Study pro	y program Compulsory/ Elective Semester								
M.Sc. Agri (ARTS)	) Agricultural science and Resource Management in the Tropics and Subtropics E 2./4.								
M.Sc. Nati	ure Conser	vatic	on and Landscape Ecology				E		2./4.
4. Teachi	ing and lea	arni	ng methodes		I	I	1	1	
Type of	Interval		Торіс		Language of	Group	SWS	Wo	orkload [h]
course					Instruction	size		Conta	ct Self-
S	during the semester	9	Central European forestry		English	30	2,0	30,0	60,0
5. Course	ourse cycle 6. Workload [h] 7. Duration 8. Credits (ECTS)								
SS	90 1 3,0								



Module Title: Ba	sics of Central European Forestry			
Module ID/Code: AR	TS-BS12 [780750120]			
9. Requirements for	r the rewarding of credits (ECTS)			
Types of Assessment	Prerequisites for admission to the Assessment	Graded yes/no	Language (exam)	Weighting factor
Written exam [780750129]		graded	English	70%
Presentation [780750128]		graded	English	30%
Academic Achieveme	nts	·	•	•
10. Module coordin	ation			
Module coordinator				
Dr. Alexander Röll				
Teaching person				
The teaching persons https://basis.uni-bonr	in the current semester can be found in basis: n.de/			
Institute/ Departmen	t			
Agrar-, Forst- und Erna	ährungswissenschaften			
11. Further informa	tion			



### Elective modules of the second and third semester (ARTS-B) -Molecular approaches

You can choose 18-30 ECTS-CP from the elective modules. The specialisation Molecular approaches is only awarded if 24 ECTS-CP from this specialisation are completed.



Module	Title: 0	ienc	ome Analysis in Plant Breeding							
Module I	e ID/Code: ARTS-BM01 [780800480]									
1. Conter	nt and int	t and intended learning outcomes								
Learning content:	The stude are releva crops and classical p have the recent sta by trait as the estab	ints v Int to I tran Ilant Oppo Ite-o Isocia	vill be introduced to the theoretical ar o plant breeding. The primary learning sfer of improved traits for establishing breeding and the relatively recent fiel rtunity to learn a broad range of meth f-the art whole genome DNA sequenc ation, gene isolation and functional an nent of new varieties.	nd practical a aim is focus g new crop v d of molecul nods for gen ing. In additi alyses of gen	aspects of plan ed on the mo varieties. This lar genetics ar ome analysis ion, this modu nes as well as	nt genomes lecular anal area is loca nd biology. using DNA ile offers in the concep	analys lysis of ted at t Therefo marker depth t of mo	is tech inherit he jund ore, the techni learnin blecular	nique able ction e stuc ques g of r bree	es which traits in of dents and marker eding for
Learning o	outcomes									
After a sur - compreh - compreh	ccessful co bend and a bend and a	mple re ab re ab re ab re ab re ab re ab re ab	tion of the course, the students le to apply DNA marker techniques. le to apply high-throughput genotypin le to apply genome analysis using nex le to apply genetic linkage analysis an le to apply trait by gene associations a le to apply gene mapping associated t le to apply isolation of genes and thei le to apply marker-assisted selection le to apply molecular breeding and de	ng. t generation d developme analyses (QT to qualitative r allelic dive and transfer evelopment o	n sequencing r ent of linkage 'L mapping, G\ e and quantita rsity. of favorable a of improved c	nethods. maps. WAS). Itive traits. Alleles in cro rop varietie	op varie	eties.		
2. Prereo	uisites			velopment						
obligatory	/									
recomme	nded	Basi ART	c knowledge of genetics and genome S-A01, A02, A03, A04, AM05a and AM	as heredity r 05b	material					
of studen	ts	703	tudents							
3. Study	program	alloc	ation							
Study pro	gram					Compulso	ry/ Ele	ctive	Se	mester
M.Sc. Agri (ARTS)	icultural Sc	ience	e and Resource Management in the Tr	opics and Su	ubtropics		E			3.
M.Sc. Cro	p Sciences						E			3.
M.Sc. Plar	nt Sciences	es								
4. Teachi	ng and le	learning methodes								
Type of course	Interval		Торіс		Language of instruction	Group size	SWS	Wo Conta	orklo act	ad [h] Self-
								tim	e	study
L	during the semester	9			English	70	2,0	30,0	)	60,0
P (blocked)	full-day b	lock			English	10	2,0	30,0	)	60,0
5. Course	e cycle		6. Workload [h] 7. Duration 8. Credits (ECTS)							
WS			180 1 6,0							



Module Title: Ge	enome Analysis in Plant Breeding			
Module ID/Code: AR	TS-BM01 [780800480]			
9. Requirements for	r the rewarding of credits (ECTS)			
Types of Assessment	Prerequisites for admission to the Assessment	Graded yes/no	Language (exam)	Weighting factor
Written exam [780800489]		graded	English	100%
Report (presentation) [780800488]		not graded	English	0%
Academic Achieveme	nts			•
10. Module coordin	ation			
Module coordinator				
Prof. Dr. Annaliese Ma	ason			
Teaching person				
The teaching persons https://basis.uni-bonr	in the current semester can be found in basis: n.de/			
Institute/ Departmen	t			
Agrar-, Forst- und Erna	ährungswissenschaften			
11. Further informa	tion			



Module	Title: C	rop	Abiotic Stresses								
Module I	<b>D/Code:</b> A	RTS	-BM02 [780800220]								
1. Contei	nt and int	end	ed learning outcomes								
Learning content:	Students deficienci monitored measuren in the labo in which t this stress <b>outcomes</b> ccessful co	carry es, s d reg nent orat hey , an mple	y out experiments in the greenhouse, salinity, drought, submergence and iro gularly by non-invavise measurements ts, gas exchange measurements, etc. P ory, such as mineral analyses. At the e provide scientific background on one d present their own results. etion of the course, the students	in which crop n toxicity). S is including m Plants are the end of the mo particular ab	ps are expo tress respo anual pher en harveste odule, stud piotic stress	osec onse noty ed a lent s, pr	d to differe es in contra ving, spectr nd subjecte s present a resent a scie	nt abic sting g al refle ed to b semin entific	otic stre enotyp ctance iochem ar talk paper c	esses es ar iical a and dealir	(nutrient e analyses a report, ng with
- will be al - will be al - will be al - will be al - summari	ble to prep ble to diag ble to com be to devis ze, report	are nios oare e an and	and execute stress experiments with one e and analyze stress response in plant e and evaluates the stress response in and design meaningful stess experiment write-up results and drw cronclusions	crops. ts. different gents ts with crops from them.	notypes.						
2. Prereq	uisites										
obligatory	/										
recomme	nded	Bas	ic understanding of plant stress biolog	gy and (bio)cl	hemistry						
Maximum of studen	n number ts	30 s	students								
3. Study	program a	allo	cation								
Study pro	gram						Compulso	ory/ Ele	ective	Se	mester
M.Sc. Agri (ARTS)	cultural Sc	ienc	e and Resource Management in the Ti	ropics and Su	ubtropics			E			2.
M.Sc. Cro	o Sciences						E Foc	us PER	С		2.
4. Teachi	ng and le	arni	ing methodes								
Type of course	Interval		Торіс		Language instructio	of on	Group size	SWS	W Conta tim	orklo act e	ad [h] Self- study
(blocked)	block				LIIGIISII		15	4,0	00,	0	120,0
5. Course	e cycle			6. Workloa	ad [h]		7. Duratio	on	8. Cre	dits	(ECTS)
SS				180			1		6,0		
9. Requir	ements f	or tl	he rewarding of credits (ECTS)								
Types of A	Assessmen	t Pi	rerequisites for admission to the Asse	essment		Gr ye:	aded s/no	Langu (exam	iage 1)	We fact	ighting tor
Presentati [78080022	ion 29]	Pa	articipation in the practical work			gra	aded	Englis	h	50%	0
Report [78080022	28]	Pa	articipation in the practical work			gra	aded	Englis	h	50%	6
Academic	Achievem	ents	5			•				•	
1											



### Module Title: Crop Abiotic Stresses Module ID/Code: ARTS-BM02 [780800220] 10. Module coordination Module coordinator Prof. Dr. Mathias Becker Teaching person The teaching persons in the current semester can be found in basis: https://basis.uni-bonn.de/ Institute/ Department Agrar-, Forst- und Ernährungswissenschaften 11. Further information



Module	Title: S	oil microbi	ology									
Module I	<b>D/Code:</b> A	RTS-BM04 [73	80790180]									
1. Contei	nt and into	ended learn	ing outcomes									
Learning content:	In this mo microorga biogeoche factors tha that allow In the tuto advance. In the sem	dule, student nisms is intro mical cycles, at determine to analyze th orial, recently ninar, each stu	s gain advanced oduced and the especially their life of soil micro pe presence and published resea	d knowledge i role of micro important ro organisms w activity of m arch articles v ent a specific i	in soil microk organisms in ole in carbon rill be discuss icroorganisn will be jointly research arti	piology. In soils is dis and nitrog sed. Metho ns in soil. / discussed cle.	the lescusse gen cy odolo I. Stu	ectures, ti ed. This in ycling. Fui gical appi dents hav	he soil a icludes rthermo roaches re to rea	as habit their co ore, bio will be ad thes	at fo ontrib tic ar expl e art	r oution to nd abiotic ained icles in
Learning o	outcomes											
After a suc - have obt methods u - can sum - are able - can critic	ccessful con ained know used to stu- marize the to prepare cally evalua	npletion of tl vledge about dy soil microc findings of ar and present te research a	he course, the si the life of micro organisms. Ind discuss resea research results rticles.	tudents porganisms in rch articles in and discuss	n soil, the fur n the field of them with th	nctions mic soil microl ne audience	croor biolo e.	ganisms fi gy.	ulfill in :	soil and	l abo	ut
2. Prerec	luisites											
obligatory	/											
recomme	nded											
Maximum of studen	n number ts	20 students										
3. Study	program a	im allocation										
Study pro	gram		Compulsory/ Elective Semester									
M.Sc. Agri (ARTS)	cultural Sci	ence and Res	source Manager	nent in the T	ropics and Si	ubtropics			E			2.
M.Sc. Nat	ure Conser	vation and La	ndscape Ecolog	У					E			2.
M.Sc. Cro	o Sciences							E Foo	cus MCS	5		2.
4. Teachi	ng and lea	arning meth	odes									
Type of course	Interval	Торіс				Language instructio	e of on	Group size	SWS	Wo Conta time	orklo act e	ad [h] Self- study
L	during the	2				English		20	2,0	20,0	C	60,0
т	during the semester	2				English		20	0,5	5,0		40,0
S	during the semester				-	English		20	1,5	15,0	)	40,0
5. Course	e cycle				6. Workloa	ad [h]	7	7. Durati	on	8. Cre	dits	(ECTS)
SS		180 1 6,0										
9. Requir	ements fo	or the rewar	ding of credits	s (ECTS)					1.			
Types of A	Assessment	Prerequisit	tes for admissio	n to the Asse	essment		Gra	ded /no	Langu	age	Wei	ighting
Presentati [78079018	ion 39]						grad	led	Englis	h	50%	, <b>01</b>
Written ex [78079018	kam 38]						grac	led	Englis	h	50%	, D
Academic	Achievem	ents					1		1		1	



# Module Title: Soil microbiology Module ID/Code: ARTS-BM04 [780790180] 10. Module coordination Module coordinator Prof. Dr. Claudia Knief Teaching person The teaching persons in the current semester can be found in basis: https://basis.uni-bonn.de/ Institute/ Department Agrar-, Forst- und Ernährungswissenschaften 11. Further information Teaching person



Module	Title: A	nim	nal breeding and genetics								
Module ID	<b>D/Code:</b> A	RTS-	BM05 [780750050]								
1. Conter	nt and inte	ende	ed learning outcomes								
Learning content:	From this - principle - animal ge - modern a broading	cour s of enet anim	rse students are going to learn animal breeding and genetics tic resources nal breeding techniques	vorsity.							
Learning o	- breeding	tor	sustainable animal production and div	/ersity							
After a suc	rcessful cou	nnle	ation of the course, the students								
- understa - understa - understa	ind the scie and breedin and various	ntifi Ig sti anir	ic explanation about animal breeeding rategies. nal genetic resources and their effecti	; and genetic ve utilizatior	cs. ns.						
2. Prereq	uisites										
obligatory	1										
recomme	nded	ART	S-A01, A02, A03, A04, AM05a and AM	05b							
Maximum of student	number ts	25 s	tudents								
3. Study	program a	alloc	cation								
Study pro	gram						Compulso	ory/ Ele	ctive	Sem	ester
M.Sc. Agri (ARTS)	cultural Sci	ence	e and Resource Management in the Tr	opics and Su	ubtropics			E		2	2.
4. Teachi	ng and lea	arni	ng methodes								
Type of	Interval		Торіс		Language	of	Group	SWS	W	orkload	l [h]
course					instructio	n	size		Conta	act	Self-
	- (1				Eu aliah		25	1.0	tim	e :	study
L (blocked)	afternoon block				English		25	1,0	15,0	0	75,0
S (blocked)	afternoon block				English		25	1,0	15,	0	75,0
5. Course	cycle			6. Workloa	ad [h]		7. Durati	on	8. Cre	edits (E	CTS)
SS				180			1		6,0		
9. Requir	ements fo	or th	ne rewarding of credits (ECTS)								
Types of A	ssessment	t Pr	erequisites for admission to the Asse	ssment		Gr	aded	Langu	age	Weigh	nting
		_				ye	s/no	(exam	1)	factor	•
Written ex [78075005	kam 59]					gra	aded	Englis	h	70%	
Presentati [78075005	on 58]					gra	aded	Englis	h	30%	
Academic	Achievem	ents	i								
10. Modu	ule coordi	nati	on								
Module co	oordinator										
Dr. Ernst T	holen										
Teaching	person										
The teaching	ing persons	s in t	the current semester can be found in b	pasis:							
Institute/	Departme	nt.ae	e/								
Agrar- Fo	rst- und Fri	nähr	ungswissenschaften								
11. Furth	er inform	atio	n								



Module	Title: A	dva	ances in Plant Breeding Method	ology						
Module II	D <b>/Code</b> : A	RTS-	-BM07 [780800470]							
1. Conte	nt and int	end	ed learning outcomes							
Learning	The stude	nts v	will learn to construct a plant breeding	program by	<pre>regarding s</pre>	everal scena	rios. Th	ie goal	is to	maximize
content:	the select	ion i will l	response of different populations when	n different r	estrictions a	re met. New lant breeding	anaiyt '	ical and	i moi	ecular
Learning	outcomes	vv III I		xperties in ti	ne area or p		5.			
After a su	ccessful co	mple	etion of the course, the students							
- know an	d understa	nd ii	nnovation in breeding methodology.							
- know an	d understa	nd f	ield evaluations for optimized selection	n process.						
- know an	d understa	nd h	nigh-throughtput phenotyping.							
- know an	d understa	nd g	enetic gain and selection theory.							
- know an	d understa	nd f	uture breeding methodologies.	~						
2 Prerec		na c	RISPR-Cas mediated precision breeding	lg.						
obligatory	/									
recomme	, nded	Fun	damental of knowledge of plant breed	ling and gen	etics					
Maximum	numbor	20 6	tudents							
of studen	ts	50 5	students							
3. Study	program a	allo	cation							
Study pro	gram					Compulso	ory/ Ele	ective	Se	emester
M.Sc. Agri	- icultural Sc	ienc	ce and Resource Management in the Tropics and Subtropics E 2.							
(ARTS)			ç	•	•					
M.Sc. Cro	p Sciences						E			2.
M.Sc. Plar	nt Sciences									
4. Teachi	ng and le	arni	ng methodes					T		
Type of	Interval		Торіс		Language o	of Group	SWS	W	orklo	oad [h]
course					instruction	size		Cont	act	Self-
	during the				Englich	20	2.0	20	e o	study
L	semester	=			LIIGIISII	50	2,0	50,	0	00,0
S	full-day b	ock			English	15	2,0	30,	0	60,0
(blocked)					5			,		
5. Course	e cycle			6. Workloa	ad [h]	7. Durati	on	8. Cre	dits	(ECTS)
SS				180		1		6,0		
9. Requir	ements f	or th	ne rewarding of credits (ECTS)				1		1	
Types of A	Assessmen	t Pr	rerequisites for admission to the Asse	ssment	(	Graded	Langu	lage	We	ighting
Ducient	l.:				Y	/es/no	(exan	<u>1)</u>	fact	tor
Project we	Drk 701				٤	graded	Englis	n	100	)%
[7808004	/9]									
Report					1	not graded	Englis	h	0%	
(presenta	tion)									
[7808004]	78]									
Acadomia	Achiovar	onto								
Academic	Acmevem	ents	,							



Module Title: Advances in Plant Breeding Methodology
Module ID/Code: ARTS-BM07 [780800470]
10. Module coordination
Module coordinator
Dr. Mariana Báez
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module	Title: P	roje	ects in Crop Protection Researc	h						
Module I	D <b>/Code:</b> A	RTS-	BM08 [780800270]							
1. Conter	nt and int	end	ed learning outcomes							
Learning	Project ac	tiviti	ies are conducted in close association	with ongoin	g research p	rojects, pern	nitting t	the app	olicati	ion of
content:	<b>content:</b> state-of-the art methodologies and leading to an in-depth understanding of research concepts and problems associated with microbial and animal pathogenic organisms.									IS
Learning o	Learning outcomes									
After a su	After a successful completion of the course, the students									
- are able to appropriately select and apply methods required for specific research questions.										
- are able	to underst	and	and analyze scientific literature.	•	·					
- are able	to plan a s	cient	tific project.							
2. Prereq	luisites									
obligatory	/									
recomme	nded									
Maximum	n number	10 s	tudents							
of studen	ts									
3. Study	program a	alloc	cation			-				
Study pro	gram					Compulse	ory/ Ele	ective	Se	mester
M.Sc. Agri (ARTS)	cultural Sc	ienco	e and Resource Management in the Tr	opics and Su	ubtropics		Е			2./3.
(ARTS) E Focus PERC 2./3.								2./3.		
4. Teachi	ng and le	arni	ng methodes							-
Type of	Interval	-	Topic Language				SWS	w	Workload [h]	
course					instruction	size		Cont	act	Self-
								tim	e	study
Proj	during the	5			English	10	3,0	45,	0	90,0
	semester									
S	during the	5			English	10	1,0	15,	0	30,0
5. Course	cycle			6. Worklo	ad [h]	7. Durati	on	8. Cr	dits	(ECTS)
WS/SS	•			180		1		6,0		
9. Requir	ements f	or th	ne rewarding of credits (ECTS)			•				
Types of A	Assessmen	t Pr	erequisites for admission to the Asse	ssment	Ģ	iraded	Langu	age	We	ighting
			-		у	es/no (exam		n) factor		tor
Report					g	raded	Englis	h	80%	6
(presentat	tion)									
[78080027	79]									
Assignme	nt				g	raded	Englis	English 20%		
[78080027	78]									
Academic	Achievem	ents			I		<u> </u>			
10. Modu	ule coordi	nati	ion							
Module co	oordinator									
Prof. Dr. F	lorian Gru	ndler	r							
Teaching	person									
The teach	ing person	s in t	the current semester can be found in t	basis:						
https://ba	isis.uni-boi	nn.de	e/							
Institute/	Departme	nt								
Agrar-, Fo	rst- und Er	nähr	ungswissenschaften							
11. Furth	er inform	atio	on							
·										



### **Cross-cutting modules of the second and third semester**

You can choose 18-30 ECTS-CP from the elective modules.



Module	Title: L	and	use and land degradation									
Module I	<b>D/Code:</b> A	RTS-	BC02 [780750060]									
1. Conter	nt and int	end	ed learning outcomes									
LearningLearn about land uses, resource management strategies and their implicationscontent:Apply simple field methods for ecosystem analysis												
Present case studies												
Learning o	outcomes											
After a suc	After a successful completion of the course, the students											
- land uses	s, resource	mar	nagement strategies.									
- ability to	analyze in	nplic	ations of different strategies.									
- compile	a case stuc	ly an	id present to plenum.									
2. Prereq	uisites ,											
recomme	nded	Com	anlation of >24 ECTS out of APTS_A									
	ilueu	25										
of student	ts	25 S	students									
3. Study	program	alloc	cation									
Study pro	gram						Compulso	ory/ Ele	ctive	Se	emester	
M.Sc. Agri (ARTS)	cultural Sc	ience	e and Resource Management in the Tr	ropics and Su	ubtropics			E			2.	
4. Teachi	ng and le	arni	ng methodes				L					
Type of	Interval		Торіс		Language	of	Group	SWS W		orkload [h]		
course					instructio	n	size		Cont	act	Self-	
									tim	e	study	
E (blocked)	full-day b	ock			English		25	4,0	60,	0	120,0	
5. Course	cycle			6. Workloa	ad [h]	7. Duration		on	n 8. Cre		edits (ECTS)	
SS				180			1 6		6,0			
9. Requir	ements f	or th	ne rewarding of credits (ECTS)									
Types of A	Assessmen	t Pr	rerequisites for admission to the Asse	ssment		Graded Language			age	Weighting		
						yes/no (exar			1) factor		tor	
Presentati	on					no	t graded	Englis	h	0%		
[/80/5006	99]											
Report						σr	aded	Fnglis	h	100	)%	
[78075006	58]					6.,		21.81.5		100	,,,,	
	_											
Academic	Achievem	ents	5									
10. Modu	ule coordi	nati	ion									
Module co	oordinator											
PD Dr. Joh	annes Bot	sche	k									
Teaching	person											
The teach	ing person	s in t	the current semester can be found in b	pasis:								
https://ba	sis.uni-boi	nn.de	e/									
	Departme	nt	ungowies on schoft or									
Agrar-, FO		nanr										
11. Furth	erintorm	atio										



Module	Title: D	Development Economics							
Module I	D/Code: A	RTS-BC03 [780763240]							
1. Conte	nt and int	ended learning outcomes							
Learning content:	Empirical developm managem discussior transition change in	patterns in economic development, e ent across countries, including the rol ent of natural resources for developm of empirical policy problems, specifi , the impact of high resource endowm developing countries.	conomic grow le of institutior nent and pover cally, regardin nents on develo	th models, cau ns, labor marke ty reduction: l g water and la opment, oppol	ses of differo ets and migra eey theoretic nd managem tunities and	ential e ation. S al conc ient, er challer	conomi ustainal cepts, cr nergy ac nges pos	c gro ble titica ccess sed b	wth and I and by climate
Learning	outcomes								
After a su - are able - can expl developm - are able - can cont - will appr - are able 2. Prerec obligator	accessful co to describe lain the role nent. to apply le trast metho raise empir to generali quisites y ended	mpletion of the course, the students e key concepts and structure of econo e of institutions, labor markets, migrat arned concepts for analysis of develop ods for conducting research on sustain ical examples through case studies. ize lessons learnt from case studies to Modules "Advanced Applied Econom and "Economics of Sustainability"	mic growth mo ion and sustain oment polices. able natural re broader devel etrics", "Resea	odels and drive nable natural r esource manag opment issues rch Seminar o	ers of socio-e esource mar ement topic n agricultura	s.	ic devel ent for e	lopm	ient. omic
Marinerus		and "Economics of Sustainability"							
of studen	n number hts								
3. Study	program a	allocation							
Study pro	ogram				Compuls	ory/Ele	ective	Se	mester
M.Sc. Agr	icultural an	d Food Economics				E			2.
M.Sc. Agr (ARTS)	icultural Sc	ience and Resource Management in th	he Tropics and	Subtropics		E			2.
4. Teach	ing and le	arning methodes							
Type of	Interval	Торіс		Language o	f Group	SWS	Wo	orklo	ad [h]
course				instruction	size		Conta time	act e	Self- study
L	during the semester	e Development Economics		English	25	2,0 30,		C	60,0
т	during the semester	e Assignement		English	25	2,0	30,0	C	60,0
5. Course	e cycle		6. Work	load [h]	7. Durati	on	8. Cre	dits	(ECTS)
SS			180		1		6,0		
9. Requir	rements fo	or the rewarding of credits (ECTS) t Prerequisites for admission to the	Assessment	(	Graded ves/no	Langu (exan	iage n)	We fac	ighting tor
[7807632 Academic	49] c Achievem	ents			ומעכע				



Module Title: Development Economics
Module ID/Code: ARTS-BC03 [780763240]
10. Module coordination
Module coordinator
Prof. Dr. Matin Qaim
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module	Title: De	ecision Analysis and Fore	casting in	Agricultu	ire							
Module I	D/Code: AR	TS-BC05 [780800230]	U									
1. Content and intended learning outcomes												
Learning - Introduction to decision analysis												
content:	- Forecastir	ng and cognitive biases										
	- Calibratio	n training										
	- Participat	ory modeling building										
	- Decision r	nodeling in R										
- Group project on decision analysis												
Learning o	outcomes											
After a suc	ccessful com	pletion of the course, the stud	lents									
- will unde	erstand the v	value of decision analysis appro	paches for a	agricultural	research.							
- will be al	ble to recog	nize their own biases and provi	ide accurat	e range esti	mates for u	uncertain var	iables.					
- will be al	ble to analyz	e a decision context.										
- will be al	ble to draw	conclusions from a decision mo	odel and re	commend s	teps forwa	rd.						
- will be al	bie to develo	op decision models, comprehei	nsively eva	iuate their f	indings and	a compose a	report a	bout th	ie mo	ael they		
developed	1. •••											
2. Prereq	luisites											
obligatory	/											
recomme	nded											
Maximum	number 3	0 students										
of studen	ts											
3. Study	program al	location										
Study pro	gram					Compul	sory/ Ele	ective	Se	mester		
M.Sc. Agri (ARTS)	cultural Scie	nce and Resource Managemer	nt in the Tr	opics and Su	ubtropics		E			2.		
M.Sc. Cro	o Sciences					E Fo	cus PER	С		2.		
4. Teachi	ng and lea	rning methodes										
Type of	Interval	Торіс			Language	of Group	SWS	W	orklo	ad [h]		
course					instructio	n size		Conta	act	Self-		
								tim	e	study		
L	during the	Decision analysis and parti	cipatory m	odeling	English	24	2,0	30,	0	30,0		
(blocked)	semester											
PS	during the	Practical decision analysis	project		English	12	2,0	30,	0	90,0		
(blocked)	semester			a 11						(		
5. Course	e cycle			6. Workloa	ad [h]	7. Dura	7. Duration 8. Cre			edits (ECTS)		
SS				180		1		6,0				
9. Requir	ements fo	r the rewarding of credits (E	ECTS)						-			
Types of Assessment Prerequisites for admission to the As			o the Asse	ssment		Graded yes/no	Langı (exan	iage n)	Weighting factor			
Project wo	ork					not graded	Englis	h	0%			
[78080023	39]											
Report Project work complete, so that a re			at a report	on it can be		graded	Englis	h	100	%		
[78080023	38]	composed	·			-						
<b>.</b>												
Academic	Achieveme	nts										



### Module Title: Decision Analysis and Forecasting in Agriculture

Module ID/Code: ARTS-BC05 [780800230]

### 10. Module coordination

### Module coordinator

Prof. Dr. Eike Lüdeling

### **Teaching person**

The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

### Institute/ Department

Agrar-, Forst- und Ernährungswissenschaften

### 11. Further information

Hubbard, 2014. How to Measure Anything: Finding the Value of "Intangibles" in Business (3rd edition). Wiley.

Luedeling and Shepherd, 2016. Decision-focused agricultural research. Solutions 7, 46-54.

https://www.thesolutionsjournal.com/article/decision-focused-agricultural-research/

Whitney et al., 2018. Decision analysis methods guide. Working paper, World Agroforestry Centre, Nairobi.

https://www.researchgate.net/publication/324978583\_Decision\_analysis\_methods\_guide\_agricultural\_policy\_for\_nutrition Lanzanova et al., 2019. Improving development efficiency through decision analysis: Reservoir protection in Burkina Faso.

Environmental Modelling & Software 115: 164–175. (contact instructors)

Shepherd et al., 2015. Development goals should enable decision-making. Nature 523: 152–154.

https://www.nature.com/news/policy-development-goals-should-enable-decision-making-1.17915

Whitney et al., 2017. Homegardens and the future of food and nutrition security in southwest Uganda. Agricultural Systems 154: 133–144. (contact instructors)



Module	Title: Ag	icultural Entomology								
Module ID/Code: ARTS-BC06 [780800080]										
1. Content and intended learning outcomes										
Learning content: Learning After a su - have obt - are able	Insects are r module incr beneficial ar - Functional - Identificati - Host-paras - Developme - Case studie - Antagonist - Use of inse - Options for - Insecticide outcomes ccessful comp tained specific	aed learning outcomes najor pests in agriculture but can pro- eases the in-depth understanding of ad harmful organisms regarding the morphology and anatomy on of insects ite interactions ent of symptoms es from major crop types s of insect pests cts in IPM apporaches insect control resistance	ovide benefitial f enthomologica follogiwng aspe	effects suc Il aspects in cts:	h as pollinatic agriculture a	n or pe nd pres	st contr ents ex	ol. Tł	nis es of	
- can expl	ain specific pr	oblem issues related to biocontrol o	or the use of ins	ecticides.						
2. Prerec	quisites									
obligator	y									
recomme	nded									
Maximun of studen	n number 20 ts	) students								
3. Study	program all	ocation								
Study pro	gram				Compuls	ory/ Ele	ective	Sei	mester	
M.Sc. Agr (ARTS)	icultural Scier	ice and Resource Management in th	e Tropics and S	ubtropics		E			2.	
M.Sc. Cro	p Sciences				E Foo	cus PER	C		2.	
4. Teach	ing and lear	ning methodes			-1					
Type of course	Interval	Торіс		Language instructio	of Group n size	SWS	Wo Conta time	orkloa Ict	ad [h] Self- studv	
L (blocked)	full-day bloc	k Agricultural Entomology			20	2,0	10,0	)	50,0	
Т	during the semester	Agricultural Entomology		English	20	1,0	40,0	)	20,0	
S	during the semester	Agricultural Entomology		English	20	1,0	40,0	)	20,0	
5. Course	e cycle		6. Worklo	ad [h]	7. Durati	on	8. Cre	dits	(ECTS)	
SS			180		1		6,0			
9. Requi	rements for	the rewarding of credits (ECTS)								
Types of <i>I</i>	Types of Assessment Prerequisites for admission to the Assessment			Graded yes/no	Language (exam)		Weighting factor			
Report (presenta [7808000	tion) 89]				graded	Englis	h	80%		
Assignme [7808000	nt 88]				graded	Englis	h	20%		
Academic	Achievemen	ts								


# Module Title: Agricultural Entomology Module ID/Code: ARTS-BC06 [780800080] 10. Module coordination Module coordinator Prof. Dr. Florian Grundler Teaching person The teaching persons in the current semester can be found in basis: https://basis.uni-bonn.de/ Institute/ Department Agrar-, Forst- und Ernährungswissenschaften 11. Further information



Module	Title: A	gricu	ultural Nematology								
Module I	<b>D/Code</b> : A	RTS-B	3C07 [780800090]								
1. Conte	nt and int	ende	d learning outcomes								
Learning content: Learning After a su - familiar - able to p - explain a	The modu plant-para -functiona -identifica -host-para -developm -case stuc -nematod -applicatio -options f outcomes accessful co with specif present anc	alle pro asitic al mor ation o asite i nent o dies in le anta on and or nei mplet ic nen d explate spe	ovides in-depth knowledge in Agricu and entomopathogenic nematodes i rphology and anatomy of nematodes interactions and their mechanisms of plant symptoms i important crop plants agonists d mode of action of entomopathoge matode control tion of the course, the students natological expertise. ain complex biological situations. ecific problems in nematode pest con	ltural Nemat s presented i nic nematod	ology. The including t e lication of	biol he fo	ogy of the ollowing to	most ir pics:	nporta	nt gr	oups of
2. Prerec	quisites	.e spe	ene proveno in nematore pest con			2011			-		
obligator	y										
recomme	ended										
Maximun of studen	n number its	25 st	udents								
3. Study	program a	alloca	ation								
Study pro	ogram						Compulso	ory/ Ele	ctive	Se	mester
M.Sc. Agr	icultural Sc	ience	and Resource Management in the T	ropics and Su	ubtropics			E			3.
M.Sc. Cro	p Sciences						E Foc	us PER	2		3.
4. Teach	ing and le	arnin	g methodes								
Type of	Interval	-	Topic		Language	of	Group	SWS	W	orklo	ad [h]
course					instructio	n	size		Conta tim	act e	Self- study
L	during the semester	e /	Agricultural Nematology		English		25	2,0	30,	0	60,0
Т	during the semester	e /	Agricultural Nematology		English		25	1,0	15,	0	30,0
S	during the semester	e /	Agricultural Nematology		English		25	1,0	15,	0	30,0
5. Course	e cycle			6. Workloa	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)
WS				180			1		6,0		
9. Requi	rements f	or the	e rewarding of credits (ECTS)			r		1		1	
Types of <i>I</i>	Assessmen	t Pre	erequisites for admission to the Asse	essment		Gra ves	ided /no	Langu (exam	age 1)	We fact	ighting or
Report (presenta [7808000	tion) 99]					gra	ded	Englis	h	80%	,
Assignme [7808000	nt 98]					gra	ded	Englis	h	20%	, )
Academic	c Achievem	ents									



Module Title: Agricultural Nematology
Module ID/Code: ARTS-BC07 [780800090]
10. Module coordination
Module coordinator
Prof. Dr. Florian Grundler
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



Module	Title: Su	ustainable Entrepreneurship	o & Ve	nturing							
Module I	<b>D/Code:</b> Af	RTS-BC08 [780750100]									
1. Conter	nt and inte	ended learning outcomes									
Learning content: Learning of After a suc - understa - are able - have kno	The modul entreprene sustainable which ence entreprene Building or entreprene develop a develop id Students a and turn th business ic putcomes ccessful cor nd the spe to apply to wledge and	le "Sustainable Entrepreneurship & eurship may help foster urgent sus eurial process of discovering, evalu e development. During the course, ompasses the fundamentals of ent eurial tools for sustainability. In this, sustainable venturing embra eurship to solve global social and e sustainable business idea. Course eas for solutions, analyse and eval re guided through the process of a nem into business models. Student dea.	& Ventu stainab uating, , studen trepren acces an environ particip luate al applyin; ts are a ts able en a genera te, and	uring" is desig ility transforr and implements will explo eurship and active role a mental challe bants will be ternatives, and g entreprene lso familiariz trepreneursh ation and eva determine sp	gned for sti mations. The enting new re the com- sustainable and aims to enges. In the able to ide nd develop eurial tools ed with co hip. aluation. ustainable	ude ne n bus cep e bu ha nis c ntif o pla to a nce	nts interes nodule pro siness idea t of sustair isiness mod rness the in context, stu y social and advance th pts and to siness mod	ted in s vides a s and m hable en dels as idents v d enviro ement eir entr ols for p els.	tart-up n overv odels t htreprei well as ve pow will wor onment their so eprene oresent	s and iew o o pro neur: er of k in ral pr lutio urial ing tl	d how of the omote ship, teams to oblems, n. ideas heir
- create th	e foundatio	ons of an entrepreneurial mindset.	•								
2. Prereq	uisites										
obligatory	1	none									
recomme	nded	none									
Maximum	number	25 students									
3 Study	nrogram a	llocation									
Study pro	program gram						Compulse	orv/ Fle	ctive	Se	mester
M.Sc. Agri (ARTS)	cultural Sci	ence and Resource Management i	n the T	ropics and Su	ubtropics		computer	E			2.
M.Sc. Nut	rition Scien	се						E			2.
M.Sc. Mol	ecular Food	l Technology						E			2.
4. Teachi	ng and lea	rning methodes									
Type of course	Interval	Торіс			Language instructio	of n	Group size	SWS	Wo Conta time	orklo act e	ad [h] Self- study
L (blocked)	full-day blo	pck			English		25	2,0	30,0	)	60,0
pT (blocked)	full-day blo	ock			English		25	2,0	30,0	)	60,0
5. Course	cycle			6. Workloa	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)
SS				180			1		6,0		
9. Requir	ements fo	r the rewarding of credits (ECT	rs)								
Types of A	ssessment	Prerequisites for admission to t	he Asse	essment		Gra ye:	aded s/no	Langu (exam	age I)	Wei fact	ighting or
Project wo [78075010	ork )9]	Regular participation				gra	aded	Englis	h		
Academic	Achieveme	ents				l		1		I	



Module Title: Sustainable Entrepreneurship & Venturing
Module ID/Code: ARTS-BC08 [780750100]
10. Module coordination
Module coordinator
Prof. Dr. Denise Fischer-Kreer
Teaching person
The teaching persons in the current semester can be found in basis:
https://basis.uni-bonn.de/
Institute/ Department
Agrar-, Forst- und Ernährungswissenschaften
11. Further information



# Compulsory modules of the second and third semester (ARTS-C)

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



Module	Title: C	urre	ent issues of research managem	nent						
Nodule IL	D/Code: A	15-	-C01 [780750070]							
1. Conter	nt and inte	ende	ed learning outcomes							
Learning	New trend	ls in	resource management							
content:	(presentat	ions	s by invited guest speakers)							
	Participati	on a	at international conference (Tropentag	;)						
Learning o	outcomes									
After a suc	ccessful cor	nple	etion of the course, the students							
- have lea	rned about	curi	rent issues in resource management.							
- have exe	rcised disc	JSSI	ng implications with speakers.							
- are able	to analyze	and	synthesize information acquired at Tro	opentag con	ference.					
2. Prereq	uisites									
obligatory	/									
recomme	nded									
Maximum of student	n number ts	60 s	students							
3. Study	program a	lloc	cation							
Study pro	gram					Compulso	ory/ Ele	ctive	Se	mester
M.Sc. Agri	cultural Sci	ence	e and Resource Management in the Tr	opics and Su	ubtropics		C			2.+3.
(ARTS)										
4. Teachi	ng and lea	irni	ng methodes		1					
Type of	Interval		Торіс		Language	of Group	SWS	Wo	orklo	ad [h]
course					instruction	n size		Conta	act	Self-
								time	e	study
L	during the				English	60	3,0	50,0	)	50,0
	semester									
S*	during the				English	60	1,0	20,0	)	60,0
	semester									
5. Course	e cycle			6. Workloa	ad [h]	7. Durati	on	8. Cre	dits	(ECTS)
WS+SS				180		2		6,0		
9. Requir	ements fo	or th	he rewarding of credits (ECTS)			•				
Types of A	Assessment	Pr	rerequisites for admission to the Asses	ssment		Graded	Langu	age	We	ighting
1			·			ves/no	(exam	າ)ັ	fact	tor
Presentati	ion	Pa	articipation (presence) at >20 lectures/	'seminars		not graded	Englis	<u>,</u> h		
[78075007	79]					0	Ū			
-										
Academic	Achievem	ents	5							
10. Modu	ule coordi	nati	ion							
Module co	oordinator									
Kai Behn										
Teaching	person									
The teach	ing persons	in t	the current semester can be found in b	basis:						
https://ba	isis.uni-bon	n.de	e/							
Institute/	Departme	nt								
Agrar-, Fo	rst- und Err	nähr	rungswissenschaften							
11. Furth	er inform	atio	on							



Module	Title: S	cier	ntific communication								
Module II	D/Code: A	RTS-	-C02 [780800190]								
1. Conte	nt and int	end	ed learning outcomes								
Learning content:	Students theses, p	aqui epai	re technical skills to effectively commu ring posters, oral presentations)	unicate with	other scier	ntis	ts (writing o	of rese	arch pa	pers	and
Learning	outcomes										
After a su	ccessful co	mple	etion of the course, the students								
- know ab	out scienti	fic co	ommunication strategies.								
- are able	to target r	esera	ach journals based on aim and scopes.								
- can strue	cture scien	tific	data for oral presentations.								
- can arra	nge resear	ch da	ata in the form of posters.								
- can anal	yze resear	:h pa	apers.								
- can com	pose own	eser	rach paper.								
2. Prerec	quisites										
obligatory	Y										
recomme	nded	all c	compulsory modules ARTS A								
Maximum of studen	n number ts	50 s	students								
3. Study	program	allo	cation								
Study pro	gram						Compulso	ry/ Ele	ctive	Se	mester
M.Sc. Agri (ARTS)	icultural Sc	ienc	e and Resource Management in the Tr	opics and Su	ibtropics			C			3.
M.Sc. Cro	p Sciences						E Foci	us PER	2		3.
4. Teachi	ing and le	arni	ng methodes								
Type of	Interval		Topic		Language	of	Group	SWS	W	orklo	ad [h]
course					instructio	n	size		Conta	act	Self-
									tim	e	study
L (blocked)	afternoor block	I			English		50	2,0	30,0	D	70,0
P (blockod)	afternoor				English		50	2,0	20,0	C	60,0
5 Course				6 Worklog	d [b]		7 Duratio	 n	8 Cre	dite	(FCTS)
W/S				180	ia [ii]		1	<b>,</b> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	6.0	unts	(LCI3)
9. Requi	rements f	or th	ne rewarding of credits (ECTS)	100			-		0,0		
Types of A	Assessmen	t Pr	rerequisites for admission to the Asse	ssment		Gra	aded	Langu	age	Wei	ghting
.,,						ye	s/no	(exam	- 8- 1)	fact	or
none									-		
Academic	Achievem	ents	5								
at least 3	group exer	cises	s must be submitted								
10. Mod	ule coord	nati	ion								
Module c	oordinato										
Dr. Janina	Dierks										
Teaching	person										
The teach	ing person	s in 1	the current semester can be found in b	basis:							
https://ba	asis.uni-bo	nn.d	e/								
Institute/	Departme	nt									
Agrar-, Fo	rst- und Er	nähr	rungswissenschaften								
11 Eurth											
11.1010	ner inform	atio	on								



Module	Title: S	Sustainability and Risk
Module I	D <b>/Code</b> : A	RTS-C03 [780764260]
1. Conter	nt and int	ended learning outcomes
Learning content:	Knowledg change ar teaching	ge about sustainability, risk(s) and transformation is key to understanding the societal challenges of global nd to considering them in one's own field of action. In this course we take an interdisciplinary approach to these concepts integrating knowledge from social and natural theory and science.
	Starting f associate the terms theoretic discussing including	rom the current state of global sustainability problems and transformation perspectives as well as d political processes, this interdisciplinary and multi-perspective course first illustrates the fundamentals of s 'sustainability', 'risk' and ' transformation' as well as other related concepts and terms. Building on this al unterpinning, particular attention is paid to the 2030 Agenda for Sustainable Development by critically g aspects such as implementation and measurement of the Sustainable Development Goals (SDGs) the basics and critical aspects of economic growth.
	Furtherm associate sustainab as on mea manage r pest man	ore, we explore how farmers, consumers and insurances take decisions in the face of increasing risks d with global change as well as transformation. This is done by providing insights into the field of le consumption, such as on types, motives and barriers of sustainable production and consumption, as well asures to promote sustainable consumer behaviour. We furthermore explore how natural ecosystems isks and if and how these principles could be also applied in an agricultural context e.g. in the context of agement. Furthermore, we introduce complex systems thinking as a tool to deal with risks.
	The exam limited to case stud in own pe	ples used during the course often refer to agriculture and the food industry, but are intentionally not them. Besides the continuous use of built-in short exercises, interactive teaching formats (e.g. live quizzes, ies, simulation game), students will be engaged in lively discussions on the topics and encouraged to bring erspectives.
	As a basis small self results of	for the grading, students will engage in group work to develop and implement either a board game or a -experiment (will be decided each year) incorporating aspects of risks, sustainability or transformation. The this group work will be presented during a public game or poster presentation.
Learning o	outcomes	
After a suc - know ab transform	ccessful co out the dif ation.	mpletion of the course, the students ferent scientific and political debates as well as their development in the context of sustainability, risks and
- have dev	veloped a g	general and interdisciplinary understanding of complex challenges and concepts related to sustainability,
risks and t	ransforma	ition.
- understa	nd the pra	actical challenges and chances related to these concepts for agriculture in different contexts (different
- are able	to apply th	idiffi Sizes etc. J.
2. Prereg	uisites	
obligatory	/	
recomme	nded	
Maximum	number	50 students

of students



Module	Title: Sus	tainability and Risk								
Module ID	O/Code: ART	S-C03 [780764260]								
3. Study	program all	ocation								
Study pro	gram					Compulso	ory/ Ele	ective	Se	emester
M.Sc. Agri	cultural and I	Food Economics					Е			3.
M.Sc. Agri	cultural Scier	nce and Resource Management in the T	ropics and Su	ubtropics			С			3.
(ARTS)										
M.Sc. Crop	o Sciences					E Foc	us PER(	С —		3.
4. Teachi	ng and lear	ning methodes								
Type of	Interval	Торіс		Language	of	Group	SWS	W	orklo	oad [h]
course				instructio	n	size		Conta	act	Self-
	during the			Faclish		20	10	tim	e o	study
L	semester			English		80	4,0	45,0	0	135,0
5. Course	cycle		6. Workloa	ad [h]		7. Duratio	on	8. Cre	dits	(ECTS)
WS			180			1		6,0		
9. Requir	ements for	the rewarding of credits (ECTS)								
Types of A	ssessment	Prerequisites for admission to the Asse	essment		Gra	aded	Langu	age	We	eighting
					ye	s/no	(exam	ı)	fac	tor
Presentati	on				gra	aded	Englis	h		
[/80/6426	9]									
Academic	Achievemen	ts								
10. Modu	le coordina	ition								
Module co	oordinator									
JunProf.	Dr. Lisa Biber	-Freudenberger								
Teaching	person									
The teachi	ing persons ir	n the current semester can be found in	basis:							
https://ba	sis.uni-bonn.	de/								
Institute/	Department									
Agrar-, Foi	rst- und Ernä	hrungswissenschaften								
11. Furth	er informat	ion								
External g	uests e.g. far	mers to talk about their perspectives or	n sustainabili	ty, risks an	d tr	ansformati	on			



Module	Title: I	nter	national research managemen	t and prop	oosal writin	g			
Module I	D <b>/Code:</b> A	RTS-(	C04 [780750080]						
1. Contei	nt and int	ende	ed learning outcomes						
Learning content:	Internatic Donors fo Discussion Technical Do's and basic und Principles Proposal	nal c r inten stra aspe don't ersta of pe writir	organizations for technical, scientific a ernational reserach and development ategies for reserach planning cts of proposal planning and develop s's in proposal writing nding of team work and research ethi eer-reviewing ng, presentation and defense	nd financial projects (aiı ment (budge ics	support ms, scope, req et, time plan, b	uirements) preak-dowr	ı struct	ure, Log Fi	ame)
Learning	outcomes								
After a sur - know ab - can effec - can plan - can effec - can form - can press	ccessful co out donors ctively sele and develo ctively revio nulate a res ent and de	mple and ct an op elo ew ar eracl fend	tion of the course, the students potential partners. d approach donors and partners. ements of a research proposal. nd assess the work of others (peer rev h proposal and target it to donors. the content of the proposal to a dono	viewing). or or reviewe	er.				
2. Prereo	uisites								
obligatory	y								
recomme	nded	ARTS	5 A modules (knowledge and compret	nension of re	esources for a	gricultural p	oroduct	tion)	
Maximum of studen	n number ts	25 st	tudents						
3. Study	program	alloc	ation						
Study pro	gram					Compulso	ory/ Ele	ective S	emester
M.Sc. Agri (ARTS)	icultural Sc	ience	e and Resource Management in the Tr	opics and Su	ubtropics		С		3.
4. Teachi	ing and le	arnir	ng methodes						
Type of	Interval		Торіс		Language of	Group	SWS	Work	oad [h]
course					instruction	size		Contact time	Self- study
L (blocked)	afternoor block		International organizations		English	25	1,0	10,0	20,0
T* (blocked)	afternoor block		Proposal elements		English	25	1,0	10,0	40,0
S (blocked)	afternoor block		Assessing proposal quality		English	25	1,0	10,0	20,0
PS (blocked)	afternoor block		Developping a reserach proposal		English	25	1,0	10,0	60,0
5. Course	e cycle			6. Worklo	ad [h]	7. Durati	on	8. Credit	s (ECTS)
WS				180		1		6,0	



Module Title: In	ternational research management and proposal w	riting		
Module ID/Code: AR	TS-C04 [780750080]			
9. Requirements for	r the rewarding of credits (ECTS)			
Types of Assessment	Prerequisites for admission to the Assessment	Graded yes/no	Language (exam)	Weighting factor
Project work [780750089]	Presence at >10 lectures / exercises	graded	English	100%
Assignment [780750088]	Homework exercise on breakdown, budget table Ghannt chart	not graded	English	0%
Colloquium [780750087]	Presentation of at least 1 homework assignment	not graded	English	0%
Academic Achieveme	nts			
10. Module coordin	ation			
Module coordinator				
Prof. Dr. Mathias Beck	ker			
Teaching person				
The teaching persons	in the current semester can be found in basis:			
https://basis.uni-bonr	n.de/			
Institute/ Departmen	t			
Agrar-, Forst- und Ern	ährungswissenschaften			
11. Further informa	tion			



Module	Title: D	ata	Analysis and Visualization								
Module I	<b>D/Code:</b> A	RTS-	-C05 [780800010]								
1. Conter	nt and int	end	ed learning outcomes								
Learning	Introduct	on t	o planning of field experiments and th	eir analysis	(Feldversuc	hswesen	). Intr	oducti	on to si	tatist	ics and
content:	to statisti	cal s	oftware "R": exploratory data analysis	and visualiz	ation of da	ta, hypot	hesis	testing	, analy	sis of	:
	variance,	regr	ession. Introduction to research data r	managemen	t. Introduct	ion to sy	stem	analysi	is and n	node	ling.
Learning o	outcomes										
After a suc	ccessful co	mple	etion of the course, the students								
- can gene	erate and ir	nterp	pret box piots, histograms, scatter plot	S.							
- can perfo	orm and in	terp	ret basic hypothesis tests, ANOVA and	l linear regre	ession.						
2. Prereq	uisites										
obligatory	/										
recomme	nded	at le	east 5 successfully completed modules	in ARTS-A							
Maximum	n number										
of studen	ts										
3. Study	program a	allo	cation								
Study pro	gram					Com	pulso	ry/ Ele	ctive	Se	mester
M.Sc. Agri (ARTS)	cultural Sc	ienc	e and Resource Management in the Tr	ropics and Su	ubtropics			С			3.
M.Sc. Cro	o Sciences							С			1.
4. Teachi	ng and le	arni	ng methodes								
Type of	Interval				Language	of Gro	an	SWS	Wo	orklo	ad [h]
course					instructio	n siz	e.		Conta	nct	Self-
									time	5	study
L	during the	5	Methods for agricultural research dat	ta	English	12	20	3,0	45,0	)	45,0
	semester										
Р	during the	ē	Computer exercises methods for agri	cultural	English	30	0	2,0	30,0	)	60,0
	semester		research data								
5. Course	e cycle			6. Workloa	ad [h]	7. Di	uratio	on	8. Cre	dits	(ECTS)
WS				180		1			6,0		
9. Requir	ements f	or th	ne rewarding of credits (ECTS)								
Types of A	Assessmen	t Pr	rerequisites for admission to the Asse	ssment		Graded		Langu	age	We	ighting
						yes/no		(exam	ı)	fact	or
Assignme	nt					graded		Englis	h		
[78080002	19]										
Acadomic	Achiovom	onto									
Academic	Acmeven	ents									
10 Made	المرمم مار										
10. Ivioal	lie coordi	nati	ion								
		.f									
Prof. Dr. H		JT									
Teaching	person		the ourrest competer can be found in h								
https://ba	ing person	s III I an da	a/ در من	Jasis:							
Institute/	Departme	nt									
Agrar- Fo	rst- und Fr	nähr	rungswissenschaften Mathematik								
11 Furth	erinform	atio	n								



### Free elective module

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



Module	Title: T	ech	nology and Sensors in Precision	n Crop Pro	duction				
Module II	D/Code: N	PW-	002 [780800020]						
1. Conter	nt and inte	end	ed learning outcomes						
Learning content:	Knowledg and use o site specif including	e of f pre ic m mult	the sensors used in precision farming cision localisation systems (e.g. GNSS anagement. The use of different sense i-spectral imagery at different scales (	and the mo and differer ors and sens (e.g. from sa	tivation for htial GNSS) f sing technol tellites, UA	their use. Inc for control tr ogy to estima /s).	cluding t affic far ate farm	the fund ming, p and cr	damentals lanting and op health
Learning	outcomes				,-	-1			
After a su	ccessful co	nple	tion of the course, the students						
- will have	e an unders	tanc	ling of precision farming principles.						
- will unde	erstand the	fun	ction of different sensors and their us	e in precisio	n farming.				
- will have	e an unders	tanc	ling of GNSS and differential GNSS.						
2. Prerec	luisites								
obligatory	/								
recomme	nded	Mo	dule "Precision Farming" (B.Sc. Agrarw	vissenschafte	en)				
Maximum of studen	n number ts								
3. Study	program a	llo	ation						
Study pro	gram					Compuls	ory/ Ele	ective	Semester
M.Sc. Agri (ARTS)	icultural Sci	enc	e and Resource Management in the Tr	ropics and S	ubtropics		0		3.
M.Sc. Cro	p Sciences						С		1.
M.Ed. Agr	icultural Sc	ienc	e (Teacher's Training)				E		1.
4. Teachi	ing and lea	arni	ng methodes						
Type of	Interval		Торіс		Language	of Group	SWS	W	orkload [h]
course					in at working	n sizo		Cont	act Self-
					Instruction	1 312C		Conta	Jet Jen
	during the				English	1 3120	2.0	tim	e study
L	during the semester	!			English	120	2,0	tim 30,0	e study 0 60,0
L	during the semester during the	2			English	120 30	2,0	tim 30,0 30,0	study           study           0         60,0           0         60,0
L	during the semester during the semester	2			English	120 30	2,0	<b>tim</b> 30,0 30,0	study           study           60,0           60,0
L S 5. Course	during the semester during the semester cycle	2		6. Worklo	English English ad [h]	120 120 30 <b>7. Durat</b>	2,0 2,0 ion	tim 30,0 30,0 <b>8. Cre</b>	a     study       a     study       b     60,0       c     60,0       c     60,0
L S S. Course WS	during the semester during the semester cycle	2		<b>6. Worklo</b> 180	English English ad [h]	120 120 30 7. Durat	2,0 2,0 ion	tim 30,0 30,0 <b>8. Cre</b> 6,0	e study 60,0 60,0 dits (ECTS)
L S 5. Course WS 9. Requir	during the semester during the semester e cycle	or th	ne rewarding of credits (ECTS)	<b>6. Worklo</b> 180	English English ad [h]	120 120 30 7. Durat	2,0 2,0 ion	tim 30,0 30,0 <b>8. Cre</b> 6,0	e study 60,0 60,0 dits (ECTS)
L S <b>5. Course</b> WS <b>9. Requir</b> Types of A	during the semester during the semester e cycle	or th	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo 180 essment	English English ad [h]	120 120 30 7. Durat 1 Graded	2,0 2,0 ion	tim 30,1 30,1 8. Cre 6,0	e study 60,0 60,0 dits (ECTS) Weighting factor
L S 5. Course WS 9. Requir Types of A Written et	during the semester during the semester e cycle rements for Assessment	e or th : Pr	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo 180 essment	English English ad [h]	120 120 30 7. Durat 1 Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 age n)	e study 60,0 60,0 dits (ECTS) Weighting factor
L S <b>5. Course</b> WS <b>9. Requir</b> <b>Types of</b> Written et [78080002	during the semester during the semester e cycle rements for Assessment xam 29]	pr tł	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo 180 essment	English English ad [h]	120       30       7. Durat       1       Graded       yes/no       graded	2,0 2,0 ion Langu (exan Englis	tim 30,1 30,1 8. Cre 6,0 age 1)	e     study       b     60,0       c     <
L S S. Course WS 9. Requir Types of A Written e: [7808000]	during the semester during the semester e cycle rements for Assessment xam 29]	pr th	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo 180	English English ad [h]	120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 age 1)	e study 60,0 60,0 edits (ECTS) Weighting factor
L S <b>5. Course</b> WS <b>9. Requir</b> <b>Types of</b> Written e: [78080002	during the semester during the semester e cycle rements for Assessment xam 29]	or the sents	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo	English English ad [h]	120       120       30       7. Durat       1       Graded       yes/no       graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 10 10 10 10 10 10 10 10 10 10 10 10 10	e study 60,0 60,0 edits (ECTS) Weighting factor
L S S. Course WS 9. Requir Types of A Written e: [7808000] Academic	during the semester during the semester e cycle rements for Assessment xam 29]	pr the sents	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo 180	English English ad [h]	120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 age 1) h	e study 60,0 60,0 edits (ECTS) Weighting factor
L S S. Course WS 9. Requir Types of A Written e: [7808000] Academic 10. Module c	during the semester during the semester e cycle rements for Assessment xam 29] Achievem	ents	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo	English English ad [h]	120     120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 10 10 10 10 10 10 10 10 10 10 10 10 10	e     study       p     60,0       p     60,0       cdits (ECTS)       Weighting       factor
L S S. Course WS 9. Requir Types of A Written e: [7808000] Academic 10. Modu Roof Dr. C	during the semester during the semester e cycle rements for Assessment xam 29] Achievem ule coordi oordinator	ents	ne rewarding of credits (ECTS) erequisites for admission to the Asse	6. Worklo 180 essment	English English ad [h]	120     120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 age n) h	e study 60,0 60,0 dits (ECTS) Weighting factor
L S S Course WS 9. Requir Types of A Written ex [78080002 Academic 10. Module Prof. Dr. C Teaching	during the semester during the semester cycle rements for Assessment xam 29] Achievem ule coordi oordinator Christopher person	ents	ne rewarding of credits (ECTS) erequisites for admission to the Asse on	6. Worklo	English English ad [h]	120       120       30       7. Durat       1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 1age 1) h	e     study       p     60,0       p     60,0       cdits (ECTS)       Weighting       factor
L S S. Course WS 9. Requir Types of A Written e: [7808000] Academic 10. Modu Prof. Dr. C Teaching The teach	during the semester during the semester e cycle rements for Assessment xam 29] Achievem ule coordi oordinator Christopher person ing persons	ents	ne rewarding of credits (ECTS) erequisites for admission to the Asse on Cool	6. Worklo 180 essment	English English ad [h]	120       120       30       7. Durat       1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 age n) h	e study 60,0 60,0 dits (ECTS) Weighting factor
L S S. Course WS 9. Requin Types of A Written ex [78080002 Academic 10. Modu Module c Prof. Dr. C Teaching The teach https://ba	during the semester during the semester e cycle rements for Assessment xam 29] Achievem ule coordi oordinator Christopher person ing persons asis.uni-bor	ents	e rewarding of credits (ECTS) erequisites for admission to the Asse on Cool	6. Worklo	English English ad [h]	120       120       30       7. Durat       1       Graded       yes/no       graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 10 6,0 10 10 10 10 10 10 10 10 10 10 10 10 10	e study 60,0 60,0 dits (ECTS) Weighting factor
L S S. Course WS 9. Requir Types of A Written e: [7808000] Academic 10. Modu Prof. Dr. C Teaching The teach https://ba	during the semester during the semester e cycle rements for Assessment xam 29] Achievem ule coordi oordinator Christopher person ing persons asis.uni-bor Departme	ents mati	ne rewarding of credits (ECTS) erequisites for admission to the Asse on Cool	6. Worklo	English English ad [h]	120     120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 age n) h	e study 60,0 60,0 dits (ECTS) Weighting factor
L S S Course WS 9. Requir Types of A Written e: [7808000: Academic 10. Modu Module co Prof. Dr. C Teaching The teach https://ba Institute/ Agrar-, Fo	during the semester during the semester e cycle rements for Assessment xam 29] Achievem ule coordi oordinator Christopher person ing persons asis.uni-bor Departme rst- und Err	ents nati s in 1 n.do nt	erewarding of credits (ECTS) erequisites for admission to the Asse on Cool the current semester can be found in l e/ ungswissenschaften, Vermessungswe	6. Worklo	English English ad [h]	120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 h	e study 60,0 60,0 dits (ECTS) Weighting factor
L S S Course WS 9. Requir Types of A Written e: [7808000] Academic 10. Modu Prof. Dr. C Teaching The teach https://ba Institute/ Agrar-, Fo 11. Furth	during the semester during the semester e cycle rements for Assessment xam 29] Achievem ule coordi oordinator Christopher person ing persons asis.uni-bor Departme rst- und Ern	ents mati	ne rewarding of credits (ECTS) erequisites for admission to the Asse on Cool the current semester can be found in l e/ ungswissenschaften, Vermessungswe n	6. Worklo	English English ad [h]	120     120     30     7. Durat     1   Graded yes/no graded	2,0 2,0 ion Langu (exan Englis	tim 30,0 30,0 8. Cre 6,0 h	e study 60,0 60,0 dits (ECTS) Weighting factor



Module	Title: T	ree phenology analysis in R									
Module I	D/Code: N	PW-034 [780800340]									
1. Conte	nt and inte	ended learning outcomes									
Learning	Using the	chillR package for R, data on the timing	of tree life cyc	cle events v	vill I	be related	to temp	peratur	e dat	a and	
content:	analyzed i	n a number of ways. Students will learn	how to:								
	- Efficientl	y compute common chill and heat metr	ics								
	- Illustrate	and evaluate temporal trends in therm	al metrics								
	- Design fu	inctions for additional metrics									
	- Relate phenology data to temperature records using multivariate statistics										
	- Identify temperature response phases of temperate tree crops										
	- Generate past and future temperature scenarios using a weather generator										
	- Evaluate past and prospective future impacts of climate change on thermal metrics										
	- Participate in a phenology monitoring experiment under semi-controlled conditions										
	- Analyze a phenology dataset and compile a report about their findings										
	- Use git a	nd github for version control and collab	oration and R-	-Markdown	n for	r report wr	iting				
Learning	outcomes										
After a su	ccessful cor	npletion of the course, the students							_		
- will be a	ble to apply	R functions and develop code using ver	rsion control (	github).							
- will be a	ble to analy	ze phenology records and relate them t	o temperatur	e data.							
- will be a	ble to evalu	ate climate change impacts on thermal	metrics.								
- will be a	ble to comp	ile a comprehensive and fully reproduc	ible report on	the agrocli	ima	tic history	and pro	spects	for a		
particular	context, co	mbining results from several analyses.									
- will be fa	amiliar with	phenology monitoring protocols and at	ole to apply th	em.							
2. Prerec	quisites										
obligator	y										
recomme	nded										
Maximun	n number	12 students									
of studen	ts										
3. Study	program a	llocation									
Study pro	gram					Compulse	ory/ Ele	ective	Se	mester	
M.Sc. Cro	p Sciences					E Fo	cus DA			3.	
M.Sc. Agr (ARTS)	icultural Sci	ence and Resource Management in the	Tropics and S	ubtropics			0			3.	
4. Teach	ing and lea	arning methodes									
Type of	Interval			Language	of	Group	sws	W	orkla	ad [h]	
course				instructio	n	size	5115	Conta	act	Self-	
								tim	e	study	
PS	during the	Phenology data analysis		Fnglish		12	10	15 (	- )	15.0	
	semester						_,.	_0,	-	_0,0	
Р	during the	Phenology monitoring and data and	alysis	English		12	3.0	45.0	)	105.0	
	semester	exercises		8			-,-	,	-		
5. Course	e cycle		6. Worklo	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)	
WS			180			1		6,0			
9. Requi	rements fo	or the rewarding of credits (ECTS)	•								
Types of A	Assessment	Prerequisites for admission to the As	sessment		Gr	aded	Langu	age	We	ighting	
					ye	s/no	(exam)		factor		
Term pap	er				gra	aded	Englis	h			
[7808003	49]				[						
Acadami	Achiover										
Academic	Achievem	2015									



#### Module Title: Tree phenology analysis in R

Module ID/Code: NPW-034 [780800340]

#### 10. Module coordination

#### Module coordinator

Prof. Dr. Eike Lüdeling

#### **Teaching person**

The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

Institute/ Department

Agrar-, Forst- und Ernährungswissenschaften

#### 11. Further information

Luedeling, 2019. chillR: Statistical methods for phenology analysis in temperate fruit trees. https://cran.r-project.org/web/packages/chillR/index.html

Luedeling et al., 2011. Climate Change Affects Winter Chill for Temperate Fruit and Nut Trees. PLoS ONE 6, e20155. https://doi.org/10.1371/journal.pone.0020155

Luedeling, 2012. Climate change impacts on winter chill for temperate fruit and nut production: A review. Scientia Horticulturae 144, 218–229. https://doi.org/10.1016/j.scienta.2012.07.011

Luedeling and Gassner, 2012. Partial Least Squares Regression for analyzing walnut phenology in California. Agricultural and Forest Meteorology 158–159, 43–52. https://doi.org/10.1016/j.agrformet.2011.10.020

Luedeling et al., 2013. Differential responses of trees to temperature variation during the chilling and forcing phases. Agricultural and Forest Meteorology 181, 33–42. https://doi.org/10.1016/j.agrformet.2013.06.018

Guo et al., 2015. Responses of spring phenology in temperate zone trees to climate warming: A case study of apricot flowering in China. Agricultural and Forest Meteorology 201, 1–7. https://doi.org/10.1016/j.agrformet.2014.10.016

Benmoussa et al., 2018. Climate change threatens central Tunisian nut orchards. Int J Biometeorol 62, 2245–2255. https://doi.org/10.1007/s00484-018-1628-x

Benmoussa et al., 2017. Performance of pistachio (Pistacia vera L.) in warming Mediterranean orchards. Environmental and Experimental Botany 140, 76–85. https://doi.org/10.1016/j.envexpbot.2017.05.007

Each student needs a computer for the exercises.



Module	Title: Le	ecture Se	ries on Future Competer	nt Agricultu	iral and F	Foo	d System	IS				
Module I	D <b>/Code</b> : N	PW-053 [78	80800530]									
1. Contei	nt and inte	ended lear	ning outcomes									
Learning The interdisciplinary lecture series will take up the societal debate on the future of Agriculture and Food Systems. It												
content:	will cover	important a	aspects of sustainability, supp	ly chains, plar	netary hea	lth, i	innovative	produc	ction sy	sten	ıs,	
	biodiversit	ty, life cycle	assessment, digitalization an	nong others to	o discuss tl	he tr	ansformat	ion of t	the cur	rent	systems	
	into future	e competen	t ones. In this context a syste	m approach v	vill be take	en to	discuss th	e challe	enges a	nd h	ow the	
different scientific fields could contribute to the solutions.												
Learning	outcomes											
After a su	ccessful cor	npletion of	the course, the students									
- obtain ai	n overview	of a specifi	c research field.									
- will have	an underst	tanding of a	agricultural and nutritional sci	ences in a soo	cietal conte	ext.						
- will unde	erstand the	possible in	teractions between agricultur	e, food syster	ms, and su	stair	nability.					
- are able	to discuss k	ey topics o	f agricultural and food system	ns, sustainabil	lity, food si	uppl	y chains.					
- will be a	ble to take	part in scie	ntific discourse.									
- commun	icate and d	iscuss findi	ngs and evaluations with colle	eagues/other	students.							
2. Prereq	luisites											
obligatory	/											
recomme	nded	For each le	cture a list of additional readi	ngs will be of	fered.							
Maximum	n number	25 students	5									
of studen	ts											
3. Study	program a	llocation										
Study pro	gram						Compulso	ory/ Ele	ective	Se	emester	
M.Sc. Agri	icultural Sci	ence and R	esource Management in the 1	Γropics and Sι	ubtropics			E			13.	
(ARTS)												
M.Sc. Cro	p Sciences							E			13.	
4. Teachi	ing and lea	arning met	hodes									
Type of	Interval	Topic			Language	e of	Group	SWS	Work		rkload [h]	
course					instructio	on	size		Contact		Self-	
									tim	е	study	
L	during the	1			English		500	1,5	22,0	)	30,0	
6	semester		·		<b>E</b> 11 1		25	0.0			10.0	
S		single	appointment		English		25	0,3	4,0	)	10,0	
C		single	appointment		English	_	25 0,3		\$ 4,0		) 20,0	
5. Course	e cycle			6. Workloa	ad [h]		7. Durati	on	8. Cre	dits	(ECTS)	
WS				90			1		3,0			
9. Requir	rements fo	or the rew	arding of credits (ECTS)									
Types of A	Assessment	Prerequis	sites for admission to the Ass	essment	Gr		aded	Langu	age	Weighting		
					ye		s/no	(exam	ו)	factor		
Term pape	er	Participat	tion at minimum of 80% of lec	ctures		gra	ded	Englis	h	100	)%	
[78080053	39]											
Callandia		Dentisiner				<u> </u>		<b>F</b> . 11		001		
	m 1901	Participat	cion at minimum of 80% of lec	ctures		not	graded	Englis	n	0%		
[/808005:	50]											
Academic	Achievem	ents				<u> </u>		I		I		
Academic	ACHIEVEIII											



#### Module Title: Lecture Series on Future Competent Agricultural and Food Systems

Module ID/Code: NPW-053 [780800530]

#### 10. Module coordination

Module coordinator

Dr. Thorsten Kraska

#### **Teaching person**

The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

Institute/ Department

#### 11. Further information

The "Fakultätentag" is the official oganization of Agricultural and / or Nutritional Sciences faculties at Germany Universities. Member faculties come from the Universities of Berlin, Bonn, Gießen, Göttingen, Halle, Hohenheim, Jena, Kassel-Witzenhausen, Kiel, Munich, andRostock.

The lectures will be given by scientists from member faculties or by invited speakers. The program will be corporately organized by the members of the Fakultätentag.

While the examination is limited to 25 students of the M.Sc. programs, the lecture series open for guests.



Module	Title: L	ecture Series on Current Topics i	in Agricultu	ral and Foo	d Researc	h				
Module II	D/Code: N	PW-058 [780800580]								
1. Conte	nt and inte	ended learning outcomes								
Learning       The interdisciplinary lecture series will take up current research topics from the member faculties of the         content:       "Fakultätentag Agrarwissenschaften und Ökotrophologie. It will highlight ongoing research and future research fields.										
Learning	outcomes									
After a su	ccessful co	npletion of the course, the students								
- obtain an overview of a specific research field.										
- will have an understanding of agricultural and nutritional research topics.										
- will unde	erstand the	possible interactions between agricult	ure, food syste	ems, and sust	ainability.					
- are able	to discuss l	ey topics of agricultural and food resea	arch, sustainal	oility, food su	pply chains.					
- will be a	ble to take	part in scientific discourse.								
- commur	icate and d	iscuss findings and evaluations with co	olleagues/othe	r students.						
2. Prerec	luisites									
obligatory	/	none								
recomme	nded	For each lecture a list of additional read	dings will be o	ffered.						
Maximum of studen	n number ts	30 students								
3. Study	program a	llocation								
Study pro	gram				Compuls	ory/ Ele	ective	Se	mester	
M.Sc. Agri (ARTS)	M.Sc. Agricultural Science and Resource Management in the Tropics and Subtropics O 13. (ARTS)							13.		
M.Sc. Nat	ure Conser	vation and Landscape Ecology				0			13.	
M.Sc. Cro	p Sciences					Е			13.	
4. Teachi	ing and lea	arning methodes								
Type of	Interval	Торіс		Language o	of Group	SWS	Wo	orklo	kload [h]	
course				instruction	size		Conta	act	Self-	
							time	e	study	
L	during the semester	Agricultural and food systems of the	he future	English	500	1,5	22,0	C	22,0	
S*		Preparation for colloquium		English	30	0,3	4,0		10,0	
C*		Presentation and discussion of sel	ected topics	English	30	30 0,2			28,0	
		from the lecture series							1	
5. Course	e cycle		6. Worklo	oad [h]	7. Durat	ion	8. Cre	dits	(ECTS)	
WS			90		1		3,0			
9. Requi	rements fo	or the rewarding of credits (ECTS)				1		r		
Types of Assessment		Prerequisites for admission to the Assessment			Graded ves/no	Langu (exam	Language (exam)		Weighting factor	
Presentation [780800589]		Participation at minimum of 80% of lectures g			graded	aded English				
Academic	Achievem	ents						•		



#### Module Title: Lecture Series on Current Topics in Agricultural and Food Research

#### Module ID/Code: NPW-058 [780800580]

#### **10. Module coordination**

#### Module coordinator

Dr. Thorsten Kraska

#### **Teaching person**

The teaching persons in the current semester can be found in basis:

https://basis.uni-bonn.de/

Institute/ Department

Agrar-, Forst- und Ernährungswissenschaften

#### 11. Further information

The "Fakultätentag" is the official oganization of Agricultural and / or Nutritional Sciences faculties at Germany Universities. Member faculties come from the Universities of Berlin, Bonn, Gießen, Göttingen, Halle, Hohenheim, Jena, Kassel-Witzenhausen, Kiel, Munich, and Rostock.

The lectures will be given by scientists from member faculties or by invited speakers. The program will be corporately organized by the members of the Fakultätentag.

While the examination is limited to 30 students of the M.Sc. programs, the lecture series is open for guests.

This lecture series will be every 2nd year



## **Masterthesis and Colloquium**

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



Module	Title: N	/las	terthesis							
Module I	<b>D/Code</b> : A	RTS-	-D1 [8900]							
1. Content and intended learning outcomes										
Learning       Formulate a relevant research question         content:       Elaborate a research proposal         Present the proposal at a department seminar       Conduct independently thesis reserach activity         Summerize and write-up reserach findings       Discuss own results in relation to the state of knowledge         Discuss the findings of defend thesis during a research colleguium										
Learning	Present k	ey m	ndings and defend thesis during a rese	erach colloqi	uium					
After a suc - has show - ability to - ability to Monate.	ccessful co vn proof to o conduct ro o synthesize	mple be a esea e res	etion of the course, the students able to independently formulate a rese rch under guidance. ults and present them in public.Die Be	earch questi	on. auer beträg	gt mindestens	s zwei u	nd höc	hsten	s sechs
2. Prereq	luisites									
obligatory	/	All c	compulsory modules of the first and th	ird semeste	r are compl	eted (54 ECTS	5 credit	points)		
recomme	nded	Res	east 24 credit points have been achieve erach concept has been presented dur	ing a depart	met semin	e modules ar				
Maximum	n number	nes			.ince seriin					
of student	ts									
3. Study	program a	allo	cation							
Study pro	gram					Compulse	ory/ Ele	ective	Sei	mester
M.Sc. Agri (ARTS)	icultural Sc	ienc	e and Resource Management in the Tr	opics and Su	ubtropics		С			4.
4. Teachi	ing and le	arni	ng methodes							
Type of	Interval		Торіс		Language	of Group	SWS W		orkload [h]	
course					instruction	n size		Conta	act Self-	
Proj	during the	9	individually agreed upon with supervi	isor	English	1		0,0		<b>study</b> 900,0
5. Course	e cvcle			6. Workloa	ad [h]	7. Durati	on	8. Cre	edits (ECTS)	
SS	<b>,</b>			600		1		20,0		(/
9. Requir	ements f	or th	ne rewarding of credits (ECTS)					<u>,                                     </u>		
Types of A	Assessmen	t Pr	rerequisites for admission to the Asses	ssment		Graded	Langu	age	Wei	ghting
Masterthe	esis					graded	Englis	<b>יו</b> h	Idel	01
[8900]						8.0000	8			
Academic	Achievem	ents	5							
10. Modu	ule coordi	nati	ion							
Module co	oordinator	•								
All indepe	ndent teac	hing	g staff							
Teaching	person									
The teach	ing person	s in t an d	the current semester can be found in b	basis:						
Institute/ Department										
Agrar-, Fo	rst- und Er	nähr	rungswissenschaften							
11. Furth	er inform	atio	on							



Module	Title: C	ollo	oquium									
Module ID	<b>)/Code:</b> A	RTS-	D2 [8901]									
1. Content and intended learning outcomes												
Learning												
content:	content:											
Learning o	outcomes	<u> </u>										
After a suc	cessful co	mple	etion of the course, the students									
- 2. Prerea	uisites											
obligatory	Digatory											
recommen	/ecommended											
Maximum	number											
of student	s											
3. Study	program a	alloc	cation						,			
Study prog	gram						Compulso	ory/ Ele	ctive	Se	mester	
M.Sc. Agri (ARTS)	cultural Sci	ienco	e and Resource Management in the Tro	opics and Su	ubtropics			С			4.	
4. Teaching and learning methodes												
Type of	Interval		Торіс		Language	of	Group SWS		Workload [h]			
course					instructio	n	size	Con		tact Self-		
									tim	e	study	
5. Course	cycle			6. Workloa	ad [h]		7. Duratio	on	8. Cre	edits (ECTS)		
SS				300			1		10,0			
9. Requir	ements fo	or tr	ne rewarding of credits (ECTS)					1.				
Types of A	ssessment	t Pr	rerequisites for admission to the Asses	ssment		Graded Languag			age	e Weighting		
						ye	5/110	(Exaii	'/	Taci		
[8901]												
Academic	Achievem	ents	; 									
10. Modu	ile coordi	nati	ion									
Module co	pordinator											
All indepe	ndent teac	hing	staff									
Teaching p	person											
The teachi	ing persons	s in t	the current semester can be found in b	asis:								
nttps://ba	sis.uni-bor	n.de nt	e/									
institute/	Departine											
11 Furth	er inform	atio	n									
11. T UI UI		atio										