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ANNUAL REPORT 2019

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LEIBNIZ CENTRE FOR AGRICULTURAL LANDSCAPE RESEARCH (ZALF)



ANNUAL REPORT 2019

LEIBNIZ CENTRE FOR AGRICULTURAL LANDSCAPE RESEARCH (ZALF)

RESHAPING LANDSCAPES

WE LEAD THE WAY TOWARDS SUSTAINABLE LANDSCAPES OF THE FUTURE. TOGETHER WITH SOCIETY.

BY RETHINKING AGRICULTURE

WE DELIVER SOLUTIONS FOR AN ECONOMICALLY, ENVIRONMENTALLY AND SOCIALLY SUSTAINABLE AGRICULTURE.

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PREFACE

In 2019, the challenges faced by agriculture have received more and more public attention. The drought of the previous year continued in large parts of Germany and, for the first time since the beginning of instrumental recording, led to significant droughtrelated yield losses in two consecutive years. The issue of insect decline and the role of agriculture were the subject of many reports and public debates. Furthermore, the groundwater pollution caused by fertilizers and nitrate in parts of Germany was again criticized by the EU Commission, threatening to impose a fine in the millions of Euros. The discussion on the digitization of agriculture and the associated opportunities and challenges also received further attention. The issue of food security remains just as present. The number of undernourished people has been rising again globally for some years now and is taking on dramatic proportions, especially in crisis regions.



Prof. Frank A. Ewert, Scientific Director of ZALF

ZALF has again contributed to solving these problems in 2019 through its research and transfer activities. In the OPTAKLIM project, cultivation strategies and methods for climate adaptation were optimized, paying special attention to the interactions with crop protection, productivity, cultivar distribution and greenhouse gas emissions (p. 29). The BIBS project continued the research into biodiversity (p. 25). The recording and modelling of water dynamics on the slope scale were the subject of VAMOS (p. 26). Modelling and remote sensing data were used in the BARLEY-IT project to grow marketable malting barley with lower nitrous oxide emissions (p. 28). The AGORA-NATURA online marketplace was developed to provide greater support for nature conservation projects on agricultural land (p. 24). The increased cultivation of legumes is an important element in this context and was also investigated in the VEGI-LEG project for areas in Africa, with a special consideration of processing technologies and a food security (p. 27).

The very successful acquisition of new projects further complemented the ongoing research work. Examples include the DAKIS project about the digitization of agriculture and the BIOKUM junior research group for estimating the cumulative effects of bio-economic strategies for more sustainable agriculture (pp. 17 and 19). ZALF also coordinates the EU project CONTRACTS 2.0 for the joint development of new contractual models for innovative agri-environmental climate protection measures and for the valorization of public environmental goods (p. 20). The KRUMENSENKE project (p. 21) focuses on questions of how to reduce the environmental and climate impact of raw material crops by means of optimized methods of deepening the plowed layer. ZALF also plays a leading role in the preparation of an »Insect Protection Action Plan« for Brandenburg (p. 18). Epidemics caused by zoonoses became a worldwide topic at the end of the year. In CERATOVIR, ZALF investigates mosquitoes and zoonoses transmitted by them in Germany (p. 16).

I cordially invite you to learn more about our research on the following pages.

PROF. FRANK A. EWERT Scientific Director

THE MISSION OF ZALF IS TO DELIVER SOLUTIONS FOR AN ECONOMICALLY, ENVIRONMENTALLY AND SOCIALLY SUSTAINABLE AGRICULTURE – TOGETHER WITH SOCIETY

As a contribution to overcoming global challenges such as climate change, food security, biodiversity conservation and resource scarcity, we develop and design crop systems, integrated in their landscape contexts, that combine food security with sustainability. Therefore we process complex landscape data with a unique set of experimental methods, new technologies and models as well as socio-economic approaches.

ZALF research is integrated systems research: starting from processes in soils and plants to causal relationships on the field and landscape level up to global impacts and complex interactions between landscapes, society and economy.



RESEARCH STRUCTURE

LEIBNIZ CENTRE FOR AGRICULTURAL LANDSCAPE RESEARCH (ZALF)

AGRICULTURE OF THE FUTURE:

ENVIRONMENTALLY FRIENDLY. PRODUCTIVE. DIGITAL. KNOWLEDGE-BASED.

In contrast to natural landscapes, agricultural landscapes are characterized by both their use as well as their users. The interdisciplinary research at ZALF therefore covers not only economically and environmentally sustainable management strategies, but also societal demands on agricultural landscapes. Thus, solutions are generated that address the grand challenges facing society as a whole: climate change, sustainable land use, food security and the conservation of natural resources, biodiversity and ecosystem services.

Three Research Areas, one Research Platform and an Experimental Infrastructure Platform provide the necessary disciplinary excellence and technical infrastructure.

RESEARCH AREAS



Research Area 1 »Landscape Functioning« How do agricultural landscapes function? Co-Heads: Prof. Steffen Kolb Prof. Michael Sommer



Research Area 2 »Land Use and Governance« How can we sustainably develop and shape intensively used agricultural landscapes? Co-Heads: Prof. Sonoko Dorothea Bellingrath-Kimura Prof. Klaus Müller



Research Area 3 »Agricultural Landscape Systems« What will the agricultural landscapes of the future look like? Co-Heads: Prof. Katharina Helming Prof. Frank Ewert (acting)

RESEARCH PLATFORMS



Research Platform »Data Analysis & Simulation« Co-Heads: Prof. Gunnar Lischeid Prof. Claas Nendel



Experimental Infrastructure Platform Head: Dr. Gernot Verch

ZALF RESEARCH AREAS AND RESEARCH PLATFORMS



Research Area 1 »Landscape Functioning«

Research activities lead towards an integrated understanding of biogeochemical cycles in agricultural landscapes (C,N, Si) – including the interactions between land and atmosphere (e.g. trace gas and dust fluxes) and their relevance for agricultural production. The focus is on interactions between crop plants, microorganisms and soils as well as lateral transport processes.



Research Area 2 »Land Use and Governance«

Research Area 2 »Land Use and Governance« analyzes the interactions between land use, ecosystems, their services to society, emerging conflicts and the governance of the overall system. It is the aim to develop resource-efficient, site-specific and conflict-minimizing production and governance systems which account for the social and economic value of agricultural ecosystems for humans.



Research Area 3 »Agricultural Landscape Systems«

In consideration of the spatial and system context, Research Area 3, »Agricultural Landscape systems«, develops and applies systems analysis and assessments to support decision making for sustainable land management. Changing societal demands on agricultural landscapes are analyzed, management options developed and the consequences for food security and the provision of ecosystem services and biodiversity assessed.



Research Platform »Data Analysis & Simulation«

At ZALF the focus is on interactive and easy-to-use models and data analysis methods in landscape research. The research platform »Data Analysis and Simulation« develops a coherent concept for integration of data, models and simulation methods for landscape research, from technical solutions to a landscape theory.



Experimental Infrastructure Platform

The Experimental Infrastructure Platform integrates ZALF's numerous field- and landscape-scale research infrastructures such as the Experimental Stations, the Landscape Laboratory »AgroScapeLab Quillow« and the landscape monitoring. In addition, the platform supports experimental research by, for example, operating and maintaining scientific instrumentation, conducting measurement campaigns and providing and managing experimental sites on grass- and croplands.



RESEARCH AREA 1 »LANDSCAPE FUNCTIONING«

PROF. STEFFEN KOLB PROF. MICHAEL SOMMER

HOW DO AGRICULTURAL LANDSCAPES FUNCTION?

Comprising of six working groups at present, Research Area 1 »Landscape Functioning« is performing knowledge-oriented research on deepening our understanding of processes, cause-and-effect relationships and causal chains as well as the interactions within and among the different landscape elements such as cropland, grassland, waterbodies and forests. In this context, memory effects must also be considered, i.e. mid- to long-term effects of previous actions or interventions in agricultural landscapes. Research activities in Research Area 1 include the detection and analysis of new phenomena, the continuous improvement and development of research methods as well as the analysis of process dynamics by coupling data with models.

The aim of our research is to improve the understanding of biogeochemical cycles (carbon, nitrogen, silicon) and their driving forces (soil, plants, microorganisms) in agricultural landscapes. This is where the research of our individual working groups is interlinked. The results are incorporated into the development of sustainable land management systems, as it is being done in Research Areas 2 and 3. For cross-scale research questions, Research Area 1 works closely with the Research Platform »Data Analysis & Simulation« as well as Research Area 3 »Agricultural Landscape Systems«. The central platform for investigations and experiments on the field and landscape scale is the AgroScapeLab Quillow of the Experimental Infrastructure Platform.

CORE RESEARCH QUESTIONS:

- Which role do the long-term structures and processes of soil landscapes play in recent water and solute fluxes, biogeochemical cycles (C, N, Si), land-atmosphere interactions and agricultural productivity?
- How do both positive and negative interactions between crop plants and their microbiome influence agricultural productivity, C and nutrient dynamics, and land-atmosphere interactions?
- How can stable isotopes and radionuclides be used to quantify and spatially characterize C and N metabolic processes in soils and land-atmosphere interactions?

WORKING GROUPS

Landscape Pedology Contact: Prof. Michael Sommer | sommer@zalf.de

Hydropedology Contact: Dr. Horst Gerke | gerke@zalf.de

Silicon Biogeochemistry Contact: Prof. Michael Sommer | sommer@zalf.de Isotope Biogeochemistry & Gas Fluxes Contact: Prof. Jürgen Augustin | jaug@zalf.de

Microbial Biogeochemistry Contact: Prof. Steffen Kolb | steffen.kolb@zalf.de

Fungal Interactions Contact: Dr. Marina Müller | mmueller@zalf.de



RESEARCH AREA 2 »LAND USE AND GOVERNANCE«

PROF. SONOKO DOROTHEA BELLINGRATH-KIMURA PROF. KLAUS MÜLLER

HOW CAN WE SUSTAINABLY DEVELOP AND SHAPE INTENSIVELY USED AGRICULTURAL LANDSCAPES?

The focus of this Research Area lies on the investigation of land use practices and their interactions with associated ecosystem services and biodiversity. These interactions are not only studied for agriculturally managed crop- and grasslands, but also in the context of adjacent ecosystems such as forests and waterbodies. It is the aim to use research results to support the site-adapted management of agricultural landscapes under the impact of climate change and in different socio-economic and socio-cultural contexts. This adapted management must be supported by stakeholders and institutionally promoted. Research on the interactions, the development of suitable indicators for the valorization of the services provided by agricultural landscapes and embedded ecosystems, the development of suitable governance approaches as well as the dissemination of institutional, technological and management-related innovations are additional topics of research in this Research Area.

CORE RESEARCH QUESTIONS:

- What are the effects of land use and individual management measures on the provisioning of ecosystem services and biodiversity and how can these services be improved?
- How can the provisioning, change and site-dependency of ecosystem services and biodiversity as well as the trade-offs between agricultural management measures and ecosystem services and biodiversity be modelled and valuated?
- What are the demands and expectations of different stakeholders and stakeholder groups regarding the provisioning of ecosystem services and biodiversity? What are the resulting land use conflicts and locally adapted options and how are these spatially distributed?
- What are suitable governance approaches for ensuring the societally desired provisioning of ecosystem services and biodiversity and for reducing land use-related conflicts? What is the role of research in the development and dissemination of such innovations?

WORKING GROUPS

Resource-Efficient Cropping Systems Contact: Dr. Johann Bachinger | jbachinger@zalf.de

Sustainable Grassland Systems Contact: Dr. Jürgen Pickert | juergen.pickert@zalf.de

Provisioning of Ecosystem Services in Agricultural Systems

Contact: Prof. Bellingrath-Kimura | belks@zalf.de

Provisioning of Biodiversity in Agricultural Systems Contact: Dr. Michael Glemnitz | mglemnitz@zalf.de

Farm Economics and Ecosystem Services Contact: Dr. Peter Zander | peter.zander@zalf.de

Biodiversity of Aquatic and Semiaquatic Landscape Features Contact: Dr. Doreen Werner | doreen.werner@zalf.de Lowland Hydrology and Water Management Contact: Prof. Christoph Merz | merz@zalf.de

Biotic Interactions between Forest and Agricultural Land Contact: Prof. Monika Wulf | mwulf@zalf.de

Governance of Ecosystem Services Contact: Prof. Bettina Matzdorf | matzdorf@zalf.de

Sustainable Land Use in Developing Countries Contact: Dr. Stefan Sieber | stefan.sieber@zalf.de

Co-Design of Change and Innovation Contact: Prof. Thomas Weith | thomas.weith@zalf.de



RESEARCH AREA 3 »AGRICULTURAL LANDSCAPE SYSTEMS«

PROF. KATHARINA HELMING PROF. FRANK EWERT (ACTING)

WHAT WILL AGRICULTURAL LANDSCAPES OF THE FUTURE PROVIDE?

Agricultural landscapes are subject to constant changes. The uses of the landscape interact with natural site conditions and are changed by external factors such as climate change. Our goal is to understand these complex changes with foresight and to design them in such a way that sustainable land use is possible. This means maintaining and improving agricultural productivity, biodiversity, ecosystem services and the attractiveness of landscapes as recreational areas.

The future developments of agricultural landscapes are of utmost importance for the implementation of many sustainability goals. Agricultural landscapes are the object of research in numerous scientific disciplines, each with its own specific theories and methods. The task of the »Agricultural Landscape Systems« research area is to take a systemic approach across disciplines and scales in order to develop robust assessments of landscape use despite their complexity and to create a basis for action for farmers, political decision-makers and other users of agricultural landscapes.

CORE RESEARCH QUESTIONS:

- How do different systems and their interlinkages develop and what contribution can they make at landscape level to contribute to sustainable development? Which determinants and patterns do they follow? How can they be strengthened in urban-rural relationships? How do land uses, the supply chain and food systems interact and how can they be coordinated in such a way that regional sustainable development is reinforced?
- How can modelling approaches of cropping systems be combined to generate insights to support improved incomes, build climate resilience and promote biodiversity and reduced environmental impacts across different spatio-temporal scales?
- How can future developments of farming systems (e.g. cultivation technologies, autonomous machinery, modified crop rotations, agroforestry systems) be anticipated, integrated into future scenarios together with other drivers, and evaluated with respect to their impact on resource efficiency (water, land, energy, raw materials, cost) and ecosystem services under changing frame-work conditions (e.g. climate change, policy)? Which indicators are suitable when the analytical knowledge basis is scarce?

WORKING GROUPS

Impact Assessment of Land Use Changes Contact: Prof. Katharina Helming | helming@zalf.de

Land Use Decisions in the Spatial and System Context Contact: Dr. Annette Piorr | apiorr@zalf.de Integrated Crop and Grassland Systems Analysis and Assessment Contact: Dr. Heidi Webber | heidi.webber@zalf.de

Farm Economics and Ecosystem Services Contact: Dr. Peter Zander | peter.zander@zalf.de



RESEARCH PLATFORM »DATA ANALYSIS & SIMULATION«

PROF. GUNNAR LISCHEII PROF. CLAAS NENDEL

CONTRIBUTION TO ZALF RESEARCH

A sound knowledge of a variety of interacting processes is a necessary prerequisite for a sustainable use of landscapes. These processes are studied in numerous interconnected research projects, generating large sets of empirical data with various degrees of precision. These data need to be well documented and to be analyzed using powerful statistical methods. The research platform »Data Analysis and Simulation« ensures the compilation of meta-data, a long-term storage of well documented data and the development of user friendly interfaces for data research. In addition, powerful methods for the analysis of high-dimensional heterogeneous data sets with differing temporal and spatial coverage are further developed and applied, considering explicitly typical characteristics of these data sets like non-linearity, instationarity, spatial correlation and temporal memory.

Hypotheses derived from data analysis are tested using numerical models. Modelling is a well-established tool in many scientific disciplines with a steadily growing number and complexity of available models. Due to the complexity of landscape processes a variety of model approaches have been developed that need to be integrated in new model platforms to support integrated landscape research approaches. Beyond model development, additional challenges need to be addressed in landscape science: methods for model calibration and validation, data assimilation techniques, data-driven model approaches and model and model ensemble behaviour close to the limits of applicability. Especially models that integrate various processes at the landscape scale to describe interactions at the interface of nature, economy and society need more research. The research platform »Data Analysis and Simulation« closes that gap and provides a framework for the integration of various disciplines and modelling approaches for a better understanding of the functioning of agricultural landscapes.

WORKING GROUPS

Dimensionality Assessment and Reduction Contact: Prof. Gunnar Lischeid | lischeid@zalf.de

Landscape Modelling Contact: Prof. Claas Nendel | nendel@zalf.de

Ecosystem Modelling Contact: Prof. Claas Nendel | nendel@zalf.de

Simulation Methods and Data-driven Models Contact: Dr. Ralf Wieland | rwieland@zalf.de Research Data (Service) Contact: Adrian Krolczyk | adrian.krolczyk@zalf.de

Geodata (Service) Contact: Dr. Uwe Heinrich | uheinrich@zalf.de

Model & Simulation Infrastructure (Service) Contact: Michael Berg-Mohnicke | michael.berg@zalf.de



EXPERIMENTAL INFRASTRUCTURE PLATFORM

OR. GERNOT VERCH

CONTRIBUTION TO ZALF RESEARCH

The Experimental Infrastructure Platform integrates ZALF's numerous field- and landscape-scale research infrastructures such as the Experimental Stations, the Landscape Laboratory »AgroScapeLab Quillow« and the landscape monitoring into a single organisational unit headed by scientists with special technical expertise. The main task of the Experimental Infrastructure Platform is the implementation and support of institutionally and third-party funded research projects on behalf of ZALF working groups in the Research Areas and the Research Platform. The Experimental Infrastructure Platform is responsible for ensuring the stipulated quality and functionality of the technical scientific instrumentation (e.g. lysimeters, large automatic gas measurement chambers, irrigation system, mobile gantry crane with automated measuring technology for greenhouse gases) and the continuous development of the Experimental Infrastructure in accordance with the ZALF Research Strategy.

The three working groups of the Experimental Infrastructure Platform in Dedelow, Paulinenaue and Müncheberg support ZALF scientists both in the planning and the implementation phase of their projects, with a particular emphasis on the consideration of local aspects and the collaboration with local stakeholders. The services of the working groups include human resources and technical support, the planning, installation and management of field experiments on crop- and grassland, the maintenance and provisioning of field sites, measurement devices and instruments as well as the servicing and operation of technical facilities. On request, the service groups also conduct crop and landscape measurements as well as mapping and sampling campaigns and document the management of field sites. In addition, the service groups also support scientists from the Research Areas and Research Platform with respect to the organisation of information events for local stakeholders in the study region (e.g. farmers, authorities) and transfer activities such as field days, trials and presentations.



WORKING GROUPS

Experimental Station Dedelow (Service) Contact: Dr. Gernot Verch | verch@zalf.de

Experimental Station Paulinenaue (Service) Contact: Dr. Axel Behrendt | abehrendt@zalf.de **Experimental Station Müncheberg (Service)** Contact: Dr. Dietmar Barkusky | dbarkusky@zalf.de



SELECTED NEW PROJECTS

BEARDED GNAT MOSQUITOS AS VECTORS FOR VIRUSES IN GERMANY

DOREEN WERNER, SARAH GROSCHUPP



While increasing globalization supports the displacement of potential vectors and pathogens transmitted by them, the development of both invasive and native vectors as well as of pathogens strongly depends on climatic conditions. In the first place, climate decides whether an introduced vector species can establish in a non-endemic region and to which degree native species can become vectors. Haematophagous species of the genus Culicoides (Diptera: Ceratopogonidae), which serve as vectors of the bluetongue virus (BTV) and the Schmallenberg virus (SBV) to ruminants, are therefore subject to research in the framework of the CERATOVIR project.

Emergence traps



Despite new outbreaks of the bluetongue disease in 2018 and the ongoing circulation of the Schmallenberg virus since 2011, knowledge on the vectors of BTV and SBV, haematophagous species of the family Ceratopogonidae, is still limited. In the frame-

work of the project CERATOVIR, scientists of the Federal Research Institute for Animal Health, the Friedrich-Loeffler-Institut (FLI), and ZALF collaborate in order to better understand the breeding habitat-binding structures of ceratopgonid developmental stages under natural biotic and abiotic conditions, the role of biting midges as vectors of disease agents and the epidemiologies of the diseases associated with them.

For data acquisition, biting midges were captured during 2019 on selected sentinel farms by means of UV light traps and in potential natural breeding habitats in various landscape structures by means of emergence traps, followed by morphological identification of the midges to species or species group and their examination for viral infection. The collected data is used to deduce occurrence, breeding habitat binding and spatiotemporal distribution of biting midge species in Germany, and will be entered into a standardized SQL vector database newly established at ZALF. The purpose of the database is the long-term retention of data as a source for further analyses, such as the preparation of distribution maps, risk assessments and modelling of future scenarios. The additional collection of metadata will facilitate data filtration, combination and the evaluation of the present and future risk situation in Germany.

Currently, the focus on local hotspots has already helped in supporting targeted prophylactic measures, such as dung

management on farms, and in answering questions related to the so-called »vector-free period«, which is relevant for trade restrictions and facilitations. For example, at least in north-eastern Germany, the activity and blood feeding rates of biting midges appear to remain below predetermined thresholds between November and March. In addition, the detected SBV in the collected biting midges enabled the identification of infection risk areas. To complement the ecological and taxonomic investigations at ZALF, biting midges are bred in the high security laboratories at FLI in order to carry out in vitro and in vivo (with ruminants) infection and transmission studies.

Project: Biting midgets as vectors of viruses in Germany under consideration of changing climatic conditions (CERATOVIR) **Term:** 2018–2021 **Sponsor:** BMEL **Lead at ZALF:** D. Werner (doreen.werner@zalf.de) **Partner:** FLI

DIGITAL AGRICULTURAL KNOWLEDGE AND INFORMATION SYSTEM

SONOKO D. BELLINGRATH-KIMURA, RALF BLOCH, IOANNA MOURATIADOU



Agricultural landscapes are torn between diverse demands for the production of food and feed, as well as for the preservation of ecosystem services (ESS) and biodiversity. Small-scale site-adapted measures can make a major contribution to ESS and biodiversity. Labor-intensive and time-consuming measures can be made simple and realizable if planned and carried out using smart information and communication technology (ICT).

Also with the help of drones future agricultural production should be economically more efficient and at the same time more ecologically sustainable.



In our vision, the agricultural systems of the future will be spatially and functionally diversified in order to accommodate different, and potentially conflicting, environmental and socio-economic objectives. The DAKIS project realizes this vision by

developing a new decision support system that makes it possible to give an economic value to non-commodity products, such as ecosystem services (ESS) and biodiversity, as the result of agricultural activities. In DAKIS, agricultural activities are planned with the help of real-time digital information from sensors and models and in cooperation among the participating farms. Autonomous, interlinked, small-scale robots flexibly carry out the field work, tailored to market and societal demands. The DAKIS project has the following objectives:

1) Integrate biodiversity, ESS, and resource use efficiency into the farm decision-making process. To achieve this, new approaches to the concept of »market value« need to be developed.

2) Document, forecast and control the site-specific effects of agricultural activities in real time. To achieve this, new sensors and models need to be developed.

3) Optimize the cropping systems towards the provisioning of ESS, the promotion of biodiversity and resource use efficiency, depending on the objectives. To achieve this, we need small-scale site-specific cropping systems implemented by novel robots.

4) Optimize general targets in farm planning and for the support of complex decisions. To achieve this, new operational farm models must be developed, which summarize information and allow for short, long and medium-term planning.

5) Create new communication channels for the cooperation between farmers, producers and society. We need new types of cooperation to successfully improve ESS, biodiversity, and resource use efficiency across the study regions.

The DAKIS project utilizes the ongoing digitalization to integrate ecosystem services (ESS) and biodiversity into modern planning processes, production and marketing. It thus allows for a new, resource efficient labour organization, provides farms with information and decision support, and promotes cooperation between farmers via the development of a digital platform and interlinked robots. The analysis of the site-specific potential changes the agricultural landscape, for example by island and patch cropping. New concentric usage-type gradients will be drawn around the urban centres. DAKIS makes the ecological performance of agricultural systems more visible and facilitates financial rewards for ESS and biodiversity. DAKIS will focus on two test regions in Brandenburg and Bavaria.

Project: Digital agricultural knowledge and information system (DAKIS) **Term:** 2019–2024 **Sponsor:** BMBF **Lead at ZALF:** S. D. Bellingrath-Kimura (belks@zalf.de) **Partner:** ATB, Uni. Bonn, HNEE, FZJ, IHP, DFKI, HS-Osnabrück, Fraunhofer ISI, European University Viadrina https://adz-dakis.com/

PROGRAM OF INSECT PROTECTION MEASURES IN BRANDENBURG

PETER WEIBHUHN, KATHARINA HELMING



Bumblebee (Bombus terrestris) visits a common bugloss (Anchusa officinalis) in the National Park Unteres Odertal

The globally observed insect decline not only jeopardizes ecosystem services such as pollination and natural pest control, but also threatens birds, bats and other species groups as the results of the drastic changes in the ecosystem food web. This problem receives more and more attention in politics and society. In June 2018, the German Federal Government approved key points for an action program towards insect protection. In Brandenburg, two public initiatives for insect protection were initiated in April 2019. This was the basis for the Government of Brandenburg to also start a provincial action program for insect protection in 2019, to be scientifically supported by ZALF.



Both the total amount of insects and the diversity of insect species in Germany have declined dramatically in recent decades. According to the so-called Krefeld Study by Hallmann et al. (2017), even in the protected areas considered to be intact, insects have

lost around 75 % of their biomass within a quarter of a century. On behalf of and in close cooperation with the Brandenburg Ministry of Agriculture, Environment and Climate Protection, an action program for insect protection in Brandenburg is being developed to quickly and effectively reduce the decline in insect populations.

The participatory generation of knowledge is of central importance. By involving actors from politics, land use, civil society organizations and research, existing expertise and practical experience will be integrated and a broad range of opinions considered. In several workshops, the following core areas are addressed: agriculture, other land use types (including municipal land), and future research needs. Apart from that, the mutual exchange between the project management and the participating actors will continue throughout the entire duration of the project. In addition, existing insect protection strategies at federal and state level will be analyzed and integrated into the design of the program in Brandenburg.

The collected pool of the proposed measures will then be structured, summarized and described in more detail. This is followed by a ranking, where the main criterion is the ecological effectiveness of each measure. Further criteria include the feasibility (effort, acceptance and risks) and the potential coherence with other protection goals, such as climate protection, soil protection or bird protection.

In this project, ZALF cooperates with the Senckenberg German Entomological Institute in Müncheberg (SDEI) and the Eberswalde University for Sustainable Development (HNEE). The project team is supported by an advisory board consisting of established scientists.

Project: Action program for insect protection in Brandenburg **Term:** 2019–2020 **Sponsor:** MLUK **Lead at ZALF:** P. Weißhuhn (weisshuhn@zalf.de) **Partner:** SDEI, HNEE

CUMULATIVE EFFECTS OF BIOECONOMIC STRATEGIES FOR MORE SUSTAINABILITY

SANDRA UTHES, JANA ZSCHEISCHLER



Agriculture in Germany, particularly in livestockintensive areas, is characterized by a high nutrient surplus, contributing to the eutrophication of surface waters, nitrate pollution of the groundwater and negative impacts on biodiversity. This situation reveals that the numerous investments into a more sustainable agriculture in the past have not yet led to the desired results. Several approaches in the context of circular economy seem promising to make advancements in this field.

BIOKUM-Team f.l.t. r: Steffi Dietrich, Ingrid Bunker, Sandra Uthes, René Méité, Jonathan Friedrich, Astrid Artner-Nehls, Jana Zscheischler



The German national research strategy »Bioeconomy 2030« declares »sustainable agriculture« as one of five priority areas. One approach is to close currently open nutrient cycles either farm-internally or through horizontal and/or vertical cooper-

ation between farms. This can lead to an increased resource efficiency and contribute to the reduction of negative effects on ecosystem services. Examples are new techniques for slurry application and storage, slurry utilization in biogas plants, slurry exchanges or vertical cooperation, e.g. with feed or fertilizer manufacturers (for the production of insect flour or recycling fertilizers).

The junior research group BIOKUM aims to close existing knowledge gaps associated with these innovations. We particularly focus on their cumulative sustainability effects, existing barriers along the respective value chains and factors influencing acceptance. In addition, we are developing perspectives for additional solutions and innovations, taking into account the complex relationships, opportunities and conflicts of bioeconomic transformation processes on the way to a more sustainable agriculture.

In seven sub-projects and using the example of case studies in Lower Saxony and Brandenburg, we work on various disciplinary research questions that are relevant for the transformation towards cycle-based, bioeconomic solutions. BIOKUM pursues an integrated inter- and transdisciplinary approach. The junior research group combines the approach of bioeconomic modeling at the farm level (agricultural economics) with methods of transformative sustainability research (environmental sociology) as well as regional economic, innovation and political science approaches.

Project: Cumulative impact of bioeconomic strategies for a more sustainable agriculture (BIOKUM) Term: 2019–2024
Sponsor: BMBF Lead at ZALF: S. Uthes (uthes@zalf.de), J. Zscheischler (jana.zscheischler@zalf.de) Partner: DBFZ

NEW CONTRACTUAL SOLUTIONS FOR MORE ENVIRONMENTAL SUSTAINABILITY

ANNETT ROSENBERGER, KATHARINA GABRIEL



Objectives for promoting biodiversity as well as water and climate protection have high priority both in EU agricultural policy and in current societal discourse. The achievement of these environmental goals strongly depends on the implementation of agri-environmental and climate measures (AECMs). In agricultural landscapes, the supply of private goods is often prioritized over the enhancement of ecosystem services. The work in CONTRACTS2.0 is set up as a social innovation process to co-design novel contract models that provide the right incentives to land users to increasingly integrate sustainability goals with farm profitability targets.

The international and interdisciplinary CONTRACTS2.0 consortium of practice and research partners



approaches to contract design are needed to mitigate these undesired impacts and enhance the provision of public environmental goods. In CONTRACTS 2.0, 28 partners from 12 EU countries cooperate to develop and test novel contract models.

Centerpieces of the project are the »Innovation Labs,« in which research and practice partners collaborate in an interdisciplinary setting. The »Contract Innovation Labs« (CILs) model and test the following contract types:

- 1) result-based payment schemes,
- 2) collaborative contracts between several land users,
- 3) land-tenure-based contracts including specific environmental agreements and
- 4) contracts connecting actors within a value chain.

The actual design and feasibility of the novel contract models as strategic policy instruments are determined in the »Policy Innovation Labs« (PILs). On this basis, recommendations for future agricultural policies are developed. Scientific guidance helps to ensure a high degree of current relevance and research quality.

In addition to the project coordination by Bettina Matzdorf, ZALF fulfills further important tasks. Claudia Sattler and Rena Barghusen carry out institutional analyses focusing on the recording and presentation of existing contracts. This implies a close cooperation with practice partners in order to include their feedback on the effectiveness and practicality of current contracts. Christoph Schulze and Bettina Matzdorf support the improvement and modification of existing contract types through behavioral experiments. To ensure a high level of practical relevance, the prototypes of the contract models are tested in the field using preference analyses. Annett Rosenberger and Katharina Gabriel are in charge of project management.

The goal of CONTRACTS2.0 is to approximate the project participants' »dream contracts, « which allow farmers to effectively and permanently achieve both environmental sustainability and economic viability.

Project: Co-design of novel contract models for innovative agri-environmental-climate measures and valorisation of environmental public goods (CONTRACTS2.0) **Term:** 2019–2023 **Sponsor:** Horizon 2020 **Lead at ZALF:** B. Matzdorf (matzdorf@zalf.de), C. Sattler (csattler@zalf.de) **Partners:** EV-INBO, ESSRG Kft, CIRAD, DUH, GIP-CRPGE, Őrség National Park, BoerenNatuur, LUH, Natural England, SLU, IMIDRA, ABC Eco2, ISP, DBV, UCPH, UCG, SRK, Bornholms Regionskommune, Agriculture & Food of Bornholm, Heliconia, SWK, UAM, University of Pisa, University of Ljubljana, Wageningen University, University of Warsaw, University of Aberdeen

https://www.project-contracts20.eu/

FRACTIONAL DEEP TILLAGE TO FOSTER CLIMATE MITIGATION, SOIL FERTILITY AND YIELDS

MICHAEL SOMMER, JÜRGEN AUGUSTIN



Mobile gantry crane system to monitor flux rates of CO_2 , CH_4 , and N_2O at the long-term field experiment CARBOZALF (AgroScapeLab Quillow)

One of the biggest challenges in global agriculture is to improve soil fertility and yield while simultaneously reducing climate impact as well as nitrogen pollution. Ameliorative soil tillage has been intensively tested as a measure to enhance soil fertility and, thereby, increase crop yield. Generally, an increase in plowing depth leads to a substantial increase of soil organic carbon (CO₂ sink effect) and nitrogen stocks. However, classic deep plowing was often associated with a severe soil re-compaction, followed by reduced yields. In the KRUMENSENKE project, we will develop and test a tillage system that improves soil fertility, increases crop yields and enhances carbon and nitrogen sequestration in soils.



A significant and sustainable increase of carbon sequestration in soils (CO₂ sink effect) – such as the 4per1000 initiative strives for – can only be achieved in soil systems far below their specific C saturation potentials. Previous ZALF research on the

effects of soil erosion on carbon cycling in the project CAR-BOZALF has confirmed this basic principle. After removing the topsoil, i. e. creating an artificial erosion event, and subsequent plowing, a temporary but strong CO₂ sink occurred (approx. 150 g C m⁻² y⁻¹), as a result of the incorporation of C-unsaturated subsoil into the plow horizon (Ap). In a relatively short period, organic carbon and nitrogen compounds accumulate there, for example by adhesion to soil minerals, until the local equilibrium is reached once again. The same effect can be achieved by deep tillage – but without losing soil fertility as observed after soil erosion.

An ameliorative, fractional deep tillage (aFDT) is characterized by a one-time, partial deepening of the topsoil. In principal, slits of 10 cm width are established down to 50 cm depth by special plowshares. These slits are filled with topsoil, while the removed subsoil is incorporated into the Ap horizon. Leaving undisturbed subsoil in between, slits are created every 70 cm across a field, thus minimizing the risk of a soil re-compaction by heavy agricultural machinery. Adapted plows for aFDT were already developed from the late 1950ies until the late 1980ies at the former GDR »Research Center for Soil Fertility« (FZB, now: ZALF). Extensive research on the effects of aFDT revealed a significant increase in crop yield, which mainly resulted from enlarged rooting depths – hence better access to subsoil water and nutrients – by breaking up existing soil compaction zones at 35–45 cm depth.

The interdisciplinary project KRUMENSENKE now studies the effects of aFDT on short-term greenhouse gas fluxes (CO₂, CH₄, N₂O), yield, and long-term trends in soil organic matter (SOM) stocks and pools. A special focus is placed on the question, whether a combination of a FDT with N fertilization via biogas digestate can reduce nitrous oxide emissions while increasing crop yield. KRUMENSENKE applies a multi-scale methodological approach, which combines modern gas flux measurement techniques with proximal soil sensing and dronebased remote sensing of plants and soils. These methods are applied in a newly established manipulation and landscape experiment at the CARBOZALF site and a farmer's field. Here, we will test a new aFDT plow as well. In order to verify the long-term effects of aFDT over decades, historical field trials from the early 1960ies and late 1980ies will be re-analyzed with respect to SOM stocks and SOM pools (especially in subsoils). In addition, the Johann Heinrich von Thünen Institute will carry out the life cycle assessment of aFDT.

Project: Reduction of environmental and climate impacts of agricultural crop production through the use of an optimized topsoil deepening technique (Krumensenke) **Term:** 2019–2022 **Sponsor:** BMEL **Lead at ZALF:** J. Augustin (jaug@zalf.de), M. Sommer (sommer@zalf.de) **Partner:** TIRRECConsult, LEMKEN, TI



SELECTED CURRENT PROJECTS

AN ONLINE-MARKETPLACE FOR MORE NATURE CONSERVATION

CAROLIN BIEDERMANN, MARLEN KRAUSE, BETTINA MATZDORF



The present challenges in nature conservation require an increased public awareness for the value of ecosystem services, more private financial support as well as profound knowledge about societal preferences for conservation goals. The online marketplace AgoraNatura aims to contribute to all of these aspects. It bundles certified nature conservation projects from all over Germany, whose effects are measured using a science-based standard. This allows companies and private individuals to explicitly invest in transparent nature conservation projects while also enabling smaller environmental organisations to present their projects to the broad public.

The first pilot projects have already been financed and implemented in Brandenburg.



The research and implementation project AgoraNatura addresses two innovations simultaneously: the application of the successful »online marketplace« concept to a nature conservation context and the development of suitable certified nature conser-

vation projects to be offered on such a marketplace. ZALF leads and coordinates the interdisciplinary project funded by BMBF and BMU and is responsible for investigating the potential demand and supply side. Together with partners from research, practical nature conservation and landscape management, ZALF develops pilot offers for cultivated agricultural landscapes and supports the programming of the marketplace.

First analyses of the demand side have revealed the potential of the planned online marketplace. They allow deriving potential target groups, their characteristics and preferences as well as identifying factors that influence the voluntary private nature conservation commitment. A Germany-wide company survey launched in autumn 2019 currently further expands on the initial findings. It specifically examines the perspectives of German companies on nature conservation issues, the extent to which they are engaged and the perceived obstacles.

In order to identify promoting and inhibiting factors for the participation of environmental organisations and farmers as suppliers, behavioural economic experiments and innovative interview methods are applied. In addition, a structured transaction costs analysis will be conducted. Their results allow deriving implications for the long-term institutional design of the online marketplace. The NaturPlus-standard, developed by ZALF together with external partners, defines the certification criteria and presents methods for assessing the effects of projects on biological diversity, water quality and climate protection. Initial pilot offers for the marketplace have been developed, e.g. to create or maintain species-rich fields and meadows, protective buffer strips around sensitive water bodies, or habitats and food supplies for selected animal species. Some of these projects were already implemented before the online marketplace was launched, thanks to funding provided by committed companies.

Finally, AgoraNatura puts the much-discussed ecosystem service concept to the test: Does the presentation of nature's benefits for human well-being really lead to greater support for nature conservation? By integrating different survey formats, the online marketplace will help answering this question.

Project: AgoraNatura – NaturMarkt (AGORANATURA) Term: 2015–2021 Sponsor: BMBF, BMU Lead at ZALF: B. Matzdorf (matzdorf@zalf.de) Partner: Univ. Greifswald, DUH, DVL www.agora-natura.de

BIODIVERSITY RESEARCH: BUILDING KNOWL-EDGE BRIDGES BETWEEN ECOSYSTEMS

SEBASTIAN MAABEN, GABRIELA ONANDIA, GUNNAR LISCHEID



The research project BIBS establishes knowledge links between various research disciplines as well as connections between ecosystems. This collaborative project uses the AgroScapeLab Quillow research infrastructure of ZALF. There, as well as in Berlin, terrestrial effects on the biodiversity of small water bodies and grasslands are examined. For grasslands in Berlin, the project particularly focusses on the effects of urbanization and new types of stressors (e.g. microplastics) on biodiversity and ecosystem services. The aim of the project is to develop management concepts for promoting biodiversity.

A common inhabitant of the investigated water bodies are rotifers of the genus Keratella.



The collaborative BMBF project BIBS aims to bring together various, previously relatively distant research disciplines in order to improve our understanding of biodiversity. The results are compiled into a comprehensive synthesis in order to develop innovative management strategies.

ZALF is involved in three BIBS work packages. In work package 1, ZALF provided basic information, data from previous investigations as well as part of the research infrastructures within the AgroScapeLab Quillow as one of the joint study platforms.

Work package 2 examines the effects of aquatic-terrestrial coupling on landscape-wide biodiversity patterns. For this purpose, ZALF primarily conducts water-chemical and zooplankton investigations in kettle holes in the AgroScapeLab Quillow and in urban ponds in Berlin. The results are then combined with macroarthropod data and genetic sequencing data from other BIBS partners. The main processes and factors that influence biodiversity in the water bodies are examined in order to assess the impact of land use and urbanization and to draw conclusions regarding management measures. Initial results indicate a small influence of land use and an increased geogenic influence.

In work package 5, terrestrial ecosystems are examined and experimentally manipulated to investigate potential adaptation processes and the induced changes in organisms in response to novel ecosystems. In this context, we study extensively managed and unmanaged grasslands in the urban area of Berlin, focusing on the biodiversity, biomass and ecosystem services of the plant communities, and with special attention to invasive species. Furthermore, the effects of urbanization and new stressors such as microplastics on microbial litter decomposition and plant water use efficiency are examined.

Initial results show that the novel ecosystems provide ecosystem services (such as evaporation and nutrient absorption) to a similar extent as their natural counterparts, regardless of biodiversity. The biomass of indigenous plant species increased with biodiversity and the size of the respective grassland area, whereas the biomass of invasive species was mostly determined by the extent of urbanization (e. g. soil sealing and population density in the surroundings). The data will be further analyzed together with the project partners of the other sub-projects.

Project: Bridging in Biodiversity Science (BIBS) **Term:** 2016–2021 **Sponsor:** BMBF **Lead at ZALF:** G. Lischeid (lischeid@zalf.de) **Partner:** FU Berlin, Univ. Potsdam, TU Berlin, IGB, IZW, MfN Berlin https://www.bbib.org/bibs-project.html

VADOSE ZONE MONITORING AND MODELLING OF WATER FLOW IN HILLSLOPE SOILS

HORST H. GERKE, ANNELIE EHRHARDT



Tracer application (KBr) underneath a cultivated topsoil along a 10 m trench perpendicular to the slope above plot LP7 of the CARBOZALF-D experimental field Water movement in soils is of central importance for soil functions such as storage and filtering as well as nutrient and element cycling. Classic concepts of modelling soil water dynamics typically fail in case of fast infiltration processes and when predicting subsurface lateral flows along hillslopes. Within this collaborative project, the already existing long-term monitoring data from a lysimeter network and field experiments will be used to test alternative models for the onset of lateral water flow based on hydraulic non-equilibrium and hysteresis. The aim of the project is to develop an effective multi-dimensional model of water flow on hillslopes that combines non-linear onset of lateral flow and plot-scale preferential flow.



In well-drained, unsaturated soils, water moves predominantly vertically. Lateral flow is initiated at locations where the soil approaches water saturation and capillary forces lose relevance. The onset of lateral flow along impeding soil horizon boundaries

and other heterogeneities in hillslopes cannot be described realistically even with spatially-distributed numerical 3D models. A process-based model concept for transient lateral flow in the unsaturated zone of hillslope soils is still missing. One major difficulty is that water dynamics in field soils exhibit non-equilibrium effects and hysteresis due to structural heterogeneities. Consequently, lateral flow is triggered already at local water potentials close to zero, i. e. far before complete water saturation occurs, as is commonly assumed. Another difficulty is the need for a 2D or 3D representation of the hillslope and the corresponding high demand of both data and computing power.

In the DFG project VAMOS, a conceptual framework will be developed to describe non-equilibrium dynamics and hysteresis for 1D vertical flow in a physically consistent way. The analysis is based on unique data sets provided by the VAMOS monitoring system and the TERENO-SoilCan lysimeter network, which continuously measures water content and matric potential in different field soils (3D) and lysimeters (1D) since 2013. Upscaling to the hillslope-scale will be accomplished by a dynamic lateral coupling of vertical 1D columns triggered by local water saturation (i. e. zero potential) in order to describe lateral flows at large scales with considerably reduced complexity. The overall project is structured in (1) unified concepts to model soil water hysteresis and hydraulic non-equilibrium, (2) the identification of field evidence for the onset of lateral flow at the hillslope scale, and (3) hillslope scale model development and evaluation. For model validation, joint experiments are carried out such as, for example, a bromide tracer experiment at the CARBOZALF-D experimental field and laboratory-scale percolation experiments. We expect a better prediction of the onset and dynamics of lateral subsurface flow in unsaturated soils and an improved understanding of the temporarily changing flow paths and travel times at the scale of hillslopes, which improves the currently limited prediction of solute transport in variably saturated soils and the vadose zone.

Project: Monitoring and modelling of non-equilibrium soil water dynamics and lateral subsurface flow in hillslope soils (VAMOS) **Term:** 2019–2021 **Sponsor:** DFG **Lead at ZALF:** H. Gerke (hgerke@zalf.de) **Partner:** TU Dresden, UFZ

TAILORED FOOD PROCESSING TECHNOLOGIES TO IMPROVE FOOD SECURITY IN EAST AFRICA

CONSTANCE RYBAK, HARRY HOFFMANN, STEFAN SIEBER



Traditional dehulling method for pigeon peas in Mozambique

On a global scale, food and nutrition security is still one of the most pressing challenges. Post-harvest losses and inadequate post-harvest treatments play a crucial role, because both significantly decrease food availability and utilization. Especially high quality plant foods such as African indigenous vegetables and legumes are perishable; and inadequate post-harvest treatment therefore decreases their availability mainly during the dry season. The development and testing of innovative and tailored processing technologies and adequate post-harvest treatments to improve the year-round availability of high-quality plant foods must be addressed to improve the nutrition security situation particularly in Sub-Saharan Africa (SSA).



High post-harvest food loss, arising mainly from limited food preservation capacities, is an important factor constraining food and nutrition security in SSA. In the VEGI-LEG project, research institutions from Tanzania, Mozambique and Germany jointly aim

at safeguarding nutrition security for the local population in East Africa. Towards this goal, we work on the development of locally adapted processing technologies to improve nutrient-quality of products and to ensure their year-round availability.

The project operates in two different case study regions: the Lindi region in Tanzania and the Zambézia region in Mozambique, both characterized by a high prevalence of food insecurity and malnutrition. As starting point, a household survey was conducted in both regions to identify production systems and traditional post-harvest treatments for African indigenous vegetables (AIV) and pigeon peas. Furthermore, we conducted a dietary intake assessment to investigate the nutritional status of the target population and evaluated the farmers' capacities for business development on the local level. These results were used to design, test, pilot and implement tailored processing technologies for innovative products with extended shelf-life to improve the year-round availability of high-quality products within an action research framework. At this stage of the project, the identified tailored processing technologies encompass indirect solar driers for AIVs and pigeon peas as well as modified pea dehullers. The first technology allows small-scale farmers to dry their vegetable harvest without exposing these fragile food items to direct sunlight, thus reducing the degradation of specific vitamins and secondary plant metabolites. The second technology aims at the development and implementation of dehullers in order to encourage small- and medium-scale food processing enterprises to produce pigeon peas with an increased shelf life. This also involves further processing steps of pigeon peas such as flour production, which are vital to increase the year-round availability of high-quality food products.

At a later stage, the dissemination of the developed products and related technologies will be closely monitored and guidelines for knowledge transfer will be developed.

Project: Vegi-Leg: Implementing innovative processing technologies for nutrient-dense plant foods (African indigenous vegetables and legumes) to safeguard perennial nutrition security—an East African and Southeast African country comparison (VEGI-LEG) Term: 2018–2021 Sponsor: BMEL Lead at ZALF: C. Rybak (constance. rybak@zalf.de) Partner: Univ. of Hohenheim, SUA, SIDO, Univ. Lúrio, IIAM www.vegi-leg.org

MEETING DESIRED PROTEIN CONTENTS FOR MALTING BARLEY

CLAAS NENDEL, PABLO ROSSO



A trial field with winter barley fertilized with different levels of nitrogen

Europe produces 45 % of the global malting barley. As a prerequisite for further processing, malting barley must meet specific criteria defined by maltsters (e.g. grain protein content in the 9.5-11.5 % range), which are in turn influenced by crop fertilization. However, to date, there is no efficient tool available to optimize crop protein content by means of targeted nitrogen fertilization. BARLEY-IT aims at developing a service to help farmers reach the maltsters' criteria and reduce N₂O emissions. The service will provide advice regarding the optimal timing and amount of nitrogen input to maximize nitrogen absorption by the crop, based on the modelling of barley crop growth and N₂O emissions as well as on a weekly control of crop nitrogen status by satellite imaging.

BARLEY-IT is based on the use of numerical technologies to drive the nitrogen fertilization of growing barley in order to reach grain protein contents suitable for the malting industry. The goal is to estimate the actual nitrogen crop requirement and to accordingly adapt the applied fertilizer amount.

By adapting the input precisely to the crop need, we expect to significantly reduce greenhouse gas (GHG) emissions resulting from fertilization.

These objectives will be achieved by:

- the simulation of crop growth in the field, its interaction with the environment and the related absorption of nitrogen. Using barley crop growth models, we are able to forecast grain yield and grain quality (protein content) and to quantify greenhouse gas emissions at different crop management and pedo-climatic conditions.
- connecting remote sensing data with the crop models, thus enhancing the prediction accuracy. The accuracy of plant growth models is limited by the complexity of the plant-environment system to be modelled. In order to improve the predictions of plant simulations, data from remote sensing technologies are collected, processed and analyzed, and then incorporated into the modelling exercise. Traditionally, methods for linear systems are based on the Kalman Filter approach, but in light of the high complexity of plant growth models, extensions or more generalized approaches need to be developed. Among the most promising innovations are particle filtering methods,

which can be applied to any non-linear model. Studies have already demonstrated the potential of such methods applied to growth models of some crops, thus also offering the opportunity for generalizing barley growth models.

• using optimization methods based on crop growth modelling in order to find the best nitrogen fertilization practice while accounting for the randomness of weather and seasonal forecasts.

These technologies are combined in a user-friendly web service platform consisting of two main modules: a database manager and a simulation platform. This platform is designed to help in finding the best management options to produce a higher quality grain with a protein content that meets the standards of the malting industry, while saving on fertilizers and reducing GHG emissions.

Project: Meeting desired protein contents for malting barley (BARLEY-IT) **Term:** 2017–2019 **Sponsor:** Climate-KIC **Lead at ZALF:** C. Nendel (nendel@zalf.de) **Partner:** Cybele-Tech, INRAE, Ulg Gembloux, Agropithiviers

CLIMATE CHANGE ADAPTATION IN AGRICULTURE—REGIONALITY MATTERS!

MICHAEL GLEMNITZ, CLAUDIA BETHWELL



Overview map of the distribution of the investigation regions north, east and southwest in Germany: Considered are selected soil-climate-units according to Roßberg et al. 2007. Climate change is a global phenomenon with specific local impacts. Therefore, mitigation and adaptation strategies require local action. Taking into account the regional variability of climate change, farmers are searching for the best solutions for their specific regional setting. Which are the most suitable farming options for cropping systems with respect to the challenges caused by climate change? The project OPTAKLIM aims to quantify the regional natural, agricultural and socio-economic drivers and trade-offs for climate change adaptation in agriculture. In addition, regional adaptation measures will be optimized together with stakeholders based on scientific evidence.



The effects of current global climate change are complex, with manifold approaches for solutions. On their own, individual measures addressing the reduction of greenhouse gases or the adaptation to increasing temperatures might be quite efficient. But what is

their use if they don't fit to the actual cropping systems, can't be integrated into farming operations, don't generate marketable goods, or lead to trade-offs with contrasting environmental regulations or targets. In this case, the theoretically possible effects may not be realized at all.

The project OPTAKLIM aims at supporting farmers with respect to this optimization problem. In the frame of a co-design process together with farmers, we look for and discuss potential regional solution approaches for climate mitigation and adaptation. For this purpose, three German regions with significantly different climatic conditions were selected for study. For each target region, the most likely climate change phenomena relevant for agriculture were identified. Moreover, the state of the art of the regional cropping and plant protection systems were described und relevant pathways for the adaptation to climate change defined. These pathways serve as »storylines« designed for the development of future cropping scenarios. The resulting regional adaptation scenarios will be evaluated regarding their greenhouse gas emissions, farming economics and environmental impacts using existing agro-ecosystem models. The outcomes of these assessments will be discussed with regional stakeholders in order to identify the regionally most suitable and promising paths for climate change adaptation.

Finally, the quantitative results will feed a new online information platform for farmers, designed to support farmers' decision making with scientific data in other regions all over Germany and beyond the current project.

Project: Optimizing agricultural cropping strategies and measures for climate adaptation—analyses and assessments at the landscape level with special regard to their interactions with plant protection, productivity, cropping structure and greenhouse gas emissions (OPTAKLIM) **Term:** 2018–2021 **Sponsor:** BMEL **Lead at ZALF:** M. Glemnitz (mglemnitz@zalf.de) **Partners:** PIK, JKI, JLU Giessen, IGLU Göttingen

www.unter-2-grad.de/optaklim.html

THE YEAR



18TH ZALF AT THE INTERNA-TIONAL GREEN WEEK The main exhibit at the ZALF stand was the autonomously flying small aircraft »TRON«. ZALF uses the drone for remote sensing of agricultural areas. Researchers can thus evaluate smallscale changes in vegetation cover or in soil quality with an accuracy of up to two centimetres.

14TH-15TH INNOVATION

MANAGEMENT The closing event for the FONA project »ginkoo« took place in Berlin. ZALF subsidiary agrathaer GmbH presented a newly developed and easy-to-use software tool designed to support decision-making in innovation processes.

https://bit.ly/2Bmo9xG

https://bit.ly/3gZ0uCi

4TH MINISTER'S VISIT ON INSECT PROTECTION The

Brandenburg Minister of Agriculture and Environment visited ZALF to learn about the potential for insect protection in agricultural landscapes. The meeting was the prelude to the preparation of an action plan by ZALF with the participation of the Senckenberg German Entomological Institute and the Eberswalde University



JANUARY

30TH STRENGTHENING THE NATURAL DEFENCES OF PLANTS

A consortium of four research institutes coordinated by ZALF is investigating how wheat can be better protected against diseases and pest infestations through the formation of volatile organic substances in climate-related stress situations. The project »VolCorn« aims to better understand and use the natural defences of the plant, which are related to the microbes living on and in the plant.

https://bit.ly/2YQvcY4

FEBRUARY

25TH START OF FIRST INTE-GRATED PRIORITY PROJECT

ZALF has started its first integrated priority project (IPP) »Small Water Bodies in an agricultural landscape: Ecosystem services of spatial and temporal within-field transition zones (SWBTRANS)«. It will fill knowledge gaps about the conscious use of heterogeneities in agricultural landscapes. The project combines the expertise of four working groups.

https://bit.ly/3eTt6MP

MARCH

for Sustainable Development. This plan provides the scientific basis for a planned »Program of Measures for Insect Protection« in Brandenburg.

https://bit.ly/2FEIAYk

29TH ZALF IN THE UN ENVI-RONMENTAL REPORT »Healthy

planet—healthy people« is the motto of the global environmental report published by the UN in March. The report presents the consequences of environmental degradation for human health, which threaten to increase dramatically. Prof. Katharina Helming of ZALF was involved as lead author in the evaluation of political regulations on soil protection.

https://bit.ly/3gkVnMs
IN RETROSPECT

3RD **OPEN-ACCESS** By participating in the DEAL contract with the publisher Wiley and preparing a corresponding contract with Springer-Nature, the Open-Access options for ZALF researchers are fundamentally improved. Even before this paradigm shift, ZALF had already achieved an Open-Access share of about 50 percent of its publications by combining

16TH EUROPEAN INITIATIVE FOR LOWER PESTICIDE USE ZALF

has launched a unique European-wide research initiative with the National Research Institute for Agriculture, Food and Environment (INRAE) and the Julius Kühn Institute (JKI). The declared goal: to reduce the use of chemical synthetic pesticides to a minimum by 2050. Representatives of toplevel European research met in Berlin in May to develop a strategy paper and a roadmap to identify research gaps and gradually close them.

https://bit.ly/3eS4luU



5TH PROFESSORIAL APPOINT-MENT Steffen Kolb was appointed professor at the Albrecht-Daniel-Thaer-Institute of the Humboldt-Universität zu Berlin in a joint appointment. At ZALF he is Co-Head of Research Area 1 »Landscape Functioning« and leads the working group »Microbial Biogeochemistry«.

https://bit.ly/2AtpuCk

APRIL

various measures.

11TH AGRICULTURAL SYS-TEMS OF THE FUTURE In April, the project »Agricultural System of the Future: DAKIS—Digital Agricultural Knowledge and Information System« was launched. Together with nine other research institutions, the researchers want to develop a unique information and management system that combines production optimization with requirements from environmental and nature conservation in

https://bit.ly/38jGOWG

new farming systems.





ΜΑΥ

25TH ZALF IN BERLIN Together with the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), the Eberswalde University for Sustainable Development (HNEE) and agrathaer GmbH, ZALF presented a varied program of activities in the »Prinzessinnengärten« in Kreuzberg: from a VR flight with a drone to explore the landscape, the mosquito atlas and kitchen gardens for food supply in Africa, to the water cycle in the soil and special features of legumes.

https://bit.ly/2Vz6xW7

JUNE

18TH LUPINE FIELD DAY AT

ZALF More than 90 interested people from consulting, trade, science and international partners from Finland, Serbia, Romania and other countries attended the Lupine Field Day at ZALF. They informed themselves about the yield potential of lupine and soybean varieties and innovative cropping systems. The event was organized by ZALF together with the Society for the Promotion of Lupine (GFL).

https://bit.ly/3glNVko



THE YEAR

3RD EXCHANGE ON AGRICUL-TURAL LANDSCAPES IN CLIMATE

CHANGE In cooperation with the department for »Sustainability and Climate Protection, Climate Impacts« at the Federal Ministry of Food and Agriculture (BMEL) ZALF organized a expert discussion on the topic »Climate-Smart Agricultural Landscapes—Use of Agricultural Landscapes in Climate Change«. The discussion with representatives from research and politics aimed at exchanging views on current research questions and results achieved so far.

1ST FROM OLD TO NEW In

August the project »Krumensenke« (partial deep tillage), coordinated by ZALF, was launched as part of the BMEL's »Renewable Resources« support program. Together with the Johann Heinrich von Thuenen Institute, research will be conducted over the next three years into how the cultivation of raw material plants can be made more climate-friendly by further developing an almost forgotten soil cultivation technique.

https://bit.ly/31UZhrv





10TH 62ND MEETING OF THE »GESELLSCHAFT FÜR PFLANZEN-BAUWISSENSCHAFTEN E. V.« The annual meeting entitled »Landscape matters—agricultural landscapes of the future« was organized together with ZALF and took place at the Humboldt-Universität zu Berlin.

https://bit.ly/31N5Lsp

JULY



15TH APPRENTICESHIP Three new apprentices started their way into work life and their three-year apprenticeship as office management assistants at ZALF. In addition to their school education at the »Oberstufenzentrum Märkisch Oderland« in Strausberg, the apprentices will complete the practical part of their training on the campus in Müncheberg.

AUGUST

14TH RESEARCH PRIZE OF THE CITY OF MÜNCHEBERG The

Research Prize was awarded to Dr. Moritz Reckling, plant cultivation scientist at ZALF. In his awarded doctoral thesis he deals with a highly topical subject: the revival of legume cultivation in Europe. He researched solutions to make cultivation more attractive in Europe and developed methods to assess the economic & ecological effects of legume cultivation and their production risks in European agriculture.

https://bit.ly/3gtaofm

SEPTEMBER

https://bit.ly/2Z0EQal

11TH STATE SECRETARY VISITS MOPLASA-PROJECT State Secretary Dr. Carolin Schilde from the Brandenburg Ministry of Agriculture visited a project team of practitioners and scientists who want to save the sea buckthorn cultivation with imaginative methods. The farmers took advantage of the event and emphasized the special importance of this culture for nature conservation, adaptation to climate change, North German tradition and regional value creation.

https://bit.ly/310kl2Y



IN RETROSPECT



16TH PANEL DISCUSSION ON AGRICULTURE IN CLI-

MATE CHANGE In October, ZALF launched a new dialogue format with »querFELDein TALKS«. Under the title »Dry prospects? Agriculture in Climate Change«, an interactive panel discussion took place in the Leibniz-Gemeinschaft building in Berlin. At the panel, science, politics and practice discussed proposals for a more climate-friendly agriculture of the future.

22ND NEW ONLINE BLOG What

do sustainable farming systems look like? Is our consumer behaviour still up to date? What does digital progress do in the field? What are the consequences of climate change? These and similar questions are to be answered in the future on the new online blog www.quer-feld-ein.blog. Seven scientific institutions from Berlin and Brandenburg, coordinated by ZALF, will report on their research results in an easy to understand way and facilitate dialogue.

https://bit.ly/2ZDQ2JG





5TH ELECTION TO THE DFG REVIEW BOARD Prof. Dr. Monika Wulf was elected to the DFG Review Board 207 »Ecology of Agricultural Landscapes«. At ZALF, Ms. Wulf leads the working group »Biotic Interactions between Forest and Agricultural Land«.

https://bit.ly/2ZKhFkl

OCTOBER

23RD ZALF PRESENTS ITS OWN ENVIRONMENTAL POLICY

Environmental protection is a high priority at ZALF. In its own environmental policy the Research Centre now describes the way towards a more sustainable use of available natural resources. To this end, all ZALF sites and working processes will be continuously reviewed with regard to sustainability aspects and improvements will be implemented together with the employees. On its way to becoming a climate-neutral research institution, ZALF is counting on the active involvement of all employees.

https://bit.ly/31bleAz

NOVEMBER

26TH MUCH-CITED RESEARCH-

ERS IN 2019 Dr. Kurt-Christian Kersebaum, graduate agricultural engineer in the Ecosystem Modelling Group at ZALF, has been awarded »Highly Cited Researcher« by the Web of Science for the second year in a row, Prof. Frank Ewert, Scientific Director of ZALF and Professor of Crop Production at the University of Bonn, for the third year in a row.

https://bit.ly/2Z0B7Kc

DECEMBER



1ST **PROFESSORIAL APPOINT-MENTS** Prof. Bettina Matzdorf received a lifetime appointment at the Leibniz University of Hanover. At ZALF she leads the working group »Governance of ecosystem services«. Prof. Claas Nendel, Co-Head of the Research Platform »Data Analysis & Simulation« received the call to the University of Potsdam.



...

FACTS & FIGURES





375 Employees (among them 171 scientists)

> **1100** Visitors

28 Employees doing academic teaching

94. Tasks and offices in scientific boards and bodies

	_
	_
	-
	_
	_

4791 Newspaper articles

190 Peer-reviewed publications

106 of which are open access



18 Scientific conferences and workshops

> 31 Colloquia



10.6 million € Total amount of third party funding

22.4 million € Basic funding

33 million € Total budget

32.1% Percentage of third party funding





BACK TO CONTENT



32 New doctoral researchers at ZALF

15 Completed doctoral theses, thereof 14 by ZALF doctoral researchers

33 Master and bachelor theses



30 Newly started projects

271 Cooperating partners in 41 countries (approx.)



FINANCES

TOTAL BUDGET (IN THOUSAND EURO, INCL. CASH ASSETS FROM THE PREVIOUS YEAR) 41,917

REVENUES FROM THIRD PARTY	DFG	977	EU	3,331
FUNDED PROJECT GRANTS IN	LEIBNIZ COMPETITION	180	FROM WHICH	
THE FINANCIAL YEAR 2019	FEDERAL MINISTRIES	5,238	HORIZON 2020	699
	STATE MINISTRIES	155	ELER	47
	INDUSTRY	42	ERANET	385
	OTHER	657	INTERREG	
			EIP	
			EFRE (THIRD PARTY FUNDED	
			PROPORTION OF 80-85%) 2,227	
			ΙΝ ΤΗΟυ	SAND EURO

TOTAL THIRD PARTY FUNDS (IN THOUSAND EURO)

10,581

EXPENSES DURING BUDGET YEAR 2019



22.4 MILLION BASIC FINANCE	10.6 MILLION TP FUNDS

INSTITUTIONAL FUNDS OF THE FEDERAL MINISTRY OF FOOD AND AGRICULTURE (BMEL) AND MINISTRY OF SCIENCE, RESEARCH AND CULTURE OF BRANDENBURG (MWFK)

MANAGEMENT, BOARDS & COMMITTEES



SCIENTIFIC ADVISORY BOARD OF ZALF

Prof. Harry Vereecken

Forschungszentrum Jülich, Institute of Bio- and Geosciences Chair of the Scientific Advisory Board

Dr. Dr. habil. Stefan Mann

Federal Department of Economic Affairs, Education and Research, Agroscope (CH) Vice Chair of the Scientific Advisory Board

Prof. Christine Alewell

University of Basel, Department of Environmental Sciences (CH)

ASSEMBLY OF MEMBERS

Dr. Claudia Herok

Ministry of Science, Research and Culture (MWFK, Ref. 22), Brandenburg Chair of the Assembly of Members

Dr. Jürgen Ohlhoff

Federal Ministry of Food and Agriculture Vice Chair of the Assembly of Members **Prof. Klaus Butterbach-Bahl** Karlsruhe Institute of Technology, IMK-IFU

Prof. Nina Buchmann ETH Zürich, Department of Environmental System Science (CH)

Prof. em. Dr. Peter Gregory University of Reading (UK)

Prof. Bernd Hansjürgens Martin-Luther-Universität Halle-Wittenberg | UFZ

Dr. Laurent Philippot INRAE Dijon (FR)

Prof. Andrea Emilio Rizzoli

University of Applied Sciences of Southern Switzerland, IDSIA (CH)

Prof. Christine Watson

Scotland's Rural College (UK) | Swedish University of Agricultural Sciences (SE)

Dr. Klaus-Peter Michel Federal Ministry of Education and Research

Peter Schubert Ministry of Rural Development, Environment and Agriculture, Brandenburg

Prof. Wolfgang Bokelmann Humboldt-Universität zu Berlin, Faculty of Life Sciences **Prof. Robert Seckler** University of Potsdam, Vice President for Research and Young Scientists

Udo Folgart Agro-Glien GmbH

Prof. Klement Tockner FWF Der Wissenschaftsfonds (AT)

DOCTORAL RESEARCHERS

NEW IN 2019

Artner-Nehls, Astrid Supervision at ZALF: Dr. Sandra Uthes Humboldt-Universität zu Berlin Supervision: Prof. Peter Feindt

Barghusen, Rena Supervision at ZALF: Dr. Claudia Sattler, Prof. Bettina Matzdorf Leibniz University Hannover Supervision: Prof. Bettina Matzdorf

Bunker, Ingrid Supervision at ZALF: Dr. Jana Zscheischler, Dr. Sandra Uthes Humboldt-Universität zu Berlin Supervision: Prof. Klaus Müller

Del Río Duque, Martha Lilia Supervision at ZALF: Dr. Katharina Löhr, Dr. Michelle Chevelev-Bonatti Humboldt-Universität zu Berlin Supervision: PD Dr. Stefan Sieber

Dietrich, Steffi Supervision at ZALF: Dr. Sandra Uthes Martin-Luther-Universität Halle-Wittenberg Supervision: Prof. Thomas Herzfeld

Donat, Marco Supervision at ZALF: Dr. Johann Bachinger Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Ehrhardt, Annelie Supervision at ZALF: PD Dr. Horst Gerke Martin-Luther-Universität Halle-Wittenberg Supervision: Prof. Hans-Jörg Vogel

Eichhorn, Franziska Supervision at ZALF: apl. Prof. Monika Wulf University of Potsdam Supervision: PD Dr. Thilo Heinken

Feigs, Jannis Till Supervision at ZALF: Dr. Stephanie Holzhauer, Dr. Tobias Naaf University of Potsdam Supervision: apl. Prof. Monika Wulf, Prof. Martin Diekmann

Festbaum, Christine Supervision at ZALF: Dr. Doreen Werner University of Greifswald Supervision: PD Dr. Helge Kampen Friedrich, Jonathan

Supervision at ZALF: Dr. Jana Zscheischler Georg-August-Universität Göttingen Supervision: Prof. Heiko Faust

Gerriets, Marisa Rixte Supervision at ZALF: Prof. Michael Sommer University of Potsdam Supervision: Prof. Michael Sommer

Ghafarian, Fatemeh Supervision at ZALF: Dr. Ralf Wieland University of Potsdam Supervision: Prof. Claas Nendel

Groschupp, Sarah Supervision at ZALF: Dr. Doreen Werner University of Greifswald Supervision: PD Dr. Helge Kampen

Halwani, Mosab Supervision at ZALF: Dr. Johann Bachinger Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Karges, Kathleen Supervision at ZALF: Dr. Johann Bachinger Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Kestel, Florian Supervision at ZALF: Dr. Roger Funk University of Potsdam Supervision: apl. Prof. Monika Wulf

Kober, Klarissa Supervision at ZALF: Dr. Michael Glemnitz Brandenburg University of Technology Cottbus-Senftenberg Supervision: Prof. Klaus Birkhofer

Lewin, Simon Supervision at ZALF: Prof. Steffen Kolb, Dr. Andreas Ulrich Humboldt-Universität zu Berlin Supervision: Prof. Steffen Kolb

Macpherson, Joseph Supervision at ZALF: Prof. Katharina Helming Leibniz University Hannover Supervision: Prof. Benjamin Burkhard

Matavel, Custodio Efraim Supervision at ZALF: PD Dr. Stefan Sieber, Prof. Dr. Klaus Müller Humboldt-Universität zu Berlin Supervision: PD Dr. Stefan Sieber Méité, René Supervision at ZALF: Dr. Sandra Uthes, Dr. Jana Zscheischler Humboldt-Universität zu Berlin Supervision: Prof. Klaus Müller

Melzer, Marvin Supervision at ZALF: Prof. Sonoko Dorothea Bellingrath-Kimura Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Morales Munoz, Hector Camilo

Supervision at ZALF: Dr. Barbara Schröter, Dr. Michelle Chevelev-Bonatti Humboldt-Universität zu Berlin Supervision: PD Dr. Stefan Sieber

Nishizawa, Takamasa

Supervision at ZALF: Dr. Moritz Reckling, Dr. Peter Zander Giessen University Supervision: Prof. Joachim Aurbacher

Pernat, Nadja

Supervision at ZALF: Dr. Doreen Werner, PD Dr. Helge Kampen (FLI) Freie Universität Berlin Supervision: Prof. Jonathan Jeschke

Rodriguez Torres, Leidy Tatiana

Supervision at ZALF: Dr. Katharina Löhr, Dr. Michelle Chevelev-Bonatti Humboldt-Universität zu Berlin Supervision: PD Dr. Stefan Sieber **Schnabel, Marina** Supervision at ZALF: Dr. Marina Müller, Dr. Marlene Pätzig Humboldt-Universität zu Berlin Supervision: Prof. Carmen Büttner

Schöpke, Benito Supervision at ZALF: apl. Prof. Monika Wulf University of Potsdam Supervision: Prof. Karsten Wesche

Schwartz, Carmen

Supervision at ZALF: Dr. Annette Piorr, Prof. Dr. Tobias Plieninger (Univ. Göttingen) Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Stimmler, Peter

Supervision at ZALF: Dr. Jörg Schaller University of Bayreuth Supervision: Prof. Johanna Pausch

Vaidya, Shrijana

Supervision at ZALF: Dr. Mathias Hoffmann Humboldt-Universität zu Berlin Supervision: Prof. Steffen Kolb

SCHOLARSHIP HOLDERS

Name	Country	Funding
Arshad, Dr. Muhammad	Pakistan	Fritz Thyssen Foundation
Batunacun	PR China	China Scholarship Council
Dam, Thi Huyen Trang	Vietnam	Vietnam International Education Development, Ministry of Education and Training
Eichhorn, Franziska	Germany	Zwillenberg-Tietz Foundation
Hemminger, Karoline	Germany	Marianne und Dr. Fritz Walter Fischer Foundation
Huynh, Thanh Hien	Vietnam	Vietnam International Education Development, Ministry of Education and Training
Ibrahim, Esther Shupel	Nigeria	National Centre For Remote Sensing (NCRS)
Jabborova, Dr. Dilfuza	Uzbekistan	German Academic Exchange Service (DAAD)
Jiang, Li	PR China	German Academic Exchange Service (DAAD)
Kangondo, Angelique	Rwanda	German Academic Exchange Service (DAAD)
Lai Trinh, Anh Khoa	Vietnam	MEXT Scholarship Japan
Mahmood, Nasir	Pakistan	Punjab Higher Education Commission
Morales Munoz, Hector Camilo	Colombia	Friedrich Naumann Foundation
Pandey, Dr. Divya	India	Alexander von Humboldt Foundation
Reinke, Henrik	Germany	Marianne und Dr. Fritz Walter Fischer Foundation
Sun, Dr. Chuanzhun	PR China	China Scholarship Council
Susman, Roni	Indonesia	Ministry of Finance, Indonesia Endowment Fund of Education
Thai, Thi Huyen	Vietnam	Vietnam International Education Development, Ministry of Education and Training
Vasić, Dr. Filip	Serbia	DBU
Vijayan, Dhanya	India	German Academic Exchange Service (DAAD)
Wanting, Dr. Tan	PR China	South China Agricultural University
Weißhuhn, Peter	Germany	DBU
Wenz, Elena	Germany	Marianne und Dr. Fritz Walter Fischer Foundation
Welidehanna, Fikadu Getachew	Ethiopia	Alexander von Humboldt Foundation
Wenz, Elena	Germany	Marianne und Dr. Fritz Walter Fischer Foundation

DOCTORAL THESES

COMPLETED IN 2019

Chen, Cheng

Governmental Payments for Ecosystem Services Programs in China: The Institutional Settings and Market-based Approach Supervision at ZALF: Prof. Bettina Matzdorf Humboldt-Universität zu Berlin

Supervision: Prof. Klaus Müller

Kolk, Jens

The long-term legacy of historical land cover changes: Patterns and dynamics in herb-layer species richness in deciduous forests of the Prignitz region (NE Germany) Supervision at ZALF: apl. Prof. Monika Wulf, Dr. Tobias Naaf University of Potsdam Supervision: Prof. Florian Jeltsch

Ma, Hua

Systematic analysis of biochar performance on plant growth in soybean cropping system at marginal area in Germany and China Supervision at ZALF: Prof. Sonoko Dorothea Bellingrath-Kimura Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Mgeni, Charles

Analyses of Effects of Scaling-up Food Value Chain Upgrading Strategies on Food Security and Incomes in Tanzania: A Computable General Equilibrium-CGE Approach Supervision at ZALF: PD Dr. Stefan Sieber Humboldt-Universität zu Berlin

Supervision: Prof. Klaus Müller

Michalczyk, Anna

Modelling of nitrogen cycles in intensive winter wheat-summer maize double cropping systems in the North China Plain Supervision at ZALF: Prof. Claas Nendel, Dr. Kurt-Christian Kersebaum University of Potsdam Supervision: Dr. Kurt-Christian Kersebaum

Opitz, Ina

Interactions in Alternative food networks – motivations and effects Supervision at ZALF: Dr. Annette Piorr Humboldt-Universität zu Berlin Supervision: Prof. Klaus Müller

Rogasch, Eva

Diversity, ecology and vector potential of mosquito populations (Diptera: Culicidae) in two differentially structured zoological gardens in Germany Supervision at ZALF: Dr. Doreen Werner University of Greifswald Supervision: PD Dr. Helge Kampen

Schäfer, Merlin

Understanding and predicting global change impacts on migratory birds Supervision at ZALF: Dr. Marina Müller University of Potsdam Supervision: Prof. Florian Jeltsch

Schiro, Gabriele

Spatial distribution of phyllosphere fungi in heterogeneous wheat fields – an analysis of abiotic and biotic driving factors Supervision at ZALF: Dr. Marina Müller University of Potsdam Supervision: Prof. Volker Grimm

Schmidt, Martin

Fragmentation of landscapes: modelling ecosystem services of transition zones Supervision at ZALF: Prof. Claas Nendel, Prof. Gunnar Lischeid University of Potsdam Supervision: Prof. Gunnar Lischeid

Silungwe, Festo Richard

Integrating Crop Upgrading Strategies and Modeling for Improving Food Security in Semiarid Sub-Saharan Africa Supervision at ZALF: Dr. Frieder Graef, Prof. Sonoko Dorothea Bellingrath-Kimura Humboldt-Universität zu Berlin Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Steinke, Jonathan

New opportunities for agricultural extension services: Mainstreaming large-scale farmer participation through modern ICT Supervision at ZALF: PD Dr. Stefan Sieber Humboldt-Universität zu Berlin Supervision: Prof. Wolfgang Bokelmann

Taube, Robert

Characterisations of Fungal Communities in Temperate Lakes: With focus on diversity, abundance and methodological aspects of quantifying abundance Supervision at ZALF: Dr. Katrin Premke, Dr. Marina Müller, Dr. Arthur Gessler University of Potsdam Supervision: Prof. Hans-Peter Grossart

Ullmann, Wiebke

Understanding animal movement behaviour in dynamic agricultural landscapes Supervision at ZALF: Dr. Michael Glemnitz University of Potsdam Supervision: PD Dr. Niels Blaum

... and one external doctoral thesis with supervision by ZALF researchers

GUESTS & FELLOWS

GUESTS WITH RESEARCH STAYS AT ZALF

Djumaboev, Kakhramon International Water Management Institute, Uzbekistan

Jabborova, Dr. Dilfuza Academy of Sciences of Uzbekistan, Uzbekistan

Jiang, Li South China Agricultural University, China

Kangondo, Angelique Sokoine University of Agriculture, Tanzania

Kimaro, Anthony World Agroforestry (ICRAF), Tanzania

Lai Trinh, Anh Khoa Tokyo University of Agriculture and Technology, Japan

Li, Lei University College Dublin, Ireland **Onlassynov, Zhuldyzbek** Kazakh National Research Technical University, Kazakhstan

Saracanlao, Rochelle Joie Angor University of the Philippines Los Banos, Philippines

Sun, Dr. Chuanzhun South China Agricultural University, China

Tan, Wanting South China Agricultural University, China

... and additional long-term stays of international doctoral researchers on scholarships

FELLOWS

Burkhard, PD Dr. habil. Benjamin Leibniz University Hannover, Germany

Kimaro, Anthony World Agroforestry (ICRAF), Tanzania

Nautiyal, Prof. Sunil Institute for Social and Economic Change, India

Schönhart, Dr. Martin University of Natural Resources and Life Sciences Vienna, Austria

NEW* THIRD PARTY FUNDED PROJECTS

Duration	Title	Funding
January 2019 – December 2020	Online Blog »querFELDein«	Brandenburg Ministry of Science, Research and Culture (MWFK)
January 2019 – December 2020	Towards high water productivity in agriculture based on multi-scale modelling (PPP Australien 2019)	German Academic Exchange Service (DAAD)
January 2019 – December 2021	Volatilome of a cereal crop-microbiota system under drought & flooding (VolCorn)	Leibniz Association / Leibniz Competition
January 2019 – June 2019	Sustainability assessment of the water-energy-food nexus for irrigated agriculture: Interdisciplinary approaches for Central Asia (Summer School WEFCA)	Volkswagen Foundation
February 2019 – January 2020	Scientifically based processing of geobased data for the wind and water erosion risk and distance regulation accord- ing to § 2 AgrarZahlVerpflV (EroKul)	Brandenburg Ministry for Rural Development, Environment and Agriculture (MLUL)
February 2019 – January 2022	Web-based nutrient management in organic farming (WebMan)	Federal Ministry of Food and Agriculture (BMEL)/Federal Office for Agriculture and Food (BLE)
March 2019 – December 2019	Validation of national modeling of critical loads (Critical Loads)	Johann Heinrich von Thünen- Institut (TI)
March 2019 – April 2020	International Nitrogen Management System (INMS)	International Institute for Applied Systems Analysis (IIASA)
March 2019 – August 2021	Impact of climate on grain legume yield stability (LegSTABLE)	German Research Foundation (DFG)
March 2019 – August 2021	Disentangling forest effects on grassland biodiversity and ecosystem services in agricultural landscapes (ForGrass)	German Research Foundation (DFG)
March 2019 – February 2022	Integrative analysis of the influence of pesticides and land use on biodiversity in Germany (INPEDIV)	Leibniz Association/Leibniz Competition
April 2019 – February 2021	Bridging in Biodiversity Science (BIBS 2)	Federal Ministry of Education and Research (BMBF)
April 2019 – March 2022	Tillage erosion affects crop yields and carbon balance in hummocky landscapes (TilEro)	German Research Foundation (DFG)
April 2019 – March 2024	Digital Agricultural Knowledge and Information System (DAKIS 2.0)	Federal Ministry of Education and Research (BMBF)
April 2019 – March 2024	Cumulative impacts of bioeconomic strategies for sustaina- ble agriculture (BioKum)	Federal Ministry of Education and Research (BMBF)
May 2019 – May 2020	Mirror, mirror on the wall – evaluation of collaboration experiences of the Leibniz Research Alliance (LFV Mirror)	Leibniz Association/Leibniz Re- search Alliance Crises in a Glo- balised World/Peace Research Institute Frankfurt Member of the Leibniz Association
May 2019 – April 2022	Scenarios for agricultural landscapes' biodiversity and ecosystem services (SALBES)	EU-ERA-NET/Federal Ministry of Education and Research (BMBF)
May 2019 – April 2023	Co-design of novel contract models for innovative agri-enivronmental-climate measures and for valorisation of enviromental public goods (Contracts 2.0)	European Commission

NEW* THIRD PARTY FUNDED PROJECTS

Duration	Title	Funding
May 2019 – April 2022	Increasing productivity and sustainability of European plant protein production by closing the grain legume yield gap (LegumeGap)	EU-ERA-NET/Federal Ministry of Education and Research (BMBF)
June 2019 – December 2019	Transmission control of infections in the 21 th Century (INFECTIONS'21 2.0)	Leibniz Association/Leibniz Research Alliance Infections'21
June 2019 – May 2020	A program of measures for insect protection in Brandenburg (Insect Protection)	Brandenburg Ministry for Rural Development, Environment and Agriculture (MLUL)
June 2019 – May 2022	Reduction of environmental and climate impacts of agricul- tural crop production through the use of an optimized top- soil deepening technique (Krumensenke)	Federal Ministry of Food and Agriculture (BMEL)
June 2019 – May 2022	Improved transboundary wildlife management of European Bison and Moose (LosBonasus)	EU Interreg
July 2019 – January 2020	Detection of beaver lodges in dikes (Biber)	Brandenburg State Office for the Environment (LfU)
July 2019 – January 2021	Agricultural Systems of the future: Central Coordination Unit (ZenKo)	Federal Ministry of Education and Research (BMBF)
August 2019 – December 2021	Monitoring of mosquitoes in Germany II (CuliMo 2)	Federal Ministry of Food and Agriculture (BMEL)
August 2019 – July 2022	Sustainability assessment of the Water–Energy–Food nexus for irrigated agriculture: Examples from river basins in Uzbekistan (WEFUZ)	German Research Foundation (DFG)
August 2019 – July 2022	Mosquitoes and mosquito-borne zoonoses in Germany (CuliFo 2)	Federal Ministry of Food and Agriculture (BMEL)
September 2019 – December 2019	Energizing food processing in East Africa (EnergeastAfrica)	Federal Ministry of Food and Agriculture (BMEL)
September 2019 – December 2019	Impacts of biochar addition and microbial inoculation on plant growth	German Academic Exchange Service (DAAD)

COOPERATIONS (SELECTED)

NATIONAL

UNIVERSITIES

- Brandenburg University of Technology Cottbus-Senftenberg
- Carl von Ossietzky University of Oldenburg
- Eberswalde University of Sustainable Development
- European University Viadrina
- Freie Universität Berlin
- Friedrich Schiller University Jena
- Georg-August-Universität Göttingen
- Giessen University
- Heidelberg University
- Humboldt-Universität zu Berlin
- Leibniz University Hannover
 Martin-Luther-Universität
- Martin-Luther-Universität Halle-Wittenberg
- Technical University of Munich
- Technische Universit
 ät Berlin
- University of Applied Sciences
 Dresden
- University of Applied Sciences Osnabrück
- University of Applied Sciences Weihenstephan-Triesdorf
- University of Bayreuth
- University of Bonn
- University of Freiburg
- University of Greifswald
- University of Hohenheim
- University of Kassel
- University of Potsdam
- University of Stuttgart

NON-UNIVERSITY RESEARCH

- Bernhard Nocht Institute for Tropical Medicine
- Deutsches Biomasseforschungszentrum
- Federal Research Institute for Animal Health, Friedrich-Loeffler-Institut
- Forschungszentrum Jülich
- Fraunhofer Institute for Systems and Innovation Research
- German Centre for Integrative
 Biodiversity Research
- Helmholtz-Centre for Environmental Research – UFZ
- Johann Heinrich von Thünen Institute
- Julius Kühn Institute
- Karlsruhe Institute of Technology

... and 47 Leibniz institutes, in 4 Leibniz Research Alliances

OTHER GOVERNMENTAL AND NON-GOVERNMENTAL INSTITUTIONS

- agrathaer GmbH
- Bundesanstalt für Materialforschung und -prüfung
- Deutscher Wetterdienst
- Environmental Action Germany
- Federal Institute for Geosciences and Natural Resources
- Fruit Advisory Service of the Altes Land
- Landesamt f
 ür Umwelt Brandenburg
- Landesanstalt für Landwirtschaft und Gartenbau Sachsen-Anhalt
- Landwirtschaftskammer Niedersachsen
- proPlant Agrar- und Umweltinformatik GmbH
- Society for the promotion of mosquito control
- Stiftung Westfälische Kulturlandschaft
- The German Farmers' Association

INTERNATIONAL

UNIVERSITIES

- Aarhus University, Denmark
- Adnan Menderes University, Turkey
- Czech University of Life Sciences Prague, Czech Republic
- Estonian University of Life Sciences Tartu, Estonia
- Free University Amsterdam, Netherlands
- Gorgan University of Agricultural Sciences and Natural Resources, Iran
- Kobenhavns Universitet, Denmark
- Scotland's Rural College, United Kingdom
- Sokoine University of Agriculture, Tanzania
- Swedish University of Agricultural Sciences, Sweden
- Tashkent Institute of Irrigation and Melioration, Uzbekistan
- Tokyo University of Agriculture and Technology, Japan
- Universidad Autonoma de Madrid, Spain

- University of Natural Resources and Life Sciences Vienna, Austria
- University of Colorado Riverside, United States of America
- University of Helsinki, Finland
- University of Tasmania, AustraliaVrije Universiteit Amsterdam,
- NetherlandsWageningen University, Netherlands
- Wroclaw University of Environmental and Life Sciences, Poland

NON-UNIVERSITY RESEARCH

- Agricultural Research Institute of Mozambique, Mozambique
- Agroscope, Switzerland
- Austrian Institute of Technology, Austria
- Centre de Cooperation internationale en Recherche Agronomique pour le developpement – C. I. R. A. D., France
- Centre national de la recherche scientifique, France
- CIAT Centro International de Agricultura Tropical, Colombia
- Finnish Environment Institute, Finland
- Forschungsinstitut für biologischen Landbau, Switzerland
- Institute for Structural Policy, Czech Republic
- Institute of Botany, Plant physiology and Genetics, Tajikistan
- Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAE), France
- International Institute for Applied Systems Analysis, Austria
- International Water Management Institute – Central Asia, Sri Lanka
- Norwegian Bioeconomy Research Institute, Norway
- PBL Netherlands Environmental Assessment Agency, Netherlands
- Qatar Environment and Energy Research Institute, Qatar
- U.M. Institute of Hydrogeology and Geoecology, Kazakhstan

TEACHING

BRANDENBURG UNIVERSITY OF TECHNOLOGY

 Nachhaltige Waldbewirtschaftung Lecture, SS 2019

FREIE UNIVERSITÄT BERLIN

 Landschaftswasserhaushalt von Berlin und Brandenburg Lecture, WS 2019/2020

EBERSWALDE UNIVERSITY FOR SUSTAINABLE DEVELOPMENT

- Bodenlandschaft und Stoffhaushalt Seminar, SS 2019
- Grundlagen und Instrumente der Regionalentwicklung Lecture, WS 2019/2020
- Kreislaufwirtschaft Lecture, WS 2019/2020
- Monitoring und Indikatoren Lecture, WS 2019/2020
- Standortlehre Lecture, WS 2019/2020
- Umweltökonomie Lecture, WS 2019/2020
- Volkswirtschaftslehre Lecture, WS 2019/2020

HUMBOLDT-UNIVERSITÄT ZU BERLIN

- Integrated Natural Resource Management Lecture, SS 2019, WS 2019/2020
- Process and Quality Management in Agriculture and Horticulture
- Training, SS 2019
- Advanced Empirical Methodology for Socio-Ecological Systems Analysis Lecture, SS 2019
- Agrarökologie Lecture, WS 2019/2020
- Environmental Sociology and Environmental Policy Lecture, WS 2019/2020
- Theory and methods for an integrated analysis of ecosystem services governance Seminar, SS 2019
- In Brandenburg heulen die Wölfe in Berlin steppt der Bär. Vergleichende Geographische Konfliktforschung zwischen Stadt und Land Seminar, SS 2019
- Multifunctional agricultural landscape use Lecture, WS 2019/2020

LEIBNIZ UNIVERSITY HANNOVER

• Naturschutz- und Umweltökonomie Lecture and Seminar, WS 2019/2020

MARTIN-LUTHER-UNIVERSITÄT HALLE-WITTENBERG

 Ressourcenmanagement und Ressourcenschutz Lecture, SS 2019

TECHNISCHE UNIVERSITÄT BERLIN

- Bodenmesstechnik Lecture and Seminar, SS 2019
- Bodenchemisches Laborpraktikum f
 ür Fortgeschrittene Seminar, SS 2019

UNIVERSITY OF POTSDAM

- Biogeochemie Lecture, SS 2019
- Einführung in die Hydrochemie Lecture, WS 2019/2020
- Bodenlandschaften Lecture, WS 2019/2020
- Zeitreihenanalyse und Spektralanalyse Lecture, WS 2019/2020
- Botanische Geländeübungen Lecture, SS 2019
- Landschaftspraktikum Bodenlandschaftsanalyse in der Uckermark Seminar, SS 2019
- Stadt und Land: mehr Konflikte als Kooperation? Seminar, WS 2019/2020
- Experimental design and data analysis Lecture, WS 2019/2020

... and 14 additional individual lectures by ZALF scientists

MANDATES & RESPONSIBILITIES (SELECTED)

Augustin, Jürgen

- Board member at the Emission Factor Database der TFI (IPCC)
- Associate editor at Journal of Plant Nutrition and Soil Science

Bachinger, Johann

- Editorial board member at Organic Farming
- Member of the Scientific Advisory Board of the Biosphärenreservat Spreewald
- Member of the expert group »Research and Breeding« of Demeter e. V.
- Representative of ZALF at the working group »Ökologischer Landbau«, Senat der Bundesforschungseinrichtungen

Bellingrath-Kimura, Sonoko D.

- Member of the project group »Digital Transformation« of the Leibniz Association
- Vice Chair of Commission 4.3—Soil and land use change, International Union of Soil Science
- Chair of research area Sustainable Agriculture at the Leibniz Research Alliance »Sustainable Food Production and Healthy Nutrition«

Berger, Gert

- Member of the working group »Pflanzenschutz und Biodiversität«, Federal Office for Agriculture and Food (BLE)
- Member of the »Fachbeirat Naturhaushalt und Nachhaltiger Pflanzenbau«, Federal Office of Consumer Protection and Food Safety (BVL)

Dalchow, Claus

• Editorial advisory board member at Landscape Online

Dietrich, Ottfried

- Member of the working group 3.4 »Wetlands«, Deutsche Vereinigung für Wasserwirtschaft (DWA)
- Member of the expert group »Water (+Energy and Climate)«, round table »Internationalisierung von Bildung, Wissenschaft und Forschung: Perspektiven schaffen in Afrika« of the Federal Government

Ellerbrock, Ruth

• Editorial board member at Geoderma

Eulenstein, Frank

 Speaker of the working groups »Renewable raw material« and »Nutrition efficiency in plant production« (DWA)

Ewert, Frank

- Member of the Steering Group Research (BMEL)
- Chair of the Scientific Advisory Board within the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE, EU)

- Editorial board member at European Journal of Agronomy/Field Crops Research/Scientific Reports (Springer Nature)/Socio-Environmental Systems Modeling (SESMO)
- Expert for project proposals of the Stiftung Mercator Schweiz
- Chair of the INRAE Research Program on »Investments for the Future – Alternative crop production and protection«
- Member of the International Advisory Board of the PE&RC Graduate School for Production Ecology & Resource Conservation, University Wageningen
- Co-Chair and member of the International Organising Committee of the International Crop Modelling Symposium, iCROPM2020
- Member of the Steering Group DFG Exellenz Cluster PhenoRob
- Co-Chair of the expert working group on plant modelling of the Wheat Initiative
- Co-Leader of the Wheat Modelling Team of the Agricultural Model Intercomparison and Improvement Project (AgMIP)
- Member of the supervisory board »WIR Land Innovation Lausitz« (BMBF)

Gerke, Horst

- Associate editor at Journal of Hydrology and Hydromechanics
- Associate editor at Journal of Plant Nutrition and Soil Science

Heinrich, Uwe

- Representative of ZALF at the working group Geoinformation (BMEL)
- Representative of ZALF at the Verband der Geoinformationswirtschaft Berlin / Brandenburg
- Representative of ZALF at the Climate Navigator of the Climate Service Centre, Helmholtz Centre Geesthacht

Helming, Katharina

- Scientific advisory board member at the H2020 Research project SUREFARM
- Reviewer at Horizon 2020 (EU)
- Member of the expert committee Foresight on Demand for Soil Health and Food der EU
- Editorial board member at Agronomy for Sustainable Development/Land
- Reviewer at the research funding program FONA
- Lead author from the author panel (UNEP) for the Land Policy Chapter of the Global Environment Outlook (GEO6)

Hierold, Wilfried

Member of the Naturschutzbeirat Landkreis Barnim

Joschko, Monika

 Advisory board member of »Förderverband Humus«, Zossen

MANDATES & RESPONSIBILITIES (SELECTED)

Kächele, Harald

- Member of the Naturschutzbeirat of the Ministry of Rural Development, Environment and Agriculture (MLUL) of the state of Brandenburg
- Chair of the Deutsche Umwelthilfe e.V. (DUH)
- Chair of the Gesellschafterversammlung der DUH Umweltschutz-Service GmbH
- Chairman of the foundation council of the Tropenwaldstiftung Oro Verde
- Advisory board member of Berliner Stadtreinigungsbetriebe (BSR)
- Member of the working group »Nachhaltiges Wirtschaften« (BMBF)
- Member of the foundation board Lebendige Stadt

Kersebaum, Kurt-Christian

- Associate editor at Field Crops Research / International Journal of Biometeorology
- Communitiy Chair at Model Applications in Field Research (American Society of Agronomy)

Kolb, Steffen

- Editorial board member at Applied and Environmental Microbiology
- Guest associate editor at Frontiers in Microbiology

Lischeid, Gunnar

- Spokesman of the expert group Umwelt-System-Theorien of the Alliance working group- »Infrastructures in Terrestrial Research« (DFG and other)
- Editorial board member at Frontiers in Water: Water and Hydrocomplexity

Matzdorf, Bettina

• Advisory board member of the innovation group Ginkoo

Merz, Christoph

• Editorial board member at Landscape Online

Mirschel, Wilfried

• Editorial board member at European Agrophysical Journal

Müller, Klaus

- Referee for Land Use Policy/Ecological Indicators/GAIA/Ecology and Society/Konjunkturpolitik/Jahrbuch für Regionalwissenschaften
- National advisory board member at Landscape Online
- Chairman of the review-panel for BMBF-Calls
- Consultant for the Schweizerischer Nationalfonds
- Consultant for the Österreichische Nationalbank
- Expert at the enquete commission 6/1 »Zukunft der ländlichen Regionen vor dem Hintergrund des demografischen Wandels«, Landtag Brandenburg
- Member of the Ausschuss Siedlungsstruktur/Natur und Umwelt, Planungsgemeinschaft Oderland-Spree

• Chairman of the nature parc board of trustees Märkische Schweiz

Nendel, Claas

- Member of the steering committee C-MIP
- Member of the Scientific Committee of the International Crop Modelling Symposium iCROPM2020
- Member of the executive board and designated president of the European Society of Agronomy (ESA)
- Member of the Leibniz Strategy Forum »Digital Transformation«
- Vice Chair of Commission IV of the German Soil Science Society

Pätzig, Marlene

 Treasurer and member of the steering committee of the European Pond Conservation Network (EPCN)

Pickert, Jürgen

- Member of the steering committee for Grasland of the German Agricultural Research Alliance (DAfA)
- Member of the committee »Grünland und Futterbau«, Deutsche Landwirtschaftsgesellschaft (DLG)
- Member of the managing board of Deutsches Maiskomitee and editorial staff at Mais
- Member of the managing board of the Paulinenauer AK Grünland und Futterwirtschaft e.V.

Piorr, Annette

- Chair of the review panel on food production at FOR-MAS, Swedish National Research Council
- Appointed member of the expert committee for Naturschutz und Landschaftspflege, Senatsverwaltung für Umwelt, Verkehr und Klimaschutz Berlin

Reckling, Moritz

- Associate editor at Organic Farming
- Editorial board member at Agronomy
- Advisory board member of Praxisforschungs-Netzwerk
 NutriNet

Sieber, Stefan

• Editorial board member at Food Security

Siebert, Rosemarie

• Referee for Sociologia Ruralis/Land Use Policy

Ulrich, Andreas

- Editorial board member at European Journal of Soil Biology
- Topic editor and guest associate editor at Frontiers in Microbiology
- Delegate for biological safety at the Länderinstitut für Bienenkunde, Hohen Neuendorf

Webber, Heidi

• Editorial board member at Agricultural and Forest Meteorology/in silico Plants

Weith, Thomas

- Appointed member of the Akademie für Raumforschung und Landesplanung
- Editorial board member at Central European Review of Economics and Management

Werner, Doreen

- Member of the Bundesfachausschuss des Nature And Biodiversity Conservation Union (NABU)
- Acting head of the AK Deutscher Dipterologen
- Editorial board member at Studia dipterologica
- Coordinator for Europe at the reseach network Simuliidae

Wulf, Monika

- Editorial board member at Applied Vegetation Science / Journal of Vegetation Science
- Member of the review board Ecology of Agricultural Landscapes (DFG)

Zander, Peter

• Editorial board member at Agricultural Systems

PEER-REVIEWED JOURNAL ARTICLES

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Amjath Babu, T. S., Sharma, B., Brouwer, R., Rasul, G., Wahid, S. M., Neupane, N., Bhattarai, U., Sieber, S. (2019) Integrated modelling of the impacts of hydropower projects on the water-food-energy nexus in a transboundary Himalayan river basin. Applied Energy 239, 494–503.

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Arhonditsis, G. B., Neumann, A., Shimoda, Y., Kim, D. -K., Dong, F., **Onandia, G.**, Yang, C., Javed, A., Brady, M., Visha, A., Ni, F., Cheng, V. (2019) Castles built on sand or predictive limnology in action? Part B: Designing the next monitoring-modelling-assessment cycle of adaptive management in Lake Erie. Ecological Informatics 53, Article 100969.

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Asseng, S., Martre, P., Maiorano, A., Röt-ter, R.P., O'Leary, G.J., Fitzgerald, G.J., Girousse, C., Motzo, R., Giunta, F., Babar, M.A., Reynolds, M.P., Kheir, A.M.S., Thorburn, P.J., Waha, K., Ruane, A.C., Aggarwal, P.K., Ahmed, M., Balkovič, J., Basso, B., Biernath, C., Bindi, M., Cammarano, D., Challinor, A. J., De Sanctis, G., Dumont, B., Eyshi Rezaei, E., Fereres, E., Ferrise, R., Garcia-Vila, M., Gayler, S., Gao, Y., Horan, H., Hoogenboom, G., Izaurralde, R. C., Jabloun, M., Jones, C. D., Kassie, B. T., Kersebaum, K. -C., Klein, C., Koehler, A. -K., Liu, B., Minoli, S., Montesino San Martin, M., Müller, C., Naresh Kumar, S., Nendel, C., Olesen, J. E., Palosuo, T., Porter, J. R., Priesack, E., Ripoche, D., Semenov, M.A., Stöckle, C., Stratonovitch, P., Streck, T., Supit, I., Tao,

F., Van der Velde, M., Wallach, D., Wang, E., **Webber, H.**, Wolf, J., Xiao, L., Zhang, Z., Zhao, Z., Zhu, Y., **Ewert, F.** (2019) Climate change impact and adaptation for wheat protein. Global Change Biology 25, 1, 155–173.

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Busse, M., Siebert, R., Heitepriem, N. (2019) Acceptability of innovative biomass heating plants in a German case study – a contribution to cultural landscape

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Dam, T. H. T., Amjath Babu, T. S., Zander, P., Müller, K. (2019) Paddy in saline water: analysing variety-specific effects of saline water intrusion on the technical efficiency of rice production in Vietnam. Outlook on Agriculture 48, 3, 237–245.

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De Smedt, P., Baeten, L., Proesmans, W., Van de Poel, S., Van Keer, J., Giffard, B., Martin, L., Vanhulle, R., Brunet, J., Cousins, S. A. O., Decocq, G., Deconchat, M., Diekmann, M., Gallet-Moron, E., Le Roux, V., Liira, J., Valdés, A., **Wulf, M.**, Andrieu, E., Hermy, M., Bonte, D., Verheyen, K. (2019) Strength of forest edge effects on litter-dwelling macro-arthropods across Europe is influenced by forest age and edge properties. Diversity and Distributions 25, 6, 963–974. Dietrich, O., Fahle, M., Kaiser, T., Steidl, J. (2019) Eine Lysimeter-Studie zu Auswirkungen unterschiedlicher Grundwasser-Steuerregime auf den Bodenwasserhaushalt eines grundwassernahen Standorts. Hydrologie und Wasserbewirtschaftung 63, 1, 6–18.

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Egamberdieva, D., Wirth, S., Bellingrath-Kimura, S. D., Mishra, J., Arora, N. K. (2019) Salt-tolerant plant growth promoting rhizobacteria for enhancing crop productivity of saline soils. Frontiers in Microbiology 10, Article 2791.

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Eufemia, L., Schlindwein, I. L., Bonatti, M., Bayer, S. T., **Sieber, S.** (2019) Community-based governance and sustainability in the Paraguayan Pantanal. Sustainability 11, 19, Article 5158.

Filipović, V., Coquet, Y., **Gerke, H.H.** (2019) Representation of plot scale soil heterogeneity in dual-domain effective flow and transport models with mass exchange. Vadose Zone Journal 18, 1, Article 180174.

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ABBREVIATIONS

Fisheries

ABC Eco ²	Agroenvironmental management centre Eco ²	IGLU Göttingen	Ingenieurgemeinschaft für Landwirtschaft und
AECM	Agri-environmental and climate measures		
aFDT	ameliorative, fractional deep tillage	ІНР	Leibniz Institute–Innovations for High Performance Microelectronics
AIV	African indigenous vegetables	IIAM	Mozambique Agricultural Research Institute
Ар	Plow horizon	IMIDRA	Madrid Institute for Rural Development, Agricultural
ATB	Leibniz Institute for Agricultural Engineering and		and Food Research
PT\/		INBO	Research Institute for Nature and Forest (INBO)
		INRAE	National Research Institute for Agriculture, Food and
	Contract innovation Labs	INTERREC	
CIRAD	Development	INTERREG	European Territorial Cooperation
DAAD	German Academic Exchange Service	JKI	Cultivated Plants
DBFZ	German Biomass Research Centre	JLU Giessen	Justus-Liebig-Universität Gießen
DBU	The German Federal Environmental Foundation	Leibniz-IZW	Leibniz-Institute for Zoo- and Wildlife Research in the
DBV	The German Farmers' Association		Forschungsverbund Berlin e.V.
DFG	Deutsche Forschungsgemeinschaft	LUH	Leibniz University Hannover
DFKI	German Research Center for Artificial Intelligence	РІК	Potsdam Institute for Climate Impact Research
DUH	Environmental Action Germany	PIL	Policy Innovation Labs
DVL	Deutscher Verband für Landschaftspflege	SBV	Schmallenberg virus
EAFRD	European Agricultural Fund for Rural Development	SDEI	Senckenberg German Entomological Institute
EIP	European Innovation Partnerships	SIDO	Small Industries Development Organization
ERANET	European Research Area Networks	SLU	Swedish University of Agricultural Sciences
ERDF	European Regional Development Fund	SOM	Soil organic matter
ESS	Ecosystem services	SS	Summer semester
Europa-Uni	European University Viadrina	SSA	Sub-Saharan Africa
FLI	Friedrich-Loeffler-Institut	SUA	Sokoine Univerity of Agriculture
Fraunhofer ISI	Fraunhofer Institut for Systems and Innovation	ті	Thünen Institute
	Research ISI	TU Berlin	Technische Universität Berlin
FU Berlin	Freie Universität Berlin	TUD	Technische Universität Dresden
FZJ	Forschungszentrum Jülich	UAM	Autonomous University of Madrid
GHG	Greenhouse gas	UCPH	University of Copenhagen
GIP-CRPGE	Centre de Ressources sur le Pastoralisme et la Gestion de l'Espace	UFZ	Helmholtz Centre for Environmental Research Halle
HNEE	Eberswalde University for Sustainable Development	CAA	winter semester
HS-Osnabrück	University of Applied Sciences Osnabrück		
ІСТ	Information and communication technology		
IGB	Leibniz-Institute of Freshwater Ecology and Inland		

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Eberswalder Straße 84 15374 Müncheberg, Germany www.leibniz-zalf.de T +49 (0)33432 | 82 200 F +49 (0)33432 | 82 223 E zalf@zalf.de

Twitter: @zalf_leibniz Facebook: zalf.agrarlandschaftsforschung Blog: www.quer-feld-ein.blog

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