

zalf

**ANNUAL REPORT
2020 & 2021**



**LEIBNIZ CENTRE FOR
AGRICULTURAL LANDSCAPE RESEARCH
(ZALF)**



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2020 & 2021**

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(ZALF)

An aerial photograph of a rural landscape, showing a complex mosaic of agricultural fields in various shades of green and brown, interspersed with dark, dense forest areas. The fields are irregular in shape, creating a patchwork effect. A few small clusters of buildings are visible, nestled within the landscape. The overall tone is muted, with a teal or greenish tint.

RESHAPING LANDSCAPES

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

An aerial photograph of a rural landscape, showing a complex mosaic of agricultural fields in various shades of green and brown. A winding river or stream cuts through the center of the image, flanked by darker, forested areas. The overall tone is a muted, teal-green color.

BY RETHINKING AGRICULTURE

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

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PREFACE

The years 2020 and 2021 were dominated by the global COVID 19 pandemic, which also presented ZALF with new challenges. Due to the war in Ukraine and the imposed sanctions, agriculture is currently facing additional obstacles: costs are rising along the entire value chain, making food more expensive. ZALF's strength lies addressing inter-actively these multiple new problems together with the persistent challenges of our research field: climate change, loss of biodiversity, resource efficiency, environmental protection as well as ecosystem services and food security for a growing world population. Our systems research addresses and integrates these aspects to provide policy makers and society with the holistic knowledge required for transformation.



Prof. Frank A. Ewert,
Scientific Director of ZALF

Agri-Food systems need to become more sustainable and resilient in the face of crises: by increasing diversity in our agricultural landscapes and farming and cropping systems, by finding a new balance between global and regional food supply chains, by changing our eating habits to a diet with fewer meat-based products, and by initiating a transformation towards a bioeconomy and a circular economy based on renewable resources. This may intensify existing land use conflicts and lead to new ones, but it can also create synergies that should be explored. Communication with actors of all relevant groups from practice, policy and society, is therefore essential – both for our research and for a successful transformation.

ZALF specifically addresses the social, economic and ecological consequences of this transformation through transdisciplinary research, science communication and transfer activities. In this context, new formats are needed for the interaction between science and the respective actors from practices, policy and society. ZALF's first living labs are already making a significant contribution to developing and testing solutions in a larger landscape context and to increasing their societal acceptance.

Despite the pandemic, ZALF conducted many research projects, successfully generated new insights during the reporting period and contributed them to the societal discourse. In the KLIMERTRAG project, the MONICA agroecosystem model developed by ZALF was used to simulate crop yields across Germany up to 2060 (p. 24). The IWYP project used process-based crop models such as SIMPLACE to investigate the future yield stability of wheat varieties under the impact of climate change (p. 16). The role of crop plants and their microbiome in storing carbon dioxide in several eroded soil types was in the focus of the CropRhizoSOM project (p. 25). One important strategy for adapting to climate change, promoting biodiversity and increasing resource efficiency is the diversification of agriculture, for example by means of small-scale field management and adapted crop rotations developed and tested in the patchCROP project (p. 26). In order to use protein-rich legumes such as lucerne not only as animal feed but also as a raw material for natural fibre-reinforced plastics in a bioeconomy, the FUFAPRO project optimised leaf-stem separation during harvesting (p. 27). In the broader context of diversification, the BROMMI project focused on other insect-promoting measures and their agro-ecological and economic assessment (p. 28).

The VOLCORN (p. 17) and BISIAL (p. 18) projects are investigating how the plant microbiome and the amount of plant-available silicon in the soil can increase plant resilience, for example with respect to drought. The European network LEGUMES TRANSLATED combines research- and practice-based knowledge to develop legume-based agricultural and food systems (p. 19). Within the DAKIS project, we are working on the digital agriculture of the future, using drones,



Our particular strength resides in the combination of evidence-based research on landscape processes, land use systems and governance with methods on data analysis and mathematical modelling.



field robots and smart sensors to develop integrated solutions for food security, environmental and climate protection (p. 20). The STEP-UP project also focuses on food security and promotes sustainable development at farm and community level through innovations in mango and banana cultivation on small farms in Africa (p. 21). With the SMS project, ZALF plays a special role in shaping the EU mission »A Soil Deal for Europe«, which aims for an EU-wide transformation towards sustainable soil and land management by 2030 (p. 29).

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)

PROF. FRANK EWERT (SCIENTIFIC DIRECTOR)
MARTIN JANK (ADMINISTRATIVE DIRECTOR)

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. Bettina Matzdorf

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. Heidi Webber

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.



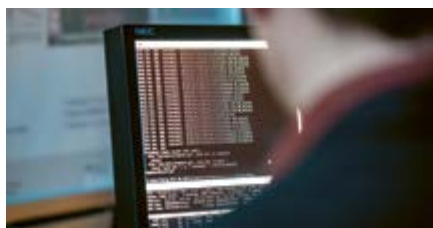
Research Area 2 »Land Use and Governance«

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

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Hydropedology

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

Silicon Biogeochemistry

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Isotope Biogeochemistry & Gas Fluxes

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Microbial Biogeochemistry

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Fungal Interactions

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RESEARCH AREA 2 »LAND USE AND GOVERNANCE«

PROF. SONOKO DOROTHEA BELLINGRATH-KIMURA
PROF. BETTINA MATZDORF
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 as a prerequisite for a necessary transformation of agricultural systems are additional topics of research in this Research Area.

CORE RESEARCH QUESTIONS:

- What are the effects of individual management measures and land use and on the provisioning of ecosystem services and biodiversity in agricultural landscapes 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 addressed and valued?
- What are the expectations and preferences of different stakeholders and stakeholder groups regarding the provisioning of ecosystem services and biodiversity? What are the resulting locally adapted land use options in agricultural landscapes?
- 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 and how can it support the necessary transformations?

WORKING GROUPS

Resource-Efficient Cropping Systems

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Sustainable Grassland Systems

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Provisioning of Ecosystem Services in Agricultural Systems

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Provisioning of Biodiversity in Agricultural Systems

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Biodiversity of Aquatic and Semiaquatic Landscape Features

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Lowland Hydrology and Water Management

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Biotic Interactions between Forest and Agricultural Land

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Governance of Ecosystem Services

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Sustainable Land Use in Developing Countries

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Co-Design of Change and Innovation

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RESEARCH AREA 3 »AGRICULTURAL LANDSCAPE SYSTEMS«

PROF. KATHARINA HELMING
PROF. HEIDI WEBBER

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 framework 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

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Land Use Decisions in the Spatial and System Context

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Integrated Crop and Grassland Systems Analysis and Assessment

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Farm Economics and Ecosystem Services

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RESEARCH PLATFORM

»DATA ANALYSIS & SIMULATION«

PROF. GUNNAR LISCHIED

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

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Landscape Modelling

Contact: Prof. Claas Nendel | claas.nendel@zalf.de

Ecosystem Modelling

Contact: Prof. Claas Nendel | claas.nendel@zalf.de

Simulation Methods and Data-driven Models

Contact: Dr. Ralf Wieland | rwieland@zalf.de

Artificial Intelligence

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Data Infrastructures (Service)

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Research Data Management (Service)

Contact: Dr. Nikolai Svoboda | nikolai.svoboda@zalf.de

Model & Simulation Infrastructure (Service)

Contact: Michael Berg-Mohnicke | michael.berg@zalf.de



EXPERIMENTAL INFRASTRUCTURE PLATFORM

DR. 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)

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Experimental Station Paulinenaue (Service)

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Experimental Station Müncheberg (Service)

Contact: Dr. Dietmar Barkusky | dbarkusky@zalf.de

SELECTED NEW PROJECTS



HIGH-YIELDING WHEAT VARIETIES NOT PROJECTED TO INCREASE FARMERS' RISK

HEIDI WEBBER, BABACAR FAYE, TOMMASO STELLA, FRANK EWERT



Crop breeding for main food security crops like wheat is challenged by future climate change. Great uncertainty exists concerning the consequences of breeding for higher yields in current climate on future crop yield levels and stability under climate change. Indeed, yield stability is a critical consideration for both farmers in adopting new technologies as well as for markets and food security. Within the project IWYP, ZALF researchers used process-based crop models capable of reproducing the responses of breeders' selected traits to quantify the interactions between high yield levels and crop yield stability under climate change.

What are the consequences of breeding for higher yields in current climate for future crop yield levels and stability?



Global wheat yields have stagnated in recent decades, raising concerns about implications for global food production and security. As such, there is a need to assess breeding options to increase yields in the future. However, crop breeding is challenged by future climate change. Great uncertainty exists around the consequences of breeding for higher yields in current climate on future crop yield levels and stability. Indeed, yield stability is critical for decisions at different levels of agricultural systems, from farmers' criteria for adopting crop varieties to the design of policies. Process-based crop models considering improved traits can quantify the interactions between crop traits and climate factors to allow assessing both average yield levels and yield stability under climate change.

Our model-based study first considered data from a series of breeding trials with high-yielding varieties in New Zealand, Argentina, France, Chile and Mexico for model improvement and testing. In a following simulation experiment contrasting current varieties with new varieties based on the traits selected by physiological breeders, we conducted simulations for 34 global high-yielding wheat producing regions. Our simulation results confirmed theoretical expectations that increased radiation use efficiency and, to a much lesser extent, improved fruiting efficiency lead to higher yields than current varieties across all study regions. While higher yields from improved traits were generally associated with increased inter-annual yield variability (measured by standard deviation), the relative yield variability (as coefficient of variation) was largely unchanged between current and improved varieties. Despite

a higher sensitivity to the harshest environmental conditions selected from these high-yielding environments, improved crop lines still outperformed the base genotype over the range of the environments tested. In this context, improved wheat under future climate change would remain a low-risk crop for farmers and the adoption of high-yielding cultivars should not be hindered by their yield variability.

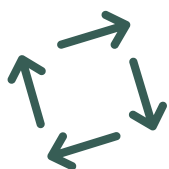
Project: Traits for increasing wheat grain yield (IWYP)
Term: 2019–2022 **Funding agency:** CIMMYT **Lead at ZALF:** Heidi Webber (webber@zalf.de) **Partners:** TU Berlin, University of Potsdam, ITUC, INRAE, UF
<https://iwyp.org/>

CLIMATE CHANGE, WATER STRESS AND CROP PRODUCTION: WHEAT AND ITS MICROBIOME

STEFFEN KOLB, MARINA MÜLLER, ANDREAS ULRICH, DAVIDE FRANCIOLI, SONJA WENDE



Pot experiment at the project partner IPK Gatersleben within the VOLCORN consortium using common wheat (*Triticum aestivum* L.). Individual plants were hermetically isolated in order to measure VOC emissions.



In light of more frequent extreme weather events due to climate change, the VOLCORN project is investigating the functional relationships between the crop plant wheat and its microbiome (i. e. all microorganisms colonising a plant). In collaborative experi-

ments, the project partners are trying to prove that both partners – plant and microbiome – jointly react to environmental stressors, i. e. that they actually are a functional unit. The focus is placed on the volatile organic compounds (VOCs) they emit, which are important for the communication between plants and the protection against herbivores.

The VOLCORN research consortium consists of researchers from the IPK Gatersleben, the IGZ Großbeeren, the iDiv in Leipzig and the working groups Microbial Biogeochemistry and Fungal Interactions at ZALF. The experimental study combines complementary and modern experimental methods of plant physiology, microbiomics and VOC analysis, aiming to investigate the entire wheat-microbiome complex. Initial results show that the microbiome-wheat plant complex reacts to flooding or water shortage in a coordinated manner, above- as well as belowground. In this process, potentially pathogenic fungi are accumulating. However, there is also evidence that plant growth-promoting bacteria become more abundant in the root zone. The central metabolism of water-stressed wheat plants reacts by redistributing energy resources to their roots. Due to the very dynamic and complex mixture of the emitted VOCs, the extent to which particular VOCs, which might

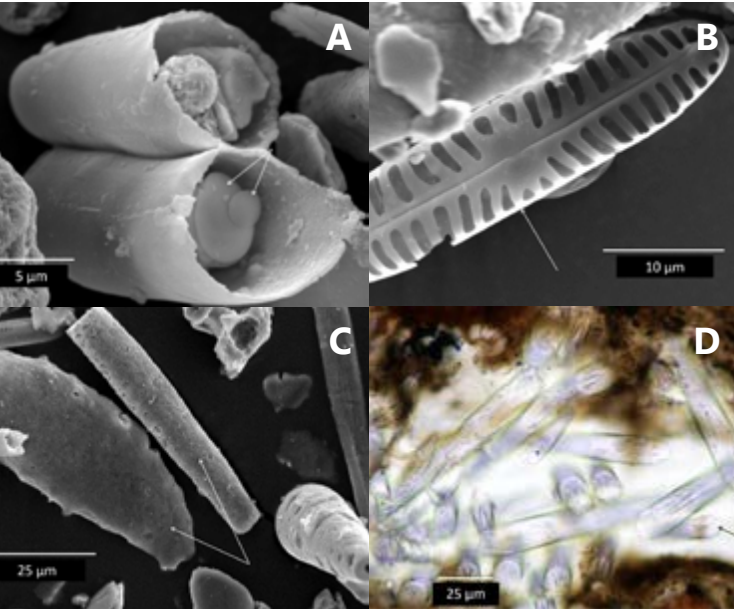
Climate change is causing an increase in extreme weather events that threaten global food production. Abiotic stressors such as floods and droughts reduce yields and make crops more vulnerable to pathogens and herbivores. Using wheat as an example, the VOLCORN project is investigating the role of the microbiome in the adaptation of plants to this intensified stress situation.

be indicators for specific stressors, are produced, has not yet been conclusively elucidated. Yet it seems certain that under water stress, bacteria that can produce plant hormones such as auxin are accumulating in the root zone. These bacteria can stimulate root growth and may ultimately help the plant to counteract water stress.

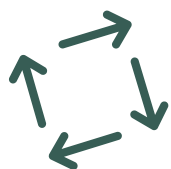
Project: Volatilome of a Cereal Crop-Microbiota System under Drought and Flooding (VOLCORN) **Term:** 2019–2022
Funding agency: Leibniz Association (SAW) **Lead at ZALF:** S. Kolb (kolb@zalf.de) **Partners:** IPK Gatersleben, IGZ Großbeeren, iDiv Leipzig
<https://comm.zalf.de/sites/volcorn/SitePages/Home.aspx>

SILICON – THE SILVER BULLET FOR SUSTAINABLE CROP PRODUCTION IN THE FUTURE?

DANIEL PUPPE



Examples of biogenic silica in soils: (A) testate amoeba idiosomes (i. e. the building blocks of testate amoeba shells), (B) pennate diatom frustule, (C) phytoliths, and (D) sponge spicules.



Although the majority (>90 %) of the Earth's crust consists of silicate minerals, only a small proportion of Si is plant- or bio-available. On a geological time scale, the ultimate source of bio-available Si (monomeric silicic acid; H_4SiO_4) is mineral weathering.

Bio-available Si in soils follows different pathways including (i) immobilization by adsorption, polymerization, and complexation, (ii) leaching as a function of rainfall and irrigation, and (iii) incorporation into living organisms. The use of inorganic bio-available Si for the formation of biogenic silica (amorphous hydrated silica; $\text{SiO}_2 \cdot n\text{H}_2\text{O}$) by plants, protists (diatoms, testate amoebae), and animals (sponges) is called biosilicification. Biosilicification and the release of bio-available Si from biogenic silica in dead organic matter have established a biological Si cycle, which determines the presence of bio-available Si in soils on shorter time scales.

In agricultural landscapes, cereal crops, featuring relatively high Si concentrations, are key drivers of biological Si cycling. Annual crop harvesting results in large exports of Si from agricultural fields – usually without compensation and with severe consequences for crop resilience. Our studies hitherto revealed that about 43–60 % of Si exports can be avoided by crop straw recycling over decades. Crop straw recycling is thus a potential key practice for managing Si supply in a sustainable crop production.

Currently, we analyze Si fluxes (inputs and outputs) and pools (bio-available Si, biogenic silica) at an instrumented

Silicon (Si) uptake has been found to increase the resistance of crops against stressors like drought or fungal infections. The International Plant Nutrition Institute (IPNI) therefore categorized Si as a »beneficial substance« for plants. However, humans actively influence Si cycling in agricultural landscapes. Mainly due to Si export in harvested biomass, the amount of plant-available Si in agricultural soils is decreasing (anthropogenic desilication). The project BISIAL aims at understanding these Si losses and corresponding effects on crops, in order to derive practice-oriented recommendations for preventing anthropogenic desilication. This knowledge is crucial for increasing the resilience and climate adaptation of crops.

experimental site to compile comprehensive Si balances at the field level. This will help us to understand Si cycling in agricultural landscapes and to identify important drivers (e. g., the degree of soil erosion, physicochemical properties of biogenic silica). In this context, special focus is placed on biogenic silica formed in plants (i. e. phytoliths), which are subject to intensive investigation using a combination of state-of-the-art microscopic and spectroscopic methods (e. g., fluorescence microscopy, micro-DRIFT spectroscopy). As phytoliths can persist in soils for centuries to millennia, the storage of carbon in phytoliths might be a promising method for sequestering carbon as a contribution to climate change mitigation. Thus, Si related agricultural research might indeed be a silver bullet to improve the stress resistance of crops and to overcome the negative effects of climate change in a modern, sustainable agriculture.

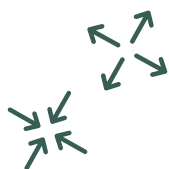
Project: Biogenic silicon in agricultural landscapes (BiSiAL) – Quantification, qualitative characterization, and importance for Si balances of agricultural biogeosystems
Term: 2018–2023 **Funding agency:** DFG **Lead at ZALF:** D. Puppe (daniel.puppe@zalf.de) **Partners:** BTU Cottbus-Senftenberg
https://www.zalf.de/en/ueber_uns/mitarbeiter/pages/Puppe_D.aspx

DEVELOPING LEGUME-SUPPORTED AGRI-FOOD SYSTEMS THROUGH KNOWLEDGE COMPILATION

INKA NOTZ, JOHANNES SCHULER, MORITZ RECKLING



Pods of narrow-leaved lupine.



European agriculture is focused on intensive cereal production and features an increasing trend for specialization, leading to several negative environmental impacts. Legume production is marginal, occupying only < 2 % of the arable land. This creates a deficit in the European protein balance, which is mainly met by substantial soybean imports. In order to address these challenges, LEGUMES TRANSLATED aims to support the production and use of legumes in Europe as part of an overall protein transition. As there is already a significant amount of knowledge and initiatives available at local, regional and international levels, the project's goal is to embed and connect the research- and practice-based actors and to thereby stimulate the compilation, validation and dissemination of knowledge and best practices. The project concept builds on the interaction of groups of farmers and other innovators within international thematic networks, which are supported by research. A strong focus is set on the empowerment of decision-makers within the whole value chain through the production of communication outputs such as videos and practice notes and the development of a multi-lingual knowledge internet platform – the Legume Hub.

At ZALF, we connect economic analyses with the co-design and assessment of cropping systems. Following a multi-actor approach, we explored options for improving current cropping systems by integrating legumes and in consideration of economic, environmental and agronomic effects. A Europe-wide network allowed incorporating the knowledge of a range of legume-experienced actors representing value chains with soybean, pea, faba bean, lupine and forage crops. We evaluated

A transition to more legume-based farming in Europe can help to reduce negative environmental impacts and increase protein self-sufficiency. The European thematic network LEGUMES TRANSLATED is dedicated to legume production and use. By linking research- and practice-based knowledge, the project supports the innovation potential of already existing resources and initiatives. A solid base for Europe-wide exchange among experts and practitioners designing legume-supported cropping systems and value chains allows for transnational and cross-border knowledge interaction. The multi-actor approach provides a knowledge platform that empowers actors in developing legume-supported agri-food systems.

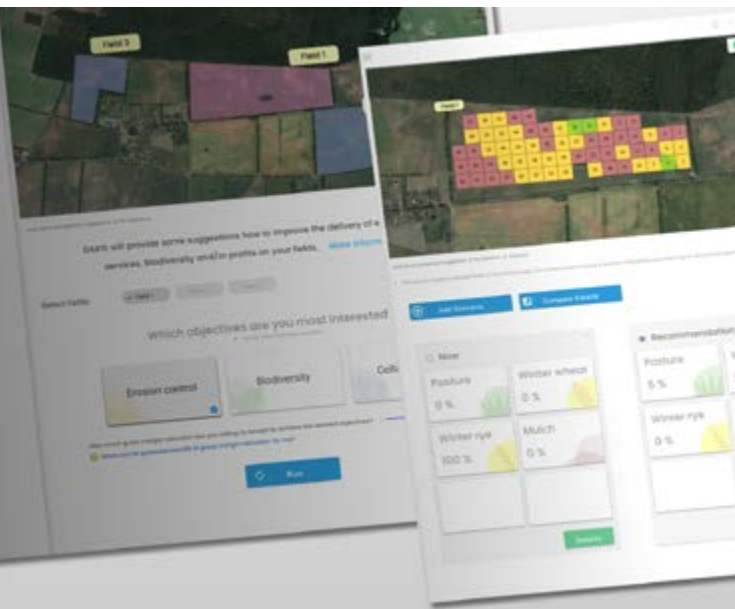
practice-based cropping systems from 17 study areas in nine European countries from Ireland in the West to Ukraine in the East. Analysing these systems allowed transforming practice-related experiences into synthesized information that supports local and European decision-makers. Legume-supported systems showed clear benefits for environmentally friendly production systems and protein self-sufficiency, but the economic performance and particularly the competitiveness of legumes pose a considerable challenge for integration in European farming.

LEGUMES TRANSLATED demonstrates how the focus on experiences and needs of users and practitioners based on an efficient networking approach allows validating and communicating crucial knowledge and innovation for legume-based farming for food and feed systems.

Project: Legumes Translated – Translating knowledge for legume-based farming for feed and food systems **Term:** 2018–2022 **Funding agency:** Horizon 2020 **Lead at ZALF:** P. Zander (peter.zander@zalf.de) **Partners:** TI, SRUC, HEL, DMB, LTZ, FIBL, TEAG, NIRE, THESGI, ABI, BESH, LLH, DS, AST, IFVC
<https://www.legumestranslated.eu/>
<https://www.legumehub.eu/>

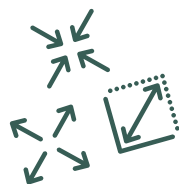
DIGITAL AGRICULTURAL KNOWLEDGE AND INFORMATION SYSTEM

NAHLEEN LEMKE, SONOKO BELLINGRATH-KIMURA, CHENG CHEN, ARIANI WARTENBERG



The DAKIS user interface.

The vision of the DAKIS project – Digital Agricultural Knowledge and Information System – is an agriculture of the future in which environmental and climate protection are balanced with food security and stable farm incomes. This can be achieved by a digital revolution in agriculture – including the utilisation and interconnection of drones with autonomous field robots, intelligent sensors and other real-time landscape data. DAKIS also integrates the societal demand for ecosystem services (ESS) into the overall system and implements its vision through automated, small-scale production systems using innovative information and management methods.



In the DAKIS project, ten research institutions are working on the implementation of a decision support system (DSS) that integrates ESS, biodiversity and resource efficiency into agricultural decision-making processes, striving for the following objectives:

- 1) Biodiversity, ESS and resource efficiency are integrated into farm decision-making processes based on the development of new market values.
- 2) For the first time, specific effects of agricultural activities at the subfield level are documented, predicted and coordinated in real time. This requires new sensors and models.
- 3) Depending on the objective, cropping systems are optimised in terms of ESS, biodiversity and resource efficiency. For this purpose, new small-scale and subfield-specific cropping systems are required, which are implemented using novel robotics.
- 4) Orientation goals are optimised for farm planning and for supporting complex decisions. New farm models must emerge that aggregate information and enable short-, medium- and long-term planning.
- 5) New communication channels for cooperation between farms, consumers and society will be created. New collaborations are needed to improve ESS and biodiversity across regions.

Over the past three years, the complex components of the envisaged DSS, as well as data and information flows have

been identified. In close cooperation with members of the project advisory board from different sectors and considering first project results, we selected a practical approach based on use cases for further developing the DSS. The first use case deals with the identification and development of measures for grassland buffer strips. Further use cases on landscape elements such as hedges or agroforestry systems are currently being developed.

In addition to the complex structure of the DSS, the different data structures and the rule-based generation of information are central challenges for the next two project years. A functioning DSS prototype is to be developed for the first use cases in the selected landscape windows within the Brandenburg test region. For the prospective second funding phase within the funding measure »Agricultural Systems of the Future«, an intensified consortial exchange by means of joint workshops and activities is planned.

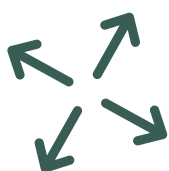
Project: Digital Agricultural Knowledge and Information System (DAKIS) **Term:** 2019–2024 **Funding agency:** BMBF
Lead at ZALF: S. Bellingrath-Kimura (belks@zalf.de)
Partners: IHP, FZJ, Uni Bonn, DFKI, HNEE, ATB, FH ISI, EUV
<https://adz-dakis.com/>
<https://agrarsysteme-der-zukunft.de/>

CO-CREATION OF INNOVATIONS TOWARDS ENTREPRENEURIAL PRODUCTION IN AFRICA

GÖTZ UCKERT, STEFAN SIEBER



In addition to mango, almost all farmers in Kitui district grew maize and beans, followed by pigeon pea, cowpea and the passion fruit shown here.



The project STEP-UP used a participatory multi-stakeholder approach where new technologies in cultivation, processing and packaging were implemented and assessed in mango and banana FVC in Kenya and Uganda, respectively. The project was part

of the EU LEAP-Agri initiative to establish partnership networks in the EU and Africa. Within this programme, African partners can be funded from their own national ministries and receive co-funding from the EU.

STEP-UP recognizes the diversity of smallholder farmers and aims to identify different strategies for smallholders to »step-up« along the value chain. Together with farmers, STEP-UP developed new farm characterization and typologies that contribute to an improved understanding of current mango and banana cultivation. Almost all crops were cultivated in intercropping. The majority of (mango) farmers in Kitui Central and Mwingi West grew grafted mango trees, or a combination of grafted and indigenous trees. More farmers consumed their produced mangoes rather than selling them. Due to the low shelf-life of mangoes and the high post-harvest losses (> 40 %), STEP-UP focused on value addition via processing of dried fruits.

The project built up capacities of young scientists as well as stakeholders at communal, regional and national levels across the banana and mango FVC, designed as training of trainers. Capacity gaps (technical, technological, operational and financial) and capacity building priorities were identified during

Rural food value chains (FVC) in sub-Saharan Africa experience various challenges with respect to the implementation of food securing innovations. Through sustainable intensification and market linkage strategies, the STEP-UP project enabled small farm enterprises to step up towards food and nutrition security, sustainable development and income generation at farm and community levels. New technologies along mango and banana FVC in Kenya and Uganda were implemented and their impacts were assessed through a participatory multi-stakeholder approach. The productivity increase of the crop production and the related market access were a major focus of the sustainable intensification strategies.

participatory baseline/feasibility studies and capacity needs assessments. In Uganda, consultations with farmers and other stakeholders in two districts identified three entry points: (i) integrated soil fertility management, (ii) value addition focusing on banana-based beverages, and (iii) farmer organizations such as cooperatives. Trainings were tailored to meet the identified stakeholder needs. The trained actors along the banana value chain in the Isingiro and Bunyangabo districts will serve as future multipliers for knowledge, skills, and tools.

Subsequent to the participatory selection of interventions by researchers and stakeholders, the STEP-UP project included a series of workshops to analyse the perceptions of identified key regional actors. The FoPIA methodology was used prior to and after their implementation to assess possible impacts on the local economic, social and ecological systems as well on food security. Understanding the differences between the participants' perspectives was key to further developing interventions to stabilise and enhance food security while strengthening gender and generational equity.

Project: Sustainable Transition to Entrepreneurial Production in Agriculture through Upgrading (STEP-UP) **Term:** 2018–2022 **Funding agency:** EU, BLE **Lead at ZALF:** Götz Uckert (uckert@zalf.de) **Partners:** WUR, JKUAT, NETFUND, EA, NARO, Solidaridad, IITA
<http://envalert.org/step-up/>
<https://susland.zalf.de/step-up/>

SELECTED CURRENT PROJECTS



CLIMATE CHANGE-INDUCED YIELD CHANGE IN GERMANY

CLEMENS JÄNICKE, DIANA-MARIA SESERMAN, STEFAN ERNST, CLAAS NENDEL



Curled maize leaves – an early warning sign of impending drought.



The consequences of climate change for German agriculture are uncertain and vary depending on the climate scenario. Current studies show that many farm-related, regional and also supra-regional factors will be affected by the impacts of climate change, but with varying intensity depending on site, crop and production system. For this reason, it is difficult to formulate clear statements about how agriculture will be affected and which adaptation strategies should be pursued. The issue is therefore addressed by an interdisciplinary project consortium around the Thünen Institute (TI), the Julius Kühn Institute (JKI), the German Meteorological Service (DWD) and ZALF in the KLIMERTRAG project.

The joint project aims to answer two core questions: How will the agricultural yields of the main crops develop until 2031–2060 under selected climate scenarios, and which adaptation options are available to agriculture and agricultural policy if significant yield declines are to be expected?

To answer these questions, climate change effects on crop yields are quantified using different methods. The DWD evaluates the expected changes in meteorological and agro-climatic indices. Process-based plant growth models are used to dynamically model yield development across Germany (ZALF) and, as an example, for wheat at selected sites with particularly good data availability (JKI). In addition, the TI uses statistical models to analyse the effects of extreme weather conditions and weather indices on yields.

Using the agroecosystem model MONICA, yield simulations for the eight most important crops are run on ZALF's

In recent years, Germany's agriculture has been exposed to increased drought, which has brought the climate change-associated impacts and uncertainties regarding the yields of important agricultural crops back into public focus. Therefore, the BMEL commissioned a study on »Climate change-induced yield change and land use« in Germany. With their expertise in regional plant growth modelling, ZALF researchers are making a central contribution to the joint project KLIMERTRAG by simulating nationwide yield changes up to the years 2031–2060 using the agroecosystem model MONICA.

high-performance computing cluster. In a relatively short time, many simulations can thus be processed with high spatial resolution over long periods of time and for a large number of alternative climate scenarios. With the help of the current crop distribution map of Germany, co-developed by ZALF, the response of crops to climatic changes can be assessed in a site-specific context. Results show that, on average, no drastic yield losses are to be expected until the middle of the century, even if significant yield failures in individual years will become more frequent. With a new generation of climate scenarios, regional weather phenomena like the common spring drought in Eastern Germany can be better represented. The simulation results serve as a basis for possible adaptation options.

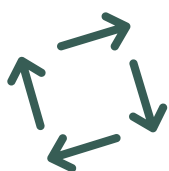
Project: The impact of climate change on agricultural yields and cropland (KLIMERTRAG) **Term:** 2021–2022
Funding agency: BMEL **Lead at ZALF:** C. Nendel (claas.nendel@zalf.de) **Partners:** TI, DWD, JKI

SOIL EROSION – MECHANISMS OF C STORAGE BY OILSEED RAPE AND ITS MICROBIOME

AYTEN PEHLIVAN, JULIAN RUGGABER, RAINER REMUS, JÜRGEN AUGUSTIN, STEPHAN WIRTH, STEFFEN KOLB



Rapeseed plants are growing in special pots that can be hermetically sealed, thus allowing separate measurements of the belowground and aboveground compartments.



About one tenth of the global soil organic carbon (C) is stored in agricultural soils, and thus directly exposed to human interventions. In this context, the translocation of C-rich topsoil due to tillage erosion and the subsequent mixing of C-poor subsoil

into the remaining topsoil are of particular importance. As a result, the capacity of the respective sites for storing atmospheric carbon dioxide (CO₂) in the form of soil organic matter (SOM) changes. Understanding the mechanisms responsible for the impact of soil erosion on soil C dynamics and storage is thus a prerequisite for quantifying the CO₂ source and sink functionality of arable soils.

The project CROP-RHIZO-SOM investigates the effects of soil erosion intensity on key processes of C dynamics and biotic actors such as the crop plant and the soil microbiome (i. e. the entirety of all microorganisms in a soil). This is experimentally quantified in pot experiments under controlled climatic conditions in phytotrons using the example of an oilseed rape-soil system. The soil material originates from the long-term experimental site CarboZALF-D dedicated to studying soil erosion in the field. Quantitative results from this project can thus more easily be transferred to field conditions.

Using ¹⁴C labelled CO₂, C fluxes and pools are determined at different growth stages of the oilseed rape plants. To investigate the effects of tillage-induced soil erosion, C-poor subsoil material is mixed into C-rich topsoil at three intensity levels. The C fluxes into the aboveground plant parts (via photosynthesis)

Tillage and tillage-induced soil erosion result in the incorporation of nutrient-poor subsoil into fertile arable topsoil. In consequence, the eroded areas offer capacities for storing carbon dioxide from the atmosphere into soil organic matter. A DFG project investigates how this process is regulated by crops and the associated microbiome. The aim is to develop a new conceptual understanding of carbon turnover processes in soils.

as well as via root exudation to the soil microbiome and SOM in different soil fractions are then measured and compared. In further experiments, soil enzyme activity and metagenomics will be used to clarify the primary C source (plant or SOM) of the soil microbiome. The microbiome plays a key role in both the degradation and formation of SOM. Our comprehensive systemic study approach aims to expand existing conceptual ideas on the dynamics of carbon and its storage in soils.

Project: Erosion-induced Impact on Carbon Dynamics in a Crop Rhizosphere-Microbiome-Soil Organic Matter-Continuum (CropRhizoSOM) **Term:** 2020–2024 **Funding agency:** DFG **Lead at ZALF:** J. Augustin, R. Remus, S. Wirth, S. Kolb (kolb@zalf.de) **Partner:** Czech Academy of Sciences
<https://gepris.dfg.de/gepris/projekt/431061957?language=en>

LANDSCAPE LABORATORY FOR INNOVATIVE AND DIVERSE CROPPING SYSTEMS

KATHRIN GRAHMANN



Drone top view of the patchCROP landscape laboratory.



In 2020, ZALF established the on-farm experimental platform PATCHCROP aiming to balance crop production with a simultaneous increase in ecosystem services and maintenance of biodiversity by minimizing resource and nutrient loss and gradually reducing the application of chemical pesticides. To this end, PATCHCROP combines different spatial and temporal diversification measures at the field and landscape scale. We test digital tools, artificial intelligence and other new technologies like autonomous field robots regarding their potential for implementing landscape diversification and changing the size and the patch geometry of future agricultural fields.

First, a large 70 ha field under conventional sole cropping was analyzed for its heterogeneity and divided into zones of high and low yield potential. Then, 30 smaller patches of 0.5 ha each were spatially arranged in consideration of small-scale soil heterogeneity. For each yield potential zone, two five-year, legume-supported crop rotations were designed, featuring a total of nine different arable crops and three cropping intensities: (1) conventional pesticide application, (2) situation-specific pesticide application, and (3) situation-specific pesticide use with adjacent flower strips. The collaborating Julius Kühn-Institute (JKI) investigates the potential of reduced pesticide use in this small-scale diversified landscape based on Integrated Pest Management principles.

The surrounding sole-cropped fields are monitored as reference areas to quantify the effects of spatial (field size) and

In the context of sustainable intensification, there is a rising demand for agricultural crop diversification by replacing sole-cropped large fields with new cropping system approaches that increase the temporal, spatial and genetic dimension of diversity at the field and landscape level. Spot farming, pixel cropping and patch cropping conceptually address diversified cropping systems with small-scale and site-specific diverse crop mosaics at different spatial scales.

temporal (crop heterogeneity) diversification. Numerous parameters are measured and assessed at different temporal and spatial scales by working groups from different Research Areas, thus providing a multi-dimensional, data-driven and integrated perspective on agricultural landscape dynamics following diversification measures.

The re-design of agricultural landscapes calls for the inclusion of on-farm research and agricultural living labs to investigate the above-mentioned issues using evidence-driven and systemic approaches. This ensures a comprehensive practicability assessment of the proposed solutions by applying a strategic co-design approach between scientists and farmers, where much effort is aimed at strengthening the farmer-centric perspective. All field operations are planned and conducted by our practice partner, the »Komturei Lietzen GmbH«, whose farm manager is consulted for pivotal decisions.

The DFG Cluster of Excellence PhenoRob uses PATCHCROP in core project 5 on new field arrangements to assess digital technologies under a wide range of different crops and soil conditions.

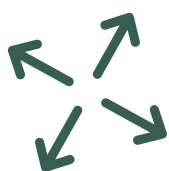
Project: patchCROP – A living lab for more diversity in agricultural landscapes **Term:** 2020–2030 **Funding agency:** ZALF **Lead at ZALF:** K. Grahmann (kathrin.grahmann@zalf.de) **Partners:** University of Bonn, JKI, UP GmbH, PhenoRob, DAKIS, ATB, TU Dresden
www.landschaftslabor-patchcrop.de

DUAL HARVESTING AND PROCESSING OF FORAGE LEGUMES

JOHANN BACHINGER, KLAUS GUTSER



Material samples for demonstration purposes and stability tests made of alfalfa stems and linseed oil-based epoxy resin, manufactured by Bio-Composites and More GmbH (B.A.M.).



In order to generate a higher added value in alfalfa cultivation through the utilisation as protein-rich forage as well as the material utilisation of the stem biomass, leaves and stems must be separated. Preliminary studies show that cutting of the top 30 cm

results in a higher forage value, while the lower stem biomass has a significantly higher content of crude fibre depending on the growth stage. This high-cutting method is a promising technique for selectively harvesting leaf and stem biomass. The multitude of research questions is addressed by different project partners. For example, IAP and B.A.M. GmbH are testing the suitability of the stem tissue for various natural fibre-reinforced plastics or building materials. Jointly, the Bauern AG Neißetal, INDITRAC and Dr.-Ing. Jürgen Paulitz are further developing the harvesting methods and testing them in practice. For better modelling of the forage value and the crude fibre content during crop growth, ZALF is conducting trials regarding different cutting times, cutting heights and alfalfa cultivars along with the determination of the respective proportion of stem and leaf biomass, as well as corresponding economic and ecological evaluations.

The results of the forage analyses show the great potential of alfalfa leaves and the high-cut biomass for use in animal husbandry as an alternative to soybean. The samples analysed so far showed a mean crude protein content of 25.9 % and an energy content of 7.8 MJ NEL per kg DM. In spring, leaves before budding featured peak values of up to 36 % crude protein and 8.5 MJ NEL per kg DM. In comparison, soybean and

In addition to its traditional use as a forage crop, alfalfa is also interesting as a renewable raw material for natural fibre-reinforced plastics. Because of its high drought tolerance and – in light of the recent surge of soybean and mineral fertiliser prices – its ability to fix nitrogen, alfalfa should be given greater attention in crop production. Compared to soybean, alfalfa has a high proportion of fibrous stem tissue, which is difficult to digest. To date, this has prevented its use in animal husbandry, despite the fact that alfalfa has the highest protein productivity of all crops. Therefore, the FUFAPRO project now aims to specifically optimise the separation of alfalfa leaves and stems.

rapeseed extraction meal have a crude protein content of 50 % and 39 % as well as an energy content of 8.4 and 7.1 MJ NEL per kg DM, respectively.

Without major alterations, disc mowers proved to be well suited for cutting at 30 cm height. Sample preparation showed that the separation of stems and leaves after threshing can be done with an air separator for seed cleaning. Based on this principle, a combination of a bale breaker with a cyclone separator for leaf-stem separation is now to be developed to practice readiness. Tests regarding the suitability of alfalfa stem biomass for producing building materials also delivered promising results (see photo). The FUFAPRO project is part of the initiative »Land-Innovation-Lausitz« within the framework of the BMBF programme »Innovation and Structural change (WIR!)«.

Project: Development and regional establishment of climate-resilient, resource-efficient farming systems for cultivation, dual harvesting and processing of forage legumes into selected, fibrous stem material for natural fibre-reinforced plastics with improved properties and leaf mass for high-quality protein utilisation (FUFAPRO)

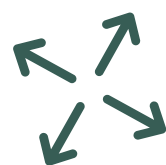
Term: 2020–2023 **Funding agency:** BMBF **Lead at ZALF:** Bachinger (jbachinger@zalf.de) **Partners:** IAP, INDITRAC, Unterauftragsnehmer: Bauern AG Neißetal, Bio-Composites and More GmbH (B.A.M.), Ingenieurbüro für Naturfasertechnologien, Dr.-Ing. Jürgen Paulitz

BIOSPHERE RESERVES AS MODEL LANDSCAPES FOR INSECT CONSERVATION

MICHAEL GLEMNITZ, PETER ZANDER, KARIN STEIN-BACHINGER, GYDE PETERSEN, SARA PREIBEL



Experimental set-up for »Exclosure« studies on the occurrence of beneficial insects in a winter wheat field in Lower Franconia as part of the BROMMI project.



The disappearance of insects is representative of the unstoppable decline of biodiversity in the cultivated landscape and is therefore considered an indicator for nature-friendly and sustainable land use. Currently, the intensity and type of agricultural management in the development zones of BRs hardly differs from other landscape areas. Even in BRs, supporting schemes to promote biodiversity are characterised by the challenge to achieve both a high acceptance by land users and thereby widespread implementation, but to provide a high effectiveness at the same time. Especially the transition zones of the BRs offer extensive options for developing new habitat qualities for insects in accordance with agricultural management.

The joint project BROMMI strives to develop, test and scientifically support new approaches for insect protection together with the BR administrations and the land users in the protected areas. With accompanying scientific research, the ZALF sub-project examines measures and options for action on agricultural land from agro-ecological and economic perspectives. Corresponding quantitative evaluations of insect-promoting measures are intended to support the acceptance of highly efficient promotional measures and their spatial consolidation, to reduce reservations and to further develop existing measures.

In consultation with the five collaborating BRs, we developed a comprehensive catalogue of measures and conducted a survey on the personal experiences and interests of land users. In order to refine measures, field studies are being carried out

Biosphere reserves (BR) are regions in which the sustainable development of landscapes in ecological, economic and social terms is to be implemented in an exemplary manner. BROMMI investigates how the special framework conditions of BRs can be used to permanently and extensively implement insect conservation in agricultural landscapes together with farmers and local authorities. In the project, ZALF is responsible for the agro-ecological and economic evaluation and further development of insect-promoting measures. This will be realised in close cooperation with five BRs throughout Germany, the WWF Germany and the umbrella organisation of large protected areas »National Natural Landscapes«.

to optimise their effects on the natural regulation of agriculturally relevant pests. In addition, approaches for fair financial compensation will be developed to promote the acceptance of ecologically efficient measures. Different support scenarios are analysed regarding their impacts on the economic situation of the respective farms and particularly cost-efficient combinations of measures and support instruments are identified. As a result, the conservational, agroecological and economic assessments will be combined to derive recommendations for the design of insect-promoting agri-environmental measures at the federal level.

Project: Biosphere reserves as model landscapes for insect conservation (BROMMI) **Term:** 2019–2025 **Funding agency:** BfN **Lead at ZALF:** Michael Glemnitz (mglemnitz@zalf.de) **Partners:** WWF Germany, National Natural Landscapes e. V., BA Schwarzwald, BR Bayrische Rhön, BR Mittlere Elbe, BR Schorfheide-Chorin, BR Schaalsee www.brommi.org

SHAPING THE EU MISSION

»A SOIL DEAL FOR EUROPE«

MICHAEL LÖBMANN, KATHARINA HELMING



SOIL MISSION SUPPORT addresses all soil and land use-related problem situations, including agriculture, forestry, natural land, infrastructure areas, urban and industrial land use.



Early in the year 2021, the European Commission launched the Mission »A Soil Deal for Europe« as part of the seven-year Horizon Europe research programme. It aims to lead the transition towards healthy soils by 2030 by means of targeted and practice-oriented research and innovation (R&I), broad monitoring of soils throughout the EU, establishing 100 living labs and lighthouses in the coming years and targeted campaigns for raising awareness on the importance of soils for our society and future generations as well as major threats to them. The SOIL MISSION SUPPORT project, scientifically coordinated by ZALF, supports the formation of this Soil Mission during the first two years and prepares the ground for future activities.

SOIL MISSION SUPPORT roots its works on co-creation together with actors and stakeholders from all relevant soil and land use sectors and policy fields, including agriculture, forestry, natural land, infrastructure areas, urban and industrial land use. To ensure a systemic overview of all relevant soil and land-related topics, a systemic research framework was developed in form of a knowledge matrix. The knowledge matrix combines »what needs to be addressed« (societal challenges) with a holistic pathway for »how to address it« (knowledge types).

The project includes an extensive mapping and analysis of existing R&I knowledge and infrastructures within soil and land management in order to define both the state of the art and the opportunities for action. Through numerous workshops

The Horizon Europe Mission »A Soil Deal for Europe« aims to lead an EU-wide transition towards healthy soils and sustainable soil and land management by 2030. It will be based on an ambitious research and innovation programme, extensive soil monitoring, co-development of good practical solutions in living labs and lighthouses, and broad campaigns for raising awareness on the vital importance of soils. The SOIL MISSION SUPPORT Project helps with the formation of the EU Soil Mission through analysing the state of the art, co-creating a research and innovation roadmap together with actors and stakeholders, and creating an online platform for continuous roadmapping.

and surveys, the project engages a broad set of actors and stakeholders covering all European regions. The stakeholder engagement helps to identify the practitioners' specific needs in order to be able to swiftly implement sustainable soil and land management on a broad scale. Comparing the knowledge stock with the stakeholder needs, R&I gaps are identified and an integrated R&I roadmap on soil systems and sustainable land management is developed in order to provide R&I topics and priority areas to the Soil Mission.

SOIL MISSION SUPPORT will ensure that its work carries on throughout the Horizon Europe programme and beyond. Therefore, an active co-design platform for R&I roadmapping will be created. After the end of the SOIL MISSION SUPPORT project, this platform will be continued and maintained by the newly launched European Soil Observatory (EUSO).

Project: Soil Mission Support (SMS) **Term:** 2020–2022
Funding agency: H2020 **Lead at ZALF:** Katharina Helming (helming@zalf.de) **Partners:** BLE, DELTARES, EAA, ECOLOGIC, INRAE, TEAGASC, WenR, INIA, ATK
<https://www.soilmissionsupport.eu/>

THE YEAR 2020



17TH–26TH INTERNATIONAL GREEN WEEK Jointly, ZALF and the Leibniz Institute of Vegetable and Ornamental Crops (IGZ) presented the BMBF funding measure »Agricultural Systems of the Future« at the International Green Week in Berlin and took part in a panel discussion on »Innovative Approaches for Sustainable and Resource-Efficient Agriculture«.

→ <https://bit.ly/37w3Eyy>

18TH FARM & FOOD 4.0 The fifth Farm & Food Congress took place in Berlin. A total of 500 guests from agriculture, industry, politics, science and the start-up scene learned about innovations and digitalization in the agricultural and food sector. In the middle of the crowd: the Leibniz Association's new knowledge hub »quer-FELDein« coordinated by ZALF.

→ <https://bit.ly/3yp5FaQ>

4TH AGRICULTURAL BIOME RESEARCH Official festive opening ceremony of the »House of Agricultural Biome Research« at ZALF with around 200 guests, among them Brandenburg's Minister of Science Dr. Manja Schüle (MWFK) and Dr. Eva Ursula Müller from the



JANUARY

FEBRUARY

MARCH



29TH AGRICULTURAL SYSTEMS OF THE FUTURE A success for Brandenburg's research institutes: IGZ and ZALF won the competition for the central coordination office »Agricultural Systems of the Future«, which supports the communication and collaboration between eight successful consortia working on innovative solutions for a future-oriented and sustainable agricultural economy across Germany.

→ <https://bit.ly/3yxXoRj>



23RD RESEARCH ALLIANCE Reducing the use of synthetic chemical pesticides in agriculture to an absolute minimum: this is the shared vision of a newly launched research alliance. In the presence of the former French Minister of Agriculture Didier Guillaume, 20 research organisations from 16 European countries, among them ZALF, signed a joint declaration at the International Agricultural Show in Paris.

→ <https://bit.ly/3y6htgl>

Federal Ministry of Food and Agriculture (BMEL). Research in the new facility will particularly focus on the influence of microorganisms on plant growth and climate change.

→ <https://bit.ly/3nsGGwC>

30TH HUMUS CERTIFICATES The BonaRes Centre for Soil Research published a study on »CO₂ certificates for fixing atmospheric carbon in soils: methods, measures and limits«. It focuses on measurement methods, the potential of humus-promoting farming systems, and difficulties in using private-sector CO₂ certificates as an incentive for climate protection measures in agriculture.

→ <https://bit.ly/3vXZsAM>

IN RETROSPECT



1ST APPOINTMENT Prof. Claas Nendel, Co-Head of the Research Platform »Data Analysis & Simulation« at ZALF, was appointed Professor of Landscape System Analysis at the University of Potsdam by the Ministry of Science, Research and Culture of the State of Brandenburg.

→ <https://bit.ly/3An9Epc>

15TH HONOURS In May, the EIP project Q2GRAS was recognised as the Project of the Month by the State of Brandenburg. The project works on improving the quality of grass silage. In February, two digital applications for improving silage quality, »WiltExpert« and »SiloExpert«, were presented at Ribbeck Castle. Both apps are based on research conducted at ZALF's Research Station in Paulinenaue.

→ <https://bit.ly/3w5HFrP>



15TH CAREER AND FAMILY For the fourth time, ZALF was presented with the »audit berufundfamilie« certificate on 15 June 2020, in recognition of its strategic human resources policy acknowledging different family and life phases as well as its family-friendly working conditions. Among the congratulants was the Federal Minister for Family Affairs, Dr. Franziska Giffey, who is the patron of the audit.

→ <https://bit.ly/3LU3Arc>

APRIL

30TH SUMMER DROUGHT Are we facing another drought season? How can agricultural systems adapt to climate change in the long term? This spring, various news channels such as Deutschlandradio, Inforadio and ZDF once again addressed the risk of drought and climate change in agriculture and interviewed ZALF researchers on the subject.

→ <https://bit.ly/38gB4RV>



MAY

30TH INTERNATIONAL NETWORKING Prof. Frank Ewert, Scientific Director of ZALF, was appointed spokesperson of the NFDI4Agri (National Research Data Infrastructure for Agricultural Sciences) consortium and invited as a member of the Scientific Group of the UN Secretary-General's 2021 Food Systems Summit.

→ <https://bit.ly/3P8w8iz>



JUNE

THE YEAR 2020



15TH CORONAVIRUS In an interview, Prof. Frank Ewert, Scientific Director of ZALF, and Dr. Annette Piore, head of the working group »Land Use Decisions in a Spatial and Systems Context«, talked about the impact of the COVID-19 pandemic on German agriculture, and highlighted the advantages and disadvantages of regional and global supply systems.

→ <https://bit.ly/3KYd03R>

18TH INSECT PROTECTION

The Research Award of the City of Müncheberg was awarded to Dr. Peter Weißhuhn for his PhD thesis on »Assessing biotope vulnerability to landscape changes«. Among other things, Dr. Weißhuhn coordinated a project aimed at developing insect protection measures in Brandenburg. As a basis for an insect protection programme in Brandenburg, a catalogue containing 52 individual measures was handed over to the commissioning authority, the Brandenburg Ministry of Agriculture, Environment and Climate Protection (MLUK).

→ <https://bit.ly/37w4WJU>



10TH PHD DAY Due to the COVID-19 pandemic, the first part of the PhD Day 2020 took part online. Along the main theme »Many researchers – one aim«, the PhD students and other researchers discussed how their projects are complementing each other and thus contributing to ZALF's research strategy.

→ <https://bit.ly/3AlaX8k>

JULY

AUGUST

SEPTEMBER



30TH NATURE PROTECTION

ONLINE The online marketplace www.agora-natura.de was launched. Via crowdfunding, companies and individuals can participate in the financing and implementation of diverse nature conservation projects. Thereby, the ZALF project Agora-Natura brings actors from agriculture and nature conservation in contact with committed private individuals and companies.

→ <https://bit.ly/3R0zgOG>



IN RETROSPECT

5TH–9TH YOUNG ACADEMY

Promoting early career researchers: supported by the German Research Foundation (DFG) and organised by ZALF, 20 young scientists participated in the Early Career Research Academy »Agroecosystems 2020«.

→ <https://bit.ly/3AihvEx>

6TH AWARD

Dr. Jana Zscheischler received the research award »Transformative Science« issued by the Wuppertal Institute and the Zempelin Foundation. The award recognises her transdisciplinary and transformative profile as well as her research concept for sustainable land management.

→ <https://bit.ly/3ugGggE>

16TH ARABLE FARMING

STRATEGY The Food and Agriculture Committee of the German Bundestag invited experts to a public hearing regarding the discussion paper on the »Arable Farming Strategy 2035« of the Federal Ministry of Agriculture and Food (BMEL). Prof. Frank Ewert, Scientific Director of ZALF, took part in the hearing.

→ <https://bit.ly/3w7AaPy>

25TH ARTIFICIAL INTELLIGENCE

The recently funded ZIM cooperation network »DeepFarm-Bots« held its official kick-off meeting online. The central objective of the network is the development and



1ST DIGIFOOD agrathaer, the Competence Centre Food & Beverage of the German Agricultural Society (DLG e. V.) and the Fördergemeinschaft Ökologischer Landbau Berlin-Brandenburg e. V. (FÖL) jointly launched the BMEL networking and transfer project DigiFood. The project wants to create a network for knowledge transfer in support of the digital transformation of the food industry.

→ <https://bit.ly/3vXRLeF>

OCTOBER



21ST INNOVATION DAYS

At the BLE Innovation Days, ZALF-sub-sidiary agrathaer offered an online webinar on »How to bait the hook to suit the fish« focusing on target group-specific communication. The webinar was organised by the project »Network for Knowledge Transfer in the Food Trade« (transNetz). agrathaer was founded for the professional implementation of transfer activities.

→ <https://bit.ly/3FxqPVB>

NOVEMBER



dissemination of new agricultural robotics as solutions for efficient and sustainable agriculture.

→ <https://bit.ly/3OIhfCY>

30TH HIGHLY CITED

Dr. Kurt-Christian Kersebaum and Prof. Frank Ewert were recognised as »Highly Cited Researchers« by the »Web of Science« in the category »Cross-Field« and »Agricultural Sciences«, respectively.

→ <https://bit.ly/3LU5cBg>

DECEMBER

3RD EMAS ZALF was the first institution of the Leibniz Association and the second non-university research institution in Germany certified in accordance with the EU Eco-Management and Audit Scheme (EMAS). With environmental management according to the EMAS standard, ZALF is on its way to becoming a sustainable and climate-neutral research institution.

→ <https://bit.ly/3P0ESXv>



THE YEAR 2021



18TH GFFA 2021 As part of the »Global Forum for Food and Agriculture 2021«, Katharina Löhr and Stefan Sieber from the working group »Sustainable Land Use in Developing Countries« hosted an expert panel on the topic »COVID-19 pandemic: insights for greater resilience along agricultural value chains«.

→ <https://bit.ly/3NEkFp4>

28TH DIGITALIZATION The »DiDaT« project contributed to the publication of a white paper on the non-intended consequences of digitalization in agriculture. It presents the results of a two-year transdisciplinary process on far-reaching changes along the agricultural production chain, including the upstream and downstream sectors.

→ <https://bit.ly/3LZf1Ot>



1ST EXECUTIVE BOARD

Martin Jank was appointed as the new Administrative Director on the ZALF Executive Board. With his arrival, he replaced Cornelia Rosenberg, who had filled this position since January 2015. Before joining ZALF, Martin Jank was Chancellor of the Film University Babelsberg KONRAD WOLF.

→ <https://bit.ly/3blrV60>

JANUARY

25TH SUSTAINABILITY ZALF participates in the Leibniz Research Network »Knowledge for Sustainable Development«. Together with other institutions and external partners, ZALF contributes to creating the knowledge required for the transformation towards a sustainable society.

→ <https://bit.ly/3nuCOuO>

FEBRUARY



MARCH

31ST PODCAST With the new »querFELDein podcasts«, the ZALF-coordinated online knowledge hub operating under the same name now features two new audio formats. In addition to the in-house »querFELDein-Podcast«, the network also produces the format »Fields, forests and crises – Landscapes in transition« together with the rbb. Currently, 19 research institutions are communicating their findings on challenges in agriculture at www.quer-feld-ein.blog.

→ <https://bit.ly/3vWo7Wt>

IN RETROSPECT

8TH ECOSYSTEM SERVICES The »SinoPES« project coordinated by ZALF held its kick-off meeting on 8 April. Over the next three years, the six partners from Germany and China will jointly develop a coordinated, efficient and sustainable management and financing mechanism for ecosystem services in Germany and China.

→ <https://bit.ly/3adaqKJ>

23RD NATAPP Together with other partners, a ZALF-coordinated project is developing an app that supports farms in implementing nature



5TH FIELD ROBOTICS Together with partners, ZALF invited participants to a full-day online workshop and networking event on the topic of field robotics. Using the ZALF landscape laboratory »patchCROP« as an example, some 150 participants from research, high-tech companies, start-ups and interested farmers discussed how field robotics can be used in science and practice.

→ <https://bit.ly/39C5DSq>



7TH SPECIES DIVERSITY The Federal Minister of Agriculture, Julia Klöckner, visited the Temmen Estate. The farm is one of 150 farms participating in the project »Agriculture for Biodiversity«, which ZALF accompanies scientifically.

→ <https://bit.ly/3AjtqCe>

APRIL



conservation measures while also reducing the bureaucracy for farms and authorities.

→ <https://bit.ly/3ybO6ZY>

30TH CLIMATE In April, the Reuters »Hot List« of the 1,000 most influential climate researchers was published, including three ZALF scientists: Prof. Frank Ewert, apl. Prof. Kurt-Christian Kersebaum and Prof. Claas Nendel.

→ <https://bit.ly/3a53z66>

MAY

25TH COOPERATION ZALF and the Julius Kühn Institute (JKI) want to collaborate even closer in their future research endeavours. To this end, the heads of both research institutes signed a cooperation agreement focusing particularly on sustainable land use, promotion of biodiversity, climate adaptation and the establishment of research data infrastructures.

→ <https://bit.ly/3wdn3MU>



JUNE

12TH LEGUMES The »FUFAPRO« research and development project was presented as part of the event »Brandenburger Landpartie«. The ZALF-coordinated project is funded by the BMBF as part of the WIR! Alliance »Land-Innovation-Lausitz« (LIL). The project innovation concerns the dual use of lucerne.

→ <https://bit.ly/3yjkawO>

30TH TRANSFER »MACSUR SciPol« started under ZALF coordination. The aim of the project is to establish an interface between politics and science for the agricultural and food sector at the European level.

→ <https://bit.ly/3NuUIbH>

THE YEAR 2021



7TH VEGETABLE CULTIVATION

Are soil conservation methods also suitable for organic vegetable production? In the EIP project »BioStrip-Plant«, three vegetable farmers, IGZ, FÖL and agrathaer are jointly testing the strip-till principle over the next three years.

→ <https://bit.ly/3Pjk66m>

14TH MODERN WORKPLACE

ZALF drafted a concept for making the use of its office space more flexible. Gradually, all ZALF premises will be categorised according to their potential use and, if possible, be made available for flexible booking.

1ST EMAS The first monitoring audit of the environmental management system EMAS at ZALF campus in Müncheberg was successfully completed.

→ <https://bit.ly/3I4BYP6>

18TH URBAN NATURE For the third time, ZALF participated in the »Long Day of Urban Nature« in Berlin. The projects »Mosquito Atlas« and »AgoraNatura« were presented as part of the meeting point »Treffpunkt StadtNatur«.

→ <https://bit.ly/3vYzAoJ>

JULY

AUGUST

SEPTEMBER

8TH–9TH SCIENCE DAYS The »Science Days for the UN Food Systems Summit 2021« took place. ZALF was represented by its Scientific Director Prof. Frank Ewert, who is a member of the »Scientific Group of the UN Food Systems Summit 2021«, and also organized a workshop.

→ <https://bit.ly/3ukLsQv>

30TH PATCHCROP In the »patchCROP« landscape laboratory, a trial that is unique in Europe started into its second season. Over the next 10 years, ZALF will be testing an innovative cultivation system relying on diversity, digitalization and new technologies – jointly with a real farmer.

→ <https://bit.ly/3ntuonN>



26TH LAUSITZ On 26 August, the kick-off workshop »Lusatia as a model region for the bioeconomy« took place at the BTU Cottbus. The WIR! Alliance »Land-Innovation-Lausitz« (LIL) had invited regional actors, stakeholders, projects and initiatives related to the bio-based economy to first develop a common vision for Lusatia. Prof. Frank Ewert was appointed as co-spokesperson.

→ <https://bit.ly/3KXk28V>



20TH–22ND LANDSCAPE ZALF virtually hosted the second edition of its in-house conference »Landscape«, featuring over 400 participants. The focus was on the transformation of agriculture towards more climate resilience and sustainability.

→ <https://bit.ly/3AhohKI>

29TH AWARD For his research on the energy production potential of giant Chinese reed in Brandenburg conducted at ZALF, scientist Ehsan Tavakoli Hashjini received the Research Award of the City of Müncheberg.

→ <https://bit.ly/3LXkTrB>

IN RETROSPECT



1ST FAO ZALF and FAO signed a Memorandum of Understanding to strengthen evidence-based measures for improving agricultural landscapes with respect to a sustainable soil and natural resource management, biodiversity conservation, as well as improved food security and nutrition.

→ <https://bit.ly/3M0JWKj>

5TH MWFK The State Secretary for Research of the State of Brandenburg, Tobias Dünow, visited ZALF. He acknowledged the work of ZALF's researchers as contribution to an overall societal transformation process towards a sustainable and resource-efficient agriculture.

→ <https://bit.ly/3FByt1q>



ENVIRONMENTAL STATEMENT

ZALF published its Environmental Statement 2021. It not only contains an overview of ZALF's resource consumption, but also lists the steps to be taken in the coming years in order to save resources.

→ <https://bit.ly/3ad6QQN>

OCTOBER

26TH SOIL STRUCTURE Soil structure is an important parameter for farming and soil health. At the field day »Digital analysis of soil structure – results of the DIWELA project«, ZALF researchers presented their method of characterizing the soil structure with modern medical computed tomography images along with their latest findings.

→ <https://bit.ly/3ylq0xL>



NOVEMBER

26TH HIGHLY CITED For the sixth year in a row, Prof. Frank Ewert, Scientific Director of ZALF, was awarded the title of »Highly Cited Researcher« in the »Agricultural Sciences« category.

→ <https://bit.ly/3a7GD6g>

BIODIVERSITY Within the EU project »SHOWCASE«, ZALF and 20 project partners from 15 countries are identifying crucial incentives for farms with respect to the integration of biodiversity-promoting agricultural practices into their daily operations. One year after the project start, a face-to-face meeting was held at BOKU Vienna in November 2021.

→ <https://bit.ly/3NACHZv>

DECEMBER



MOSQUITO ATLAS The Mosquito Atlas was represented at the World Expo in Dubai this year. The German pavilion celebrated the human inventive spirit with a presentation on Citizen Science, among other things. As one of the best-known and most successful Citizen Science projects in Germany, the Mosquito Atlas was part of the show, of course.

→ <https://bit.ly/3KUs4PO>

ANNEX





FACTS & FIGURES 2020/2021



418

Employees
(among them **202** scientists)



14485

Newspaper articles



2020 2021

9.3 | 11.6

million €

Total amount of
third party funding

53

Employees involved in
academic teaching

525

Peer-reviewed publications

354

of which are open access

22.5 | 23.8

million €

Basic funding

301

Tasks and offices in
scientific boards and bodies



31.8 | 35.4

million €

Total budget

26

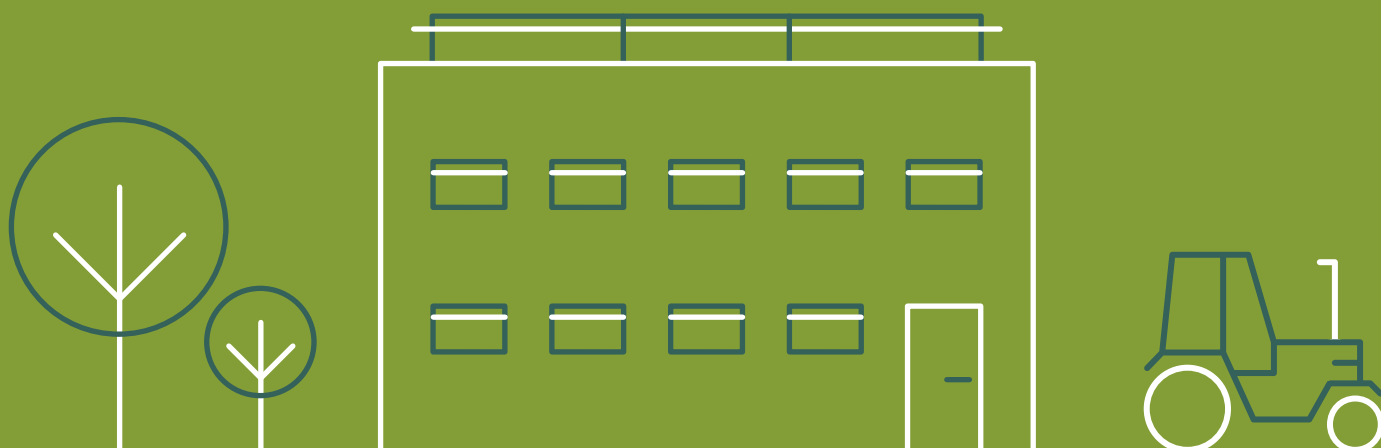
Scientific events

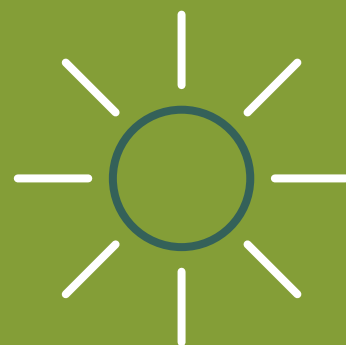
29.2 % | 32.8 %

Percentage of third party funding

46

Colloquia



**38**

New doctoral researchers at ZALF

55

Newly started projects

29Completed doctoral theses,
thereof **22** by ZALF doctoral
researchers**334**Cooperating partners
in **60** countries (approx.)**76**

Master and bachelor theses

150Hectares of ZALF
experimental sites

FINANCES 2020

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

40,625

REVENUES FROM THIRD PARTY
FUNDED PROJECT GRANTS IN
THE FINANCIAL YEAR 2019

DFG	881
LEIBNIZ COMPETITION	288
FEDERAL MINISTRIES	5,441
STATE MINISTRIES	338
INDUSTRY	39
OTHER	489

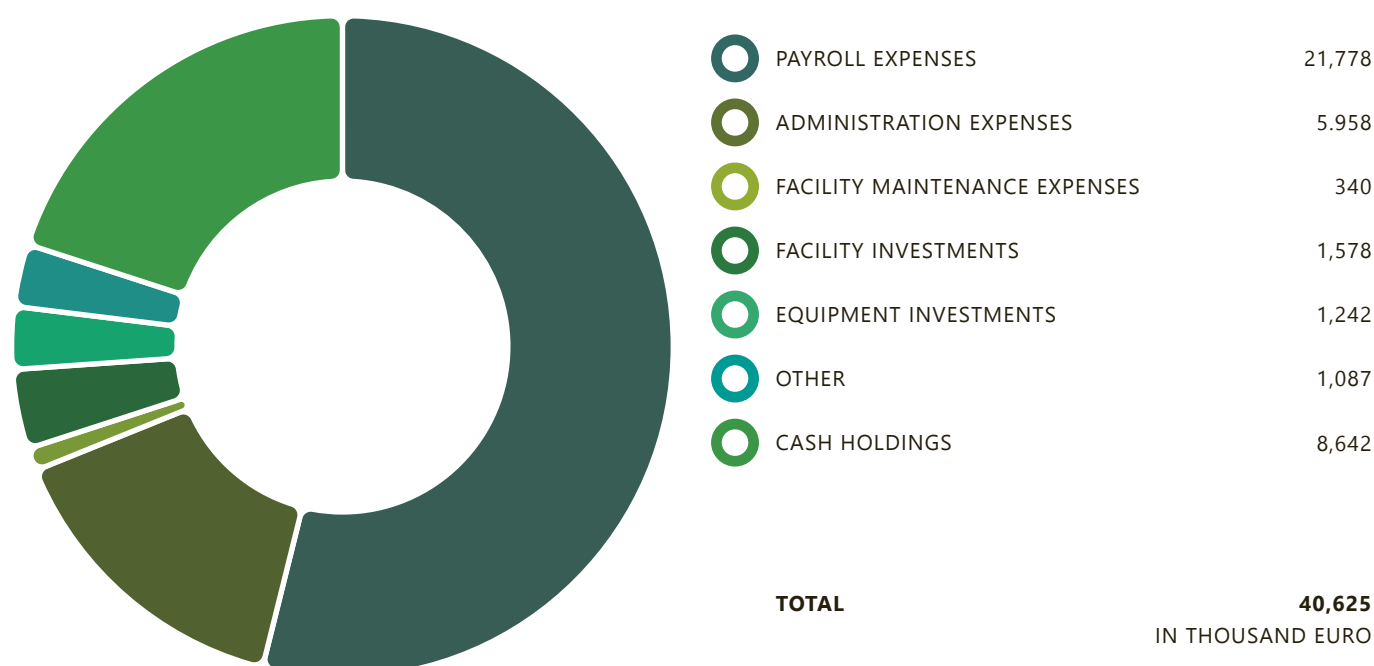
EU	1,865
FROM WHICH	
HORIZON 2020	420
ELER	0
ERANET	341
INTERREG	17
EIP	173
EFRE (THIRD PARTY FUNDED SHARE OF 80–85 %)	915

IN THOUSAND EURO

TOTAL THIRD PARTY FUNDS (IN THOUSAND EURO)

9,342

EXPENSES DURING BUDGET YEAR 2020



22.5 MILLION BASIC FUNDING

9.3 MILLION TP FUNDS

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

FINANCES 2021

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

44,526

REVENUES FROM THIRD PARTY
FUNDED PROJECT GRANTS IN
THE FINANCIAL YEAR 2019

DFG	1,251
LEIBNIZ COMPETITION	300
FEDERAL MINISTRIES	6,806
STATE MINISTRIES	372
INDUSTRY	42
OTHER	723

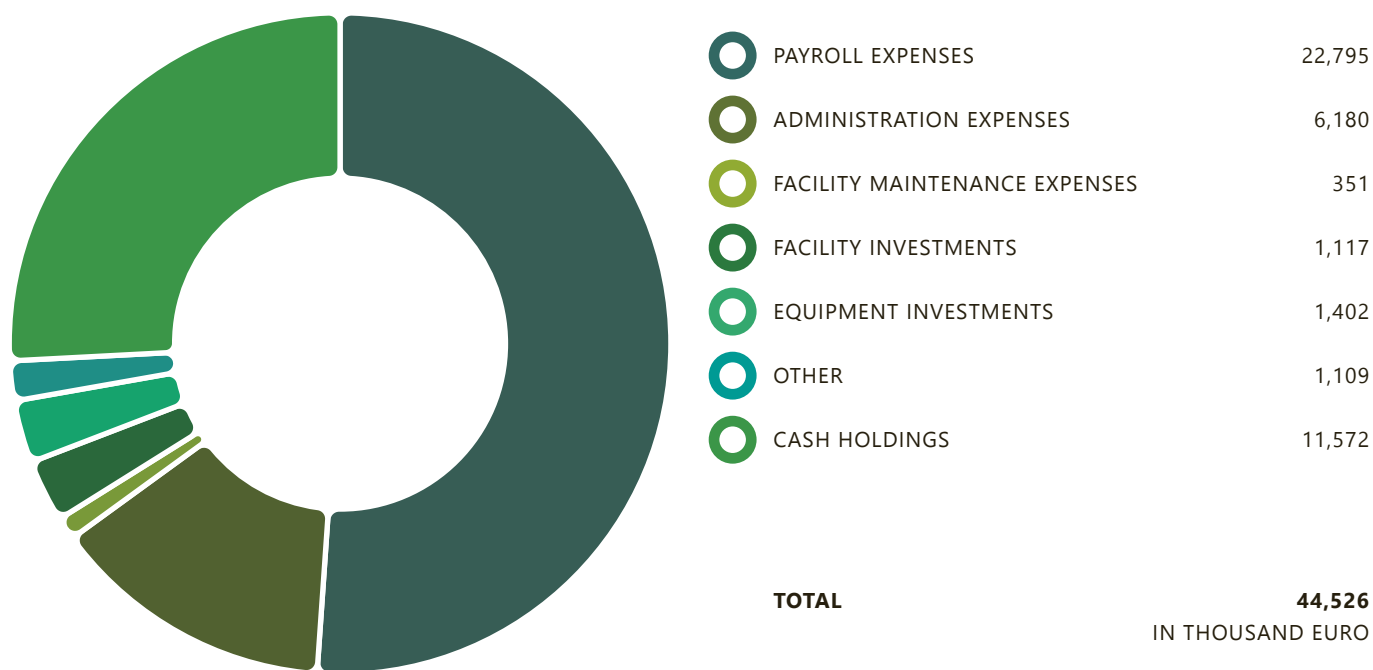
EU	2,144
FROM WHICH	
HORIZON 2020	773
ELER	0
ERANET	367
INTERREG	48
EIP	140
EFRE (THIRD PARTY FUNDED SHARE OF 80–85 %)	816

IN THOUSAND EURO

TOTAL THIRD PARTY FUNDS (IN THOUSAND EURO)

11,638

EXPENSES DURING BUDGET YEAR 2021

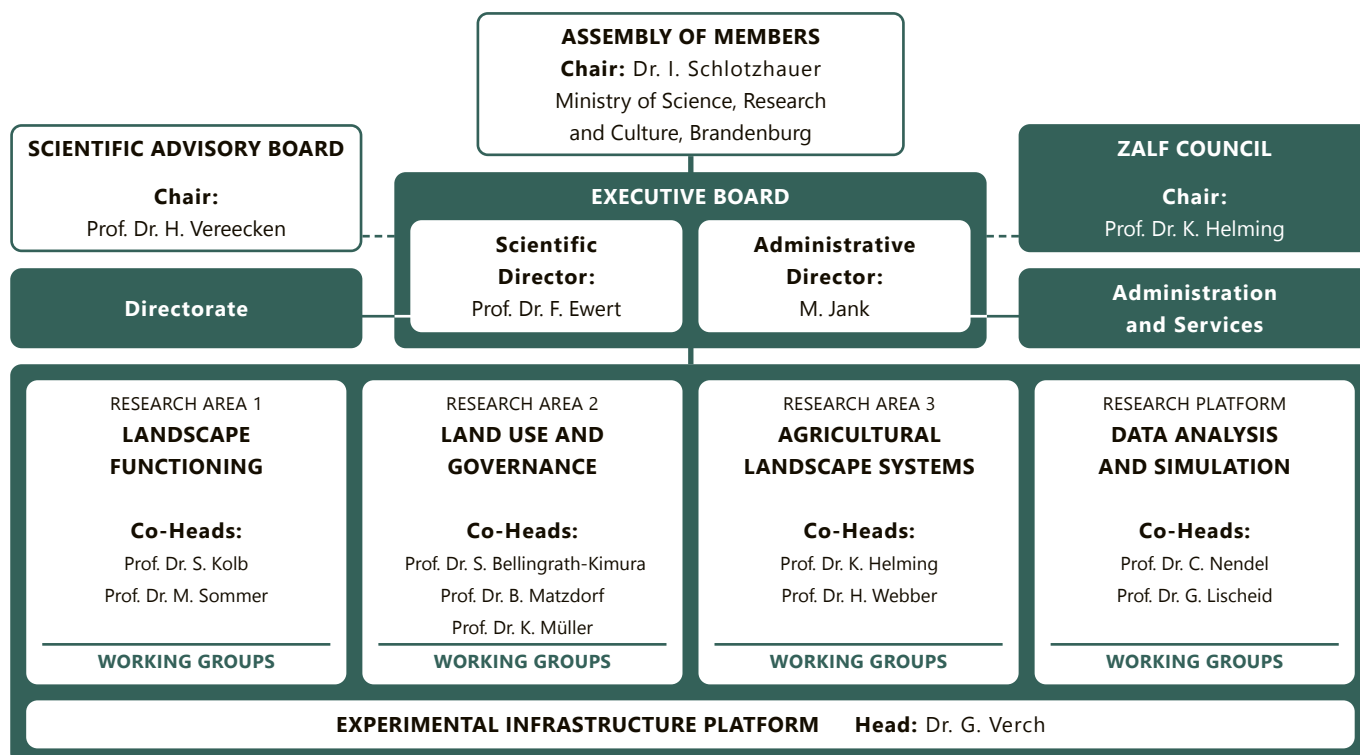


23.8 MILLION BASIC FUNDING

11.6 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)

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)

ASSEMBLY OF MEMBERS

Dr. Inge Schlotzhauer

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

Dr. Julian Braun

Federal Ministry of Food and Agriculture
Vice Chair of the Assembly of Members

Dr. Klaus-Peter Michel

Federal Ministry of Education and Research

Peter Schubert

Ministry of Rural Development, Environment and Agriculture, Brandenburg

Prof. Dr. Peter Feindt

Humboldt-Universität zu Berlin, Faculty of Life Sciences

Prof. Dr. Barbara Höhle

University of Potsdam, Vice President for Research, Early Career Researchers and Equal Opportunities

COOPERATIONS (SELECTED)

NATIONAL

UNIVERSITIES

- Brandenburg University of Technology Cottbus-Senftenberg
- Carl von Ossietzky University of Oldenburg
- Eberswalde University for Sustainable Development
- European University Viadrina
- Freie Universität Berlin
- Georg-August-Universität Göttingen
- Giessen University
- Humboldt-Universität zu Berlin
- Leibniz University Hannover
- Martin-Luther-Universität Halle-Wittenberg
- Technical University of Munich
- Technische Universität Berlin
- Technische Universität Braunschweig
- Universität Hamburg
- 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 INSTITUTIONS

- Bernhard Nocht Institute for Tropical Medicine
- Deutsches Biomasse Forschungszentrum gGmbH
- Ecologic Institute
- 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 and 36 Leibniz institutes in four research networks

OTHER GOVERNMENTAL AND NON-GOVERNMENTAL INSTITUTIONS

- agrathaer GmbH
- Bundesanstalt für Materialforschung und -prüfung
- Deutscher Wetterdienst
- Environmental Action Germany
- Ernährungsrat Berlin e.V.
- Federal Institute for Geosciences and Natural Resources
- Fruit Advisory Service of the Altes Land
- Landesamt für Umwelt Brandenburg
- Landwirtschaftskammer Niedersachsen
- proPlant Agrar- und Umweltinformatik GmbH
- Society for the promotion of mosquito control
- Stiftung Westfälische Kulturlandschaft
- The German Farmers' Association
- World Wildlife Fund (WWF)

INTERNATIONAL

UNIVERSITIES

- Aarhus University, Denmark
- Adnan Menderes University, Turkey
- Estonian University of Life Sciences Tartu, Estonia
- Free University Amsterdam, Netherlands
- Gorgan University of Agricultural Sciences and Natural Resources, Iran
- Københavns Universitet, Denmark
- Sokoine University of Agriculture, Tanzania
- Swedish University of Agricultural Sciences, Sweden
- Tokyo University of Agriculture and Technology, Japan
- Universidad Autónoma de Madrid, Spain
- Università di Pisa, Italy

- University of Colorado Riverside, United States of America
- University of Helsinki, Finland
- University of Natural Resources and Life Sciences Vienna, Austria
- University of Tasmania, Australia
- University of the Philippines Los Baños, Philippines
- Vrije Universiteit Amsterdam, Netherlands
- Wageningen University, Netherlands
- Wrocław University of Environmental and Life Sciences, Poland
- Zurich University of Applied Sciences, Switzerland

NON-UNIVERSITY RESEARCH INSTITUTIONS

- Agricultural Research Institute of Mozambique, Mozambique
- Agroscope, Switzerland
- Austrian Institute of Technology, Austria
- Centre de Coopération internationale en Recherche Agronomique pour le développement – C.I.R.A.D., France
- Centre national de la recherche scientifique, France
- Chinese Academy of Environmental Planning, China
- CIAT – Centro Internacional de Agricultura Tropical, Colombia
- Finnish Environment Institute, Finland
- Forschungsinstitut für biologischen Landbau, Switzerland
- Institute for Structural Policy, Czech Republic
- Institut national de la recherche agronomique (INRA), France
- International Institute for Applied Systems Analysis, Austria
- Japan International Research Center for Agricultural Sciences, Japan
- Norwegian Bioeconomy Research Institute, Norway
- PBL Netherlands Environmental Assessment Agency, Netherlands
- Qatar Environment and Energy Research Institute, Qatar

DOCTORAL RESEARCHERS

NEW IN 2020

Adelesi, Opeyemi Obafemi

Supervision at ZALF: Prof. Heidi Webber
Mentor: Dr. Michelle Bonatti
Martin-Luther-Universität
Halle-Wittenberg
Supervision: Prof. Norbert Hirschauer

Antonijević, Danica

Supervision at ZALF: Dr. Mathias Hoffmann
Mentor: Dr. Kathrin Grahmann
Humboldt-Universität zu Berlin
Supervision: Prof. Annette Prochnow

Burghard, Valentin

Supervision at ZALF: Dr. Andreas Ulrich
Mentor: Prof. Sonoko Dorothea Bellingrath-Kimura
Humboldt-Universität zu Berlin
Supervision: Prof. Steffen Kolb

Davies, Mariel Fiona

Supervision at ZALF: Prof. Christoph Merz
Mentor: Dr. Tobias Naaf
Freie Universität Berlin
Supervision: Prof. Christoph Merz

Geppert, Frauke

Supervision at ZALF: Dr. Ioanna Mouratiadou
Mentor: Dr. Maria Busse
Humboldt-Universität zu Berlin
Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Heyer, Ines

Supervision at ZALF: apl. Prof. Monika Wulf
Mentor: Dr. Sandra Uthes
University of Potsdam
Supervision: Prof. Catrin Westphal

Klebl, Fabian

Supervision at ZALF: Dr. Annette Piorr
Mentor: Dr. Maria Busse
Humboldt-Universität zu Berlin
Supervision: Prof. Peter Feindt

Macagga, Reena

Supervision at ZALF: Dr. Mathias Hoffmann
Mentor: Prof. Heidi Webber
Humboldt-Universität zu Berlin
Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Méité, René

Supervision at ZALF: Dr. Sandra Uthes
Mentor: Dr. Carsten Paul
Humboldt-Universität zu Berlin
Supervision: Prof. Klaus Müller

Ostermann-Miyashita , Emu-Felicitas

Supervision at ZALF: Dr. Hannes König
Mentor: Dr. Karin Stein-Bachinger
Humboldt-Universität zu Berlin
Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Pehlivan, Ayten

Supervision at ZALF: Prof. Jürgen Augustin
Mentor: Dr. Alevtina Evgrafova
Humboldt-Universität zu Berlin
Supervision: Prof. Steffen Kolb

Ruggaber, Julian

Supervision at ZALF: Prof. Steffen Kolb
Mentor: Prof. Masahiro Ryo
Humboldt-Universität zu Berlin
Supervision: Prof. Steffen Kolb

Walthall, Beatrice

Supervision at ZALF: Dr. Annette Piorr
Mentor: Dr. Rosemarie Siebert
Humboldt-Universität zu Berlin
Supervision: Prof. Peter Feindt

... and three external PhDs

NEW IN 2021

Abdelfadil, Mohamed Ramadan

Supervision at ZALF: Prof. Steffen Kolb
Mentor: Dr. Roger Funk
Humboldt-Universität zu Berlin
Supervision: Prof. Steffen Kolb

Atkinson, Christopher

Supervision at ZALF: Dr. Marina Müller
Mentor: Dr. Cara Gallagher
Freie Universität Berlin
Supervision: Prof. Matthias Rillig

Awoke, Mahlet Degefu

Supervision at ZALF: PD Dr. Stefan Sieber
Mentor: Dr. Johannes Schuler
Humboldt-Universität zu Berlin
Supervision: PD Dr. Stefan Sieber

Baldivieso Soruco, Carla Rene

Supervision at ZALF: Dr. Michelle Bonatti
Mentor: Dr. Johannes Schuler
Humboldt-Universität zu Berlin
Supervision: PD Dr. Stefan Sieber

Börger, Maria

Supervision at ZALF: Dr. Doreen Werner
Mentor: Dr. Marina Müller
Technische Universität Braunschweig
Supervision: Prof. Ulrich Nübel

Chavez Miguel, Giovanna

Supervision at ZALF: PD Dr. Stefan Sieber
Mentor: Dr. Maria Busse
Humboldt-Universität zu Berlin
Supervision: PD Dr. Stefan Sieber

Hossain, Md Tawhid

Supervision at ZALF: Dr. Kathrin Grahmann
Mentor: Dr. Gohar Ghazaryan
Humboldt-Universität zu Berlin
Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Khaledi, Valeh

Supervision at ZALF: Prof. Claas Nendel
Mentor: Dr. Joana Bergmann
University of Potsdam
Supervision: Prof. Claas Nendel

Kipkulei, Harison

Supervision at ZALF: PD Dr. Stefan Sieber
 Mentor: Dr. Jörg Schaller
 Humboldt-Universität zu Berlin
 Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Klotz, Marius

Supervision at ZALF: Dr. Jörg Schaller
 Mentor: Dr. Joana Bergmann
 Universität Bayreuth
 Supervision: Prof. Bettina Engelbrecht

Monzón, Oscar

Supervision at ZALF: Dr. Mathias Hoffmann
 Mentor: Dr. Wanderson de Sousa Mendes
 Humboldt-Universität zu Berlin
 Supervision: Prof. Eckhard George

Mundschenk, Eva Franziska

Supervision at ZALF: Dr. Maire Holz
 Mentor: Prof. Heidi Webber
 Humboldt-Universität zu Berlin
 Supervision: Prof. Eckhard George

Pfeifer, Lena Kristin

Supervision at ZALF: Prof. Katharina Helming
 Mentor: Dr. Jana Zscheischler
 Ludwig Maximilian University Munich
 Supervision: Prof. Henrike Rau

Preißel-Reckling, Sara

Supervision at ZALF: Dr. Michael Glemnitz & Dr. Karin Stein-Bachinger
 Mentor: NN
 University of Bonn
 Supervision: Prof. Thomas Döring

Rezgui, Ferdaous

Supervision at ZALF: Dr. Moritz Reckling
 Mentor: Dr. Richard Omari
 Humboldt-Universität zu Berlin
 Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Srivastava, Nimisha

Supervision at ZALF: Dr. Hannes König
 Mentor: Dr. Barbara Schröter
 Martin-Luther-Universität Halle-Wittenberg
 Supervision: Prof. Christine Fürst

Stiller, Stefan

Supervision at ZALF: Prof. Masahiro Ryo
 Mentor: Dr. Xenia Specka
 Brandenburg University of Technology Cottbus-Senftenberg
 Supervision: Prof. Masahiro Ryo

Thielicke, Matthias

Supervision at ZALF: Prof. Frank Eulenstein
 Mentor: Dr. Monika Joschko
 University of Rostock
 Supervision: Prof. Bettina Eichler-Löbermann

Thiesmeier, Alma Irma Maria

Supervision at ZALF: Dr. Peter Zander
 Mentor: Prof. Heidi Webber
 University of Rostock
 Supervision: Prof. Sebastian Lakner

Thompson, Jennifer

Supervision at ZALF: Dr. Moritz Reckling
 Mentor: Dr. Maria Kernecker
 Humboldt-Universität zu Berlin
 Supervision: Prof. Sonoko Dorothea Bellingrath-Kimura

Tougma, Inès Astrid

Supervision at ZALF: Prof. Heidi Webber
 Mentor: PD Dr. Stefan Sieber
 ETH Zurich
 Supervision: Prof. Johan Six

Voigt, Claas

Supervision at ZALF: Dr. Maren Dubbert
 Mentor: Dr. Joana Bergmann
 NN
 Supervision: NN

von Czettritz und Neuhaus, Hannah

Supervision at ZALF: Dr. Peter Zander
 Mentor: Prof. Masahiro Ryo
 Humboldt-Universität zu Berlin
 Supervision: Prof. Hermann Lotze-Campen

Yu, Jing

Supervision at ZALF: Dr. Ehsan Rezaei
 Mentor: Dr. Maren Dubbert
 University of Potsdam
 Supervision: Prof. Claas Nendel

Zentgraf, Isabel

Supervision at ZALF: Dr. Maire Holz
 Mentor: Prof. Michael Sommer
 Humboldt-Universität zu Berlin
 Supervision: Prof. Steffen Kolb

... and three external PhDs

SCHOLARSHIP HOLDERS

Name	Country	Funding
Adetoye, Ayoadé Matthew	Nigeria	DFG
Arshad, Dr. Muhammad	Pakistan	Fritz Thyssen Foundation
Awoke, Mahlet Degefu	Ethiopia	ATSAF Academy Stuttgart
Baldivieso Soruco, Carla Rene	Bolivia	ATSAF Academy Stuttgart
Chavez Miguel, Giovanna	Mexico	ATSAF Academy Stuttgart
Eichhorn-Lüneburg, Franziska	Germany	Zwillenberg-Tietz Foundation
Eshetu, Shibire Bekele	Ethiopia	Alexander von Humboldt Foundation
Haddaway, Neal Robert	Sweden	Alexander von Humboldt Foundation
Hemminger, Karoline	Germany	Marianne und Dr. Fritz Walter Fischer Foundation/Zempelin- Foundation
Heyer, Ines	Germany	University of Potsdam
Huynh, Thanh Hien	Vietnam	Vietnam International Education Development, Ministry of Education and Training
Ibrahim, Esther Shupel	Nigeria	National Centre For Remote Sensing (NCRS)
Kipkulei, Harison	Kenya	DAAD
Moluh Njoya, Hamza	Cameroon	Alexander von Humboldt Foundation
Morales Munoz, Hector Camilo	Colombia	Friedrich Naumann Foundation
Msangi, Haji	Tanzania	DAAD
Mugabe, Paschal Arsein	Tanzania	Alexander von Humboldt Foundation
Ostermann-Miyashita, Emu-Felicitas	Germany, Japan	Marianne und Dr. Fritz Walter Fischer Foundation
Pandey, Dr. Divya	India	Alexander von Humboldt Foundation
Perkovic, Stanislava	Bosnia and Herzegovina	DBU
Reinke, Henrik	Germany	Marianne und Dr. Fritz Walter Fischer Foundation/Zempelin- Foundation
Savic, Biljana	Serbia	DBU
Srivastava, Nimisha	India	DAAD
Susman, Roni	Indonesia	Ministry of Finance, Indonesia Endowment Fund of Education
Thai, Thi Huyen	Vietnam	Vietnam International Education Development, Ministry of Education and Training
Tsutskikh, Elena	Russia	Humboldt-Universität zu Berlin
Turco, Fabio	Italy	Erasmus
Vasić, Filip	Serbia	DBU
Vijayan, Dhanya	India	DAAD
Webster, Christina	USA	DAAD
Wei, Yuqi	China	China Scholarship Council
Wenz, Elena	Germany	Marianne und Dr. Fritz Walter Fischer Foundation

DOCTORAL THESES

COMPLETED IN 2020

Batunacun

Modelling land use and land cover change on the Mongolian Plateau

Supervision at ZALF: Prof. Claas Nendel

Humboldt-Universität zu Berlin

Supervision: Prof. Tobia Lakes

Busse, Maria

Conceptualizing and analysing the acceptability of sustainability innovations in the field of land use and landscape planning

Supervision at ZALF: Dr. Rosemarie Siebert

Technische Universität Berlin

Supervision: Prof. Stefan Heiland, Prof. Klaus Müller

Eufemia, Luca

A Framework for Community-based Governance in Grasslands and Savannas of South America

Supervision at ZALF: PD Dr. Stefan Sieber

Humboldt-Universität zu Berlin

Supervision: Prof. Klaus Müller

Kuhlisch, Cornelius

Distribution, habitat binding and morphological peculiarities of selected mosquito species (Diptera: Culicidae) occurring in Germany

Supervision at ZALF: Dr. Doreen Werner

University of Greifswald

Supervision: PD Dr. Helge Kampen

Mahmood, Nasir

Climate change impacts on rainfed wheat farming and farmers' adaptation response: Evidence from Pakistan

Supervision at ZALF: Prof. Harald Kächele

Humboldt-Universität zu Berlin

Supervision: Prof. Klaus Müller

Pohl, Madlen

Influence of site conditions on C dynamics of maize cultivated in the heterogeneous NE German glacial soil landscape

Supervision at ZALF: Prof. Jürgen Augustin

Humboldt-Universität zu Berlin

Supervision: Prof. Arthur Geßler

Strer, Maximilian

Between heat death and drought stress, the impact of adverse environmental conditions on critical development stages of agricultural production in the North German Plain

Supervision at ZALF: Dr. Nikolai Svoboda

Christian-Albrechts-Universität zu Kiel

Supervision: Prof. A. Herrmann, Prof. Henning Kage

van der Meij, Marijn

Co-evolution of soils and landscapes in the Anthropocene from natural to intensively managed landscapes

Supervision at ZALF: Prof. Michael Sommer

Wageningen University

Supervision: Prof. Arnaud Temme

Weißhuhn, Peter

Assessing biotope vulnerability to landscape changes

Supervision at ZALF: Prof. Katharina Helming

University of Potsdam

Supervision: Prof. Hubert Wiggering

Weltin, Meike

Sustainable intensification: Farmers' adoption behaviour and environmental outcomes

Supervision at ZALF: Dr. Ingo Zasada

University of Bonn

Supervision: Prof. Silke Hüttel

... and five external doctoral theses with supervision by ZALF researchers

DOCTORAL THESES

COMPLETED IN 2021

Arrekhi, Armin

Investigation of an alternative cropping system using salt and drought resistance plant species (*Salsola turcomanica* and *Chrysopogon zizanioides*) on semi-arid eroded agricultural lands (case study: Golestan province, Iran)
Supervision at ZALF: Dr. Johann Bachinger
Humboldt-Universität zu Berlin
Supervision: Prof. Sonoko D. Bellingrath-Kimura

Dam, Thi Huyen Trang

Impact of salinization on rice production and farmers' adaptation preferences: a case in Thua Thien Hue province, Vietnam
Supervision at ZALF: Dr. Peter Zander
Humboldt-Universität zu Berlin
Supervision: Prof. Klaus Müller

Früh, Linus

Ecology of *Aedes japonicus japonicus* (Diptera: Culicidae) in Germany and modelling of its climate dependent occurrence
Supervision at ZALF: Dr. Doreen Werner
Ruhr University Bochum
Supervision: Prof. Günter A. Schaub

Hampf, Anna Claudia

Yield gaps in the Southern Amazon, Brazil – biophysical and socio-economic factors under current and future climate conditions
Supervision at ZALF: Prof. Claas Nendel
Humboldt-Universität zu Berlin
Supervision: Prof. Hermann Lotze-Campen

Hömborg, Annkathrin

The influence of increased silicon availability on carbon mineralization and nutrient mobilization in fens under different environmental conditions
Supervision at ZALF: Dr. Jörg Schaller
University of Münster
Supervision: Prof. Klaus-Holger Knorr

Jha, Srijna

Adoption and scaling-up of climate resilient sustainable agricultural (CRSA) practices for climate change adaptation and food security: assessing the scaling up potential of selected agricultural innovations in Tanzania
Supervision at ZALF: PD Dr. Stefan Sieber
Humboldt-Universität zu Berlin
Supervision: Prof. Klaus Müller

Kameke, Daniela

Biting midges (Diptera: Ceratopogonidae) of the genus *Culicoides* Latreille – evaluation of their role as Schmallenberg virus vectors and investigation of their ecological aspects in Germany
Supervision at ZALF: Dr. Doreen Werner
University of Greifswald
Supervision: Prof. Alexander Wacker

Kerkow, Antje

New approaches in habitat modelling of invasive mosquitoes for assessing the risk of pathogen transmissions and applications to *Aedes japonicus japonicus* and the West Nile Virus in Germany
Supervision at ZALF: Dr. Doreen Werner, Dr. Ralf Wieland
Freie Universität Berlin
Supervision: PD Dr. Franz Hoelker

Khalili, Niloofar

Assessment of small farmers household consumption patterns in relation with drought: a case study of rural Iran
Supervision at ZALF: Prof. Harald Kächele
Humboldt-Universität zu Berlin
Supervision: Prof. Klaus Müller

Melzer, Dennis

Nitrogen mineralization in soils of tropical climates – concepts, experiments and implications for modelers
Supervision at ZALF: Prof. Claas Nendel
Technische Universität Berlin
Supervision: Prof. Martin Kaupenjohann

Münch, Steffen

The relevance of the aeolian transport path for the spread of antibiotic-resistant bacteria on arable fields
Supervision at ZALF: Prof. Michael Sommer
University of Potsdam
Supervision: Prof. Michael Sommer

Pernat, Nadja

The citizen science project «Mueckenatlas»: contributions of opportunistic data collection to mosquito research in Germany
Supervision at ZALF: Dr. Doreen Werner
Freie Universität Berlin
Supervision: PD Dr. Helge Kampen

... and two external doctoral theses with supervision by ZALF researchers

GUESTS & FELLOWS 2020/2021

GUESTS WITH RESEARCH STAYS AT ZALF

Adetoye, Ayoade Matthew
Environmental and Economic
Resource Centre, Nigeria

Ardanov, Pavlo
University of California, Davis, USA

González-Rosado, Dr. Manuel
University of Cordoba, Spain

Griebsch, Anne
University of Applied Sciences
Dresden, Germany

Haddaway, Dr. Neal
Stockholm Environment Institute,
Sweden

**Hernandez Ochoa, Dr. Ixchel
Manuela**
University of Bonn, Germany

Kupisch, Moritz
University of Bonn, Germany

Sanz Sanz, Dr. Maria-Esther
Institut national de la recherche
agronomique (INRA), France

Villarreal, Dr. Rafael
Laboratorio de Física de Suelos –
CISSAF, Argentina

Webster, Christina
Washington State University, USA

**... and additional long-term stays
of international doctoral research-
ers on scholarships**

FELLOWS

Burkhard, Prof. Benjamin
Leibniz University Hannover,
Germany

Filipovic, Prof. Vilim
University of Zagreb, Slovenia

Fischer, Prof. Jörn
Leuphana University Lüneburg,
Germany

Obersteiner, Prof. Michael
Environmental Change Institute
Oxford, Great Britain

Pannell, Prof. David J.
University of Western Australia,
Australia

Six, Prof. Johan
Eidgenössische Technische
Hochschule Zürich, Switzerland

NEW THIRD PARTY FUNDED PROJECTS

2020

Duration	Title	Funding
January 2020 – December 2023	Food System Hubs Innovating towards Fast Transition by 2030 (Foodshift 2030)	European Commission
January 2020 – December 2025	Biosphere reserves as model landscapes for insect conservation (Brommi)	Federal Agency for Nature Conservation (BfN)
January 2020 – October 2020	Scenarios for legume protein in European agricultural systems (Protein Paradoxes)	Leibniz Association (competitive procedure)
February 2020 – June 2022	The determinants of deforestation in Sub-Saharan Africa: An analysis of economic, demographic and institutional factors and conclusions on food security (TWAS)	German Research Foundation (DFG)
February 2020 – March 2023	Reuse of pineapple residues at small farms to improve income stability and nutrient cycling as well as to reduce agriculture GHG-emissions (rePRISING)	Federal Ministry of Food and Agriculture (BMEL)/Federal Office for Agriculture and Food (BLE)
February 2020 – January 2025	New cooperation and pooling models for sustainable land use and food supply in urban-rural areas (KOPOS)	Federal Ministry of Education and Research (BMBF)
February 2020 – February 2023	Erosion-induced impact on carbon dynamics in a crop rhizosphere-microbiome-soil organic matter-continuum (CropRhizoSOM)	German Research Foundation (DFG)
March 2020 – February 2023	Advancing the understanding of hydrologic connectivity between kettle holes and adjoining groundwater system using a hybrid modelling approach	German Research Foundation (DFG)
April 2020 – December 2021	Spatiotemporal variation in iron plaque formation around rice roots: How does it affect plant P uptake?	German Academic Exchange Service (DAAD)
April 2020 – September 2024	Integrating biodiversity research with movement ecology in dynamic agricultural landscapes (Biomove II)	German Research Foundation (DFG)
May 2020 – November 2020	Detection of beaver constructions in dikes (Biber II & III)	Brandenburg State Office for the Environment (LfU)
May 2020 – December 2022	Adaptation Strategy for the Sustainability of Ecosystem Services and Food Safety in Harsh Natural Conditions (SustES)	European Commission
May 2020 – September 2022	Entwicklung eines Gesamtkonzeptes zur leistungsdifferenzierten und kohärenten Honorierung von Umweltleistungen des ökologischen Landbaus (UGÖ)	Federal Ministry of Food and Agriculture (BMEL)
July 2020 – December 2023	Optimierung der Microbiota vitaler Eschen-Genotypen (Frax-ProMic2)	Federal Ministry of Food and Agriculture (BMEL)
July 2020 – June 2023	The exchange flow between preferential flow paths and matrix in soils: from pore to continuum scale with tensors (FLEXPO)	German Research Foundation (DFG)
July 2020 – December 2021	Science Practice Podcast »querFELDeinFUNK«	Brandenburg Ministry of Science, Research and Culture (MWFK)
July 2020 – June 2021	Assessing the impacts of Corona in Iran, Brazil and Tanzania: Targeting key indicators on Food Security and Socio-Economy in rural and peri-urban areas.	Leibniz Association (competitive procedure)
July 2020 – December 2022	Cross-federal state implementation study on the use of the nature conservation app (NatApp) in agricultural and administrative practice	Federal Ministry of Food and Agriculture (BMEL)

Duration	Title	Funding
July 2020 – June 2022	Optimized utilization of valuable secondary raw materials in crop production: reduced climate impact and increased efficiency of nutrient use through improved application of digestate; sub-project: GHG, C and nutrient balances of different methods for the application of digestate.(Regain-C)	Federal Ministry of Education and Research (BMBF)
September 2020 – August 2023	Development and regional establishment of climate-resilient, resource-efficient farming systems for cultivation, dual harvesting and processing of feed legumes (FuFaPro)	Federal Ministry of Education and Research (BMBF)
September 2020 – April 2022	Landscape genetics of insect-pollinated forest herbs in changing agricultural landscapes	German Research Foundation (DFG)
October 2020 – September 2023	Boost ecosystem services through high biodiversity-based Mediterranean farming systems (Biodiversify)	European Commission
October 2020 – September 2023	Water protection through erosion prevention in energy crop cultivation (PrevEro)	Federal Ministry of Food and Agriculture (BMEL)
October 2020 – September 2023	Establishment of a truffle plantation in the lignite mining area of Lower Lusatia (Brandenburg)	Federal Ministry of Education and Research (BMBF)
October 2020 – August 2022	Opportunities and risks of digitization in agriculture from the perspective of nature and environmental protection (DigiAgrar)	Federal Agency for Nature Conservation (BfN)
November 2020 – October 2024	AGROforestry and MIXed farming systems – Participatory research to drive the transition to a resilient and efficient land use in Europe (AGROMIX)	European Commission
November 2020 – October 2022	Soil Mission Support: Towards a European research and innovation roadmap on sustainable soil and land management	European Commission
November 2020 – October 2025	SHOWCASing synergies between agriculture, biodiversity and Ecosystem services to help farmers capitalising on native biodiversity.	European Commission
November 2020 – April 2023	The economic trade-off between root hairs and mycorrhizal extraradical hyphae along a land use gradient (HAIRphae)	German Research Foundation (DFG)
*(Start 2017) – September 2021	Is higher silicon availability increasing the mineralization of organic matter in fen peatlands? (Si-Fen)	German Research Foundation (DFG)
*(Start 2018) – August 2022	Modelling the effect of silicon and calcium availability on the future sustainability of Arctic permafrost carbon pools based on laboratory and field experiments (Si-Modelling)	German Research Foundation (DFG)
*(Start 2019) – April 2024	How silicon affects phosphate availability and carbon turnover in soils (Si Phosphate)	German Research Foundation (DFG)

* projects newly taken over by ZALF in 2020

NEW THIRD PARTY FUNDED PROJECTS

2021

Duration	Title	Funding
January 2021 – December 2023	Fostering Agroecological Intensification to improve farmers' Resilience in Sahel (FAIR)	European Commission
January 2021 – January 2023	Innovation in governance of ecosystem services – improving economic instruments by result-based, cooperative and digital-driven approaches (SinoPES)	The Sino-German Center for Research Promotion
January 2021 – December 2023	Small-scale processes, large effect: rhizosphere traits as key for P efficiency in upland rice	German Research Foundation (DFG)
March 2021 – February 2024	Reduction of nitrogen emissions by improving nutrient efficiency Sub-project: Raw material crop cultivation and measurement of gaseous N-losses at the on-farm experiment Dedelow and during incubation experiments (Win-N)	Federal Ministry of Food and Agriculture (BMEL)
April 2021 – September 2023	Research for sustainable development – design, impact assessment, quality management (LeNa Shape)	Federal Ministry of Education and Research (BMBF)
April 2021 – March 2024	Reduction of the groundwater-relevant nitrogen and phosphorus surplus through the combined application of microgranulate and microorganisms on digestate-fertilized areas in energy maize cultivation (MikroMais)	Federal Ministry of Food and Agriculture (BMEL)
April 2021 – March 2024	Environmental policy instruments across commodity chains – Comparing multi-level governance for biodiversity protection and climate action in Brazil, Colombia, and Indonesia (EPICC)	Federal Ministry of Education and Research (BMBF)
April 2021 – December 2023	FABulous Farmers project – Capitalisation initiative	European Commission
May 2021 – April 2022	Climate change-induced changes in yields and land use (KlimErtrag)	Federal Ministry of Food and Agriculture (BMEL)
May 2021 – July 2023	Impact assessment of Vascular plant Encroachment on water and carbon cycling in a Sphagnum dominated Bog (VESBO)	German Research Foundation (DFG)
May 2021 – April 2023	Cultivation process development using innovative field robotics, UAS (unmanned aerial system) & practical research for organic sugar beet cultivation in the Uckermark, Germany (zUCKERrübe)	Federal Ministry of Education and Research (BMBF)
May 2021 – December 2024	Intensification of agricultural production through up-scaling of innovative adapted irrigation practices and technologies (IRRINN)	European Commission
May 2021 – December 2022	Enhancing biodiversity & resilience in crop production	ETH Zurich
June 2021 – November 2022	Modelling European agriculture with climate change for food security: Science-policy knowledge forum pilot (MACSUR)	Federal Ministry of Food and Agriculture (BMEL)
June 2021 – December 2023	The ecological role of silicon in tropical forests: effects on plant nutrient stoichiometry, drought resistance, and herbivory (Si tropical forest)	German Research Foundation (DFG)

Duration	Title	Funding
July 2021 – June 2025	Infections-InfUrb – IPT4: Arthropods as vectors for AMR microbes	Leibniz Association (competitive procedure)
August 2021 – December 2023	Fertilization of Kenyan soils with local tephra to improve crop yield by increasing the plant phosphorus nutrition and decreasing toxic aluminum uptake	Seeding the Future Foundation Plymouth
October 2021 – August 2024	Co-design of ecologically and economically efficient policy instruments and measures for conserving biodiversity and ecosystem services in cultural landscapes (ECO ² SCAPE)	Federal Ministry of Education and Research (BMBF)
November 2021 – October 2024	Potentials to increase nutrient efficiency and to reduce nitrogen emissions in starch potatoes	Federal Ministry of Food and Agriculture (BMEL)
November 2021 – October 2025	TREES – Tropical Restoration Expansion for Ecosystem Services, Accompanying research to Forest Landscape Restoration and Governance in the Forest sector (Forests4Future)	Federal Ministry of Education and Research (BMBF)
November 2021 – December 2024	Rhizosphere traits to improve crop breeding for enhanced P efficiency under water limitation (RhizoBreeding)	Federal Ministry of Food and Agriculture (BMEL)
November 2021 – April 2023	Accompanying and evidence-based research within the water, energy, and food nexus to support the provision and dissemination of economically viable, climate-smart, energy- and water-efficient innovations among SMEs and smallholder farmers in East and West African food systems (WEcap4F)	Federal Ministry of Education and Research (BMBF)
December 2021 – November 2024	Bioeconomy international 2020: Frontiers in soybean cropping systems in Central Europe: Exploiting plant growth-promoting rhizobacteria for stable and resource-efficient production (FISBea)	Federal Ministry of Education and Research (BMBF)

MANDATES & RESPONSIBILITIES (SELECTED)

Augustin, Jürgen

- 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
- Representative of ZALF at the working group »Ökologischer Landbau«, Senat der Bundesforschungsanstalten

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"

Dubbert, Maren

- Editorial board member at [Hydrological Processes](#)

Egamberdieva, Dilfuza:

- Co-editor at [Frontiers in Microbiology](#) / [Frontiers in Political Science](#) / [Microorganisms](#) / [Environmental Sustainability](#)

Eulenstein, Frank

- Speaker of the working groups »Renewable raw material« and »Nutrition efficiency in plant production« at »Deutsche Vereinigung für Wasserwirtschaft« (DWA)

Ewert, Frank

- Member of the Steering Group Research (BMEL)
- Speaker of the National Research Data Infrastructure for Agriculture (NFDI4Agri)
- Member of the International Advisory Board of the Soil Mission Support (SMS)
- 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 \(SESOMO\)](#)
- 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, iCROP2020
- Member of the Steering Group DFG Excellence Cluster PhenoRob
- President of the Scientific Evaluation Board of the French National Research Agency (ANR)

- 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)
- Co-speaker of »WIR Land Innovation Lausitz« (BMBF)
- Appointed member of the Cultural Landscape Advisory Council of the State of Brandenburg by the Ministry of Agriculture, Environment and Climate Protection of the State of Brandenburg

Fienitz, Meike

- Appointed member of the Ethics Committee of the Thae Institute, Humboldt-Universität zu Berlin

Funk, Roger

- Associate editor at [Aeolian Research](#)

Gerke, Horst

- Associate editor at [Journal of Plant Nutrition and Soil Science](#)

Helming, Katharina

- Scientific Advisory Board member at the H2020 Research project SUREFARM
- Chair of the Scientific Advisory Board of the European Joint Program Soil
- Reviewer at Horizon 2020 (EU)
- Editorial board member at [Agronomy for Sustainable Development](#) / [Land](#)

Hoffmann, Carsten

- Member of the AGROVOC Editorial Community of the FAO

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 foundation council of the Tropenwaldstiftung Oro Verde

Kersebaum, Kurt-Christian

- Associate editor at [Field Crops Research](#)
- Member of the award committee of the Soil Science Society of America
- Member of the ASA Fellow Committee of the American Society of Agronomy

Kolb, Steffen

- Editorial board member at [Applied and Environmental Microbiology](#) / [American Society of Microbiology](#)
- Associate editor at [Frontiers in Microbiology](#)

Kramp, Katja

- Treasurer of the Board Deutsche Gesellschaft für allgemeine und angewandte Entomologie (DGaE) e.V.

Lischeid, Gunnar

- Speaker of the Scientific Council of the pearls Foundation (Potsdam Research Network)
- Editorial board member at *Frontiers in Water: Water and Complexity*

Müller, Klaus

- Referee for *Land Use Policy/Ecological Indicators/GAIA/Ecology and Society/Konjunkturpolitik/Jahrbuch für Regionalwissenschaften*
- Chair of the review-panel for BMBF-Calls
- Consultant for the Schweizerischer Nationalfonds & for the Österreichische Nationalbank
- Chair of the nature parc board of trustees Märkische Schweiz
- Member of the steering committee Potential Analysis Solar Brandenburg

Nendel, Claas

- Editorial board member at *European Journal of Agronomy*
- President of the European Society of Agronomy (ESA)
- Chair of Commission IV of the German Soil Science Society

Piorr, Annette

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

Reckling, Moritz

- Editor-in-chief at *Organic Farming*
- Editorial board member at *Agronomy/Agronomy for Sustainable Development*
- Advisory board member of Praxisforschungs-Netzwerk NutriNet

Ryo, Masahiro

- Editorial board member at *Ecological Informatics/Journal of Sustainable Agriculture and Environment*

Schaller, Jörg

- Editorial board member at *Agronomy/Frontiers in Forests and Global Change*

Sieber, Stefan

- Editorial board member at *Food Security/East African Journal of Social Sciences and Humanities*
- Speaker of the »Leibniz Research Network CrisEn: Environmental Crisis – Crisis Environments«
- Reviewer of the Postdoc Academy of the Robert Bosch Foundation
- Member of the GFRAS Nutrition Working Group FAO

Siebert, Rosemarie

- Referee for *Sociologia Ruralis/Land Use Policy*

Stein-Bachinger, Karin

- Member of the Advisory Board at the Supreme Nature Conservation Agency of Brandenburg

Ulrich, Andreas

- Associate editor at *Frontiers in Microbiology*

Vijayan, Dhanya

- Editorial board member at *International Journal of Advanced Interdisciplinary Sciences (IJ AIS)*

Webber, Heidi

- Editorial board member at *Agricultural and Forest Meteorology*

Weith, Thomas

- Speaker of the Academy for Territorial Development in the Leibniz Association (ARL)
- Editorial board member at *Central European Review of Economics and Management/Zeitschrift für Evaluation*

Werner, Doreen

- Member of the Federal Expert Committee of the Nature And Biodiversity Conservation Union (NABU)
- Deputy head of the AK Diptera
- Editorial board member at *Studia dipterologica*
- Member of the Executive Board of Deutsche Gesellschaft für Medizinische Entomologie und Acarologie (DGMEA)

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*

Zasada, Ingo

- Editorial board member at *Land Use Policy*

Zscheischler, Jana

- Editorial board member at *One Ecosystem*
- Coordinator of the working group »Co-Production of Sustainable Land Systems« of the Global Land Programme

TEACHING

UNIVERSITY OF FREIBURG

- Angewandte Klimafolgenforschung
Lecture, SS 2021
- Ecohydrology
Lecture, WS 2021/2022

BRANDENBURG UNIVERSITY OF TECHNOLOGY COTTBUS-SENFTENBERG

- Nachhaltige Waldbewirtschaftung
Lecture, SS 2021
- Environmental Data Science
Lecture, WS 2021/2022

FREIE UNIVERSITÄT BERLIN

- Landschaftswasserhaushalt von Berlin und Brandenburg
Lecture, WS 2020/2021
- Grundwassermodellierung I
Lecture, WS 2020/2021
- Spezielle Themen der Hydrogeologie
Lecture, SS 2021

EBERSWALDE UNIVERSITY FOR SUSTAINABLE DEVELOPMENT

- Bodenkundliche Geländeübung
Seminar, WS 2020/2021
- Bodenlandschaft und Stoffhaushalt
Seminar, SS 2020
- Grundlagen und Instrumente der Regionalentwicklung
Lecture, WS 2020/2021
- Kreislaufwirtschaft
Seminar, SS 2021
- Monitoring und Indikatoren
Lecture & Seminar, WS 2020/2021
- Nachhaltigkeit messen und bewerten
Lecture, WS 2020/2021
- Naturraum und Naturschutz im Nationalpark Unteres
Odertal
Seminar, SS 2020
- Standortlehre
Lecture, WS 2020/2021
- Volkswirtschaftslehre
Lecture, WS 2020/2021

HUMBOLDT-UNIVERSITÄT ZU BERLIN

- Agroecosystems, environment and sustainable natural
resource use
Lecture, SS 2020
- Enhancing social cohesion through natural resource
management in post-conflict environments
Seminar, WS 2020/2021
- Forschungsmethoden im Pflanzenbau
Seminar, SS 2020 & 2021
- Institutional economics and political economy
Lecture, WS 2021/2022
- Environmental sociology and policy
Lecture, WS 2020/2021

- Multifunctional agricultural land use
Seminar, WS 2020/2021

LEIBNIZ UNIVERSITY HANNOVER

- Conservation Economy
Lecture, WS 2021/2022

TECHNISCHE UNIVERSITÄT BERLIN

- Bodenmesstechnik
Lecture, SS 2020
- Bodenchemisches Laborpraktikum für Fortgeschrittene
Seminar, WS 2020/2021
- Transition to a more sustainable and resilient city-region
agri-food system with agroecology food hubs
Seminar, WS 2021/2022

UNIVERSITY OF GÖTTINGEN

- Model approaches and applications in agro-ecosystems
Lecture, WS 2021/2022

UNIVERSITY OF POTSDAM

- Agriculture and Nature Conservation: Conflicts and
Synergies
Seminar, SS 2021
- Agroecology
Lecture, SS 2021
- Biogeochemie
Lecture, SS 2020
- Einführung in die Hydrochemie
Lecture, WS 2020/2021
- Humangeographisches und fachdidaktisches Doktoran-
denseminar
Seminar, WS 2020/2021
- Landgrabbing – ein Thema auch in Deutschland?
Seminar, WS 2020/2021
- Bodenlandschaften
Lecture, WS 2020/2021
- Landschaftspraktikum Bodenlandschaftsanalyse in der
Uckermark
Seminar, SS 2020
- Experimental design and data analysis
Lecture, WS 2020/2021

**...and 21 additional individual lectures by ZALF
scientists**

PUBLICATIONS AT A GLANCE



2020

PUBLICATIONS
(PEER-REVIEWED)

231

OUT OF WHICH

IN JOURNALS WITH JIF > 3

114

FIRST AUTHORSHIP

103

CONTRIBUTIONS TO EDITED VOLUMES 25



2021

PUBLICATIONS
(PEER-REVIEWED)

294

OUT OF WHICH

IN JOURNALS WITH JIF > 3

205

FIRST AUTHORSHIP

127

CONTRIBUTIONS TO EDITED VOLUMES 47

A LIST OF ALL
PUBLICATIONS CAN BE
FOUND AT WWW.ZALF.DE



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- Acuña-Castillo, R., Romoleroux, K., Luebert, F., **Henning, T.**, Weigend, M. (2021) Morphological, ecological and geographical evolution of the Neotropical genus *Nasa* (Loasaceae subfamily Loasoideae). *Botanical Journal of the Linnean Society* 196, 4, 480–505.
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ABBREVIATIONS

ABI	Agrobioinstitute	IDSIA	Istituto Dalle Molle di Studi sull'Intelligenza Artificiale
AST	Arvum Seed Technology	IFVC	Institute of Field and Vegetable Crops, Serbia
ATB	Leibniz Institute for Agricultural Engineering and Bioeconomy	IHP	Leibniz Institute for High Performance Microelectronics
ATK	Centre for Agricultural Research, Hungary	IITA	International Institute of Tropical Agriculture, Kenya
BESH	Bäuerliche Erzeugergemeinschaft Schwäbisch Hall WV	IMK-IFU	Karlsruhe Institute of Technology
BfN	Federal Agency for Nature Conservation	INIA	National Institute for Agricultural and Food Research
BLE	Federal Office for Agriculture and Food	INRAE	Institut national de recherche pour l'agriculture, l'alimentation et l'environnement
BMBF	Federal Ministry of Education and Research	ITUC	International Trade Union Confederation
BMEL	Federal Ministry of Food and Agriculture	JKI	Julius Kühn Institute
CIMMYT	International Maize and Wheat Improvement Center	JKUAT	Jomo Kenyatta University of Agriculture and Technology
DAAD	German Academic Exchange Service	LLH	Landesbetrieb Landwirtschaft Hessen
DBU	German Federal Environmental Foundation	LTZ	Landwirtschaftliches Technologiezentrum Augustenberg
DELTARES	Stichting Deltares	MJ NEL pro kg DM	Megajoule per kilogram dry matter (net energy lactation)
DFG	German Research Foundation	MLUK	Ministry of Agriculture, Environment and Climate Protection of the State of Brandenburg
DFKI	German Research Center for Artificial Intelligence	MWFK	Brandenburger Ministerium für Wissenschaft, Forschung und Kultur
DMB	Donal Murphy-Bokern	NARO	National Agricultural Research Organisation, Uganda
DS	Donau Soja GmbH	NETFUND	National Environment Trust Fund, Kenya
EA	Environmental Alert, Uganda	NIRE	Aquaculture Nirefs, Greece
EAA	Environment Agency Austria	rbb	Rundfunk Berlin-Brandenburg
ECOLOGIC	Ecologic Institute	SOM	soil organic matter
EFRE	European Regional Development Fund	SRUC	Scotland Rural University College
EIP	European Innovation Partnerships	TEAG	The Irish Agriculture and Food Development Authority
ELER	European Agricultural Fund for Rural Development	THESGI	Agricultural Cooperative of Thessaly
EMAS	Eco-Management and Audit Scheme	TI	Thünen Institute
ERANET	European Research Area Networks	UF	University of Florida
EUSO	EU Soil Observatory	UFZ	Helmholtz Centre for Environmental Research
EUV	European University Viadrina	VOC	volatile organic compounds
FAO	Food and Agriculture Organization	WenR	Stichting Wageningen Research
FH ISI	Fraunhofer Institute for Systems and Innovation Research	WUR	Wageningen University
FIBL	Research Institute of Organic Agriculture	ZIM	Central Innovation Programme for small and medium-sized enterprises
FZJ	Forschungszentrum Jülich		
HEL	University of Helsinki		
HNEE	Eberswalde University for Sustainable Development		
IAP	Fraunhofer Institute for Applied Polymer Research		
iDiv	German Centre for Integrative Biodiversity Research		

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