

**Stellungnahme zum
Leibniz-Zentrum für Agrarlandschaftsforschung,
Müncheberg/Mark (ZALF)**

Inhaltsverzeichnis

1. Beurteilung und Empfehlungen	2
2. Zur Stellungnahme des ZALF	4
3. Förderempfehlung	4

Anlage A: Darstellung

Anlage B: Bewertungsbericht

Anlage C: Stellungnahme der Einrichtung zum Bewertungsbericht

Vorbemerkung

Die Einrichtungen der Forschung und der wissenschaftlichen Infrastruktur, die sich in der Leibniz-Gemeinschaft zusammengeschlossen haben, werden von Bund und Ländern wegen ihrer überregionalen Bedeutung und eines gesamtstaatlichen wissenschaftspolitischen Interesses gemeinsam außerhalb einer Hochschule gefördert. Turnusmäßig, spätestens alle sieben Jahre, überprüfen Bund und Länder, ob die Voraussetzungen für die gemeinsame Förderung einer Leibniz-Einrichtung noch erfüllt sind.¹

Die wesentliche Grundlage für die Überprüfung in der Gemeinsamen Wissenschaftskonferenz ist regelmäßig eine unabhängige Evaluierung durch den Senat der Leibniz-Gemeinschaft. Die Stellungnahmen des Senats bereitet der Senatsausschuss Evaluierung vor. Für die Bewertung einer Einrichtung setzt der Ausschuss Bewertungsgruppen mit unabhängigen, fachlich einschlägigen Sachverständigen ein.

Vor diesem Hintergrund besuchte eine Bewertungsgruppe am 11. und 12. Mai 2023 das ZALF in Müncheberg. Ihr stand eine vom ZALF erstellte Evaluierungsunterlage zur Verfügung. Die wesentlichen Aussagen dieser Unterlage sind in der Darstellung (Anlage A dieser Stellungnahme) zusammengefasst. Die Bewertungsgruppe erstellte im Anschluss an den Besuch den Bewertungsbericht (Anlage B). Das ZALF nahm dazu Stellung (Anlage C). Der Senat der Leibniz-Gemeinschaft verabschiedete am 19. März 2024 auf dieser Grundlage die vorliegende Stellungnahme. Der Senat dankt den Mitgliedern der Bewertungsgruppe und des Senatsausschusses Evaluierung für ihre Arbeit.

1. Beurteilung und Empfehlungen

Der Senat schließt sich den Beurteilungen und Empfehlungen der Bewertungsgruppe an.

Das ZALF erforscht die Wechselwirkungen in Agrarökosystemen und Agrarlandschaften mit dem langfristigen **Ziel** einer nachhaltigen, widerstandsfähigen Landwirtschaft. Um dies zu erreichen, wird am ZALF Expertise aus den Agrar-, Erdsystem-, Bio- und Sozialwissenschaften zusammengeführt. Das Institut unterhält wichtige Forschungsinfrastrukturen und vermittelt seine Ergebnisse erfolgreich in die Anwendung.

In den vergangenen Jahren hat sich das ZALF organisatorisch, strukturell und personell hervorragend entwickelt. Grundlage dafür ist ein **Veränderungsprozess**, der nach einer kritischen Evaluierung 2012/2013 begann. Seit der Evaluierung vier Jahre später wird er vom Wissenschaftlichen Direktor, der damals sein Amt antrat, und den Beschäftigten mit großem Engagement vorangetrieben. Im Vorstand arbeiten der Wissenschaftliche Direktor und der 2021 berufene Verwaltungsdirektor ausgezeichnet zusammen.

Ein wichtiger Bestandteil der Veränderungen war es, sechs weitgehend disziplinär organisierte Teilinstitute in drei interdisziplinär zusammengesetzte Programmbereiche und eine Forschungsplattform für Datenanalyse und Simulation zu überführen. Diese größeren Einheiten sind in Arbeitsgruppen gegliedert, die auf mittlere Dauer angelegt sind. Damit hat das ZALF eine überzeugende Struktur für seinen Systemforschungsansatz

¹ Ausführungsvereinbarung zum GWK-Abkommen über die gemeinsame Förderung der Mitgliedseinrichtungen der Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e. V.

gefunden, der zu einer weiteren Vernetzung zwischen den Bereichen beitragen sollte. Bei der Forschungsplattform, die im Einklang mit diesem Ansatz eine enge Verbindung von Dienstleistung, Methodenentwicklung und Forschung gewährleistet, sollte die Balance zwischen den verschiedenen Anforderungen an die Mitarbeitenden gut im Blick behalten werden.

Zwei der vier Bereiche werden mit „sehr gut“ bewertet, die beiden anderen jeweils einmal mit „sehr gut bis exzellent“ und „gut bis sehr gut“. Es ist erfreulich, dass das ZALF seine **Forschungsergebnisse** wie empfohlen inzwischen regelmäßig in Fachzeitschriften mit hoher internationaler Sichtbarkeit veröffentlicht. Insbesondere vor dem Hintergrund des sich derzeit massiv wandelnden internationalen Publikationswesens muss das Institut wie die gesamte Wissenschaft verstärkt darauf achten, nur in Zeitschriften mit anerkanntem *Peer-Review*-Verfahren zu publizieren. Ein großer Teil der Arbeiten ist interdisziplinär angelegt und schlägt den transdisziplinären Bogen von der Grundlagenforschung in die Anwendung. Akteure aus landwirtschaftlicher Praxis, Politik und Gesellschaft werden zunehmend frühzeitig in die Projektarbeit und die Entwicklung von Forschungsfragen eingebunden. Bei einzelnen Projekten werden bereits *impact pathways* genutzt, um den **Transferprozess** der Forschungsergebnisse in die Anwendung zu verfolgen. Dieses Instrument ist vielversprechend und sollte wie geplant auf weitere Projekte ausgeweitet werden. Das Institut verfügt über zahlreiche feld- und landschaftsbezogene **Forschungsinfrastrukturen** sowie umfangreiche Beobachtungsdaten in unterschiedlichen Maßstäben, die in großen Konsortien erhoben und über das Institut zugänglich gemacht werden.

In den kommenden Jahren will das ZALF seine Arbeiten auf weitere Agrarlandschaften ausweiten. Es ist sinnvoll, in die **Planungen** mit großen Datenmengen auch die verstärkte Nutzung künstlicher Intelligenz einzubeziehen. Dabei sollte das Institut abwägen, welche Aktivitäten es selbst durchführt und für welche es die Zusammenarbeit mit starken Partnern auf dem jeweiligen Gebiet sucht. Auch die geplanten *Living Labs* in Brandenburg und Hessen würden sich sehr gut in diesen Kontext einfügen. Dafür wurde bei der GWK eine Institutserweiterung beantragt, die derzeit in dem dafür vorgesehenen Verfahren begutachtet wird.

Das Institut bietet seinen **Beschäftigten** sehr gute Arbeits- und Forschungsbedingungen. Wie empfohlen hat es sein Personalkonzept weiterentwickelt. Dieses beinhaltet einen strategischen Stellenbesetzungsplan, der auch die zahlreichen anstehenden Ruhestände berücksichtigt. Die Kriterien für eine Entfristung sollten noch klarer vermittelt werden. Außerdem wurden die Betreuung und die Förderung der Promovierenden weiter strukturiert. Dies sollte nun auch dazu führen, dass die Promotionsdauer im Grundsatz bei vier Jahren liegt (derzeit 4,8 Jahre). Etwa die Hälfte der wissenschaftlich Beschäftigten des ZALF ist weiblich, von den 31 Führungspositionen in diesem Bereich sind zwölf mit Frauen besetzt (38 %). Damit ist das Institut auf einem guten Weg, ein ausgewogenes Geschlechterverhältnis zu erreichen. Begrüßt wird auch, dass mittlerweile zahlreiche Wissenschaftlerinnen und Wissenschaftler aus dem Ausland an das Institut kommen, um dort ihre Karriere zu beginnen oder fortzusetzen.

Die Programmbereiche und die Forschungsplattform werden jeweils von zwei in Kooperation mit Hochschulen berufenen Professorinnen und Professoren geleitet. Insgesamt ist

das ZALF mit sieben verschiedenen Hochschulen in und außerhalb der Region verbunden, was angesichts der Fächerkonstellation am Institut sinnvoll ist. Auch ist das Institut federführend oder mitwirkend an mehreren großen Forschungs- und Infrastruktur-**Verbundprojekten** beteiligt. Auf internationaler Ebene arbeitet es besonders eng und gewinnbringend mit den Einrichtungen des *National Research Institute for Agriculture, Food and Environment* (INRAE) in Frankreich sowie der *Wageningen University & Research* (WUR) in den Niederlanden zusammen.

Die **institutionelle Förderung** des ZALF ist für die derzeitigen Aktivitäten auskömmlich. Mit Blick auf die leistungsorientierte Vergabe von Grundaussstattungsmitteln wird empfohlen, über die wissenschaftlichen Leistungen hinaus auch die Infrastruktur- und Transferleistungen einzubeziehen. Das Institut ist seit der letzten Evaluierung deutlich gewachsen, was vor allem auf die sehr erfolgreiche Einwerbung von **Drittmitteln** zurückzuführen ist. Dabei ist es erfreulich, dass inzwischen erhebliche Mittel über wettbewerbliche Verfahren, wie die der DFG, eingeworben werden. Neben seinem Landschaftslabor am Standort Müncheberg verfügt das ZALF über zwei weitere Versuchsstationen, modernste **Ausstattung** für Feld- und Laborexperimente sowie für Modellierungs- und Simulationsaktivitäten. Das Institut entwickelt Pläne, um nachhaltige und energieeffiziente Bedingungen für seine Forschungsaktivitäten zu schaffen. Dabei wird es vom Land Brandenburg sehr gut unterstützt.

Der **Wissenschaftliche Beirat** hat den Veränderungsprozess des ZALF in vorbildlicher Weise begleitet. Er bewertet die zahlreichen, auf mittlere Dauer angelegten Arbeitsgruppen und gibt Hinweise zu deren weiterer Entwicklung, Umstrukturierung oder ggf. Beendigung. Es ist wichtig, dass der Beirat weiterhin an diesem kontinuierlichen Monitoring beteiligt ist.

2. Zur Stellungnahme des ZALF

Der Senat begrüßt, dass das ZALF beabsichtigt, die Empfehlungen und Hinweise aus dem Bewertungsbericht bei seiner weiteren Arbeit zu berücksichtigen.

3. Förderempfehlung

Der Senat der Leibniz-Gemeinschaft empfiehlt Bund und Ländern, das ZALF als Einrichtung der Forschung und der wissenschaftlichen Infrastruktur auf der Grundlage der Ausführungsvereinbarung WGL weiter zu fördern.

Annex A: Status report

Leibniz Centre for Agricultural Landscape Research, Müncheberg/Mark (ZALF)

Contents

1. Key data, structure and tasks	A-2
2. Overall concept and core results	A-3
3. Changes and planning	A-7
4. Controlling and quality management	A-10
5. Human Resources	A-12
6. Cooperation and environment.....	A-15
7. Subdivisions of ZALF	A-17
8. Handling of recommendations from the previous evaluation.....	A-20

Appendices:

Appendix 1: Organisational chart.....	A-23
Appendix 2: Publications.....	A-24
Appendix 3: Revenue and expenditure	A-25
Appendix 4: Staff.....	A-26

1. Key data, structure and tasks

Key data

Year established:	1992 (with the present research profile)
Admission to joint funding by Federal and <i>Länder</i> Governments:	1992
Admission to the Leibniz Association:	1997
Last statement by the Leibniz Senate:	2017
Legal form:	Non-profit association (eingetragener Verein)
Responsible department at <i>Länder</i> level:	Ministry for Science, Research and Culture (MWFK)
Responsible department at Federal level:	Federal Ministry of Food and Agriculture (BMEL)

Total budget (2022, see appendix 3):

- 22.9 M€ institutional funding
- 11.7 M€ revenue from project grants
- 0.04 M€ revenue from services

Number of staff (2022, see appendix 4):

- 223 individuals in “research and scientific services”
- 113 individuals in “science supporting staff (laboratories, technical support etc.)”
- 64 individuals in “science supporting staff (administration and management)”

Mission and structure

“The purpose of the association [i.e., ZALF e. V.] is the advancement of science and research. The purpose of the association lies in particular in scientific research of interactions in agricultural landscapes with the goal of providing scientific foundations for the sustainable use of agricultural landscapes. [...]

The work at ZALF serves the public welfare by communicating scientific insights to the relevant sections of the population, technical communities, and business circles.” (ZALF statutes §2 (1))

Scientific work at ZALF is structured into three Research Areas (RA) and one Research Platform (RDS). The RA are exclusively dedicated to research activities, while the RDS comprises activities related to research and to scientific services for the development and maintenance of research data and modelling infrastructure. RA and RDS are supported by the Experimental Infrastructure Platform (EIP). All of these units are structured into working groups (WG) as the smallest organizational entity.

The Directorate is headed by the Scientific Director and includes the Strategic Science

Management Department, the Transfer Office, and the Public Relations and Science Communication Department. The Administration and Services unit is headed by the Administrative Director (see appendix 1 for the organisational chart of ZALF).

2. Overall concept and core results

ZALF conducts basic to application-oriented research addressing societally relevant challenges that cluster around five topics: healthy soils and biodiversity, climate change, digitalization, globalization, and agriculture in transition. The institute's integrated systems research on natural, technological, and socio-economic processes, interactions and feedbacks, spans from soils, plants, and water; relationships at field and landscape levels to the effects of policies and institutions on agricultural production, ecosystem services, biodiversity, and to consumer-producer interactions. This research aims at improving the design of sustainable crop and grassland systems within a landscape context. Research is the main activity of ZALF. It is supported with advanced infrastructures for research data management, models, and simulation in the service working groups of RDS, as well as within the Experimental Infrastructure Platform (EIP). The EIP carries out field and landscape experiments on three research stations in Müncheberg, Dedelow and Paulinenaue and the two landscape laboratories AgroScapeLab Quillow and patchCROP. Development and operation of these infrastructures comprises about 10 percent of the activities. About another 10 percent of activities are dedicated to science transfer and exchange. This includes science communication, policy support as well as consultancy and participation using a range of instruments such as policy briefs, panel discussions, podcasts and citizen science projects among others. These activities are supported by a Transfer Office, and the Public Relations and Science Communication Department.

The institute's three **Research Areas (RA)** and one **Research Platform (RDS)** are:

- Research Area 1: Landscape Functioning (6 working groups, 62 individuals) aims to improve understanding agricultural landscapes' biogeochemistry and related drivers, cause-and-effect-relationships, and feedback loops.
- Research Area 2: Land Use and Governance (10 working groups, 101 individuals) focuses on options for sustainable land use and governance and on supporting the balanced use of agricultural landscapes, including their transformation.
- Research Area 3: Agricultural Landscape Systems (4 working groups, 52 individuals) is dedicated to integrated and future oriented system assessments of land use to support decision making of stakeholders like farmers, political decision-makers, and other land users.
- Research Platform: Data Analysis and Simulation (8 working groups, thereof 5 in research and 3 in services, 34 individuals) combines data analysis and integrated landscape modelling with technical and advisory services on data infrastructure as well as model and simulation infrastructures.

Results

Research

Between 2020 and 2022, work at ZALF led to \emptyset 274 publications in peer-reviewed journals p.a. (see appendix 2), with a three year-average of 2.6 peer-reviewed articles per scientist full-time equivalent (FTEsci). 46 % of these are ZALF first authorships. The average share of articles with co-authorships across structural units and groups is ~17 % at the level of the RA/RDS and ~23 % at the level of WG.

ZALF names the following ten most important research results that led to publications by presenting them from integrative research perspectives (see italics below) that reflect the institute's interdisciplinary research and organizational approach.

Understanding Agroecosystems and Agricultural Landscapes

1. ZALF developed a novel robotic chamber system (Gantry Crane) allowing to accurately and precisely determine spatio-temporal CO₂ flux dynamics of heterogeneous croplands. [*Agriculture and Forest Meteorology*, RA1, EIP]
2. A report showed that Silica fertilization improved wheat performance and increased phosphorus concentrations during drought at the field scale. [*Scientific Reports*, RA1, EIP]
3. The analysis of plant- and soil-associated microbiomes resulted in the identification of drivers of methane degradation by soil bacteria. [*Global Change Biology*, RA1]
4. The use of crop model ensembles detected underlying processes driving climate change responses for important crops in Europe. [*Nature Communications*, RA3, RDS]

Balancing Trade-offs for the Sustainable Use of Agricultural Landscapes

5. ZALF published a special Issue in *Agronomy for Sustainable Development* on diversification of agricultural land use as a key strategy to combat biodiversity loss and to build resilience of crop and grassland systems in the face of increasing climate and other changes and shocks. [*Agronomy for Sustainable Development*, RA2, RA3]
6. A study showed what is required for businesses to commit to nature conservation and biodiversity protection. [*Business Strategy and the Environment*, RA2]

Transforming Agricultural Systems

7. A study demonstrated equity and fairness as crucial to ensuring effectiveness of payments for ecosystem services as incentive instruments. [*Proceedings of the National Academy of Science*, RA2]
8. ZALF's foodshed model has been successfully applied to assess the self-sufficiency of various city regions. [*Environmental Science and Policy*, RA3]
9. By placing soil health in a societal perspective, a group analysed socio-economic, natural, and technological drivers and identified key research needs regarding challenges and emerging practices. [*Advances in Agronomy*, RA3, RDS]

Integrating Landscape Data and Models

10. Through the combination of remote sensing data and process-based biophysical modelling, the first crop maps for Germany at a national scale were developed. [*Remote Sensing of Environment*, RDS]

Transfer

ZALF's concept of transfer encompasses communication, consultancy, and application for transferring new research-based concepts, analyses, recommendations and specific products to policy, practice, and society. The institute understands transfer as a multi-directional exchange including the translation of research-based knowledge for non-academic target groups and of experience-based knowledge back to research in long-term cycles. ZALF's researchers are engaged in a variety of activities, ranging from dialogue events (e.g., field days with farmers, events with policy makers) to advice (e.g., talks in political boards, policy briefs) to research-based tools (e.g., mobile applications, knowledge platforms). The institute sees its particular strength in the cooperation with practitioners using and adapting different transdisciplinary formats and co-design. ZALF's activities are centrally supported with a Transfer Office and the Department for Public Relations and Science Communication.

ZALF gives the following selected best practice and impact examples:

- In the field of **developing applications**, since 2017, ZALF has been involved in three European Innovation Partnerships AGRI (EIP-AGRI) projects (Spreewälder Gurke, Q2GRAS, MoPlaSa) that aim at implementing innovations in agricultural production systems. So far, Q2GRAS, a project to improve the quality of grass silage and increase the economic efficiency of dairy cattle farming, concluded with two software applications to estimate optimal mowing dates and silage quality, developed together with farmers and ZALF's Paulinenaue Research Station.
- The institute provides **policy support** by e.g., contributing to the United Nations Food System Summit 2021, the 6th IPCC Assessment with a study detecting underlying processes driving climate change responses for important crops in Europe (see No. 4 of the research results). ZALF also coordinates the Modelling European Agriculture with Climate Change for Food Security (MACSUR) - Science Policy Forum. Another example is the participatory synthesis report for insect protection measures in Brandenburg led by ZALF.
- ZALF led the AgoraNatura project, a **social innovation**, which presents targeted investment opportunities, facilitating engagement for private individuals and companies. The underlying quantification of ecosystem services builds on analyses and model applications conducted by ZALF landscape hydrology and crop scientists. In the first year, 10 pilot projects certified via the Naturplus standard were funded with a total of 23 k€; by 2023, four projects were completed and 10 are in the implementation phase.

- The Mosquito Atlas is a **citizen science** project created in 2012 in cooperation with the Friedrich-Loeffler-Institute (FLI), with a total of > 22k samples submitted by citizens.
- Starting in 2017 with the bilingual research magazine FELD (1 544 subscribers), ZALF further established the **communication brand** and network querFELDein, consisting of a blog (\approx 4k visits p. m.), a newsletter (700 subscribers), two podcast formats and various social media channels (reaching \approx 475k people in 2022). ZALF received a price for online communication *Deutscher Preis für Onlinekommunikation* (DPOK) in 2022 for the established dialog between science, society, and practice under the new querFELDein brand.

Research Infrastructures

ZALF operates research infrastructures in the field of **data and simulation**:

- In 2017, the BMBF-funded BonaRes Repository for Soil and Agricultural Research Data in collaboration with the Helmholtz Centre for Environmental Research (UFZ), Senckenberg, and the Federal Institute for Geoscience and Natural Resources (BGR) was established. As part of international data infrastructure networks, BonaRes has evolved from a project infrastructure into an institutional repository and a publishing resource for the German soil science and agricultural community. As of January 2023, 420 datasets have been published according to FAIR principles.
- Coordination of the FAIRagro consortium in the context of the National Research Data Infrastructure (NFDI), bringing together scientists and research data management experts from all disciplines of agricultural system research.

Furthermore, ZALF operates **landscape laboratories** supported by the Experimental Infrastructure Platform (EIP):

- The AgroScapeLab Quillow (ASLQ), partner of ZALF's site in Dedelow, was established in 2011 and features a unique large-scale sensor platform (AgroFLUX) for automated GHG, water and isotope flux measurements. ASLQ research has resulted in 51 peer-reviewed publications (2020–2022).
- In 2020, ZALF initiated and developed patchCROP as a co-designed experimental platform and part of a future living lab case study, jointly set-up with the Komturei Lietzen farm near Müncheberg and closely linked to the DFG Excellence Cluster PhenoRob (U Bonn). patchCROP applies a multidisciplinary research approach to investigate novel, site-specific field arrangements, crop rotations, and crop protection strategies with respect to their impact on biodiversity and ecosystem services, crop performance, and soil quality, using digitalization and new technologies such as robotics, sensors, and AI.

3. Changes and planning

Development since the previous evaluation

Between 2016 and 2017, ZALF re-organized its research and organizational structure in strategic discussions involving the Scientific Director, ZALF leading scientists, internal boards, the SAB and national and international collaborators. These developments also considered the recommendations of the 2016 Leibniz Evaluation (see Chapter 8) and the 2019 audit by ZALF's Scientific Advisory Board (SAB).

The **research strategy** "ZALF 2025 – Agricultural Landscapes of the Future" focuses on the development of an integrated agricultural landscape research agenda capable of delivering solutions to the many urgent challenges facing agriculture and agri-food systems. ZALF refined its core research domain to agriculturally managed crop- and grassland production systems in a landscape context, considering interactions with adjacent land use types (forests, protected and peri-urban areas), other sectors, and elements of the value chain (mainly consumers) where relevant. The institute also aims to integrate bio-physical and socio-economic relationships to better address the complexity of challenges at landscape scale.

To support this new strategy ZALF implemented a new research **organizational structure** in January 2018. The former six institutes were replaced by broader interdisciplinary and programmatically organized research units: three Research Areas (RA) and two Research Platforms (RP Data and RP Modelling). The RP were later combined into one Research Platform (Data Analysis and Simulation, RDS). Field and landscape experimental infrastructures and services were reinforced by merging existing activities into one Experimental Infrastructure Platform (EIP). Different to the RA, which focus solely on research, the RDS includes research as well as infrastructures and service activities for research data management and analysis, and model development and simulation. To promote interdisciplinary research, the RA and RDS are headed by two professorial Co-Heads from different disciplines. Each of the former six institute heads is now Co-Head of one of the new research units. Within the units, the thematic and methodological expertise was re-organised within research working groups (WG), implemented consistently as a third organizational level. All WG are headed by experienced scientists with, depending on the respective topic, a composition of up to five institutionally-funded scientist and technician FTE.

With respect to the RA/RDS-management level, the following significant **changes on leadership level** have been made:

- Strengthening of RA3 with the joint appointment of the Co-Head with BTU Cottbus (Integrated Crop Systems Analysis and Modelling) in 2022 via the Leibniz Programme for Women Professors.
- Expertise in big data analysis was strengthened with the appointment of one RDS-WG-Lead in a joint appointment with BTU Cottbus (Environmental Data Science).

Strategic work planning for the coming years

For the coming years, ZALF has the following plans (presented alongside the **institute's integrative research perspectives**; see Chapter 2):

Understanding Agroecosystems and Agricultural Landscapes

- Complementing ZALF's contribution to analysing long-term effects on the soil-water-plant system in the national TERENO network and the planned European LTER research infrastructure (eLTER RI).
- Coupling the AgroFlux infrastructure at the CarboZALF-D site with high-resolution multi-temporal remote sensing (satellites, drones), geophysical methods, in-situ, and stable isotope techniques (water and CO₂).
- AgroscapeLab Quillow, patchCROP and landscape monitoring programs will be used to design and develop new experimental and monitoring infrastructures and capabilities for agricultural living labs in general and the planned strategic extension in particular.

Balancing Trade-Offs for the Sustainable Use of Agricultural Landscapes

- Harnessing the potential of new and emerging technologies including sensors, robotics, and digitalization for a sustainable use of agricultural landscapes and continue its engagement in respective larger projects such as DAKIS (BMBF) and the DFG Excellence Cluster PhenoRob. The landscape labs will be the basis for advancing landscape experimentation with novel monitoring and sensing platforms.

Transforming Agricultural Systems

- Contributing to ZALF's endeavors to expand living lab research capabilities (patchCROP, HEU partnership Agroecology Living Labs, planned strategic extension), the institute plans to integrate participatory approaches in the respective model development, validation, and regional application.

Integrating Landscape Data and Models

- Development of new data management and analysis tools in Germany and closely interacting with international partner and programs (AgMIP, GLASSNET, GARDIAN of CGIAR).
- As part of ZALF's involvement in international modelling initiatives and networks (e.g., AgMIP, MACSUR, ISMC), the institute plans among others to link remote sensing data to agroecosystem models and to continue leading efforts around model improvements (e.g. on water and heat stress, soil processes) and advancing integrated climate risk and change assessments.

Regarding its **transfer** performance, ZALF develops impact pathways to create a stronger link between the institute's research and its societal impact. The institute plans to reinforce active communication to the broad public. Therefore, it strengthened its Transfer Office with one new FTE in 2022. The Transfer Office will also be the link to agrathae

GmbH, which became an independent company in January 2023 under-pinned by a strategic cooperation agreement to facilitate continued cooperation in joint transfer projects. agrathaer GmbH was founded in 2011 as a subsidiary of ZALF to make research results usable for politics, practice and society.

Regarding its **research infrastructures**, the planned transformation of the BonaRes Repository to adopt the Open Source Geospatial Content Management System Geonode will serve as a role model for open data infrastructures and will be used to strengthen ZALF's links to international and national networks (NFDI). ZALF aims to develop the Agro-ScapeLab Quillow (ASLQ) into a multi-purpose experimental landscape laboratory with international visibility and increased opportunity for participation, placing a stronger focus on agricultural crop production under climate change and its feedbacks on the environment. In the institute's landscape laboratory patchCROP, field robotics will be increasingly used for managing crops in new production systems in an on-farm research setting.

Planning of a Strategic Institutional Extension

ZALF plans to establish an **Innovation Centre for Agricultural System Transformation (IAT)**. The demand for transforming agri-food systems requires, according to ZALF, long-term, institutionalized, and interdisciplinary multi-actor cooperation approaches between science, practice, and policy, extending beyond previous bi-directional transfer.

As a large extraordinary item of expenditure, the evaluation of this institutional extension will be conducted in a separate assessment procedure by the Leibniz Association and the German Science and Humanities Council ("*Wissenschaftsrat*") in 2023. Subject to positive evaluation, funding of the IAT will start in 2026, reaching full funding extent by end of 2027.

With the additional funding, ZALF plans to establish long-term agricultural living lab infrastructures to implement a new research mode. In ZALF's definition, living labs ("*Real-labore*") are spaces of joint research, development and innovation between science and practice to solve real-world and socially relevant sustainability problems, e.g. in the field of land use, and thereby reducing environmental and climate change impacts and greenhouse gas emission.

The IAT would initially work in five such landscape-scale living labs, provide specific infrastructures for data, monitoring and modelling, governance structures and staff to support co-design processes, and hosting working groups for relevant research topics. It would provide coordination, synthesis, and capacity building within ZALF and for partners. With the IAT, the institute would aim to successively establish a network of living labs for mutual learning and synthesis beyond regional solutions and innovations. The first five living labs will cover all important agricultural production systems and regions with different soil-climate and socio-economic characteristics. Two living labs will be established in Brandenburg (Eastern-Brandenburg agricultural region; grass and fenland in the Havelland region) and three in Hesse (North Hessian Loess Plain; Hessian low mountain range; Rheingau). The living labs in Hesse will be supported by new ZALF-units in Hesse and

cooperate closely with U Gießen, U Kassel and U Geisenheim. The total budget for the extension, including contributions from ZALF's current institutional budget for this extension, is 10,195 k€ from 2027.

4. Controlling and quality management

Facilities, equipment and funding

Funding

Between 2020 and 2022, the **institutional funding** of ZALF was Ø 22.3 M€ p.a. In the same period, revenue from project grants was Ø 10.3 M€ p. a., covering 32 % of the institute's budget. Of these, an average of annually 6.6 M€ were raised from Bund und *Länder*, 1.45 M€ from the EU, and 1.14 M€ from the DFG. For an overview of ZALF's revenue and expenditure, see appendix 3.

ZALF aims to acquire **third-party funds** from various funding sources in accordance with its mission to conduct basic and application-oriented research extending into various disciplines. The institute plans to further increase the share of third-party funding with high visibility at national and international levels.

Facilities and equipment

ZALF's main campus is located in Müncheberg, Brandenburg. In addition, the institute maintains three experimental stations in Müncheberg, Dedelow, and Paulinenaue, with in total about 160 hectares of experimental fields as well as equipment and infrastructure to carry out field and laboratory experiments and to support modelling and simulation activities:

- AgroScapeLab Quillow landscape laboratory in the Uckermark region near Dedelow, where long-term monitoring of soils, water, land use, and biodiversity was initiated in 2000;
- patchCROP on-farm diversification experiment in Tempelberg near Müncheberg, 70 ha plus 750 ha surrounding agricultural fields for comparative assessments, initiated 2020;
- ZALF-internal central laboratory for analyses of soil, water, and plant samples;
- BonaRes Data Repository;
- High Performance Computing (HPC) facility, recent version established in mid-2019, Capability-assisted Simulation Infrastructure CASSIS;
- Conference Center for events with up to 300 participants, an international Welcome Center, and a guest house, accommodating our national and international guests.

IT-Infrastructure

ZALF's **IT strategy** is developed and overseen by a newly established CIP Board (Chief Information Office Board), which advises the institute's Executive Board. It coordinates

the deployment and use of existing and future systems to optimally meet the requirements of research, service structure, and external interfaces. The institute's IT supports the digitalization of administrative processes as one important element of improving administrative services as recommended in the SAB audit.

ZALF's High Performance Computing (HPC) facility provides state-of-the-art computing infrastructure for data-intensive operations and is handled in the respective RDS service groups. The institute constantly updates its IT security; All critical data is backed up in two stages. The backup devices are located in a separate fire compartment.

Organisational and operational structure

ZALF is a research institution with the legal form of a **registered non-profit association (e. V.)**. Its internal official bodies are the Executive Board and the ZALF Council. The **Executive Board** consists of the Scientific and the Administrative Director and is responsible for strategic planning and running ZALF's daily operations. It meets approx. every two weeks.

The ZALF Council is the official internal body to advise the Executive Board in scientific and organizational matters, further supported by the **Research Commission** for scientific-strategic advice. They hold monthly meetings. The ZALF Council consists of all RA/RDS/ EIP Co-Heads and three elected WG Heads. The Research Commission consists of the Scientific Director and five researchers with different disciplinary backgrounds appointed for two to four years. Of these, two are directly selected by the Scientific Director and three are selected by the Scientific Director from self-nominated candidates from the group of RA/RDS Co-Heads and WG Heads. The chair of the ZALF Council attends the meetings of the Research Commission as a regular guest.

The organizational restructuring in January 2018 (see Chapter 3 for details) transferred more responsibility for research topics, resources, and staff supervision to the WG level. At the same time, ZALF strove to relieve its researchers of administrative tasks by establishing administrators in the RA/RDS and enhancing central services. The institute states, that the new organizational structure, built on smaller working groups with dedicated expertise, enables more flexibility to adapt quickly to emerging research questions and societal demands around sustainable agriculture and its transformation.

Quality Management

ZALF follows the recommendations for **good scientific practice** as developed by the DFG and adopted by the Leibniz Association. The institute has two ombudspersons. In 2022, the establishment of an Ethics Committee was decided, which starts its regular work in 2023.

ZALF explains that research results are to be published in an adequate number of scientific articles, particularly in high-quality journals with good visibility in the respective scientific communities. With the ZALF Open Access Policy of 2022, the institute aims to realize a comprehensive **Open Access (OA)** transformation, in accordance with the Open Access

Policy of the Leibniz Association. Open access is centrally supported via the ZALF publication fund (80 k€ p. a.) and the participation in transformative agreements (DEAL-Wiley, DEAL-Springer Nature, and beyond in future). The institute increased the share of open access publications from 62 to 70 % (2020–2022) and the number of DOI-registered datasets by ZALF researchers published via the BonaRes Repository to 52 (with more datasets published via other repositories).

ZALF is committed to the rules of good scientific practice in **data management** following the FAIR principles. The institute provides its staff with data publishing support.

The institute's **transfer strategy** is committed to the quality standards as set-up in the Leibniz guidelines for knowledge transfer and policy advice. ZALF regularly provides seminars for social media use including good practice. Various indicators related to transfer activities are regularly assessed which target both input and output. To better illustrate and develop the complex relation between research activities, outcomes and societal impacts, ZALF recently established a concept for "impact pathways". It is specifically tailored towards the SDGs relevant of ZALF research. The ZALF approach is predominantly ex-ante, the impact pathway development is participatory and assisted by data on research activities, outputs (e.g., publications, applications), outcomes and impacts at ZALF. The concept was exemplary applied ex-post in the domain of soil health and will be extended to other sustainability targets.

Quality management by advisory board and supervisory board

The **Scientific Advisory Board** (SAB) advises ZALF on all significant scientific and cross-disciplinary questions. It consists of at least six and up to ten external scientists. As recommended during the last evaluation, since 2017, ZALF has won several scientists from abroad for the board. The SAB conducted an audit in 2019 and holds at least bi-annual SAB meetings.

ZALF's Supervisory Board is the **Assembly of Members** (AoM) consisting of representatives of up to eight member institutions of the association. The four regular members are the Federal Ministry of Food and Agriculture (BMEL), the Brandenburg Ministry for Science, Research and Culture (MWFK), HU Berlin and U Potsdam. The AoM is responsible for all fundamental matters of the association. It defines the guidelines for the association's activities and monitors the Executive Board.

5. Human Resources

On 31 December 2022, ZALF had 400 employees (332 FTE), excluding student assistants and trainees (see appendix 4). Within this group, 36 % FTE were employed on third-party funding. Of the 223 employees in research and scientific services, 53 % were female, 31 % came from abroad, and 79 % held fixed-term positions. The institute's staff comprises a comparatively high share of senior employees: 34 % are older than 55 years and 14 % will reach standard retirement age within the next five years.

In 2022, ZALF introduced a revised **personnel development concept**, which forms the basis for the personnel planning and hiring policy with the aim to position ZALF further

as an attractive employer in the competition for highly qualified staff, both nationally and increasingly internationally.

ZALF is guided by the European Charter for Researchers with regard to recruitment and selection criteria, working conditions, and career development opportunities. Job advertisements in English language and on international platforms were implemented as standard for Tenure Track positions and professorial appointments in 2017, and for all other scientific positions in 2018 (for suitable job profiles). Professional handling of the recruitment phase is supported by a digital applicant management system established in 2022.

Leading scientific and administrative positions

In 2016, ZALF implemented the model of the Leibniz Association's dual leadership, which consists of a Scientific and an Administrative Director forming the institute's **Executive Board**. The position of the Scientific Director was filled shortly before the last Leibniz evaluation in 2016. A new Administrative Director was recruited in March 2020. The **second management level** (RA/RDS Co-Heads) is involved in management tasks via the ZALF Council as official internal advisory body. As members of the ZALF Council or the Research Commission, WG Heads can systematically contribute to strategic and management tasks.

Staff with a doctoral degree

As of 31.12.2022, 49 postdocs were employed at ZALF. The majority (63 %) of postdocs on temporary contracts are third-party funded.

ZALF aims to support researchers in the **postdoc phase** and beyond into the next career steps (e.g., towards Junior Research Group (JRG) leaders). In 2020, a memorandum for a code of conduct for postdoc support at ZALF was concluded as a joint agreement of leadership staff and in accordance with the Leibniz Career Guidelines. Since 2020, five ZALF researchers have been offered a full professorship position at institutes of higher education.

In 2018, ZALF established a Tenure Track System, which offers scientists a long-term career perspective at the institute and is particularly relevant for early-career researchers (ECR). Three different Tenure Tracks are used to promote high-potential early-career researchers (Regular Tenure Track), successful and experienced scientists with essential topical or methodological expertise (Fast Tenure Track) as well as particularly promising scientists (Immediate Tenure Track). By the end of 2022, 13 Tenure Track candidates have been appointed of which two have by now received tenure.

The group of staff with a doctoral degree **beyond the early career stage** which are not RA/RDS or WG leaders is mainly comprised of institutionally funded senior researchers with a permanent position at ZALF (25 employees). The group also includes some individuals with part or full-time temporal leave from their main occupation in other institutes, as well as others with main occupation at ZALF in third-party funded projects. All of them have access to the personnel development offers of ZALF and are often active in internal services, boards, and offices.

Doctoral Candidates

Most of ZALF's doctoral researchers are employed in third-party funded projects. As of 31.12.2022, 98 doctoral researchers were working at ZALF, 88 of which were employed in projects and 10 on third-party stipends. In 2020–2022, 40 doctorates have been completed, with an average duration of five years (median of 4.8 years).

In 2019, ZALF finalized a new Guideline for doctoral researchers. On this basis all ZALF doctoral researchers are included in a **structured programme** to complement universities' standards and offers. It includes, among others, three mandatory in-house trainings, presentations at ZALF PhD-colloquia and PhD-Day. A **Doctoral Commission**, consisting of at least three researchers, evaluates doctoral research project plans with respect to internal standards before approving ZALF supervision agreement. To further complement this programme, the institute cooperates with external structured programs, e. g. the DFG Research Training Group BioMove (phase II), and the Doctoral Certificate Program in Agricultural Economics, which is attended by currently 10 doctoral researchers affiliated with the Department of Agricultural Economics at the HU Berlin. As ZALF is a partner institution of the Potsdam Graduate School (PoGS), doctoral and postdoctoral researchers can attend PoGS trainings and network activities.

In 2017, ZALF established an **ECR (early career researcher) working group**. The institute has an ECR Coordination in the directorate, which organizes training courses and information events particularly for new doctoral and postdoctoral researchers twice a year. Since 2021, regular meetings with the Scientific Director and the ECR Coordination with the groups of doctoral researchers, the postdocs and additionally the group of Tenure Track candidates take place.

Science supporting staff

ZALF supports a wide range of other **education and training measures** such as workplace and device-specific qualifications for science supporting technical and administrative staff. With regard to **vocational training**, ZALF collaborates with the working group on dual education of the Leibniz Association (*Arbeitskreis Duale Ausbildung*). The institute offers **traineeships** for IT specialists in systems integration (one ongoing). Between 2020 and 2022, three trainees for office management concluded their three-year dual training and continued on permanent positions at ZALF, substituting retiring staff. The institute plans to establish an apprenticeship for a management assistant for digitalization (*Kaufmann/frau Digitalisierungsmanagement*), to be filled in August 2023. ZALF further offers traineeships for public relations (*Volontariat*) hosted at the PR department. Since 2020, two traineeships were completed, one continuing at ZALF, a new one ongoing. The position will be refilled after completion.

Equal opportunities and work-life balance

On 31.12.2022, ZALF employed 243 women amounting to 54 % of all employees. Four of the nine RA/RDS Co-Heads were female and jointly appointed, two were scientists from abroad. By the end of 2022, of 29 WG Heads, 11 were female researchers, as compared to eight in 2018 (year of WG establishment).

In 2022, ZALF established an **Equal Opportunities Team**, including the Equal Opportunities Officer, the Administrative Director, the Human Resources Department, the Work Council, and representatives of the institute's individual interest groups. It initiates equality-related measures and projects to ensure equal opportunities for all employees and to promote overall diversity. Also, in 2022, ZALF's Gender Equality Plan (GEP) was updated and redesigned. The institute seeks to support women in underrepresented areas starting with the recruitment.

To increase the number of **women in leading scientific positions** and upper salary groups, ZALF follows the Leibniz Association's cascade model for defining flexible target quota for salary groups. Chances to further increase the proportion of women overall and in (third) leadership positions (group leaders or equivalent) and higher salary groups will arise particularly from 2023 on, when many ZALF employees will retire.

ZALF holds a certificate within the audit *berufundfamilie*. In 2017, the institute established a mobile work scheme (*Mobiles Arbeiten*), which allows mobile work where possible with regard to individual tasks and positions and up to 40% of working time as a standard.

6. Cooperation and environment

In the evaluation period, ZALF cooperated with more than 120 universities in 43 countries through strategic cooperation agreements, projects, and teaching. Approximately 70 % of the institute's peer-reviewed publications (2020–2022) are with partners abroad. ZALF actively promotes scientific exchange through its Fellowship Program by appointing five to ten Fellows for up to two years each.

Nationally, ZALF is tightly connected to universities via jointly appointed professorships i.e., Humboldt University Berlin (3), University of Potsdam (3), Brandenburg University of Technology Cottbus-Senftenberg (BTU) (2), Eberswalde University for Sustainable Development (HNEE) (2), University of Hannover (1), and a special professorial appointment arrangement with University of Bonn (1). Other partnerships exist with the appointment of three extracurricular and three honorary professorships, as well as two associate professors ("Privatdozent").

Internationally, ZALF cooperated with more than 80 universities during the evaluation period. Universities of particular strategic importance and with active cooperation via projects and publications include Wageningen University and Research (WUR) with currently 11 EU-funded projects in collaboration with ZALF, and the Swedish University of Agricultural Sciences (SLU). Other partner universities with at least four joint EU-funded projects and at least 20 joint publications since 2017 include the University of Natural Resources in Life Sciences Vienna (BOKU), Aarhus University (AU), and the University of Copenhagen. ZALF also promotes cooperation in Japan, particularly with the Tokyo University of Agriculture and Technology (TUAT). In Sub-Saharan Africa, the Sokoine University of Agriculture (SUA) in Tanzania is an important partner with seven collaborative projects.

ZALF (co)-coordinates and supervises several **large collaborative research and infrastructure projects** both nationally and internationally, i.e.:

- MACSUR SciPol (2020–2022) is a ZALF coordinated follow-up project to the European Knowledge Hub MACSUR, to which ZALF already contributed together with 70 other European institutes, funded under EU FACCE-JPI between 2012–2017. ZALF now coordinates via this initiative the efforts of nine institutions (e.g., AU, TI, WUR, BOKU) to establish a European forum for evidence-based policy support.
- FAIRagro (FAIR Data Infrastructure for Agrosystems), is a ZALF-led consortium of the National Research Data Infrastructure (NFDI) funded through DFG with 29 partner institutions. The project started in March 2023 and will run for five years. ZALF will provide infrastructure to the FAIRagro consortium and the agricultural science community by hosting the project infrastructure including the project management platform, developing use cases and training data stewards among others.
- The BonaRes-Centre (main coordination by UFZ, ZALF leads the data centre) within the BMBF program Soil as a sustainable resource, is a long-term program (2015–2025). Further partners are the Federal Institute for Geosciences and Natural Resources (BGR), U Giessen, Senckenberg Museum of Natural History Görlitz and the TU Munich. Main tasks of ZALF include, e.g., the establishment of the BonaRes Repository, collection and provision of information from long-term field experiments and the development of tools for sustainability assessment of future expected changes in soil functions due to changes in soil management practices.
- The Agricultural Systems of the Future BMBF funded program consists of eight consortia with the overall coordination at ZALF jointly with the Leibniz Institute of Vegetable and Ornamental Crops (IGZ). Within this program ZALF leads the DAKIS consortium (2017–2024) including ATB, U Bonn, HNEE, FZJ, Leibniz Institute for Innovative Microelectronics (IHP), German Research Center for Artificial Intelligence, Osnabrück University of Applied Sciences, Fraunhofer ISI and University Viadrina Frankfurt/Oder as partners. ZALF's tasks is to develop a Digital Agricultural Knowledge and Information System which integrates ecosystem services and biodiversity into modern planning, production and marketing processes.
- LIL (Land-Innovation-Lausitz, 2022–2025) is a BMBF funded project, the aim of which is to support the development of the Lusatia region towards a sustainable bioeconomic model region. ZALF co-leads together with BTU the current second phase of the project. Special focus is on the development of land use-related bioeconomic knowledge and innovations in the Lusatia region considering partnerships between scientists and small and medium sized enterprises.
- Contracts 2.0 is a large ZALF led project (2019–2023, H2020) with the aim to Co-design novel contract models for innovative agri-environmental-climate measures and for valorisation of environmental public goods. It brings together 27 partners from 12 countries including CIRAD, SLU, WUR, and Universities of Pisa, Ljubljana,

Warsaw, Aberdeen, and several non-academic actors. ZALF contributes institutional analyses based on current contracts and support of improvements of existing contract types through behavioural experiments. To ensure a high level of practical relevance, the prototypes of the contract models are tested in the field using preference analyses.

Institution's status in the specialist environment

According to ZALF, the institute's focus on agricultural landscape research with a high degree of interdisciplinarity and the integration of basic, application-oriented and transformative research, is unique. On the national level, ZALF names as an institute with the closest topical link with ZALF's research profile the *Johann Heinrich von Thünen-Institut* (TI), one of the four departmental research institutes of the federal ministry BMEL.

On an international level, ZALF names the National Research Institute for Agriculture, Food, and Environment (INRAE) in France, Wageningen University and Research (WUR) in the Netherlands, and Aarhus University (AU) in Denmark.

7. Subdivisions of ZALF

Research Area 1: Landscape Functioning

[As of 31 December 2022: 65 FTE, thereof 25 FTE Research and scientific services, 18 FTE Doctoral candidates, and 22 FTE science supporting staff]

The vision of Research Area 1 is the understanding of agricultural landscape biogeochemistry and related drivers to improve climate mitigation and adaptation strategies as well as soil and plant health in crop- and grasslands. The Research Area sees significant scientific progress regarding soil erosion, its influence on Greenhouse Gas (GHG) emissions, water flux dynamics, and carbon sequestration, nutrient dynamics (N, P, Si) in soil-plant systems, the role of plant and soil microbiomes for GHG sink function and pathogen control, and the spatial modelling of soil landscapes. The subdivision's research relies on its experimental infrastructures, including analytical laboratories, phytotrones, lysimeters, and experimental field sites in the AgroScapeLab Quillow (ASLQ), e.g., CarboZALF-D including the sensor platform AgroFLUX. The latter enables an integrative analysis of GHG, water fluxes, stable isotopes, plant growth, and soil processes with ongoing cropland management. Research activities are complemented by solution-oriented projects, e.g., on innovative tillage systems, and the communication of research results to stakeholders. Research Area 1 will continuously develop its interdisciplinary, cross-scale approach to the agricultural landscape system by coupling plant-scale studies with experiments from plot to landscape scale. Upscaling will be supported by soil sensing and spatial soil landscape modelling. Key future research comprises (a) soil erosion and feedbacks, (b) carbon, nutrients, and water dynamics as regulated by plants, microbiomes, and soils, (c) biotic processes in the crop rhizosphere, and (d) the role of Si for a sustainable crop production by increasing both soil water and nutrient availability.

Research Area 1 comprises seven working groups (WG): Microbial Biogeochemistry (MIC), Fungal Interactions (FIA), Landscape Pedology (LAP), Hydropedology (HYP, until

12/2022), Soil Erosion & Feedback (SEF), Isotope Biogeochemistry & Gas Fluxes (IBG), and Silicon Biogeochemistry (SIB).

Between 2020 and 2022, Research Area 1 published \emptyset 73 articles in peer-reviewed journals p.a. In the same period, the revenue from project grants was \emptyset 2.1 M€ p.a. Of these, on average 950 k€ were spent from Bund und *Länder*, and 654 k€ from the DFG. In total, seven doctoral degrees and one habilitation were completed.

Research Area 2: Land Use and Governance

[103 FTE, thereof 45 FTE Research and scientific services, 24 FTE Doctoral candidates, and 34 FTE science supporting staff]

Research Area 2 aims at improving the understanding of the interactions between land use, biodiversity, and ecosystem services and at supporting the development of effective governance models and innovation processes in order to balance the diverse demands on the use of agricultural landscapes. In its research projects, Research Area 2 analyses the interactions of natural and social systems and delivers contributions to the sustainability-oriented transformation of land use systems. The area's research is devoted to the development and implementation of resource-efficient and regionally adapted agricultural production systems based on land use diversification and the use of new digitalization tools and processes as options to support management. The group contributed to scientific progress regarding the diversification of cropping systems, targeted measures for promoting biodiversity and ecosystem services in agricultural landscapes, institutional design of novel instruments and governance models, and the adoption of innovations regarding the transformation of land use systems, extending to community-level innovations to improve food security in the Global South. Based on its expertise in inter- and transdisciplinary research and co-design processes, Research Area 2 takes part in respective national and international projects such as DAKIS, patchCROP, Contracts2.0, ReGerecht or ClimBeR.

Research Area 2 comprises ten working groups (WG): Resource Efficient Cropping Systems (RCS), Sustainable Grassland Systems (SGS), Provisioning of Ecosystem Services (ESS), Provisioning of Biodiversity (BIO), (Semi)-Aquatic Biodiversity (AQB), Biotic-Forest Agriculture Interaction (IFA), Lowland Hydrology (LHW), Governance of Ecosystem Services (GOV), Co-Design of Change and Innovation (CCI), and Sustainable Land Use in Developing Countries (SUS).

Between 2020 and 2022, Research Area 2 published \emptyset 139 articles in peer-reviewed journals p.a. In the same period, revenue from project grants was \emptyset 5.2 M€ p.a. Of these, on average 3.7 M€ were spent from Bund und Länder, 634 k€ from the EU, and 341 k€ from the DFG. In total, 23 doctoral degrees were completed.

Research Area 3: Agricultural Landscape Systems

[42 FTE, thereof 25 FTE Research and scientific services, 13 FTE Doctoral candidates, and 3 FTE Science supporting staff]

Integrating methods for sustainability assessment and co-design of emerging interventions supporting the transformation of agricultural landscape and agri-food systems towards resilience and sustainability are at the core of Research Area 3. Particular scientific progress is related to advancing methods to assess climatic risk and impacts on cropping systems, farm level bio-economic and soil health assessments and scenario development of climate adaptation measures, and understanding the role of value chain transformations for agri-food systems. The Research Area endeavors to achieve impact through cooperation with stakeholders starting early in research processes, disseminating results to policy and practice actors, and through its role in shaping strategic research agendas. Going forward, Research Area 3 will further develop its integrative systems research with emphasis on assessing risks and resilience, as well as understanding and supporting transformation processes. Finally, Research Area 3 will explore the use of systems analytical methods in transdisciplinary research.

Research Area 3 comprises four working groups (WG): Integrated Cropping Systems Analysis (CSA), Farm Economics and Ecosystem Services (LBW), Spatial and System Context (DSC), and Impact Assessment (IMA).

Between 2020 and 2022, Research Area 3 published \emptyset 45 articles in peer-reviewed journals p.a. In the same period, revenue from project grants was \emptyset 2.6 M€ p.a. Of these, on average 1.5 M€ were spent from Bund und Länder, 800 k€ from the EU, and 101 k€ from the DFG. In total, four doctoral degrees were completed.

Research Platform Data Analysis and Simulation (RDS)

[33 FTE, thereof 20 FTE Research and scientific services, 5 FTE Doctoral candidates, and 8 FTE Science supporting staff]

RDS develops methods for analysing heterogeneous data and integrating data, tools, and modelling approaches for landscape research. It was formed by combining five research WG with three service WG. Significant research progress was made with the delineation of different processes using dimensionality reduction, applying artificial intelligence (AI) techniques to elucidate complex interrelations in high-dimensional data, providing essential input for mechanistic simulation models from various sensing platforms, and operating multi-model ensembles using the recently developed ZALF simulation infrastructure CASSIS and the High-Performance Computing (HPC) facility. The three service WG serve for meta-data acquisition, long-term data storage, user-friendly tools for data access, data and model repositories, model and simulation infrastructure, the HPC facility, as well as technical and advisory support. RDS will continue the application of advanced multi-variate statistics and AI, advance the representation of innovative cropping systems in models, increase model ubiquity for large-area simulations, and develop innovative approaches that take advantage of advanced sensor technologies, hybrid modelling approaches, and distributed data sources.

The Research Platform comprises five research working groups: Artificial Intelligence (AIA), Data Dimensionality (DIM), Ecosystem Modelling (ESM), Landscape Modelling (LSM) and Simulation Methods (SDM). The three service working groups (WG) of RDS, Data Infrastructure (DIS), Research Data Management (FDM), and Model & Simulation Infrastructure (MAS), provide support for all ZALF units and partly for the broader scientific community.

Between 2020 and 2022, RDS published \emptyset 48 articles in peer-reviewed journals p.a. In the same period, revenue from project grants was \emptyset 320 k€ p.a. Of these, on average 245 k€ were spent from Bund und Länder, and 12 k€ from the DFG. In total, seven doctoral degrees were completed.

8. Handling of recommendations from the previous evaluation

ZALF responded as follows to the nine recommendations of the last external evaluation (highlighted in italics, see also statement of the Senate of the Leibniz Association issued on 9 March 2017, page B 3):

1) *“ZALF’s **publication performance** has been improved since the last evaluation. However, the self-imposed goal of two peer-reviewed publications per scientific position per year has not yet been achieved by most institutes. There is also still upward potential concerning the number of publications in top-ranked journals. Consequently, it is recommended to be more ambitious and self-confident in the choice of publication organs.”*

ZALF states that it increased its publication output by 85 % as compared to the last evaluation reporting period (average of 148 peer-reviewed articles 2013–2015; 274 in 2020–2022), with a three year-average of 2.6 peer-reviewed articles per scientist full-time equivalent (FTEsci), of which nearly half (46 %) were ZALF first authorships. The institute states that it substantially improved the quality and visibility of its publications, as indicated by the proportion of articles listed in Web-of-Science (WoS) or Scopus, the proportion in top-ranked journals (i.e., Q1 journals in WoS relevant subject categories) of 50 %, and a pronounced increase of publications in journals with JIF > 6 since 2017. ZALF agreed on incentive measures to further support this trend (ZALF Performance Indicators and Objectives until End of 2025).

2) *“As established at the last evaluation already, ZALF must acquire more funding from the **German Research Foundation (DFG)**; in 2014 and 2015, the relevant revenue fell below the fees paid by ZALF to participate in DFG funding programmes. However, the acquisition of four larger-scale projects in the second half of 2015, which will only be of full financial relevance in the following years, indicates a decidedly positive trend.”*

ZALF made DFG funding acquisition a specific goal and provided various internal incentives and support towards this aim. The revenues from DFG projects 2020–2022 increased and were on average twice as high as the annual fees. Since 2020, 19 new DFG projects were granted.

3) *“ZALF should take greater note of strategic considerations in determining its **international collaborations** and focus on especially strong partners. Given, amongst other things, its excellent facilities it can offer them a great deal. Furthermore, ZALF is recommended to strengthen its global perspective, for example by collaboration with international organisations (WHO, FAO etc.). It is welcomed that ZALF has recognised the need for action and is already planning to increase human resources in the international field.”*

ZALF states to have strengthened the global perspective in its vision and research strategy and intensified its active cooperation with partners both internationally (e.g., WUR, INRAE, CGIAR centers, FAO, Aarhus University) and nationally (e.g., FZ Jülich, UFZ, KIT, HU Berlin, U Potsdam) via joint projects and initiatives, new or renewed cooperation agreements, board memberships of ZALF researchers and international partners becoming member of the ZALF SAB.

4) *“It is recommended to implement the **staffing concept** as quickly as possible and then to develop career profiles for the staff in the technical sector, as well.”*

With the organizational restructuring in 2018, the former Staffing Concept 2016 was revised, and new roles and procedures were defined. ZALF states to now use funds from vacant institutional positions to strengthen the main research foci of the RA/RDS and to fill (future) strategic gaps that arise within or between RA/RDS programs. This includes ensuring the continuity of expertise where strategically relevant. An internal mapping process was set up to identify the expertise gaps that need to be filled via the Tenure Track System as the main recruiting instrument for scientific staff. Career profiles for doctoral researchers were revised and included in the new doctoral guideline. Expectations for post-doctoral researchers were included in the Tenure Track System and for mentoring of post-docs in a leadership agreement. Offers for training and career support for the postdoctoral stage have been extended. The staffing concept for supporting staff was developed further aligned with the new structures and governance, and profiles and allocation of (new) science supporting staff is discussed in yearly strategy talks between the RA/RDS Co-Heads and the Executive Board.

5) *“ZALF should use the forthcoming changes in personnel to further increase the proportion of **women in scientific leadership positions**.”*

ZALF made use of the structural changes to create more independent positions overall, allowing for more leadership positions also for female researchers. As of 31.12.2023, 11 out of 29 WG are led by female researchers, compared to eight out of 28 at the time of the WG establishment in 2018. Currently, four out of nine positions of the second leadership level are held by female professors, compared to one at the time of the last evaluation.

6) *“ZALF is recommended to continue structuring the supervision and promotion of its **doctoral researchers** yet further and to extend it according to its specific areas of expertise. It is welcomed that the Centre is already making good progress: The staffing concept, which is still*

in the implementation phase, implies that all future Ph.D. students will be integrated in a structured doctoral programme and will take part in qualification measures.”

ZALF further structured the supervision and promotion of doctoral researchers as documented in a comprehensive guideline adhering to Leibniz Career Standards. The ZALF doctoral program includes the participation of all doctoral researchers in several standard and additional individual qualification measures and series of events, including colloquia, PhD-Day, and other.

7) *“ZALF has increased its efforts to promote **post-doctoral junior researchers** and should continue to do so.”*

ZALF developed and implemented the Tenure Track System with clear procedures and career options. Out of 13 appointed Tenure Track positions, five were filled with (former) ZALF postdocs in a competitive selection process. The institute increased support for qualification measures, career orientation, and networking, laid out standards for internal mentorship, improved opportunities to establish junior research groups, and included the perspective of postdocs in the development of measures and strategies via their representatives and via regular rounds of exchange.

8) *“Care should be taken to ensure that in future all institutes **advertise their positions** for junior researchers internationally.”*

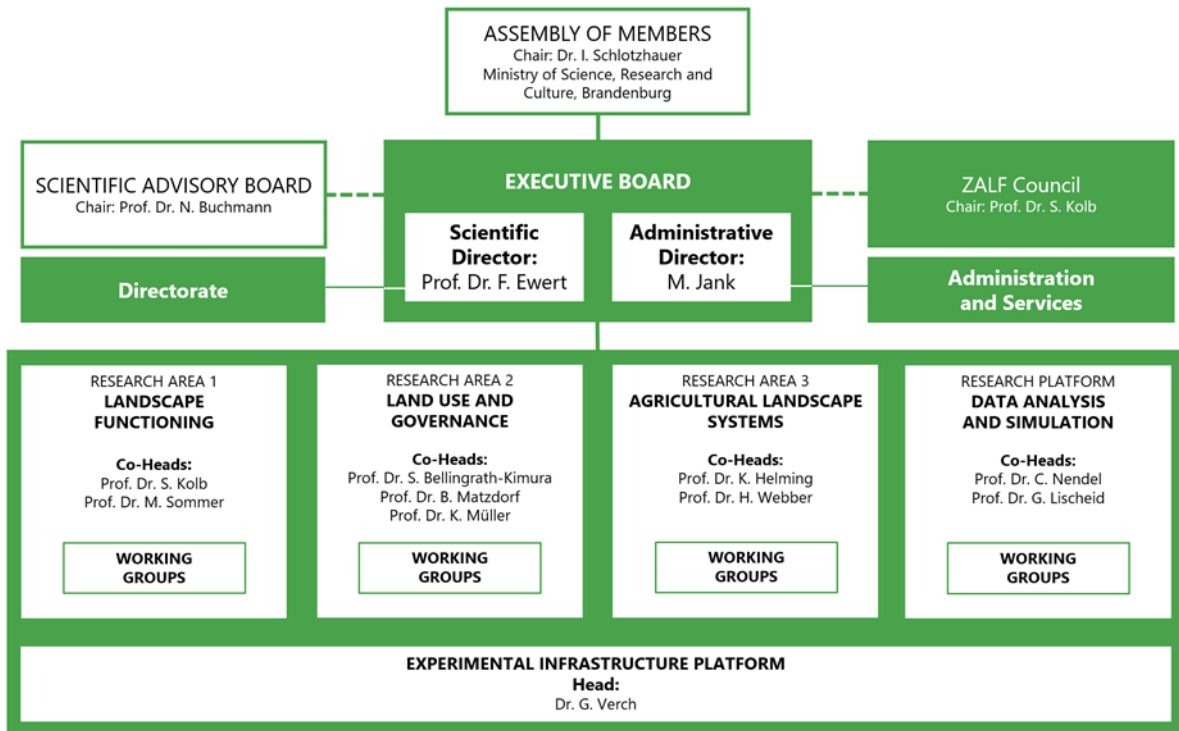
Job advertisements in English language and on international platforms are standard. This was implemented for Tenure Track positions and professorial appointments in 2017, and for all other scientific positions in 2018 (where it fits the profile of the post). ZALF has revised the vacancies website and provides templates and guidelines for preparing and publishing job adverts. The increased number of ZALF staff from abroad (31 % of research and scientific service staff, as compared to 12 % in the last evaluation) and the institute’s visibility in international networks will further improve the global visibility of ZALF’s job posts.

9) *“The plans to increase the share of international members on the **Scientific Advisory Board** are welcomed.”*

Following the last evaluation, eight SAB members have been newly appointed in November 2016. To date, eight of the 10 SAB members are researchers working at institutions abroad.

Appendix 1

Organisational Chart



Effective: 10 May 2022

Appendix 2

Publications

	Period		
	2020	2021	2022
Total number of publications	293	356	359
Monographs	14	5	2
Individual contributions to edited volumes	25	45	30
Articles in peer-reviewed journals (plus online first)	229	286	308 (21)
Articles in other journals	24	17	15
Editorship of edited volumes	1	3	4

Appendix 3 Revenue and Expenditure

Revenue		2020			2021			2022 ¹⁾		
		k€	% ²⁾	% ³⁾	k€	% ²⁾	% ³⁾	k€	% ²⁾	% ³⁾
Total revenue (sum of I., II. and III.; excluding DFG fees)		40 624			44 526			48 723		
I.	Revenue (sum of I.1., I.2., and I.3.)	30 454	100		32 806	100		34 610	100	
1.	<u>Institutional Funding (excluding construction projects and acquisition of property)</u>	21 970	72		21 905	67		22 876	66	
1.1	Institutional funding (excluding construction projects and acquisition of property) by Federal and <i>Länder</i> governments according to AV-WGL	21 970			21 905			22 876		
1.2	Institutional funding (excluding construction projects and acquisition of property) not received in accordance with AV-WGL	0			0			0		
2.	<u>Revenue from project grants</u>	8 427	28	100	10 822	33	100	11 689	34	100
2.1	DFG	881		10	1 251		12	1 299		11
2.2	Leibniz Association (competitive procedure)	288		3	300		3	652		6
2.3	Bund and <i>Länder</i>	5 883		70	7 178		66	6 581		56
	thereof Federal Ministry of Education and Research (BMBF)	2 856		34	3 344		31	3 025		26
	thereof Federal Ministry of Food and Agriculture (BMEL)	2 193		26	2 869		27	2 770		24
	thereof other federal ministries	391		5	594		5	609		5
	thereof <i>Länder</i> governments	443		5	371		3	177		2
2.4	EU	958		11	1 328		12	2 066		18
2.5	Industry	39		0	75		1	117		1
2.6	Foundations	59		1	115		1	168		1
2.7	Other (e.g., foreign ministries, NGO, GIZ...)	319		4	576		5	806		7
3.	<u>Revenue from services</u>	57	0		79	0		45	0	
3.1	Revenue from publications	0			0			0		
3.2	Revenue from exploitation of intellectual property for which the institution holds industrial property rights (patents, utility models, etc.)	0			0			0		
3.3	Revenue from exploitation of intellectual property without industrial property rights	0			0			0		
3.4	Revenues from other services	57			79			45		
II.	Miscellaneous revenue (sum of II.1 and II.2)	8 755			9 005			11 875		
1.	Institutional funding - rental income, self-managed surpluses, cash assets from the previous year [4]	6 769			7 483			8 074		
2.	Project - grants - cash assets from the previous year	1 987			1 522			3 801		
III.	Revenue for construction projects (institutional funding by Federal and <i>Länder</i> governments, EU structural funds, etc.)	1 415			2 716			2 238		

Expenditures		k€	k€	k€
Expenditures (excluding DFG fees)		40 078	43 972	48 160
1.	Personnel	21 778	22 795	24 424
2.	Material expenses	1 872	2 176	1 963
2.1	Proportion of these expenditures used for registering industrial property rights (patents, utility models, etc.)	0	0	0
3.	Equipment investments	1 242	1 403	1 444
4.	Construction projects, acquisition of property	1 578	1 117	1 679
5.	Other operating expenses (e. g. property management, maintenance, contributions, self-managed surpluses and cash-assets)	13 609	16 483	18 650
DFG fees (if paid for the institution - 2.5 % of revenue from institutional funding)		546	554	563

1) Preliminary data: no

2) Figures I.1., I.2. and I.3. add up to 100 %. The information requested here is thus the percentage of "Institutional funding (excluding construction projects and acquisition of property)" in relation to "Revenue from project grants" and "Revenue from services".

3) Figures I.2.1 bis I.2.7 add up to 100 %. The information requested here is thus the percentage of the various sources of "Revenue from project grants".

4) 2022: cash assets: 1.071 k€; self-managed surpluses: 6.700 k€ - thereof large GWK-construction project: 950 k€ - thereof small construction projects: 1.450 k€ - thereof unclaimed WGL-fee: 522 k€.

Appendix 4

Staff

(Basic financing and third-party funding / proportion of women (as of: 31 December 2022))

	Full time equivalents		Employees		Female employees		Internationals ¹⁾
	Total	on third-party funding	Total	on temporary contracts	Total	on temporary contracts	Total
	Number	Percent	Number	Percent	Number	Percent	Number
Research and scientific service	178	54	223	79	115	84	70
1 st level (Scientific Directors)	1	0	1	100	0		0
2 nd level (department leaders or equi.)	9	11	9	11	4	0	2
3 rd level (group leaders or equi.)	19	5	20	25	7	29	1
Junior research group leaders	1	100	1	0	1	0	0
Scientists in non-executive positions (A13, A14, E13, E14 or equivalent) ²⁾	88	53	104	77	51	84	36
Doctoral candidates (A13, E13, E13/2 or equi.)	60	77	88	100	52	100	31
Science supporting staff I (laboratories, technical support etc., incl. EIP staff)³⁾	97	22	113				
Technical service, workshops (from E13, senior service)	5	41	6				
Technical service, workshops (E9 to E12, upper-mid-level)	53	24	64				
Technical service, workshops (E5 to E8, mid-level service)	20	33	23				
Laboratory (E9 to E12, upper-mid-level)	4	0	4				
Laboratory (E5 to E8, mid-level)	1	0	1				
Library (from E13, senior service)	1	0	1				
Library (E9 to E12, upper-mid-level)	2	0	2				
Information technology (from E13, senior service)	5	0	5				
Information technology (E9 to E12 upper-mid-level service)	5	0	6				
Guest housing services (E5 to E8, mid-level service)	2	0	2				
Science supporting staff II (administration, management)⁴⁾	56	3	64				
Head of the administration	1	0	1				
Internal administration (from E13, senior service)	7	0	8				
Internal administration (E9 to E12, upper-mid-level service)	7	0	7				
Internal administration (E2 to E8, mid-level service)	27	0	30				
Staff positions (Directorate) (from E 13, senior)	8	6	9				
Staff positions (Directorate) (E9 to E12, upper-mid-level)	5	20	6				
Staff positions (Directorate ²⁾) (E5 to E8, mid-level)	2	0	3				
Student assistants	13	50	51				
Trainees			1				
Scholarship recipients at the institution			10		9		7
Doctoral researchers			10		9		7
Post-doctoral researchers			0		0		0

1) Individuals with non-German or dual citizenship.

2) Includes graduates that do not pursue a doctorate (pre-doc), postdocs, (incl. TT candidates) and senior scientists.

3) Includes central services (18.2 FTE / 21 employees for IT, central laboratory, library and guest housing) and decentral services in the RA/RDS/EIP, thereof 20.9 FTE / 23 employees in the EIP.

4) Includes central administration (32.1 FTE / 35 employees for the administrative director and secretariat, human resources, controlling, finance, third-party funding management, facility management, purchasing and procurement, environmental management) staff in the directorate (15.3 FTE/ 18 employees; secretariat, Public Relations Department, Transfer Office, Strategic Science Management Department and fixed-term coordination positions for strategic projects) and decentral staff in the RA/RDS (administrators, secretariat and similar).

Annex B: Evaluation Report

Leibniz Centre for Agricultural Landscape Research, Müncheberg/Mark (ZALF)

Contents

1. Summary and main recommendations	B-2
2. Overall concept, activities and results	B-3
3. Changes and planning	B-5
4. Controlling and quality management	B-7
5. Human Resources	B-9
6. Cooperation and environment.....	B-11
7. Subdivisions of ZALF	B-11
8. Handling of recommendations of the last external evaluation.....	B-14

Appendix:

Members of review board

1. Summary and main recommendations

ZALF researches interactions in agroecosystems and agricultural landscapes, with the long-term goal of achieving sustainable, resilient agriculture. It makes important contributions to key issues in the areas of land use, food security, biodiversity and climate change. The institute has access to extensive observational data at various scales that are collected within large consortia and made available through the institute.

In the past seven years, ZALF has made outstanding progress in terms of its organisation, structure and personnel. This is based on a renewal process that began after a critical evaluation in 2012/2013. In the evaluation four years later, under the then newly appointed Scientific Director, a clearly positive trend was apparent. Since 2021, the Scientific Director has had first-rate support from a newly appointed Administrative Director. The change process of the past few years was closely accompanied by the Scientific Advisory Board, and the institute staff was very committed to its implementation.

The six former ZALF “institutes” have been replaced by three interdisciplinary research areas (RAs) and one research platform (RDS). One research area is rated “very good to excellent”, two are rated “very good” and one “good to very good”. All areas regularly produce internationally acknowledged research results that are successfully transferred into application. The institute keeps track of this process with the help of impact pathways, and pursues a very convincing approach to the early integration of relevant stakeholders in its research work. ZALF maintains important research infrastructure facilities and landscape laboratories.

The institute has grown considerably since the last evaluation, largely as a result of successfully securing third-party funding. Recruiting and developing staff in all areas and at all hierarchical levels is a challenge that ZALF meets with great commitment. Overall, ZALF offers its employees very good working and research conditions. It is connected to seven different universities through joint professorship appointments. The institute (co)-coordinates and supervises several large collaborative research and infrastructure projects, both nationally and internationally. Since the last evaluation, it has increased its international visibility significantly and is now a highly recognised partner in its field.

Special consideration should be given to the following comments and recommendations (highlighted in **bold face** in the text):

Overall concept, activities and results (chapter 2)

1. The transfer of the six largely disciplinary “institutes” into three thematically broader research areas (RAs) and one research platform for modelling and simulation projects (RDS) has created a convincing structure for ZALF’s systems research approach. This approach is fruitful and should be pursued further. On this basis, options for intensified interdisciplinary collaboration and networking between the research units should be explored.
2. By developing impact pathways, ZALF has found a convincing instrument for keeping track of the transfer process of its research results into application. It is likely that this monitoring will lead to further improvement of the interaction between research and

application. The impact pathways tool should therefore be rolled out gradually to other projects.

Changes and planning (chapter 3)

3. ZALF's two research platforms were merged into a single Data and Analysis Simulation unit (RDS) with the aim of pooling personnel capacity and focusing the research work. This step is in line with ZALF's integrated research approach and ensures a close link between service and research in the field of data, modelling and simulation. For the RDS staff, however, it remains a challenge to meet internal service demands, develop innovative methods and have enough scope for their own research. This should be kept well in mind at ZALF.
4. The 28 current working groups are flexible units with different staffing configurations and sizes. In view of the present-day focus of ZALF's research, the flexibility of these groups is very well suited for responding quickly to new, topical research questions. The review board welcomes the fact that the working groups are monitored for quality assurance purposes by the Scientific Advisory Board, which provides important guidance concerning their continued operation, restructuring or even termination.
5. In the coming years, ZALF plans to reach out to additional regions from its agricultural landscape and systems perspective. In doing so, it also intends to work more with artificial intelligence and big data. Looking ahead, the institute should weigh up which activities it will carry out itself, and for which ones it will seek to collaborate with strong partners in the respective field.

Controlling and quality management (chapter 4)

6. 70% of the working groups' institutional funding is attributed on the basis of performance. ZALF should ensure that indicator categories for this are designed in a task-specific way, i.e. that transfer and infrastructure activities are recognised appropriately.
7. It is good to see that the institute provides its staff with data publishing support and that €80,000 p.a. is available for open access publications. However, the institute should make a greater effort to ensure that papers are only published in OA journals that have well recognised peer-review procedures.

2. Overall concept, activities and results

ZALF researches interactions in agroecosystems and agricultural landscapes, with the long-term goal of achieving sustainable, resilient agriculture. In this way, the institute makes important contributions to key issues in the areas of land use, food security, biodiversity and climate change. It has access to extensive observational data at various scales that are collected within large consortia and made available through the institute.

In its research, ZALF adopts a broad perspective on agricultural landscapes in their respective contexts. The aim is to research processes in the soil, plants and water, and inter-relationships at field and landscape level and even global impacts, as well as complex in-

teractions between landscape, society and the economy. To achieve this, different disciplines at ZALF, including agricultural, earth, biological and social sciences, work together. **The transfer of the six largely disciplinary “institutes” into three thematically broader research areas (RAs) and one research platform for modelling and simulation projects (RDS) has created a convincing structure for ZALF’s systems research approach. This approach is fruitful and should be pursued further. On this basis, options for intensified interdisciplinary collaboration and networking between the research units should be explored.** The work of all units is supported by the Experimental Infrastructure Platform (EIP), which brings together the research stations in Müncheberg, Dedelow and Paulinenaue and the two landscape laboratories, AgroScapeLab Quillow and patchCROP.

ZALF’s overall concept includes involving relevant practice, policy and society stakeholders in research projects or project development from the start. This co-design approach is extremely promising and is already practised successfully in ZALF’s landscape laboratories. It is good to see that the path taken from scientific findings into application is increasingly being documented, so that it can be traced (see below).

Results

Research

ZALF regularly produces research results that achieve international recognition. These include, for example, the work regarding positive effects of silica on soil health and climate adaptation. Since the last evaluation, ZALF has increased its expertise in process-based agro-ecosystem modelling and is now a strong and visible player in this area. Particularly worth mentioning is the fact that a large proportion of the research work is interdisciplinary and application-oriented. Examples include the methodological work that led to the development of a novel robotic chamber system for automated high-resolution CO₂ exchange measurements (gantry crane), and the decision-making aid developed in the DA-KIS project for managing sustainable farming systems (Digital Agricultural Knowledge and Information System).

It is good to see that ZALF has improved its publication output, in line with the recommendations made during the last evaluation. The institute regularly publishes its research results in specialist journals with high international visibility.

Transfer

ZALF successfully communicates the results of its research activities to stakeholders in politics, practice and society, both regionally and nationally. The transfer activities are coordinated by a Transfer Office and the Department for Public Relations and Science Communication. *Agrathaer*, a subsidiary established in 2011 to utilise research results for policy, practice and society, is now an independent company, with future collaboration governed by a cooperation agreement. ZALF’s award-winning activities in the context of its science communication brand *querFELDein* reach a broader (specialist) audience.

In order to involve stakeholders in its research projects and in the development of new research questions at an early stage, some projects are already following a co-design approach. This helps ensuring that research activities and outcomes have practical relevance. One suitable partner, with which the institute already collaborates very fruitfully, is the German Farmers' Association. When extending this approach, it will be important to identify additional stakeholders and their interests, so as to enter into new collaborations at an early stage. **By developing impact pathways, ZALF has found a convincing instrument for keeping track of the transfer process of its research results into application. It is likely that this monitoring will lead to further improvement of the interaction between research and application. The impact pathways tool should therefore be rolled out gradually to other projects.**

Research infrastructure

The institute makes important research infrastructure available to the scientific community. Within the BonaRes research initiative coordinated by the Helmholtz Centre for Environmental Research (UFZ), ZALF is responsible for the Repository for Soil and Agriculture Research Data, which holds data on soil, agricultural research and ecology. These data are extremely relevant for the development of novel research questions. Another great success is the FAIRagro consortium, a research data infrastructure for agrosystem research, which was established at ZALF in 2021 as part of the NFDI. Furthermore, ZALF is in the process of building the simulation infrastructure CASSIS (Capability ASsisted Simulation InfraStructure), a promising environment enabling the coordination of complex simulation scenarios.

ZALF operates two landscape laboratories: AgroScapeLab Quillow (ASLQ) is the central platform for research and experiments on a field and landscape scale with shared access. It is linked to observatory networks like TERENO (Terrestrial Environmental Observatories), which was initiated by the Helmholtz Association. It is very good to see that research activities at ASLQ also strongly encourage participatory projects with stakeholders. In 2020, ZALF set up PatchCROP as a co-designed experimental platform and future living lab case study, applying a multidisciplinary research approach to investigate site-specific field arrangements, crop rotations, and crop protection strategies. Here, digitalization and new technologies such as robotics, sensors and AI are used. With this innovative basis, outstanding results can be expected in future in the area of optimising crop farming systems and diversity in agricultural landscapes. PatchCROP is very well connected with the Julius Kühn Institute (JKI), the DFG Cluster of Excellence PhenoRob and DAKIS.

3. Changes and planning

Development since the previous evaluation

ZALF was already starting to show positive developments at the last evaluation. Since then, the institute has made outstanding progress in terms of its organisation, structure and personnel. This change process was managed very capably by the current Scientific Director, who had just taken up his post at the time of the last evaluation, and the Administrative Director, who was appointed in 2021, and with excellent support by the Scientific

Advisory Board. The institute's staff is highly committed to the implementation of the new structures.

In 2018, the six former ZALF "institutes" were replaced by three research areas (RAs) and two research platforms (RP Data and RP Modelling). ZALF's field and landscape experimental infrastructures and services were reinforced by merging the existing activities into one Experimental Infrastructure Platform (EIP). Following the recommendation of the Scientific Advisory Board, **ZALF's two research platforms were later merged into a single Data and Analysis Simulation (RDS) unit with the aim of pooling personnel capacity and focusing the research work. This step is in line with ZALF's integrated research approach and ensures a close link between service and research in the field of data, modelling and simulation. For the RDS staff, however, it is still a challenge to meet internal service demands, develop innovative methods and have enough scope for their own research. This should be kept well in mind at ZALF.**

Research area 1 on Landscape Functioning pools natural and life science expertise for studies related to agricultural landscape biogeochemistry. Research area 2 on Land Use and Governance brings together most of the expertise from the socio-economics and land use systems institutes, while the systems approach was anchored in research area 3. Research questions that have already been worked on in the past at ZALF are being linked to new approaches relating to the future-oriented system assessment of land use. Each of the research areas and the RDS are jointly managed by two senior scientists as co-heads. Most of them were previously heads of ZALF "institutes". They bring their specific professional perspectives to the interdisciplinary research fields with profitable results. The joint appointment, by ZALF and BTU Cottbus, of a new senior scientist as co-head in 2022 strengthened the research on systems analysis and modelling in the area of climate risk and impact assessment.

Within the research areas and the RDS, the research and service activities are carried out in, currently, 28 working groups, which form a third organisational level. These working groups were created in the course of the restructuring of ZALF in a bottom-up process. **The working groups are flexible units with different staffing configurations and sizes. In view of the present-day focus of ZALF's research, the flexibility of these groups is very well suited for responding quickly to new, topical research questions. The review board welcomes the fact that the working groups are monitored for quality assurance purposes by the Scientific Advisory Board, which provides important guidance concerning their continued operation, restructuring or even termination.**

The Integrated Priority Projects (IPPs) are a very promising tool for promoting integration across research units, although their effectiveness has yet to be demonstrated. IPPs have to involve at least three working groups from three different research units. As of today, five IPPs have been selected in annual internal competitive calls for proposals. They are

supported with funding for doctoral students and for infrastructure and material expenses.

Strategic work planning for the coming years

In the coming years, ZALF plans to reach out to additional regions from its agricultural landscape and systems perspective. In doing so, it also intends to work more with artificial intelligence and big data. Looking ahead, the institute should weigh up which activities it will carry out itself, and for which ones it will seek to collaborate with strong partners in the respective field.

The plans to develop new forms of collaboration and pursue systematic cooperation with actors in the agrifood domain are also very much welcomed. The planned living labs in Brandenburg and Hesse for mutual learning and synthesis beyond regional solutions are a very good fit in this context. They are to be financed as an Innovation Centre for Agricultural System Transformation (IAT) as part of the institute's expansion (large extraordinary item of expenditure). The project is currently being assessed in a separate evaluation procedure.

ZALF has specific expertise in hydrology, which, following the dissolution of its Landscape Hydrology institute, is now held in several different research areas. Two working groups in this field have also been/about to be terminated (Hydropedology in RA1 and Lowland Hydrology in RA2), in part because the group leaders are retiring. Instead, a tenure track position was recently filled in ecosystem physiology and ecohydrology, which is located in RA1 (Isotope Biogeochemistry and Gas Fluxes working group). It is important for the institute to keep hold of its hydrological expertise, as planned. This should also be made visible externally, for instance by naming a working group accordingly.

The expertise of ZALF's former Socio-Economics institute has largely been transferred to RA2 on Land Use and Governance. Here, social science and agricultural economics expertise plays a key role in the cross-disciplinary development of new methods and theory, an area which should be strengthened further in future (see chapter 7). The former head of this institute, now one of the co-heads, will be retiring shortly. He is a jointly appointed professor for Economics and Politics of Rural Areas (W2) at HU Berlin. ZALF plans to fill his succession as a junior professorship, which should have a tenure option.

4. Controlling and quality management

Funding

Between 2020 and 2022, ZALF's institutional funding totalled on average €22.3m p.a., which is adequate to cover its current portfolio of activities.

ZALF's third-party revenues have risen significantly and now represent 32% (average 2020–2022) of the budget. As before, grants from the federal and *Länder* governments play an important role. It is good to see that the institute now secures significant funding through competitive procedures, such as those run by the DFG. As well as numerous indi-

vidual projects, it is also involved in large consortium projects (FAIRagro, PhenoRob cluster of excellence at the University of Bonn). ZALF is also successful in the EU framework programmes. In addition, it received funding for transfer projects through the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI).

ZALF currently has access to significant self-managed institutional funding carried over from previous years (*Selbstbewirtschaftungsmittel*). This is likely to be used up in the foreseeable future, as the institute has explained. It includes funds for upcoming retirement payments and building works.

Facilities and equipment

The main ZALF campus is located in Müncheberg with three experimental stations in Müncheberg and two more sites in Brandenburg (Dedelow and Paulinenaue). In total, ZALF disposes of about 160 hectares of experimental fields with state-of-the-art equipment to carry out field and laboratory experiments as well as to support modelling and simulation activities.

The institute plans to meet its increased space requirements with sustainable concepts, including flexible use of office spaces in view of the increase in employees working from home. The forward-looking plans to set up a flexible laboratory facility that can be used for the duration of a research project are also welcomed.

It is very good to see that ZALF is also tackling the challenges of climate change and future energy scarcity and is developing further plans to create sustainable conditions for its research activities. It has, for instance, introduced a certified environmental management system according to the European EMAS standard and, with the support of the state of Brandenburg, is striving to obtain its energy from renewable sources.

Organisational and operational structure

ZALF's Executive Board consists of the Scientific Director and the Administrative Director. They both perform their jobs excellently, work together successfully and have implemented modern, participatory decision-making processes at ZALF.

The restructuring and replacement of the disciplinary "institutes" with thematically broader research areas (see chapter 2) has been implemented very well. It makes sense that the new units are each jointly headed by two senior scientists. It is also good that administrators work in the new research areas in order to relieve researchers of administrative tasks. The working groups in the research areas and in the RDS are responsible for their own research topics, resources, and staff supervision. Each working group is headed by a senior scientist. **70% of the working groups' institutional funding is attributed on the basis of performance. ZALF should ensure that indicator categories for this are designed in a task-specific way, i.e. that transfer and infrastructure activities are recognised appropriately.**

Quality management

ZALF's quality management is well aligned with the expected standards. The institute follows the recommendations for good scientific practice as developed by the German Research Foundation (DFG) and adopted by the Leibniz Association. ZALF has two ombudspersons and has established an Ethics Committee, which started its regular work in 2023.

With the ZALF Open Access Policy of 2022, the institute aims to realize a comprehensive Open Access (OA) transformation, in accordance with the Open Access Policy of the Leibniz Association. **It is good to see that the institute provides its staff with data publishing support and that €80,000 p.a. is available for open access publications. However, the institute should make a greater effort to ensure that papers are only published in OA journals that have well recognised peer-review procedures.**

ZALF also addresses data security issues, which are of particular significance, not least in view of the steep increase in cyber-attacks on research institutions in recent years. The institute has an overall IT strategy which is overseen by a newly established CIO Board (Chief Information Office Board).

Quality management by advisory boards and supervisory board

The Scientific Advisory Board (SAB) has accompanied and supported the organisational and scientific restructuring of ZALF in an exemplary fashion. As well as conducting an audit in 2019 and holding meetings at least twice a year, the SAB has evaluated all the working groups over the past few years. It is good to see that ZALF has increased the share of SAB members coming from abroad, as was recommended at the last evaluation.

5. Human resources

In terms of personnel, the institute has grown considerably since the last evaluation (2016: 308 employees/2023: 400 employees). This is largely a result of successful third-party funding applications.

Recruiting and developing staff in all areas and at all hierarchical levels is a challenge that ZALF meets with great commitment. Because of its rural location, ZALF in particular has to present itself as an attractive employer to potential applicants. By making its working culture flexible (mobile working, flexible use of office space), ZALF has already taken a major step in this direction. The institute's various university partnerships are another suitable way of attracting qualified staff.

As recommended, the staffing concept has been developed further and implemented. It includes a strategic staff appointment scheme, which also takes account of the numerous upcoming retirements. In addition, ZALF has set up an early-career researchers working group and an equal opportunities team.

Leading scientific and administrative positions

The Scientific Director has been at the Institute since 2016 and the Administrative Director since 2021 (see chapter 3 and 6). The co-heads of the research areas and the RDS are

jointly appointed professors at a total of five different universities. Working group heads were selected internally, five of them with a professorial appointment.

In 2023 there will be a leadership change, when the Deputy Scientific Director retires (co-head of research area 2, see chapter 3).

Staff with a doctoral degree

ZALF employees with a doctoral degree include postdocs in the first six years following their doctorate (49 individuals) and senior researchers with permanent roles (25 individuals). It is very good to see that, since 2020, five ZALF researchers have been offered full professorships at higher education institutions.

Through a tenure track system introduced in 2018, ZALF aims to offer scientists long-term career prospects at the institute, which is a welcome development. However, ZALF should make affiliations and decision-making within this complex system more transparent and understandable. Currently, 13 postdocs have a tenure track position at ZALF, of whom five are working group heads. Two candidates have received tenure so far.

Doctoral candidates

At 31 December 2022, 98 doctoral candidates were working at ZALF, of whom 88 were employed in projects and 10 on third-party stipends. Between 2020 and 2022, 40 doctorates were completed. The institute provides an attractive environment for PhD students, including those coming from abroad (39%). The average doctoral period is currently 4.8 years (also as a result of the pandemic). It is good to see that the institute is striving to ensure that ZALF PhD projects are completed within four years.

As recommended at the last evaluation, ZALF has further structured the supervision and promotion of its doctoral candidates, including setting up a doctoral commission, a supervision agreement, an annual workshop, colloquia and mandatory training courses. Doctoral candidates also have the opportunity to take part in training sessions and network activities organised by the Doctoral Certificate Program in Agricultural Economics (HU Berlin) and the Potsdam Graduate School (PoGS).

Science supporting staff

It is good to see that ZALF is involved in vocational training. It offers traineeships for IT specialists in systems integration (one on-going), in office management (three completed) and in public relations, hosted in the PR department (*Volontariat*). In future, ZALF also plans to train digitalization management assistants. Generally, trainees are taken on after they complete their apprenticeships, replacing retiring staff.

Equal opportunities

At the end of 2022, 52% of ZALF employees in research and scientific services were female. Of the 31 leadership roles in this area, 12 were held by women (38%). This means the institute is well on its way to achieving a gender balance. Upcoming retirements will provide opportunities for further improvements.

It is also good to see that there are now several researchers of foreign nationality working at ZALF.

6. Cooperation and environment

ZALF is connected to a number of **universities** through joint appointments to professorships. Because of the specific subject-related requirements, it makes sense to have strategic connections to several different universities, including some outside the region. Three co-heads are professors at Humboldt University Berlin, and three are professors at the University of Potsdam. The other three co-heads are professors at the University of Hannover, Brandenburg University of Technology Cottbus-Senftenberg (BTU), and Eberswalde University for Sustainable Development (HNEE). There are two more jointly appointed professors at working group level who are appointed in collaboration with BTU and HNEE. There is a special professorial appointment agreement for the Scientific Director of ZALF with the University of Bonn. The institute plans to strengthen cooperation with the University of Bonn further in the future. In view of the University of Bonn's strength in research, notably in the agricultural sciences, this will be a worthwhile and profitable connection for ZALF.

ZALF (co)-coordinates and supervises several large **collaborative research and infrastructure projects**, both nationally and internationally, including FAIRagro and the BonaRes Repository (see chapter 2). Another key collaboration project was MACSUR SciPol (2020–2022), an initiative of nine national and international institutions (including Aarhus University, the Thünen Institute and Wageningen University & Research), coordinated by ZALF to establish a European forum for evidence-based policy support. Together with BTU Cottbus, ZALF also leads the BMBF-funded WiR! consortium *Land-Innovation-Lausitz* (LIL), which aims to develop the region of Lausitz, a former lignite mining area, into a model region for adapting land use to climate change.

Since the last evaluation, ZALF has increased its **international visibility** in research significantly and is now a highly recognised partner in its field. It has a particularly close and fruitful collaborative relationship with the National Research Institute for Agriculture, Food and Environment (INRAE) in France. Also worth highlighting is the collaboration with Wageningen University & Research (WUR, the Netherlands), which could be further strengthened at the strategically important, overarching landscape level.

7. Subdivisions of ZALF

Research Area 1: Landscape Functioning

[At 31 December 2022: 65 FTE, of whom 25 FTE research and scientific services staff, 18 FTE doctoral candidates, and 22 FTE science supporting staff]

Research area 1 is ZALF's second largest research subdivision, comprising six working groups. It very successfully conducts basic to application-oriented research on interactions between crop plants, microorganisms and soils, as well as lateral transport processes.

The research area makes a valuable contribution to intensive global carbon research efforts in the area of carbon cycling in eroded croplands, with good handling of multi-scale processes. The researchers have established themselves at the forefront of several fields, including the emerging field of silicon research with the establishment of a new working group. The research area's AgroFlux Sensor Platform with FluxCrane is an internationally unique infrastructure and achieves outstanding results. Also worth mentioning are the landscape experiments on innovative tillage systems, like the "Krumensenke" deep-tillage project, in which technologies and measurements from the 1960s and 1980s are revisited and analysed, and the "CarbonTillage" transfer project, another applied research project for climate mitigation.

This research area is very successful at bringing together natural and life science working groups to generate an integrated landscape-scale research perspective. An example of the productive combination of these approaches is the research area's very good work on wheat microbiota and phytopathogenic fungi. It is good to see that there are plans to continue the work of these groups on hydrology and fungal pathogens. This could be better reflected in the group name, however. It is also good to see that new scientists have been appointed to strengthen existing working groups, both in terms of their subject-matter expertise and in terms of the research area's overall strategic direction. Now it is important to intensify interactions with RA2 and develop more cross-cutting topics.

Research Area 1 raises a remarkably high amount of third-party funding, especially from the DFG. There is potential to secure additional funding at EU level. The subdivision publishes on an internationally highly visible level. Research area 1 is rated "very good to excellent".

Research Area 2: Land Use and Governance

[103 FTE, of whom 45 FTE research and scientific services staff, 24 FTE doctoral candidates, and 34 FTE science supporting staff]

Research area 2 analyses the interactions between land use ecosystems, their services to society, emerging conflicts and the governance of the overall system. The aim is to contribute to the sustainable development of intensively used agricultural landscapes.

This research area is very large, with ten working groups. It is good to see that the many projects and case studies have been grouped into clusters. The *biodiversity* cluster is innovative in the landscape context. It is close in content to Research area 1 and should look for collaboration opportunities with the working group on microbiology based there. The *governance and transformation* cluster pursues innovative and application-oriented projects and there is scope to exploit the potential for synergies on working group level further. The *agricultural land use* cluster is home to one of the most prominent ZALF projects: patchCROP pursues a co-design approach for multifunctional, sustainable crop farming with a farmer-centric focus.

The research area has very good observational data. Innovative impulses come primarily from application-oriented projects, but should be achieved more frequently also in basic research and methodological work. When filling the vacancy in agricultural economics,

particular attention should be paid to expertise in cross-disciplinary development of new methods and theory (see chapter 3).

The research area maintains profitable collaborations, including with the German Centre for Integrative Biodiversity Research (IDiv), Halle-Jena-Leipzig. It is very successful in promoting young researchers and secures high levels of third-party funding, especially from federal ministries (BMEL, BMBF). Recently, it was also very successful at EU level (Horizon 2020, Horizon Europe). The research area should now improve its international visibility through publications and a clearer focus of its research work. Research area 2 is rated “good to very good”.

Research Area 3: Agricultural Landscape Systems

[42 FTE, of whom 25 FTE research and scientific services staff, 13 FTE doctoral candidates, and 3 FTE science supporting staff]

Research area 3 aims at a systemic approach across disciplines and scales in order to develop robust assessments of landscape use. It is dedicated to integrated, primarily future-oriented systems assessment of land use to support decision-making by stakeholders. Projects in the four working groups are grouped into clusters at farm level, regional level, national level and international level. They take up new developments in agriculture (e.g. consumer nexus, self-sufficiency) from an innovative perspective. Worth mentioning is the research on measuring sustainability indicators (e.g. in relation to soil or the water-energy-food nexus), which is carried out in various projects.

An example of an extremely successful link between well-published, interdisciplinary research findings and successful application transfer is the work on carbon farming as an instrument for climate change mitigation. It is good to see that the path to application is set out at an early stage (see impact pathways, chapter 2). As the projects continue to progress, in the future it should be possible to apply this approach even more frequently. The research conducted by the research area covers a broad geographical range (from the Global North to the Global South), now special care should be taken to ensure that the research projects are well related to each other in terms of methodology and content, so that the projects on different regions can benefit one another.

The research area has considerable third-party funding (primarily from the BMBF, but also from the EU). It is good to see that it produces a broad range of different types of publication. The research results are highly visible, which is a particular achievement in view of the interdisciplinary nature of the work. The area is well connected with the other ZALF units and with the institute’s overall research profile. Research Area 3 is rated “very good”.

Research Platform Data Analysis and Simulation (RDS)

[33 FTE, of whom 20 FTE research and scientific services staff, 5 FTE doctoral candidates, and 8 FTE science supporting staff]

RDS develops methods for analysing heterogeneous data and integrating observations, tools and modelling approaches for landscape research. The platform has outstanding

technical infrastructure, which is essential for the research conducted in all research areas. It also provides technical and advisory services (see also chapter 3).

Work is conducted in five research working groups and three service working groups. The groups are relatively small, considering their range of tasks, so the question of critical mass should be considered. Some are still in the process of being established. It is recommended that the research platform analyses its own strengths and develops its research strategy on this basis. For instance, one of the RDS platform's strengths lies in the generation of geospatial data. It is good to see that the group intends to make further advances in method development (multi-scale modelling skills) and in its work in the area of remote sensing. In some areas (e.g. AI), it can make sense to collaborate with strong partners.

The research platform does outstanding work for the two ZALF infrastructure facilities: the BonaRes Repository and the FAIRagro consortium. Also worth highlighting is the work to estimate the impacts of climate change on wheat production (AgMIP) and the platform's contributions in the area of precision farming. Merging research and service tasks is in keeping with the times and leads to a dynamic developmental process. However, this is a challenge for staff. RDS needs to better navigate a clearly identifiable path between service platform and research.

The very good interdisciplinary research of RDS together with the other research areas leads to many joint projects and outcomes. Accordingly, employees are involved in numerous publications. RDS's own research results are currently published primarily in agronomy-related journals. In future, efforts should be made to increasingly reach the academic community beyond this scope, for example by publishing more papers in modelling-related journals. The RDS research platform is rated "very good". It has the potential to become excellent once internal structures are more settled.

8. Handling of recommendations of the last external evaluation

ZALF successfully addressed the recommendations made by the Leibniz Association Senate in 2017 (see Status Report, p. A-20ff).

Appendix

1. Review board

Chair (Member of the Leibniz Senate Evaluation Committee)

Wolfgang Cramer	Institut Méditerranéen de Biodiversité et d'Ecologie Marine et Continentale/IMBE, Aix Marseille Université
------------------------	--

Deputy Chair (Member of the Leibniz Senate Evaluation Committee)

Thiess Büttner	Chair of Public Economics, University of Erlangen-Nürnberg
-----------------------	--

Reviewers

Tommy Dalgaard	Department of Agroecology, Aarhus University
-----------------------	--

Simone Graeff-Hönninger	Department of Agronomy, University of Hohenheim
--------------------------------	---

Christian Henning	Department of Agricultural Economics, University of Kiel
--------------------------	--

Sander Janssen	Earth Informatics, Wageningen Environmental Research, Wageningen UR
-----------------------	---

Margreth Keiler	Department of Geography, University of Innsbruck; Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences
------------------------	---

Thomas Scholten	Chair of Soil Science and Geomorphology, University of Tübingen
------------------------	---

Irmi Seidl	Economics and Social Sciences Research Unit, Swiss Federal Institute for Forest, Snow and Landscape Research WSL
-------------------	--

<i>[cancellation at short notice]</i>	[Biogeochemistry]
---------------------------------------	-------------------

Representative of the federal government (member of the Leibniz Senate Evaluation Committee)

Volker Wiesenthal	Federal Ministry of Education and Research, Berlin
--------------------------	--

Representative of the Länder governments

no participation

13 December 2023

Annex C: Statement of the Institution on the Evaluation Report

**Leibniz Centre for Agricultural Landscape Research,
Müncheberg/Mark (ZALF)**

ZALF thanks the chair, co-chair and all members of the review board as well as the guests and the staff of the Leibniz Association's evaluation office for the thorough evaluation process and review report including the valuable comments and recommendations.

ZALF has undertaken a comprehensive change process of its organisational structure since the last evaluation in 2016. We therefore were very pleased that the review board explicitly acknowledged the success of the change process and considers its progress as outstanding in terms of ZALF's organisation, structure and personnel. It was rewarding to see that our substantial improvements in scientific publications and third-party funding, as well as the development of experimental and data infrastructures and transfer activities, were explicitly high-lighted and applauded together with our Open Science approach.

ZALF's performance across the three Research Areas as well as the Research Platform Data and Simulation has improved considerably since the last evaluation. This upward trend was substantiated by the reviewers through their enumeration of several specific outstanding activities within the research units. We read with great pleasure that activities related to the development of our landscape laboratories (AgroScapeLab Quillow and patchCROP), research data infrastructures (FAIRagro and BonaRes) and the Impact Pathway Explorer, as well as our science communication brand querFELDein have been considered a great success.

We have taken a range of measures to improve our international visibility and position in our research domain since the last evaluation. We were gratified to read that the review board confirmed the significant improvement of our international visibility in research and our role as a highly recognised partner in the field.

Given our ambitions to further strive towards excellence in science, while at the same time improving the relevance and impact of our work, we were very pleased to read that our plans for a strategic extension of ZALF (large extraordinary item of expenditure) was very much welcomed and supported. The development of an Innovation Centre for Agricultural System Transformation (IAT), including living labs in Brandenburg and Hesse, is well underway and will be evaluated separately in January 2024.

We are also pleased that reviewers confirmed that we have addressed all recommendations of the last evaluation well.

Finally, we appreciate the recommendations of the review board to further develop our institute and advance our activities. We will carefully address all recommendations.