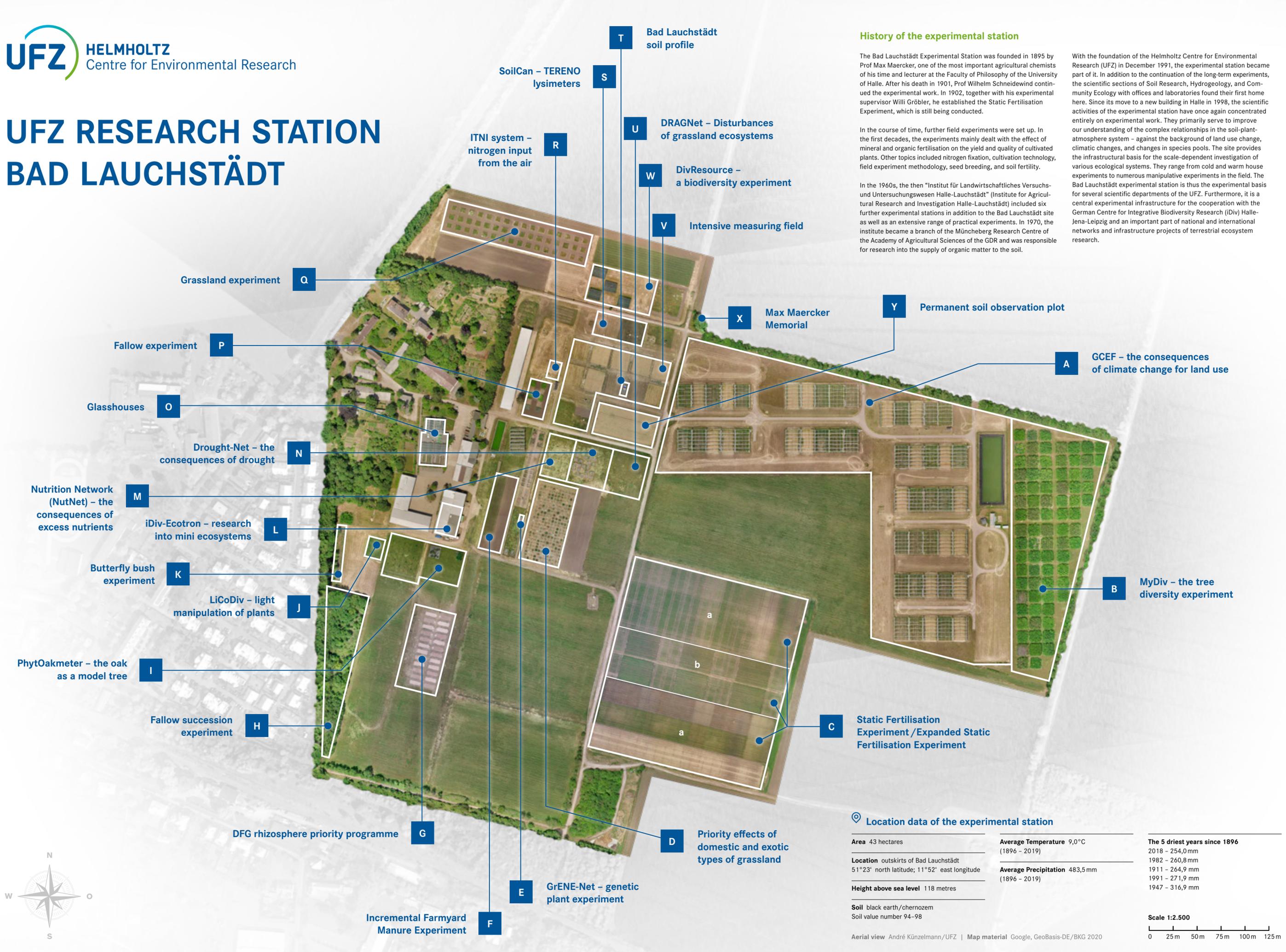


# UFZ RESEARCH STATION BAD LAUCHSTÄDT



## History of the experimental station

The Bad Lauchstädt Experimental Station was founded in 1895 by Prof Max Maercker, one of the most important agricultural chemists of his time and lecturer at the Faculty of Philosophy of the University of Halle. After his death in 1901, Prof Wilhelm Schneidewind continued the experimental work. In 1902, together with his experimental supervisor Willi Gröbler, he established the Static Fertilisation Experiment, which is still being conducted.

In the course of time, further field experiments were set up. In the first decades, the experiments mainly dealt with the effect of mineral and organic fertilisation on the yield and quality of cultivated plants. Other topics included nitrogen fixation, cultivation technology, field experiment methodology, seed breeding, and soil fertility.

In the 1960s, the then "Institut für Landwirtschaftliches Versuchs- und Untersuchungswesen Halle-Lauchstädt" (Institute for Agricultural Research and Investigation Halle-Lauchstädt) included six further experimental stations in addition to the Bad Lauchstädt site as well as an extensive range of practical experiments. In 1970, the institute became a branch of the Müncheberg Research Centre of the Academy of Agricultural Sciences of the GDR and was responsible for research into the supply of organic matter to the soil.

With the foundation of the Helmholtz Centre for Environmental Research (UFZ) in December 1991, the experimental station became part of it. In addition to the continuation of the long-term experiments, the scientific sections of Soil Research, Hydrogeology, and Community Ecology with offices and laboratories found their first home here. Since its move to a new building in Halle in 1998, the scientific activities of the experimental station have once again concentrated entirely on experimental work. They primarily serve to improve our understanding of the complex relationships in the soil-plant-atmosphere system – against the background of land use change, climatic changes, and changes in species pools. The site provides the infrastructural basis for the scale-dependent investigation of various ecological systems. They range from cold and warm house experiments to numerous manipulative experiments in the field. The Bad Lauchstädt experimental station is thus the experimental basis for several scientific departments of the UFZ. Furthermore, it is a central experimental infrastructure for the cooperation with the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig and an important part of national and international networks and infrastructure projects of terrestrial ecosystem research.

## Location data of the experimental station

<b>Area</b> 43 hectares	<b>Average Temperature</b> 9,0°C (1896 – 2019)	<b>The 5 driest years since 1896</b>
<b>Location</b> outskirts of Bad Lauchstädt 51°23' north latitude; 11°52' east longitude	<b>Average Precipitation</b> 483,5 mm (1896 – 2019)	2018 – 254,0 mm
<b>Height above sea level</b> 118 metres		1982 – 260,8 mm
<b>Soil</b> black earth/chernozem Soil value number 94–98		1911 – 264,9 mm
		1991 – 271,9 mm
		1947 – 316,9 mm





### GCEF – the consequences of climate change for land use

At the Global Change Experimental Facility (GCEF), researchers are investigating how climate change affects ecosystem processes in different land use scenarios. It consists of 50 plots which are cultivated with different degrees of intensity. For half the experimental fields, the scientists simulate climate conditions corresponding to the forecasts for central Germany around the year 2070. On the other half, the crops are grown under currently prevailing weather conditions.

<b>Duration</b> 2014 until at least 2029	<b>Area</b> around 7 ha
<b>Contact</b> Dr Martin Schädler, UFZ, martin.schaedler@ufz.de	<b>Web</b> www.ufz.de/gcef



### MyDiv – the tree diversity experiment

In this experiment, the contribution of mycorrhizal fungi to the relationship between the diversity of tree species and ecosystem functions is being investigated on 80 experimental plots. Mycorrhiza is an important form of symbiosis that occurs between plants and fungi in the soil. The researchers assume that tree stands with high species diversity and the presence of functionally dissimilar mycorrhizal types can use resources more efficiently than monocultures with only one mycorrhizal type.

<b>Duration</b> since 2015	<b>Area</b> around 2 ha
<b>Contact</b> Prof Nico Eisenhauer, iDiv/ Uni Leipzig, nico.eisenhauer@idiv.de	<b>Web</b> www.idiv.de/de/research/platforms-and-networks/mydiv.html



### (Expanded) Static Fertilisation Experiment

The essence of this experiment is the consistent treatment of cultivated fields with organic and mineral fertilisers (different combinations of N, P, K) over the course of decades – following the crop rotation of winter wheat – silage maize – spring barley – silage maize (until 2014, winter wheat – sugar beet – spring barley – potatoes). On a quarter of the experimental plots, fertilisation was changed in 1978 so that the influence of organic and mineral fertilisation on crops and on soil fertility could be determined based on an experimentally fixed carbon content in the soil. This configuration is particularly important for modelling carbon and nitrogen dynamics in the soil.

<b>Duration</b> since 1902 (expanded since 1978)	<b>Area</b> 4 ha
<b>Contact</b> Dr Ines Merbach, UFZ, ines.merbach@ufz.de	<b>Web</b> www.ufz.de/index.php?en=37010



### Priority effects of domestic and exotic types of grassland

Using six native and six exotic plant species, the experiment examines whether exotic species have a stronger priority effect in grassland than native species, and what role fungal diseases play in this process. Species that colonise a location first can have a long-term influence on the biological community. This priority effect could be a mechanism which invasive exotic species use to influence native ecosystems.

<b>Duration</b> 2016 until at least 2021	<b>Contact</b> Dr Harald Auge, UFZ, harald.auge@ufz.de
<b>Area</b> around 4.000 m <sup>2</sup>	



### GrENE-Net – genetic plant experiment

In the GrENE-net evolution experiment, researchers are investigating which of the 231 ecotypes of mouse-ear cress (*Arabidopsis thaliana*) thrive best in which situations under which climatic conditions since 2017 at different sites around the world. 45 research stations in Europe, North America and Asia are taking part in the experiment, including the UFZ research station in Bad Lauchstädt.

<b>Duration</b> 2017 until at least 2020	<b>Area</b> 16 m <sup>2</sup>
<b>Contact</b> Dr Walter Durka, UFZ, walter.durka@ufz.de	<b>Web</b> grenenet.wordpress.com/news



### Incremental Farmyard Manure Experiment

This experiment investigates the long-term effect of extremely high doses of farmyard manure on yield and soil properties. Between zero and 200t/ha of farmyard manure is applied to a fallow plot and a maize monoculture plot. The experiment is particularly important for modelling carbon and nitrogen dynamics and for questions of fundamental research on organic carbon in the soil.

<b>Duration</b> since 1983	<b>Area</b> 780 m <sup>2</sup>
<b>Contact</b> Dr Ines Merbach, UFZ, ines.merbach@ufz.de	<b>Web</b> www.ufz.de/stallmist-steigerungsversuch



### DFG rhizosphere priority programme

The “Rhizosphere Spatiotemporal Organisation” priority programme of the German Research Foundation (DFG) is investigating the contribution of rhizosphere processes to the stability of agro-ecosystems. For this purpose, 24 parcels of land in Bad Lauchstädt have been set aside and filled with loamy and sandy soil. Two maize genotypes with different root characteristics are grown on them. The researchers want to prove that the rhizosphere is a self-organising system and stable against disturbances.

<b>Duration</b> 2018, probably until 2024	<b>Area</b> around 4.000 m <sup>2</sup>
<b>Contact</b> Prof Doris Vetterlein, UFZ, doris.vetterlein@ufz.de	<b>Web</b> www.ufz.de/spp-rhizosphere



### Fallow succession experiment

Here the researchers are investigating whether the different starting points or the different gene pools at the beginning of putting arable land to fallow influences the subsequent development of vegetation. Depending on the time of year (spring, summer, autumn), fallow succession starts with a different set of species, because these are very different in their germination ecology and are influenced by parameters such as day length, temperature or precipitation.

<b>Duration</b> since 1995	<b>Contact</b> Dr Jutta Stadler, UFZ, jutta.stadler@ufz.de
<b>Area</b> around 1 ha	



### PhytOakmeter – the oak as a model tree

This project focuses on research on how long-living forest trees adjust to climate change. Genetically identical common oak trees propagated *in vitro* from the same mother plant have been planted on 20 sites throughout Europe. With their international partners, the researchers are measuring morphological, physiological and molecular processes. They are trying to understand how oaks share their resources between growth and interactions with beneficial species and pests under different climatic conditions.

<b>Duration</b> since 2010	<b>Area</b> around 1.600 m <sup>2</sup>
<b>Contact</b> Dr Sylvie Herrmann, UFZ, sylvie.herrmann@ufz.de	<b>Web</b> www.ufz.de/trophinoak-phytoakmeter



### LiCoDiv – light manipulation of plants

LiCoDiv (light competition and diversity) is an experiment in which traditional and new methods of light manipulation and their effects on abiotic factors and plant growth are compared. Competition for light as an essential resource for plant growth can play a decisive role in the loss of biodiversity through over-fertilisation. The effects of cutting back, tie backs and LED lamps are being investigated on 56 plots, of which half are fertilised.

<b>Duration</b> 2018 until at least 2020	<b>Contact</b> Maria-Theresa Jessen, UFZ/ iDiv, maria-theresa.jessen@ufz.de
<b>Area</b> around 75 m <sup>2</sup>	



### Butterfly bush experiment

In this experimental garden, the butterfly bush, which has migrated from China to Europe, is used to learn more about the mechanisms of biological invasions. It is hypothesised that evolutionary adaptation contributes to the invasion success of exotic species, so that the lack of natural predators leads to stronger growth, a greater competitive edge and worse defences against insects. Butterfly bush specimens from ten populations each from China and Europe respectively are compared.

<b>Duration</b> 2009 until at least 2021	<b>Contact</b> Dr Harald Auge, UFZ, harald.auge@ufz.de
<b>Area</b> around 300 m <sup>2</sup>	



### iDiv-Ecotron – research into mini ecosystems

The iDiv Ecotron is a joint research platform of the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig and the Helmholtz Centre for Environmental Research (UFZ). It houses 24 miniature ecosystems in which environmental conditions like temperature, nutrient supply and precipitation are fully controlled and ecological processes can be measured. The objective is to study the effects on ecosystem functions more accurately through this manipulation of the interactions between flora and fauna.

<b>Duration</b> since 2017	<b>Area</b> 580 m <sup>2</sup>
<b>Contact</b> Prof Nico Eisenhauer, iDiv/ Uni Leipzig, nico.eisenhauer@idiv.de	<b>Web</b> www.idiv.de/ecotron



### Nutrition Network (NutNet) – the consequences of excess nutrients

This worldwide network of more than 100 sites on six continents addresses the loss of biodiversity based on the example of grassland ecosystems. The researchers investigate how natural grassland worldwide reacts to nutrient excesses using a standardised experimental design. The network covers the majority of the world’s climate zones with experimental stations in 27 countries, including one in Bad Lauchstädt.

<b>Duration</b> since 2005	<b>Area</b> 1.000 m <sup>2</sup>
<b>Contact</b> Prof Stan Harpole, UFZ/iDiv, stan.harpole@ufz.de	<b>Web</b> www.ufz.de/nutnet



### Drought-Net – the consequences of drought

This research network with more than 100 stations worldwide seeks to investigate how and why ecosystems vary in their sensitivity to drought. For this reason, precipitation on the experimental plots is always manipulated to meet the same protocol. The 25 experimental plots in Bad Lauchstädt are subjected not only to extreme drought but also to excess nutrients in order to evaluate the interaction of these two factors on various surface and underground ecosystem processes.

<b>Duration</b> 2015 until at least 2021	<b>Contact</b> Prof Nico Eisenhauer, iDiv/Uni Leipzig, Dr Harald Auge, UFZ, nico.eisenhauer@idiv.de, harald.auge@ufz.de
<b>Area</b> around 600 m <sup>2</sup>	
<b>Web</b> www.ufz.de/droughtnet	



### Glasshouses

The glasshouse complex consists of one cold house and one hothouse as well as an experimental building between the two. The cold house erected in 1994 provides more or less outdoor conditions over a surface of 360 m<sup>2</sup>, as the roofs are only closed in rainy weather and the side windows only in strong winds. The hothouse built in 2000 consists of eight cabins in which temperature and lighting can be separately controlled. The cold house and hothouse are used in particular for pot experiments in undergraduate, masters and doctoral work. Additionally, plants for field experiments are also often being raised. In the experimental building, the pot experiments are prepared and evaluated, and thousands of plant samples are dried.



### Fallow experiment

The key question of this experiment is how different fallow types affect soil characteristics. Three types of bare fallow are investigated – mechanical fallow, herbicide fallow, and the combination of both – as well as a succession fallow repeated four times.

<b>Duration</b> since 1988	<b>Contact</b> Dr Ines Merbach, UFZ, ines.merbach@ufz.de
<b>Area</b> 672 m <sup>2</sup>	



### Grassland experiment

The significance of the origin of seed for the development of the vegetation is to the research focus of this experiment. With this in mind, the researchers sowed artificial meadow systems with an identical species inventory on a formerly fallow plot, in which the origin of the species in the experimental plots is different. Thus, there is seed from the immediate environment, from outside the region, and from various other countries. This should answer the question as to how far local adaptations influence the development of vegetation, primary production and resistance of the meadow system.

<b>Duration</b> since 2014	<b>Contact</b> Dr Jutta Stadler, UFZ, jutta.stadler@ufz.de
<b>Area</b> around 1 ha	



### ITNI system – nitrogen input from the air

Using the Integrated Total Nitrogen Input (ITNI) system, researchers determine the total nitrogen input from the atmosphere including the nitrogen directly taken up by the plants (in the experiment, winter rye and maize). In the experimental protocol, nitrogen-free quartz sand is marked with the stable isotope 15N. The nitrogen originating from the air leads to the dilution of this tracer, on the basis of which the nitrogen input is calculated. Using this method, a nitrogen input of between 50 and 75 kg/hectare/year was determined.

<b>Duration</b> since 1996	<b>Contact</b> Prof Hans-Jörg Vogel, UFZ, hans-joerg.vogel@ufz.de
<b>Area</b> 4 pots	



### SoilCan – TERENO lysimeters

In the four TERENO observatories, almost 140 lysimeters that were technically identical in design were installed at 13 sites. They serve to research the functions of soil in water and materials circulation under climate change conditions. In Bad Lauchstädt, a total of 18 lysimeters were set up and filled with soil from different regions of Germany. Water and material flows are recorded on the soil surface and in the direction of the groundwater.

<b>Duration</b> 2010 until at least 2025	<b>Extent</b> 18 lysimeters
<b>Contact</b> Prof Hans-Jörg Vogel, UFZ, hans-joerg.vogel@ufz.de	<b>Web</b> www.tereno.net



### Bad Lauchstädt soil profile

A soil profile is a vertical section through a soil mass, with which the various soil layers, the soil type and other soil parameters can be determined. The new soil profile in Bad Lauchstädt was created in 2018. It shows the black earth which, on account of its powerful dark brown to black humus-rich topsoil, is among the most fertile soils on earth. It is mainly used for teaching and training.

<b>Contact</b> Dr Ines Merbach, UFZ, ines.merbach@ufz.de	<b>Web</b> www.ufz.de/bodenprofil
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### DRAGNet – Disturbances of grassland

The DRAGNet (Disturbance and Resources Across Global Grasslands) network consists of 48 sites on six continents. Building on the NutNet global network, it examines the interactions between two omnipresent global changes by which grassland ecosystems are particularly affected: land-use changes and fertiliser inputs.

<b>Duration</b> 2019 until at least 2029	<b>Area</b> 1.000 m <sup>2</sup>
<b>Contact</b> Prof Stan Harpole, UFZ/iDiv, stan.harpole@ufz.de	<b>Web</b> nutnet.org/dragnet



### Intensive measuring field

The intensive measuring field consists of differently managed plots (e.g. arable farming, fallow, green manure), on which soil and plant characteristics are recorded as basic data to validate agro-ecosystem models. The original experiment with 64 plots was changed in 2013 and reduced to 12 plots. The measurements taken there now focus on changes in soil temperature and soil water content at different depths.

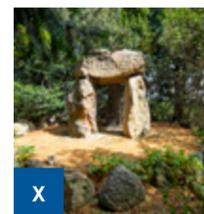
<b>Duration</b> since 1997	<b>Area</b> since 2013 around 9.000 m <sup>2</sup>
<b>Contact</b> Dr Uwe Franko, UFZ, uwe.franko@ufz.de	<b>Web</b> www.ufz.de/intensivmessfeld



### DivResource – a biodiversity experiment

This experiment investigates whether the relationships between plant diversity and ecosystem processes are determined by the availability of resources. The researchers therefore vary the plant diversity (plots with one, two or four plant species) and the resource availability (light through shading, nutrients through fertilising). Since 2019, the experimental plots have been arranged in a so-called split plot design in order to investigate the change in the species communities due to the immigration of new plant species.

<b>Duration</b> 2011 until at least 2022	<b>Area</b> around 4.000 m <sup>2</sup>
<b>Contact</b> PD Dr Christiane Roscher, UFZ/iDiv, christiane.roscher@ufz.de	<b>Web</b> www.ufz.de/divresource



### Max Maercker Memorial

This celebrates the founder of the experimental station, Prof Max Maercker. Born in 1842 in Calbe (Saale), he studied chemistry in Greifswald and Tübingen. He became head of the experimental station in 1871, and was later appointed Professor of Agricultural Chemistry and Physiological Chemistry at the University of Halle. Maercker had a reputation for being a practical researcher. Delivering more than 1,000 lectures at farming clubs and institutions, he made a name for himself as the 'Farming Professor'. During his 30 years at the experimental station, he developed it into one of the most important agricultural research sites in Germany. Maercker died in 1901 in Gießen.



### Permanent soil observation plot

On the permanent soil observation plot, researchers investigate changes in the physical, chemical and biological condition of soils. To do so, they take plant and soil samples, analyse the soil zoology and conduct vegetation surveys. They also analyse the soil's physical parameters. The experiment thus forms an important basis for preventive soil protection.

<b>Duration</b> since 2002	<b>Contact</b> Landesamt für Umweltschutz Sachsen-Anhalt
<b>Area</b> 2.800 m <sup>2</sup>	