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MAGAZINE OF THE LEIBNIZ CENTRE FOR
AGRICULTURAL LANDSCAPE RESEARCH (ZALF)

TITLE STORY

NATURE CONSERVATION GOES ONLINE

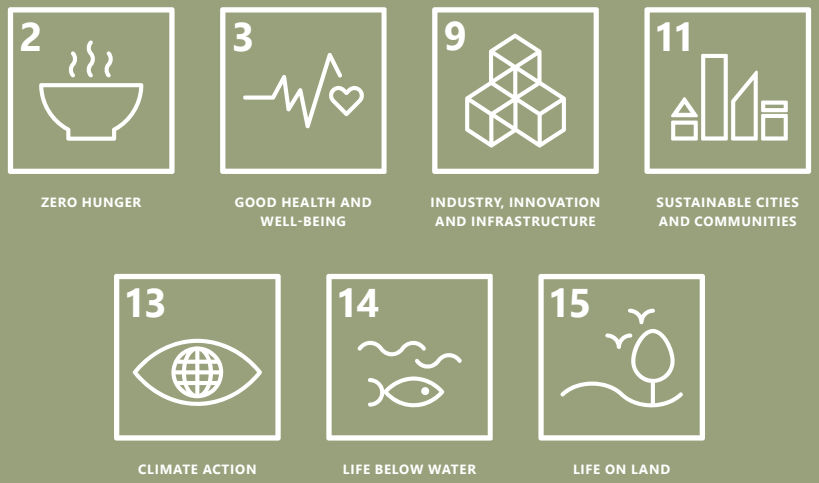
SUSTAINABLE DEVELOPMENT GOALS

17 »Sustainable Development Goals« are the centerpiece of the Agenda 2030, approved in 2015 by the United Nations (UN). The Agenda lays a foundation for global economic development in accordance with social justice and within the ecological boundaries of planet earth.

MORE INFO

https://sustainabledevelopment.un.org/sdgs

The research projects presented in this issue address the following Sustainable Development Goals:



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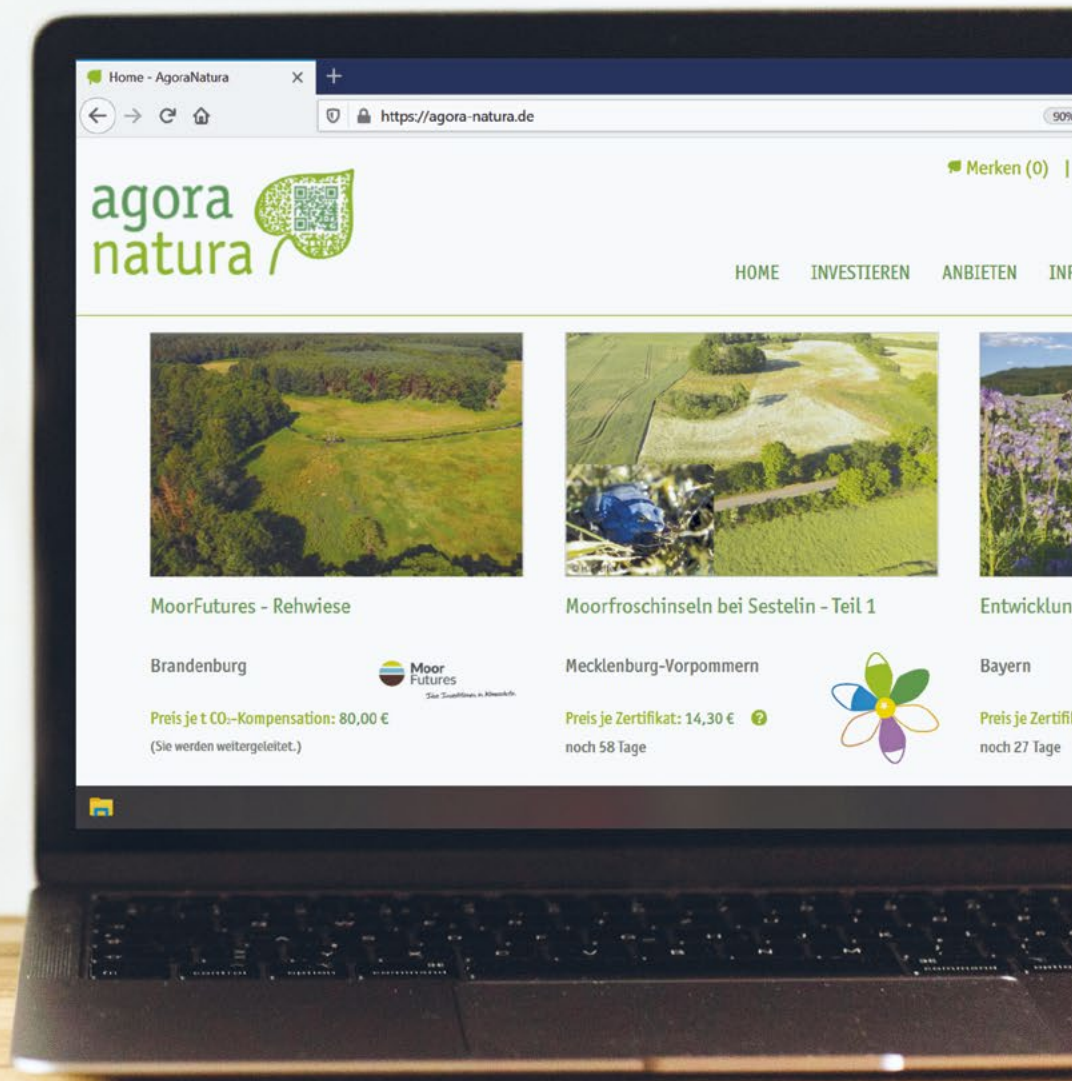
TITLE STORY

NATURE CONSERVATION GOES ONLINE

Most people think nature conservation is important and want to get involved. But only a few of them support projects financially. With »AgoraNatura«, a team of scientists, nature conservationists and farmers pursue a new approach to get more people interested in financially supporting nature conservation: Via the online marketplace www.agora-natura.de people can now invest in certified conservation projects. A newly created, scientifically tested nature conservation standard, regional projects with verifiable impacts and a great emphasis on transparency make it easier for private individuals and companies to contribute to environmental protection.



Lamb's Succory doesn't look like much: from June to September, it displays its small yellow flower heads, emerging from the ground on thin stems. Preferably on sunny waysides and in fields, Lamb's Succory grows on sandy, nutrient-poor soils. It is this frugality that makes it harder for this species to survive nowadays: The use of fertilizers in agriculture is increasingly harming the delicate plant. Nationwide, the species is highly endangered and in some federal states it is even threatened with extinction.

However, it can still be found in Matthias Prüfer's fields in the Prignitz region. Prüfer carries out nature conservation measures to ensure that it stays that way. On one hectare of land, Prüfer now farms entirely without synthetic chemical pesticides and fertilizers, and with greater spacing between grain rows. In this environment, Lamb's Succory can survive.

By doing this, Mr. Prüfer is not only taking responsibility for an endangered plant species. He also protects the groundwater and promotes insects and other wild animal species. At the same time, his project site will generate less yield and income. However, the farmer is not left to deal with this situation alone but instead receives financial compensation. That is because his field is a pioneer project of the AgoraNatura research project. Supported by the German Federal Ministry of Education and Research, researchers are working with stakeholders from agriculture and nature conservation to develop

For project leader Prof. Bettina Matzdorf (left) and Carolin Biedermann (right), AgoraNatura is also a means to study the financial commitments of citizens and companies to nature conservation.

an online marketplace for certified nature conservation projects. Thanks to AgoraNatura, farmer Prüfer and the regional energy supplier WEMAG AG have joined forces. The company now finances the conservation area. »We harness the benefits of online marketplaces for nature conservation«, says project leader Prof. Bettina Matzdorf from the Leibniz Centre for Agricultural Landscape Research (ZALF), describing AgoraNatura's main objective. In addition to ZALF, the University of Greifswald, the Environmental Action Germany (DUH) and the German Association for Landcare (DVL) are also involved. With just a few clicks, anyone can purchase shares of a nature conservation project of their choice and receive so-called nature conservation certificates in return. Each certificate is used to finance the implementation of the project on 100 square meters of land.

THOSE WHO SEE RESULTS ARE MORE LIKELY TO INVEST

The name tells the story: »Agora« is a Greek word and means »meeting place«. »This is where people come together, exchange ideas and have a say«, explains Matzdorf. On the one side are the providers of the nature conservation projects: people from agriculture and forestry, environmental organisations or landscape conservation associations who develop the measures. On the other side are the people and companies who want to get involved. Project manager Carolin Biedermann knows the »classic donor clientele«: people over 60 who donate over a long period of time and often to the same organisations. The problem, however, is that their numbers are declining and there is a lack of new donors, explains Biedermann. »Many people think nature conservation is important. But when they are asked for financial support, the majority is hesitant.« To find out why, the researchers asked citizens and companies about their attitudes towards nature conservation and a potential financial involvement. The results show that people especially get financially involved when a specific problem is identified, and they can see how and where their money is making an impact — a mechanism that is already well known from psychology as the »self-efficacy experience«. This is another reason why AgoraNatura focuses on regional projects with well-described objectives that are visible to local people: whether it is the species-rich orchard next door, the flowering area that attracts insects ten minutes away, or the extensive field with lots of wild herbs in the neighboring village. »Especially for companies that have an environmentally conscious clientele and workforce, regional commitment can mean added value«, emphasizes Matzdorf.

NEW STANDARDS AND BETTER VISIBILITY

The researchers also found that many people are unaware that an intact environment is made up of a variety of ecosystem services. Insect protection alone is often not enough. As in the case of Matthias Prüfer's Lamb's Succory project, AgoraNatura therefore provides detailed information: Do the measures on site result in more animal and plant diversity, cleaner water, or reduced greenhouse gas emissions? Almost always, several aspects of nature conservation are addressed at the same time, and everyone can support precisely those projects, whose goals seem particularly important to them.

For greater transparency and security, the researchers developed a new standard for the certification of projects, each of which is assessed according to predefined criteria. The »NaturPlus« standard describes, among other things, how the projects are to be planned and how the set goals are to be verified. Only projects meeting this standard are offered on the AgoraNatura platform. »This transparently shows what happens to the money and which services are provided with it«, adds Biedermann.

On AgoraNatura, interested parties can now support, for example, the Landcare Association Uckermark-Schorfheide. They plan to create a feeding area for the Lesser Spotted Eagle, the Red kite and the Black kite near Karlsberg. These birds are among those that are losing out against an intensified agriculture. They cannot find food on rapeseed or corn fields. Now, the land management is to be changed on an area of 16 hectares: Instead of cereals and oilseed rape, lucerne and legume-grass are to be grown as fodder. Mowing will only take place on parts of the field to promote mice and small mammals, which are the main food source for birds of prey. At the same time, the surrounding water bodies will benefit because the area is no longer fertilized.

It's examples like these, that are meant to expand and complement current nature conservation funding. »I can tackle nature conservation issues that are important to me close to my home and experience the impact of the projects«, explains Biedermann. This is because regular progress reports for all projects are provided on AgoraNatura.

After five years of research, the AgoraNatura marketplace is now going online. »Research and implementation have worked hand in hand«, says Carolin Biedermann. This linkage, she says, has been a great opportunity but at the same time also a challenge. Many different stakeholders with many different experiences and needs had to be reconciled, and the research results had to be processed and translated so that they could be incorporated into the marketplace.

Targeted donations from committed citizens or environmentally aware companies can support projects like this one in the Ferbitzer Bruch near Fahrland in Brandenburg.

With its launch, though, the research is far from being completed. Beyond the questionnaires and statements of intent, researchers can now observe what is actually happening. »There is little sound data on the financial commitments of citizens and companies—especially in the context of nature conservation«, explains Biedermann. Using the data from the online marketplace, the research

Farming without synthetic chemical pesticides and fertilizers protects not only plant species, but also groundwater, insects and other wildlife.

team will generate further knowledge about what makes projects particularly attractive, how providers and investors communicate with each other, when the willingness to support increases, and what might be the obstacles. Conversely, the data can reveal which conservation goals are unlikely to attract private donors so that funding through governmental instruments is of particular importance. The problem of soil erosion, for example, could be more difficult to convey than the protection of birds of prey.

Five pilot projects were already financed before the official launch of the online marketplace. These include Farmer Prüfer's Lamb's Succory field. Annual monitoring of the area shows that the project is successful: the plant is growing and spreading. However, not only Lamb's Succory benefits from the less intensive agriculture. Other common plant species of agricultural fields as well as breeding birds have established on the site. »Nature conservation should also benefit from the boom in online marketplaces«, says Biedermann, looking to the future.

Text: Heike Kampe

GONE WITH THE WIND

Wind creates change, moves waves and clouds, and shapes entire landscapes. We are happy about a fresh sea breeze blowing on a hot day at the beach and children flying their kites. Wind can transport many things, from the tiniest speck of dust to a glider—and sometimes also »stowaways«. These include, for example, bacteria found in fertilizer and stirred up by tillage. A research team has now taken a closer look at the spread of antibiotic-resistant germs in agriculture.

The first antibiotic came onto the market in 1942. Penicillin was considered a miracle cure for bacterial infections. Less than 100 years later, antibiotic-resistant germs are now a great cause for concern. Due to the excessive use of antibiotics in humans and animals, some bacteria became resistant to antibiotics. Their effectiveness continues to decline and more people are dying from infections with these germs. Researchers are therefore looking for new drugs to combat them. At the same time, we need to better understand how these bacteria spread.

Antibiotics are used in animal husbandry to prevent outbreaks of disease as production increases to meet the growing global demand for meat. When humans consume products from animals treated with antibiotics, they also ingest their residues. Researchers at the Leibniz Centre for Agricultural Landscape Research (ZALF) are interested in the extent to which we also come into contact with antibiotic-resistant germs through the manure used as agricultural fertilizer.

The meteorologist Steffen Münch has taken up this topic. He has been conducting research at ZALF for more than three years, currently in the »SOARiAL« project funded by the Leibniz Association. How did he get involved in agricultural landscape research? »In meteorology, the so-called atmospheric boundary layer is the crucial layer responsible for transporting the smallest particles and bacteria from the Earth's surface into the atmosphere«, explains the scientist. »During my studies, I started to look at such particles, and these also primarily include those released from arable soils.« In the project, four Leibniz institutes and the Free University of Berlin are jointly investigating the spread of antibiotic-resistant germs in agricultural landscapes. The focus is on the wind-driven »atmospheric transport pathway«.

CRITICAL PHASES IN FIELD WORK

It is certain that antibiotic-resistant germs can survive in both the meat and the manure of the animals. The multiresistant pathogens were detected by the researchers for example in chicken coops. But the excrements of pigs, cows and other animals are also used as organic fertilizers in agriculture. The researchers see a variety of risks. »We identified four phases in which there is a risk of surviving bacteria being transported, for example, through the air into the environment«, Münch says. The first critical phase is the storage of the manure. How long can the antibiotic-resistant germs survive here? The spreading of the manure on the fields is another critical phase, because

The drier the fertilizer that is spread on the field, the more fine dust is released.

STEFFEN MÜNCH

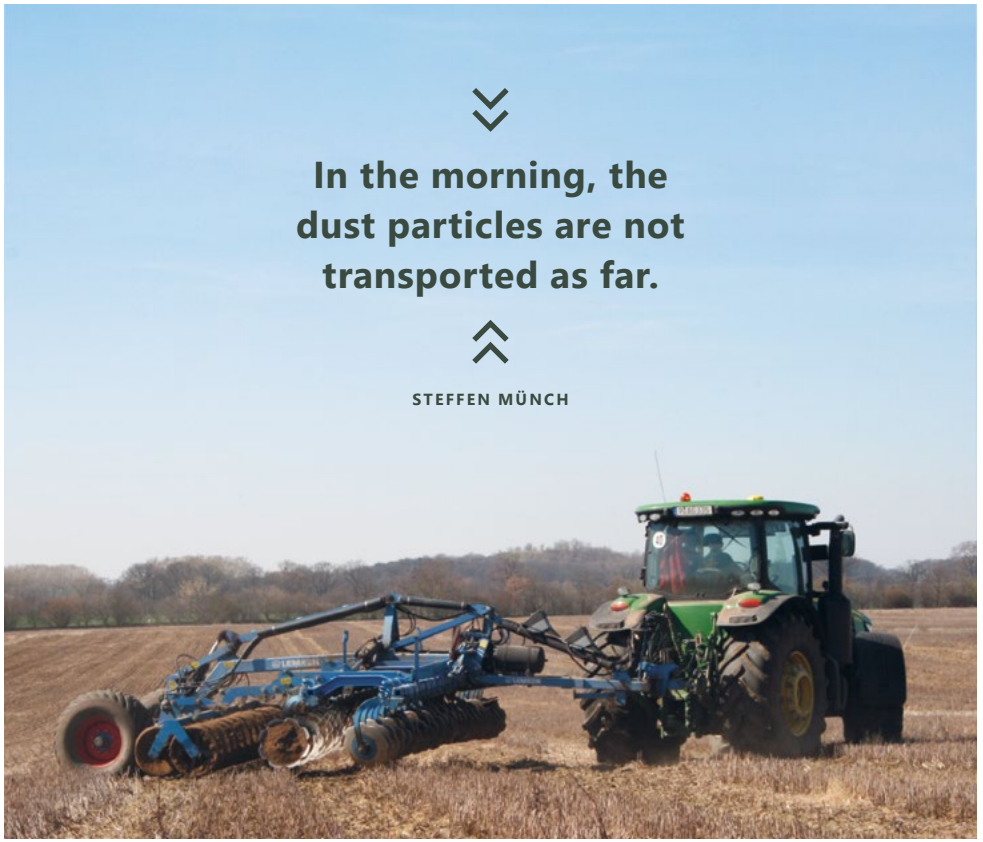
it creates a lot of dust, especially when the manure is well dried. Bacteria, in turn—and that means all of them, regardless of whether they are antibiotic-resistant or not—like to use these dust particles as carriers in order to be able to travel longer distances. Once the fertilizer has been spread onto the field, it must be incorporated into the soil. This procedure once again produces dust emissions, making it the third critical phase. If the field remains bare after fertilizer application because the plants do not grow immediately, wind erosion may occur, particularly on sandy soils. Medium to strong winds can remove and carry away the lightest soil particles—another critical phase.

Particularly the field workers and the neighboring communities are exposed to the dust clouds during these work steps and thus to an increased risk of inhaling these tiny dust particles—and therefore possibly also the antibiotic-resistant germs.

WHAT IF?

Using computer simulations, the project team discovered that the dust generated during fertilizer application in Muencheberg, Brandenburg, could theoretically be transported as far as the Black Sea—more than 1.500 kilometers away.

During field trials in Potsdam (top) and Müncheberg (left), the dust released during fertilizer application and incorporation was measured. In ZALF's wind tunnel, Steffen Münch investigates the influence of fertilizer on wind erosion under controlled conditions (bottom).



How far this dust can actually be transported depends on the time of day, along with other factors: »At night, a barrier layer is forming in the atmosphere. You can imagine this as a kind of lid that prevents air cirulcation. In the morning, this barrier layer is still active and the dust particles are not transported as far«, Münch explains. The morning hours are therefore the optimal time to apply and incorporate the fertilizers.

ALL-CLEAR

After 36 months of research, the final results are now available. The scientists can give an all-clear for the investigated 9.3-hectare field site. It is true that antibiotic-resistant bacteria were still found in the chicken coop. But

contamination with antibiotic-resistant germs was neither detected in the manure stored for up to four weeks nor in the dust clouds. The soil into which the fertilizer was incorporated also remained free of contamination with multiresistant pathogens.

»Bacteria like moisture—especially moist heat. It is thus advisable for fresh fertilizer to be dried first before it's spread on the field«, Münch explains. Does this mean that there is an easy solution? The fertilizer just needs to be completely dried? Not quite: »The drier the fertilizer that is spread onto the field, the more fine dust is released. Fine dust is also harmful to health and, after all, the fertilizer should remain on the field rather than swirling through the air as fine dust. The ideal solution would therefore be to dry it with hot air and then remoisten it. But this is very cost-intensive and time-consuming and difficult to implement in practice«, Münch knows.

In addition to the moisture content, the storage duration of the chicken manure is another crucial factor for the survival of antibiotic-resistant bacteria. »Our results show that antibiotic-resistant bacteria in manure are no longer viable after only three to five days of storage«, Münch says. In addition, his team also examined pig manure. After drying, its emission behavior resembles that of chicken manure. However, compared to chicken manure, pig manure typically has a higher moisture content and thus requires more drying to achieve the same reduction in pathogenic germs.

»In our trials, we did not observe that antibiotic-resistant bacteria were transported through wind erosion. The soil fertilized with manure was also free of antibiotic-resistant bacteria«, Münch concludes.

Text: Julia Lidauer

WIND EROSION

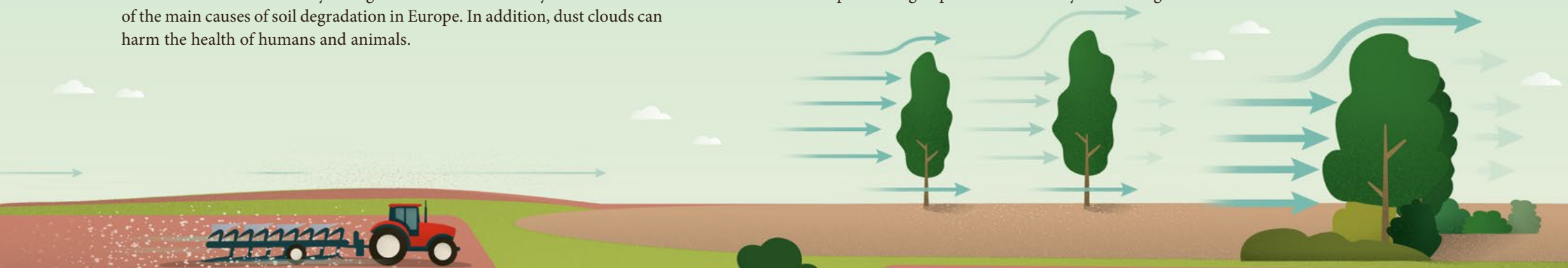
Wind and field work using machines lead to dust emissions on our fields. Light soil components, such as clay and humus particles, are most easily lifted and carried away. But particularly these particles contain nutrients and are thus most valuable for soil fertility. This gradual decline in fertility has become one of the main causes of soil degradation in Europe. In addition, dust clouds can harm the health of humans and animals.

WIND EROSION

Trees and hedges in the landscape provide wind protection

The more and the denser trees and hedges grow along the edges of fields, the better they can protect against wind. Simple tree rows do not necessarily prevent high-speed winds directly above the ground.

Tree rows lined with hedges are ideal.



How far are the airborne soil particles transported?

Sand: Is only whirled up close to the ground and transported no farther than to the edge of the field or the next hedge, etc.

Silt + humus particles: Are sometimes displaced over several kilometers from the dust source, where they also measurably reduce air quality.

Clay + soil micro-organisms: Are transported high into the atmosphere, where they are sometimes dislocated over thousands of kilometers.

Sparse ground cover makes soils more prone to wind erosion.

Bare ground
is most vulnerable to wind erosion.

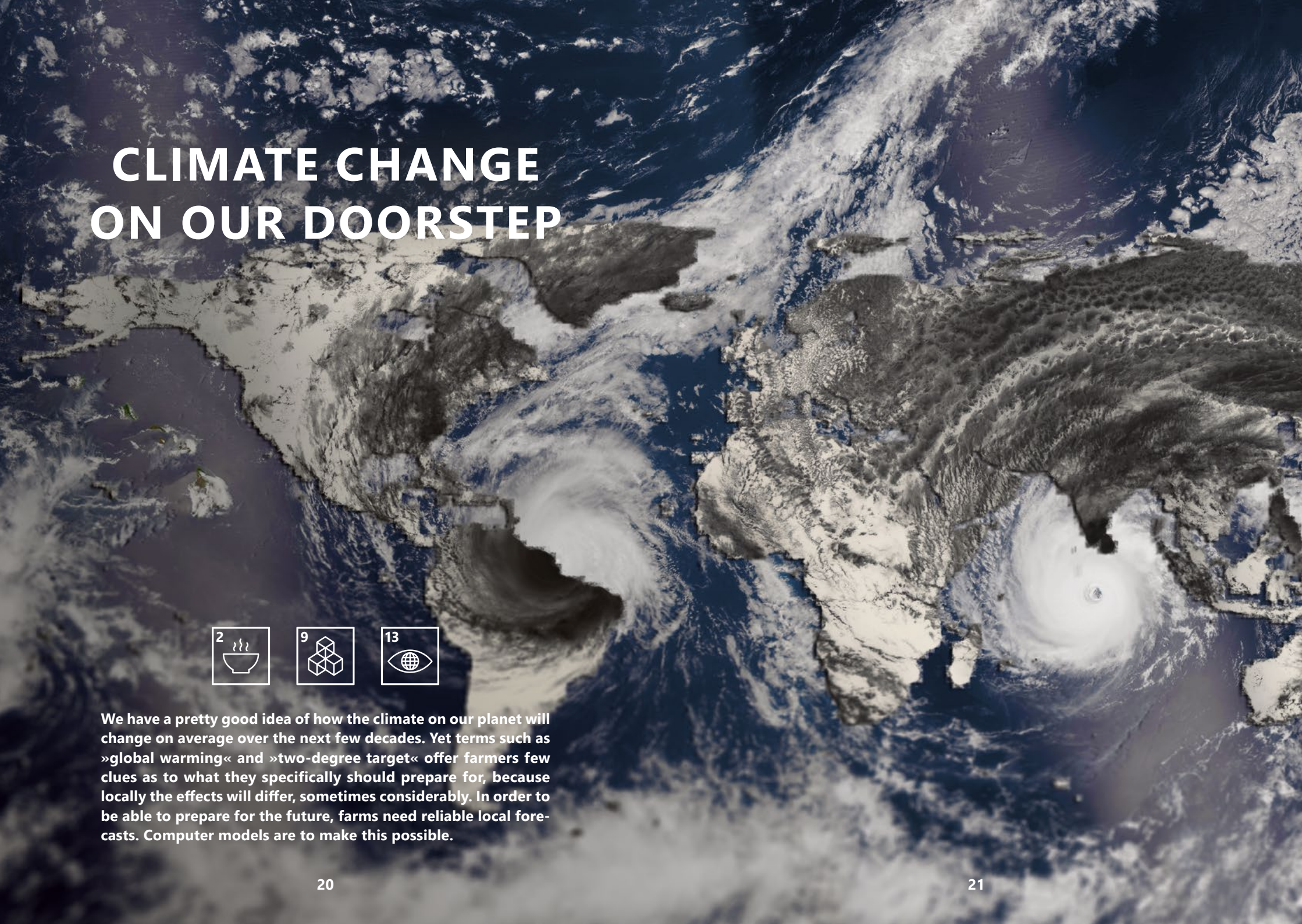
Crop residues
remaining on the field can provide some protection.

Crops
protect the soil once they reach a certain stage of growth.

A combination of crops and crop residues
provides fairly good protection.

Well-vegetated topsoil
provides the best protection.

CLIMATE CHANGE ON OUR DOORSTEP



We have a pretty good idea of how the climate on our planet will change on average over the next few decades. Yet terms such as »global warming« and »two-degree target« offer farmers few clues as to what they specifically should prepare for, because locally the effects will differ, sometimes considerably. In order to be able to prepare for the future, farms need reliable local forecasts. Computer models are to make this possible.

On a global average, rising temperatures and droughts will be the most common cause of yield loss (left). However, there are also regions where farms have to prepare for excessive rainfall (right).

»Our goal is to predict the future.« Dr. Heidi Webber knows how unrealistic this sounds at first. But the agricultural engineer remains resolute: »Agriculture has to adapt to climate change, that much is certain. But what exactly does that mean? What are the concrete effects in the Magdeburg Börde or in the Uckermark? Should farms here brace themselves to face heat and drought, or rather hail and heavy rain?« Finding reliable answers to this question is an important basis for ensuring that agriculture can continue to secure our food supply in the future. But this means adapting farming methods and crops to future conditions. New insurance policies and political programs are also needed to provide rapid assistance in the event of crop failures. All this will only work if we have reliable information about what agriculture will be facing in 10, 20 or even 50 years' time. And until mankind invents a time machine, there is only one way of looking into the future: computer models.

But how well do the numbers on the computer screens match the climate reality on the ground? This is the challenge researchers are facing around the world, including Heidi Webber. Their problem is that these models were originally designed to help assess climate change on a global scale. Now making reliable predictions of how the climate and crop yields will develop in individual regions turns out to be a much more difficult task. At the Leibniz Centre for Agricultural Landscape Research (ZALF), Dr. Webber and her team are therefore currently testing how well their computer models have been performing this task so far in the various regions of Germany.

TWO QUESTIONS, TWO SOLUTIONS

»Basically, we are facing two challenges: Do the models include all the important causes of yield variability, and can they also make predictions for a future in which the climatic conditions change?« says Webber. Two challenges that require different types of computer models.

Her team colleague Prof. Gunnar Lischeid is an expert on so-called »data-driven models«. Put simply, these computer models at ZALF independently analyze which weather events were responsible for yield losses observed in recent years. »The difficulty is to construct the models correctly.

When soils are waterlogged, heavy farm machinery can barely access fields for plowing and harvesting. In addition, wet soil compacts significantly more under the weight of the machinery, which also affects soil fertility in the long term.

Our goal is to predict the future climate for each region as accurately as possible.

DR. HEIDI WEBBER

Once that's done, however, we get valid statements without having to make overly specific hypotheses beforehand that might mislead the model.« One advantage, according to Prof. Lischeid: »We have built up a good data base in Germany over the last 40 years: on the weather, on the soils and on agricultural yields.« Based on this wealth of data, the data-driven models initially reveal an underlying correlation: It is not so much particular extreme weather conditions that are crucial factors for causing severe yield losses. Rather, it's the coincidence of unfavorable conditions at different stages of crop growth. »The negative effects of a winter that is too cold, for example, are not compensated for by a hot summer; instead, the effects reinforce each other«, says Lischeid. Looking at regional impacts in extreme weather years, Dr. Webber also discovered something fascinating in the results from the models: »While, as expected, heat and drought play a major role in large-scale yield losses, excessive precipitation is increasingly the problem in localized incidents.«

For all their advantages, however, data-driven models also have limitations. They cannot think »outside the box« and can therefore only explain conditions that they find in the input data sets. »These models found it difficult to explain 2018 well, as there simply has never before been such a combination of a wetter-than-average winter with a very hot and dry summer in Germany during the last 40 years«, Lischeid said. But how can we then look to the future, when many of the prevailing conditions will change?

LOOKING TO THE FUTURE

For this, we need a second type of computer simulation, the »process-based models«. These modells simulate the physical and chemical processes that lead to plant growth, but also plant death. »If we digitally recreate the processes correctly, they will also react realistically in the model to new prevailing conditions, for example

We have built up a good data base in Germany over the last 40 years.

PROF. GUNNAR LISCHEID

more CO_2 in the atmosphere. This allows for more valid statements about the future«, Webber says. In fact, the process-based models at ZALF were better at simulating the year 2018. However, this is only because heat and drought reduced yields in that year, which the process-based models already represent very well. »We've also learned that we can't yet simulate yield fluctuations caused by excessive precipitation well«, Webber explains. Simply incorporating these processes into the process-based models carries risks, Webber says: »Often, there is not enough data for new processes to be simulated. Therefore, as the models become more realistic, they not only become more complicated, but the uncertainty in the parameters used also increases. From a certain point onwards, the model results thus become more error-prone as opposed to improving.«

THE MODELS COMPLEMENT EACH OTHER

However, modeling rainfall damage quickly becomes very complex. »This includes everything from crops knocked down by hail to wet soils that can't be driven on with machinery. A lot of moisture also promotes fungi as well

as disease in crop stands, more nitrate is leached, and there can be a lack of oxygen in the soils«, Webber explains. So, which of these processes are the most important and absolutely need to be simulated for future predictions? »That, in turn, is something the data-driven models can tell us«, says Lischeid. »The two types of models complement each other.« In the future, the team plans to further optimize the models by expanding the study to other Central European countries. Additionally, the type of field management will be taken into account.

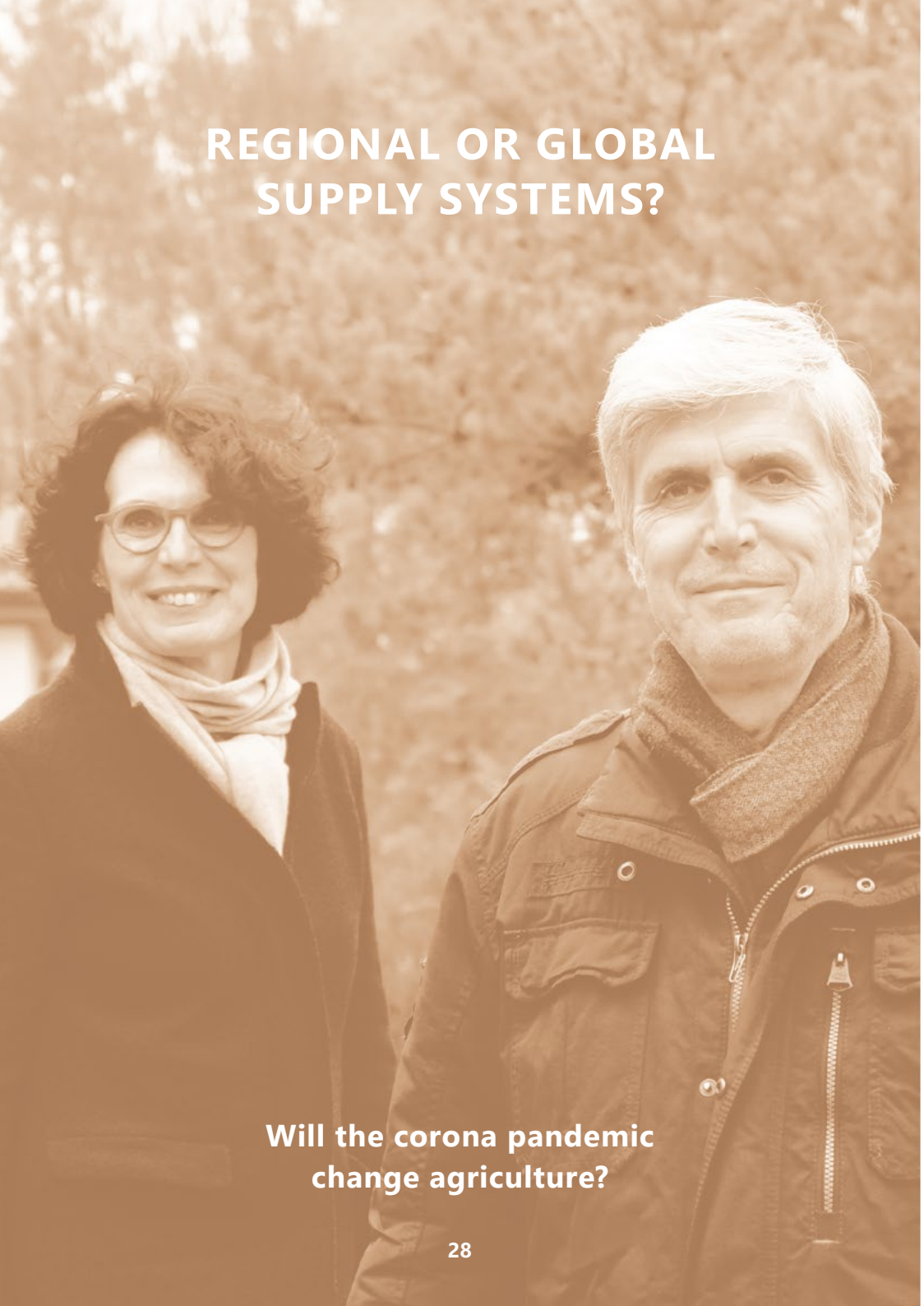
Many important decisions about the future of agriculture need to be made today. To do this, accurate predictions of the regional effects of climate change are needed as quickly as possible. The modeling experts at ZALF are optimistic, because their simulations are getting better and better.

Text: Tom Baumeister

THE RESEARCHERS

Dr. Heidi Webber heads the »Integrated Crop System Analysis and Modelling« working group at ZALF.

Prof. Gunnar Lischeid is co-head of the »Data Analysis & Simulation« research platform.



REGIONAL OR GLOBAL SUPPLY SYSTEMS?

Will the corona pandemic change agriculture?

Dr. Piorr, Prof. Ewert, we remember the panic buying at the beginning of the corona crisis in 2020. Even though food supply in Germany has been ensured without restrictions, criticism against global supply chains is growing. Can more regional approaches make our agriculture more sustainable, more climate-adapted and also more resilient?

Prof. Ewert: Overall, this is a comparatively new research field. In order to evaluate food supply in terms of sustainability, you have to look very closely at supply chains and their impact on the entire food supply system. If we shorten supply chains, i. e. rely more on regionally produced products, we can save transport costs, resources and CO_2 emissions. But if we now would have to operate greenhouses as a result, which we would not need to do in southern regions, the avoided transport costs could be outweighed by the increased energy consumption, and the regional advantage would no longer exist. This example alone shows that it is always very important to look at the entire complex system for an evaluation.

Dr. Piorr: Our experience, also from our international projects, shows that in the medium term a good balance between regional and global value chains will be important. In effect, this means developing regional systems in such a way that their advantages over the overall global system can be utilized. For example, they are more adaptable to local conditions. Moreover, and this is something we shouldn't forget in the current pandemic: Climate change has to be considered at all times.

Prof. Ewert: I agree and I would like to add one more point. If we think about regional systems—the fact that they are decoupled from the international market doesn't necessarily mean they are necessarily more resilient to crises. Just think about the droughts of 2018 and 2019, during which an exclusively regional market would have led to enormous food supply problems. When we apply this to the challenges of the corona pandemic, we see the benefits of having a system that stands on two feet, so to say.

The corona pandemic will change various areas of our lives forever. What development do you see, for example, in the case of further waves of infection and beyond?

Prof. Ewert: If the situation gets worse, we can assume that, in the short term, politics in particular will focus on securing the food supply. We all remember the flights that brought workers from Eastern Europe to Germany despite the closed borders. Businesses upstream and downstream of agriculture would certainly be most affected, such as the processing and distribution of food. Agricultural production itself is less at risk, with an average self-sufficiency rate of around 80–90 percent in Germany, depending on the product group. The empty shelves had more to do with consumer behavior. As far as our research is concerned, the goal is clear, and it has not changed as a result of the pandemic: We need more resilient, sustainable agricultural systems in general. In other words, systems that, in addition to providing food and other ecosystem services, such as clean water or clean air, are also more robust in their response to climatic changes and extreme weather events. Biodiversity is also increasingly entering public awareness. What's more: an often neglected service our agricultural landscapes are providing became much more apparent now because of the international travel restrictions: Rural areas are destinations for regional tourism and the demand for local recreation areas is increasing.

Dr. Piorr: We are also following developments on a worldwide scale that give us a good impression of the challenges ahead of us: In Qatar, the food supply completely collapsed after just a few days as the result of a food embargo. In response they now construct greenhouses on a large scale requiring enormous amounts of water and energy. But Qatar also bought vast areas of land in Africa or made supply contracts with Canada for animal feed. The aim is also to

produce food locally to secure their own supply. Of course, this strategy also bears enormous potential for international conflict. What is needed, therefore, is a system balanced between regionality and globality, specifically adapted to each region. A system in which social, economic and ecological factors and resilience considerations are addressed alike. But what we can learn from Qatar is to consider for which food products we want to set more incentives for local production to prevent supply crises.

Prof. Ewert: Also, conclusions drawn from the current crisis should not solely address the security of food supply. Especially because it is so far not foreseeable that incidents similar in extent to the corona pandemic will soon be reoccurring. Most recently, the societal debate was dominated by questions on how to deal with climate change and the declining numbers of insect species. These challenges have not disappeared. More resilient agricultural systems target all of these challenges.

We have now looked at agricultural production and the agricultural landscape. Which trends are currently foreseeable in the food sector? What role do consumers play here?

Prof. Ewert: If the situation worsens again, we can expect further political and social discussions. This will particularly affect food products, such as fresh vegetables, which are currently imported from other European countries at a high cost in terms of resources. I also still remember the general surprise when many consumers actually put the continual recommendation of a federal authority into practice, to have supplies at home for a few days, resulting in empty shelves for some products. What I would like to point out here is that the relationship between the system as a whole and the actions of individuals is, in some cases, closely interconnected. In addition to »panic buying« on the one side of the extreme, we have also seen a large number of positive examples during the crisis, such as the

increased use of our own gardens, the growing of vegetables on balconies, or more interest in concepts such as urban agriculture or the principles of community supported agriculture. During the crisis many people have started to ask more and more where our food actually comes from—this is very positive.

Dr. Piorr: Further research has to show now to what extent these cooperative structures and the exchange of knowledge on this issue in general can strengthen the robustness and resilience of the broader food system. As a result of the crisis, the exchange of experience and models of good practice, for example in food councils, is increasing. Hopefully, this will be something to remain. Empowerment and structures such as community supported agriculture are getting producers and consumers closer together again.

The interview was conducted by Hendrik Schneider.

DR. ANNETTE PIORR

heads the working group »Land Use Decisions in the Spatial and System Context« at ZALF.

PROF. FRANK A. EWERT

is the Scientific Director of the Leibniz Centre for Agricultural Landscape Research (ZALF).

THE BIG DIFFERENCE

In order to provide food security for billions of people, farming is becoming increasingly intensive—with negative consequences for the environment and biodiversity. Conventional farming stands in contrast to organic farming, which follows stricter rules. Mineral nitrogen fertilizers and synthetic pesticides, for example, are prohibited here. A study investigated the impact of both concepts on the environment—with clear results.

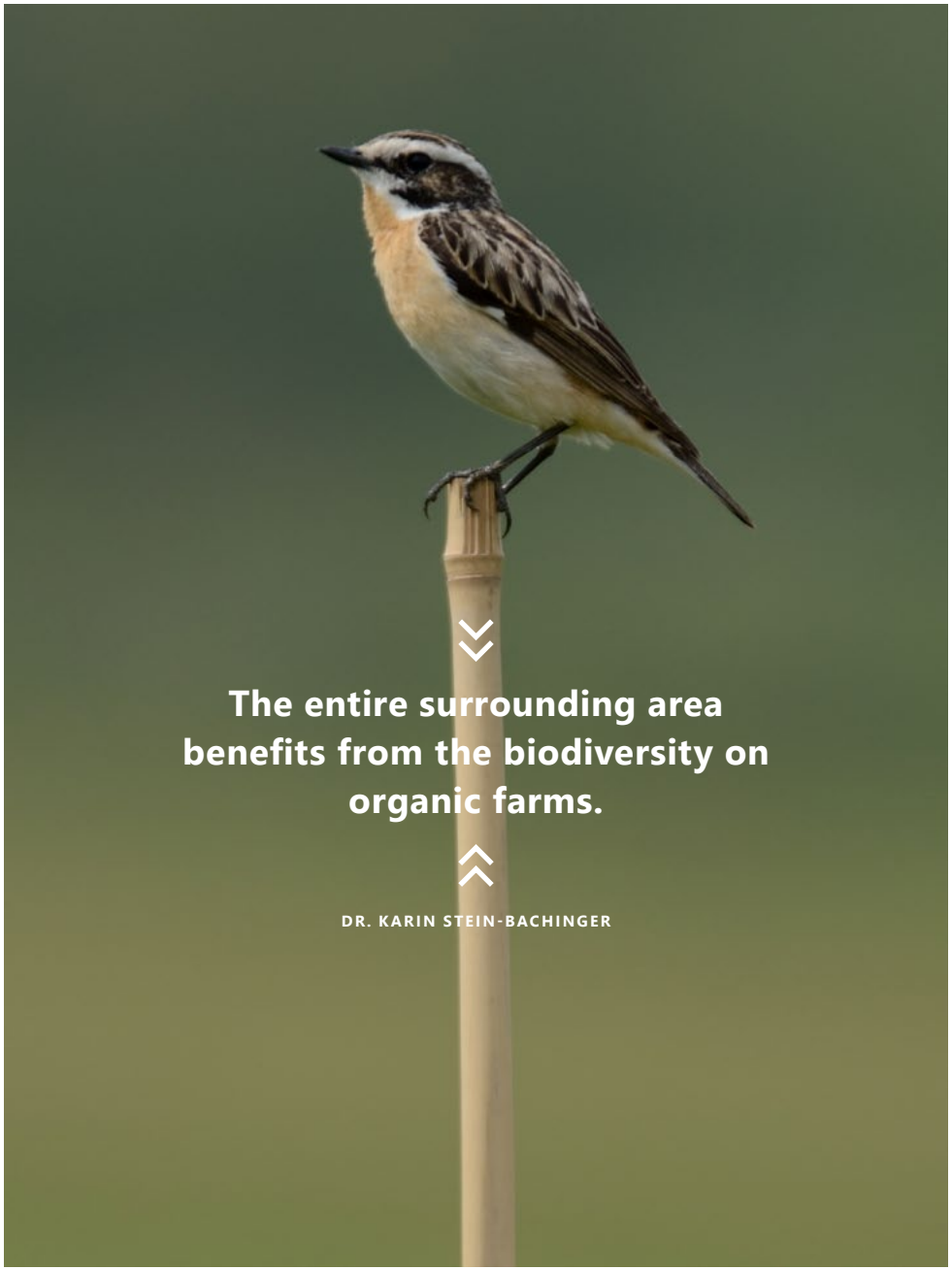
When it comes to organic farming, Dr. Karin Stein-Bachinger has a clear opinion: It could be the key to solving many pressing environmental problems—and must be expanded. This opinion is based on scientific facts, because the agricultural scientist from the Leibniz Centre for Agricultural Landscape Research (ZALF) has been conducting research in this field for already 30 years.

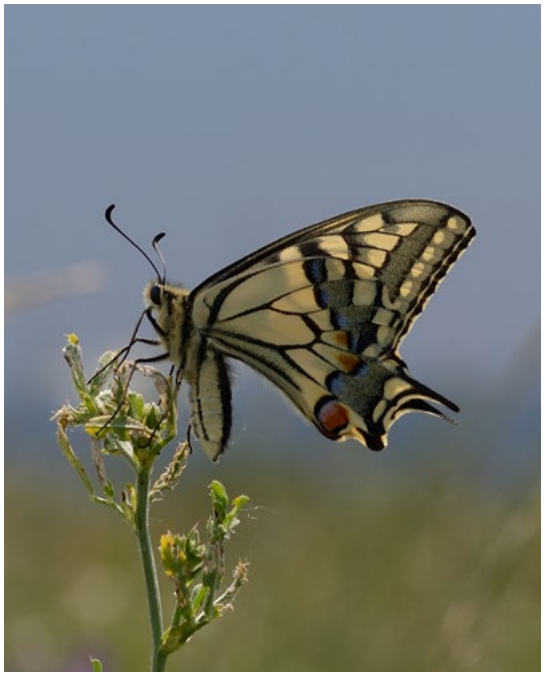
In an extensive study, Karin Stein-Bachinger and her team recently evaluated 98 scientific studies comparing conventional and organic farms with a focus on biodiversity, the loss of which is one of the greatest threats to our ecosystems. The results are clear: The diversity of wild plants was on average 95 percent higher on organically farmed sites than on conventionally farmed ones. The researchers also found 35 percent more bird species and 22 percent more insect species in the organic fields. Organic farming also scores well in terms of animal abundance: Overall, 24 percent more birds, 36 percent more insects and 55 percent more spiders find a home where farming is organic.

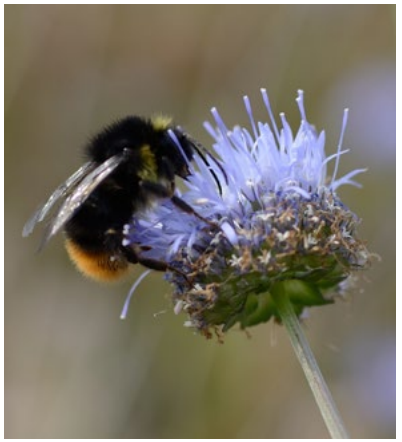
MANY WILD PLANTS DON'T STAND A CHANCE

Karin Stein-Bachinger is not surprised by these results. »It has been known for a long time that the biodiversity on organically farmed land is significantly higher«, she says. »However, there is no comparable recent study that also evaluates this quantitatively in such detail«, she emphasizes. In particular, the widespread use of herbicides and fertilization practices on conventional farms are causing the number of species of wild plants to decline. Many non-competitive wild plants such as Forking Larkspur, Scarlet Pimpernel and Field Madder do not stand a chance in the densely covered, intensively cultivated fields. »Many areas are extremely impoverished in terms of diversity«, says the researcher—and this is not only evident directly on the field, but also in adjacent areas: Around one-fifth more plant species are sprouting on the field margins of organic farms than in comparative areas under conventional management.

This has direct consequences for wildlife. Where there is a wide variety of flora, specialized species also find good habitats—such as wild bees, which are particularly efficient pollinators. This diversity of plant species on farmed land is one factor, but not the only one, explains Karin Stein-Bachinger: »Landscape elements such as hedges, field margins, and piles of stones or dead wood are also crucial. This is where insects and birds nest, find food, can survive the winter and are protected from predators.« Because organic farms usually manage smaller areas with a greater crop diversity, these important







Butterflies and bumblebees benefit from the abundance of flowers on organically farmed land.

refuges are more common in organic farming. »We know from research that in areas where there is a lot of organic farming, adjacent conventional farms also harbor more species«, Stein-Bachinger explains. »The entire surrounding area benefits from the biodiversity on organic farms.«

ORGANIC FARMING PROTECTS CLIMATE, SOIL, WATER AND BIODIVERSITY

However, the differences are not only evident in biodiversity. Soil, climate, water and nutrient balance—in all these aspects, organic farming systems perform differently than conventional ones. With her study, Karin Stein-Bachinger is one of the authors of the »Thünen Report 65«, which analyzed more than 500 scientific studies on the topic of »Social Benefits of Organic Farming« in a research network project funded by the German Federal Ministry of Food and Agriculture. The results published there show that organic farming performs better in almost all areas. Organically farmed soils store an average of 256 kilograms more carbon per hectare per year, thus protecting

the climate; they pollute water significantly less with nitrate and are home to twice as many earthworms, which is positive for soil fertility.

»All of this has a social significance and a value that should be much better rewarded«, explains Karin Stein-Bachinger. Proposals on how this new type of reward might look are now being developed in a follow-up project under the leadership of the Thünen Institute.

One model for an ecologization of conventional agriculture could be the so-called »integrated production« that has already been practiced in Switzerland for a good 20 years, says the researcher. As a link between organic and conventional agriculture, this form of production follows less strict rules than organic farming. In Switzerland, however, there are stringent requirements and annual inspections aimed at protecting the environment and resources. For example, the use of pesticides is reduced. »If we significantly expand organic farming and consistently put into practice an ecologization of conventional farming, as well as a coupling of agricultural subsidies with the provisoning of environmental and nature conservation services, we can solve many problems«, emphasizes Karin Stein-Bachinger.

Text: Heike Kampe

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querFELDein

Initiated and coordinated by ZALF, eight scientific institutions currently communicate facts, news and ideas about the agriculture of the future in an easily understandable way at www.quer-feld-ein.blog. What do sustainable cropping systems look like? Is our consumer behavior still in keeping with the times? What does digital progress accomplish on the field, and what does organic farming achieve?

EBERSWALDE UNIVERSITY FOR SUSTAINABLE DEVELOPMENT (HNEE)

CALCULATING WITH LIME

The optimal pH value of a soil can contribute to improving soil fertility. The pH-BB research project aims to clarify how the optimal value, and thus an increase in yield, can be achieved most effectively and economically through precise liming in Brandenburg.

POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH (PIK)

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DOES SUSTAINABLE AQUACULTURE HAVE A FUTURE IN GERMANY?

Aquaculture is considered the fastest growing branch of food production worldwide—in Germany it occupies only a small niche. Currently, less than 3 percent of German fish consumption is covered by domestic aquaculture. The potential for greater self-sufficiency and for the export of fish using sustainable processes could be developed instead of shifting the pressure of use on aquatic ecosystems and possible environmental impacts abroad.

LEIBNIZ CENTRE FOR AGRICULTURAL LANDSCAPE RESEARCH (ZALF)

THE AGRICULTURAL VISIONARY

How can digitalization help to reform our agriculture and stop the extinction of species? This is the big question that agricultural researcher Sonoko Dorothea Bellingrath-Kimura (ZALF) is asking herself. The first exciting answers can be found in her experimental fields in Brandenburg. There, corn, soy, wheat and meadow flowers thrive side by side in one field. Bioökonomie.de visited the agricultural visionary on site.

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NEW: RESEARCHERS IN VIDEO INTERVIEWS AT QUERFELDEIN KOMPAKT

»What does this have to do with me?« That is the central question in the short video clips in which researchers explain the relevance of their work to practitioners and society. In the first episode of querFELDein KOMPAKT, ZALF meteorologist Steffen Münch talks about the prevalence of antibiotic-resistant bacteria in agriculture. You can find these and other exciting videos at quer-feld-ein.blog.

Read on and join the discussion on:

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Infographic
Pia Bublies

Photo Credits
Titel: Hannes Schulze, Nur Mut / p. 02: Kevin Schmid, Unsplash (edited) / p. 04, 27 left: Katharina Richter, ZALF / p. 07: Klemens Karkow / p. 08: Holger Pfeffer, ZALF / p. 10: Brooke Cagle, Unsplash / p. 14 left, 15 top, 16: Roger Funk, ZALF / p. 15 bottom, 28, 30, 31, 39 right: Jan Fleischer, ZALF / p. 20: Elen31, AdobeStock / p. 22: Stefan_Weis, AdobeStock / p. 23: Astrid Oldenburg, landfotop. de / p. 24: Ole_CNX, AdobeStock / p. 27 right: Karin Groth, ZALF / p. 32: JürgenBauerPictures, AdobeStock / p. 35, 36: Frank Gottwald / p. 37: Johann Bachinger / p. 38 left: ph-BB, HNEE / p. 38 right: Comidacomafeto, Pixabay / p. 39 left: BIOCOM AG

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Mission of the Leibniz Centre for Agricultural Landscape Research (ZALF) is to deliver solutions for an economically, environmentally and socially sustainable agriculture—together with society.

As a contribution to overcoming global challenges such as climate change, food security, biodiversity conservation and resource scarcity, we develop and design crop systems, integrated in their landscape contexts, that combine food security with sustainability.

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How do agricultural landscapes function?

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How can we sustainably develop and shape intensively used agricultural landscapes?

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