WAGENINGEN WORLD

MAGAZINE OF WAGENINGEN UNIVERSITY & RESEARCH ABOUT CONTRIBUTING TO THE QUALITY OF LIFE no.2 2022

‘Wheat is not scarce but it is expensive ’

Page 24: Food prices remain high

Ways out of the nitrogen crisis

Nitrogen emissions have got to be reduced. What measures and policies will that take?

Greenhouses still need gas

Good alternatives to reliance on gas are not readily available

Food from the printer

‘The world of food is going to look very different in 10 years’ time’

COLOPHON Wageningen World is the quarterly magazine for associates and alumni of Wageningen University & Research **Publisher** Wageningen University & Research **Editor-in-chief** Willem Andrée **Editorial Board** Jeroen Balemans, Channah Durlacher, Ben Geerlings, Ike de Haan, Marieke Reijneker, Antoinette Thijssen **Magazine editor** Miranda Bettonville **Copy editor** Rik Nijland **Translators** Clare McGregor, Clare Wilkinson **Art direction** Petra Siebelink **Design** Geert-Jan Bruins, Monique Chermin **Cover picture** Shutterstock **Overall design** Hemels Publishers **Printer** Tuijtel Hardinxveld-Giessendam ISSN 2212-9928 **Address** Wageningen Campus, Droevendaalsesteeg 4, 6708 PB Wageningen, telephone +31 317 48 40 20, wageningen.world@wur.nl **Change of address, alumni** alumni@wur.nl **Change of address, associates** wageningen.world@wur.nl, mentioning code on adress label **Change of career details** alumni@wur.nl

WAGENINGEN UNIVERSITY & RESEARCH

The mission of Wageningen University & Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 7,200 employees (6,400 fte) and 13,200 students and over 150,000 participants to WUR's Life Long Learning, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.

WAGENINGEN WORLD ONLINE
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FEATURES

PHOTO GUY ACKERMANS

Re-landscaping to cope with drought

'We have built a house of cards in the Netherlands, and that house of cards is now collapsing. After World War II we created a whole network of waterways with the aim of getting rid of our water surplus and developing as much agricultural land as possible. With heavier and heavier machinery being used on farms, the groundwater level had to be lowered too. And it was lowered even further in some places in order to grow particular crops. As a result, if there's no rain for a long time, you get drought-related problems due to the lack of reserves - because we let them drain away quickly in the spring. Water is then pumped from the big rivers - water from the Maas keeps the whole of eastern Brabant and central Limburg irrigated, and water from the IJssel even supplies the eastern Netherlands!

'This summer, we are yet again seeing that the rivers are supplying less water due to climate change. The Rhine, one of the Netherlands' main fresh water sources, was originally fed by glaciers. But much of the ice in the Alps has already melted away and the amount of snow is decreasing, which means that the Rhine will become more of a rainfed river in the coming decades. In the long run, that will mean much less water will flow in our direction. So we've got to make sure we can store water longer and create a buffer with the runoff.

'The drainage of the Dutch landscape on a massive scale must be reversed. In my view, many of the ditches and gullies should simply be closed off or partially filled in and attenuated. That way more rainwater will stagnate, infiltrate the soils and be retained by them.

'That will not only alleviate the drought problem, but also help prevent flooding. Because heavy rainfall is also causing major problems with increasing frequency. The solution is the same for both problems: it's all about retaining the water longer in all the watercourses of the system. Flood plains must also be used as buffer zones.

'So the Netherlands needs re-landscaping. And water must once again take precedence. Function should come second to water, and not the other way round, as has always been the doctrine of the water boards.'

Professor Piet Verdonschot, aquatic ecologist at Wageningen Environmental Research and professor of Wetland Restoration Ecology at the University of Amsterdam

PLANT SCIENCES

Ten million euros for crop diversity in arable farming

The EU wants to cut the use of chemical pesticides by half by 2030. Crop diversity can play a key role here. A consortium led by Wageningen will investigate how to do this — from the field to the supermarket. The Dutch Research Council has allocated 10 million euros for this CropMix project. The focus is on strip cropping. That is feasible given current farm machinery and WUR already has a lot of experience with this approach. Research into crop diversity requires collaboration between a variety of disciplines.
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RANKING

WUR is best agricultural university

Wageningen University & Research (WUR) was ranked the best agricultural university in the world this year in the prestigious QS ranking for the seventh year running. WUR was fifth in the environmental sciences ranking. The QS ranking is based on investigations into researchers' reputation and scientific impact. WUR is in the top 10 per cent in the general QS ranking. Furthermore, WUR rose to 65th position in the Times Higher Education Impact Ranking, which keeps track of how organizations score in the 17 sustainability goals of the United Nations.
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LIVESTOCK AND CLIMATE

Climate targets for dairy farmers can be achieved with existing feed strategies

Existing feed methods for dairy cows can reduce methane emissions sufficiently to achieve the climate targets for dairy farming. This was shown by a meta-analysis of known methods for methane reduction, such as feed supplements in the form of methane inhibitors, oil and tannin.

Jan Dijkstra at WUR was one of the 24 experts around the world who worked on the meta-analysis, which was published in the *Proceedings of the National Academy of Sciences (PNAS)*. The methane targets (11-30 per cent reduction by 2030 and 24-47 per cent by 2050) are attainable using the existing strategies for reducing the production of methane in the intestines of dairy cows. This does not even have to impact production capacity. However, it does mean the most efficient feed solutions need to be implemented comprehensively. That is not the case at present. Achieving the target reduction is simpler in Europe than in Africa, for example, where there is a growing demand for dairy products.
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PHOTO SHUTTERSTOCK

WAGENINGEN ACADEMY

Online Winter School: Greenhouse Horticulture

Professionals from all over the world are invited to join the online Winter School in Greenhouse Horticulture. This new programme is based on the successful Summer School programme and opens up WUR expertise to an even larger audience worldwide. Leading international experts from Wageningen University & Research will be teaching on this programme. Live Q&A sessions give you the opportunity to interact with the experts and with other participants, and to explore how to apply new insights in your daily practice. Are you interested in horticulture? Do you want to become an expert and learn how to run your own greenhouse more efficiently? And do you enjoy studying online, with people from all around the world? This is your opportunity!
See www.wur.eu/academy

EXECUTIVE BOARD

OMNIA DIALOGUE CENTRE OPENS

Louise Fresco says farewell

On 1 June, Louise Fresco, President of the Executive Board, opened the new dialogue centre Omnia, on the Wageningen campus, as part of her farewell ceremony. She was personally involved in the plans for this new building, which will be a centre for dialogue on issues affecting society in the agri-food sector and the life sciences.

When she took on the job eight years ago, Fresco stressed the importance of making connections, not just between different scientific fields but also with a wide range of groups in society. Dialogue leads to better scientific insights that are of genuine value to society at large, said Fresco in 2014.

Omnia is intended above all to facilitate contacts and the exchange of knowledge. The new building has a café and restaurant for informal encounters and will host symposiums, conferences, workshops, debates and press conferences. Academic ceremonies such as PhD defences and inaugurations will also be held here from now on, rather than the Aula (see also page 47).

Two 'dialogue benches' have been installed at the entrance to Omnia. They were designed by metal artist Arthur Dreissen and are a gift on behalf of all WUR staff. The benches are intended to encourage people to spend a moment discussing their ideas.

The dialogue centre is surrounded by a wet nature garden, designed to increase biodiversity on the Wageningen campus.

Fresco received two honours during her farewell event in the new building. The minister for Education, Culture and Science Robbert Dijkgraaf announced that she has been appointed a Commander of the Order of the Netherlands Lion. 'WUR's position in society has become stronger and it has been more visible in the public debate under her leadership,' said Dijkgraaf.

PHOTO GUY ACKERMANS

Minister Robbert Dijkgraaf bestows the royal honour on Louise Fresco.

Fresco also received the Norman E. Borlaug Medallion from Barbara Stinson, the chair of the World Food Prize Foundation. This medallion was awarded in 'recognition for the exceptional innovations in life sciences research by Wageningen University & Research and the enormous impact of Louise Fresco's concern for global food security,' said Stinson. 'Few leaders and higher education institutions have meant so much for healthy, robust, sustainable food systems.'

Louise Fresco was succeeded by Sjoukje Heimovaara on 1 July (see also page 16).

PHOTO PETRA APPELHOF

LOUISE O. FRESCO FUND

To mark her departure as President, WUR has set up the Louise O. Fresco Fund. The fund will support students who get into financial difficulties through no fault of their own. University-educated refugees who are waiting for a residence permit will also get support that will allow them to take courses at WUR. This will let them keep their knowledge up to date and also feel like a student or researcher again rather than just an asylum seeker. Donations have been made to the fund by Louise Fresco herself, by WUR, by employees and alumni and by various external business relations. The fund has now reached 100,000 euros. *Info: www.wur.eu/Louise-O-Fresco-Fund*

ENVIRONMENTAL CHEMISTRY

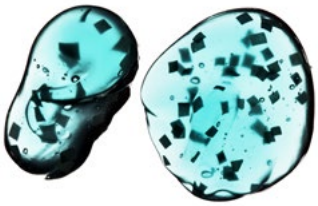

PHOTO SHUTTERSTOCK

How much microplastic do we ingest?

Nur Hazimah Mohamed Nor, a researcher in the Aquatic Ecology and Water Management chair group, investigated how much microplastic humans ingest. A study by the University of Newcastle (Australia) from 2019 suggested it was a bank card's worth per week. She built a model to calculate how many particles of between 1 and 5,000 micrometres we breathe in or ingest via eight food categories with known concentrations of microplastics (fish, molluscs, crustaceans, tap water, bottled water, salt, beer and milk). Her model shows that adults absorb 880 plastic particles per day on average. The model also calculated how many microplastics a person's body absorbs up to the age of 70. That turned out to be just a fraction of a grain of sand.
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LIVESTOCK

Further fall in antibiotic resistance in cattle

In the past 10 years, gut bacteria in farm animals have become less resistant to antibiotics. That finding comes from the NethMap/MARAN report, which Wageningen was involved in.

In this annual monitor of antibiotic resistance, the Food and Consumer Product Safety Authority (NVWA) takes random samples from broiler chickens, pigs and veal calves. The study focuses on *E. coli*, *Salmonella* and *Campylobacter* bacteria. Kees Veldman, head of the National Reference Laboratory for antibiotic resistance in animals, which is responsible for the monitor, says, 'A striking result is that antibiotic resistance in broiler chickens has fallen to its lowest level since 1998.' An important reason for this is the substantial decline in the use of antibiotics in poultry farming. That decline was over 30 per cent last year. Compared with 2009, sales of antibiotics for all farm animals have fallen by more than 70 per cent. The report also shows that the number of species of bacteria that are resistant to multiple antibiotics has stayed the same the past two years.
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PHOTO SHUTTERSTOCK

PLANT SCIENCES

PHOTO GUY ACKERMANS

Institute for photosynthesis research

In March, a new, independent institute was set up by WUR and the Photosynthesis 2.0 Research Fund (P2RF): the Institute for Advanced Studies for Photosynthetic Efficiency (IASPE). 'An important aim is to learn how to improve the efficiency of photosynthesis in food crops. That could help considerably in efforts to feed the world,' says Ernst van den Ende, a member of WUR's Board of Directors. A few plant species can grow very fast thanks to their much greater photosynthetic efficiency. One such species is the shortpod mustard. The institute wants to learn from such species. The idea is that better photosynthesis will result in higher yields for current crops. The new institute will require an investment of 62 million euros over 10 years. Fifty million euros will come from P2RF and WUR is contributing 12 million, mainly in the form of staff and laboratories.
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CLIMATE

PHOTO SHUTTERSTOCK

‘The world is heading for warming of about 3 degrees’

It will not be possible to meet the target agreed in Paris of maximum global warming of 1.5 degrees unless action is speeded up around the world. That is clear from two IPCC reports that appeared this spring. A small army of Wageningen scientists were involved in the reports.

Unless current plans are tightened up, the world is heading for warming of about 3.2 degrees in 2100, says the IPCC. ‘The next few years are critical,’ says Gert-Jan Nabuurs, professor of European Forest Resources at WUR and one of the lead authors of the report on combating climate change. ‘Time is up. We are already too late to prevent the Earth from warming up by 1.5 degrees.’

According to Nabuurs, three key measures are stopping deforestation, sustainable intensification of agriculture and the restoration of forests and biodiversity, in combination with the use of renewable resources. ‘All the measures in agriculture and forestry together can contribute about 15 per cent to the overall solution.’

His message for governments: ‘Be consistent and formulate policies for the long term.’ Nabuurs finds it ‘really strange’ to ask farmers to invest millions in reducing emissions but at the same time not do anything about cheap flights. ‘Governments can steer behaviour with regulations and price mechanisms and by encouraging research and private sector action. That is needed in sectors such as forestry and agriculture. Reduce uncertainty for farmers, forest owners and consumers.’

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MAGAZINE

Wageningen World skipped one issue

There was no spring issue of Wageningen World this year. A national paper shortage made it impossible to produce a quality magazine in time. With the current issue, the editors have picked up where they left off.

As a result, there will be three issues of WUR's magazine for associates and alumni, instead of the usual four. The next issue will be published in mid-December.

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NUTRITION AND HEALTH

Link between iron deficiency and depression

Nutrition, menstruation, depression and anaemia are interlinked. Arli Zarate Ortiz of the Human Nutrition and Health chair group discovered this in her PhD research on depression in teenage girls in Mexico. The onset of menstruation is regularly accompanied by the start of symptoms of depression and anaemia. Depression can be associated with iron deficiency, which may be caused by the loss of blood during menstruation. But obesity plays a role too. Poor nutrition can lead to obesity, but also to a lack of iron due to the inflammations caused by obesity. Furthermore, girls who start menstruating early are at greater risk of obesity. A Western diet, an unvaried vegetarian diet and unfamiliarity with the symptoms of iron deficiency also play a role, thinks the researcher.

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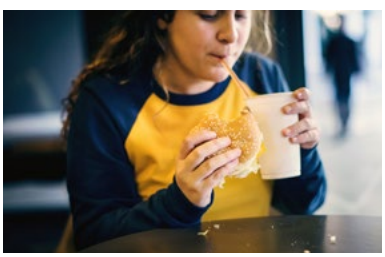

PHOTO SHUTTERSTOCK

PLATFORM

Support for researchers in the Sahel

The Wageningen Sahel Platform has drawn up a research agenda with regional partners. The aim is to support researchers in the Sahel countries. The Sahel is a broad strip of land in Africa between the dry Sahara and the wetter savannahs and rainforests. In this diverse area, 80 per cent of the farmers live in poverty with few prospects, which leads to unrest and violence. WUR is making data available from previous studies, training researchers and helping them find funding.
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NATURE AND ENVIRONMENT

PHOTO SHUTTERSTOCK

Sustainable tourism in Antarctica

More and more tourists are visiting Antarctica but that can damage the fragile ecosystem. In July, Wageningen Environmental Policy researcher Machiel Lamers and Environmental Systems Analysis researcher Bas Amelung received a Dutch Research Council grant for a study of the consequences of increasing tourism. The ecosystems are so fragile that even minor incidents such as walking on the slow-growing moss next to the path can have major consequences. The rules that are in place are drawn up by the tourist industry itself as there are no public authorities in charge. The question is how to maintain, extend and reinforce these rules and guidelines.
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STUDENT CHALLENGE

Modular design wins Urban Greenhouse Challenge 2022

LettUs Design from Delft has won the third Urban Greenhouse Challenge. The 30 participating student teams from 70 universities in 20 countries had to develop a concept for urban agriculture that guarantees year-round sustainable, affordable food production.

The students were required to take social aspects into account, more so than in previous editions. The designs were intended for Ward 7, a neighbourhood in Washington DC in the USA. The students had to come up with ideas that would generate income for local residents. The winners chose an approach in which food production goes hand in hand with employment and education. A big plus was that their process and approach could also be applied in other neighbourhoods.
The Urban Greenhouse Challenge is one of various such Challenges organized by WUR – multidisciplinary international competitions in which teams of students have to tackle a specific problem. The challenge runs through most of the academic year and is not part of the regular teaching programme.
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NUTRITION

Fifty shades of peanut butter

PhD candidate Hongwei Yu of the Food Quality and Design group at Wageningen developed a method for selecting the best peanuts for peanut butter. There are around 40,000 species of peanut. In addition to the species, the soil and climate also influence the flavour and quality. Yu was able to use light reflection to identify the best peanuts for various types of peanut butter. Yu linked the data for Chinese peanut varieties to chemical data using models. The models could then predict the peanuts' nutrient composition based on spectroscopy data. He discovered that peanuts with a high sucrose content produced peanut butter that is less oily, has a good texture that spreads well and smells like it should. Did he make the best peanut butter? 'Yes, in theory, but sensory research is needed to find out what people think of it.'

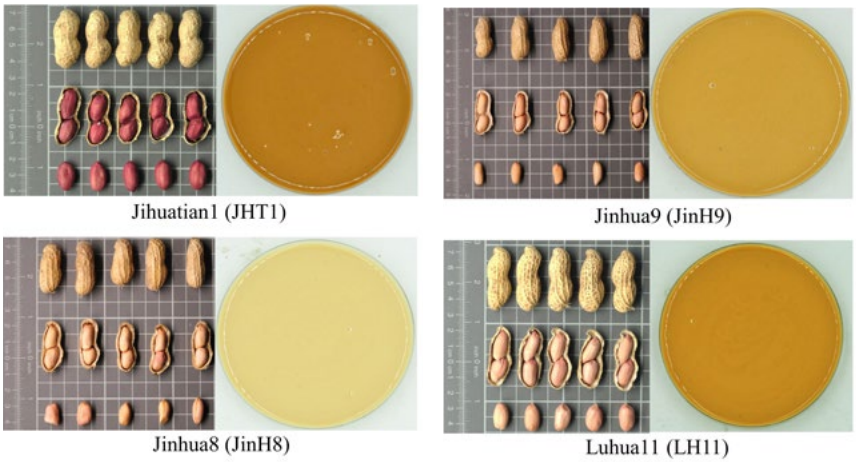

PHOTO HONGWEI YU AND SIMENG ZHAO

MARKET STUDIES

Particle physics helps visualize fraud in the form of spoofing

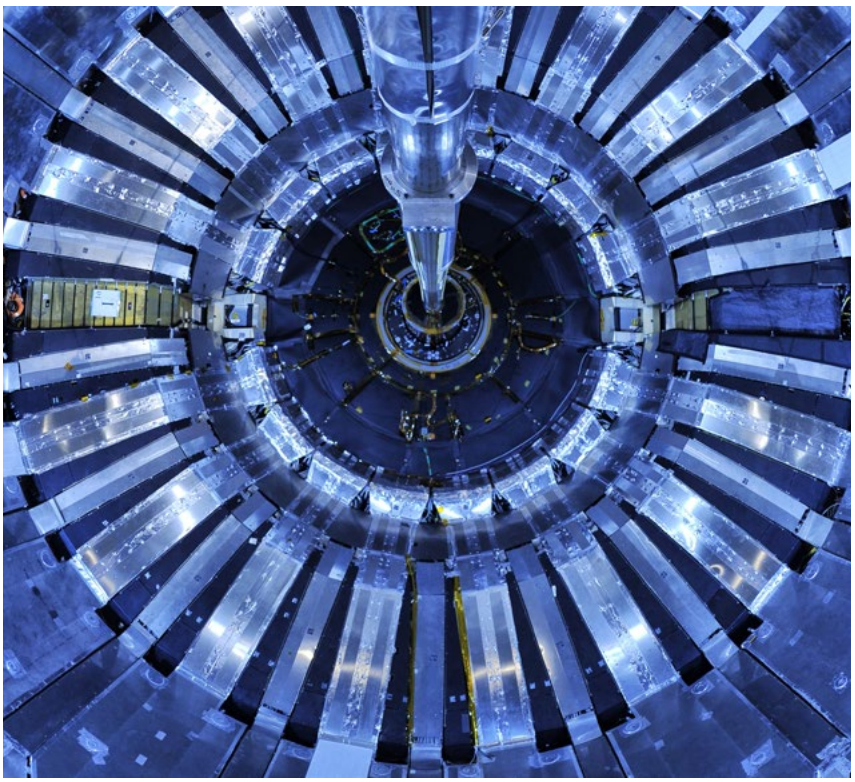

PHOTO SHUTTERSTOCK

Researchers from Wageningen and CERN have developed a visualization method that helps dissect manipulation in the form of spoofing in financial markets. This form of market manipulation can be visualized using data analysis techniques borrowed from particle physics.

Spoofing is an illegal way of manipulating financial markets whereby an order is placed without any intention of actually buying or selling. That drives up prices and defrauds other parties. In 2020, one of America's largest banks, JPMorgan, paid a record settlement of 920 million dollars for spoofing in the period 2008 to 2016.

The traditional way of studying markets in detail is to take snapshots in time, explains Marjolein Verhulst of the Marketing and Consumer Behaviour group in Wageningen. 'You take a "photo" of the market every second or minute. Traditional finance research analyses the state of the market this way, but it doesn't show what is happening between the snapshots.'

The researchers visualized the limit order books for the markets the JPMorgan traders manipulated. Using data analysis techniques borrowed from particle physics, they were able to show what happened between the snapshots.

The ultimate aim of the researchers is to develop methods in which market abnormalities can be detected in real time to combat fraud. In this study, WUR collaborated with the European Organization for Nuclear Research (CERN) and the Commodity Risk Management Expertise Centre (CORMEC).

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FOOD SAFETY

Mini-intestine replaces lab animal

New food products are subject to extensive safety tests before they are launched on the market. Animal trials are often a compulsory element. Researchers at WUR would like that to change and they are now using human organoids as a replacement. Meike van der Zande of Wageningen Food Safety Research is collaborating with scientists at Wageningen Food & Biobased Research on these mini-organs. In practice, a mini-intestine is a complex set-up with a thin layer of cells as the basis. Van der Zande: 'You can use sensors and chips to guide the liquid flows at the microscopic level. That lets us get much closer to the situation in the human body. We look at the uptake, processing and effect of substances in the intestines.' Van der Zande thinks that lab animals will no longer be needed for food safety research 30 years from now.

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CLIMATE

The soil is also getting warmer

Global warming studies focus mainly on air temperature; little research has been done on soil temperatures. Wageningen Environmental Research discovered that soil temperatures in farmland areas in the Netherlands have risen by 1.5 degrees on average in the past 40 years. Soil temperatures are highly dependent on the local microclimate and are affected by vegetation. Germination and the establishment of plants are not affected much by the soil temperature rises, but soil temperatures are important for the survival and development of plants.

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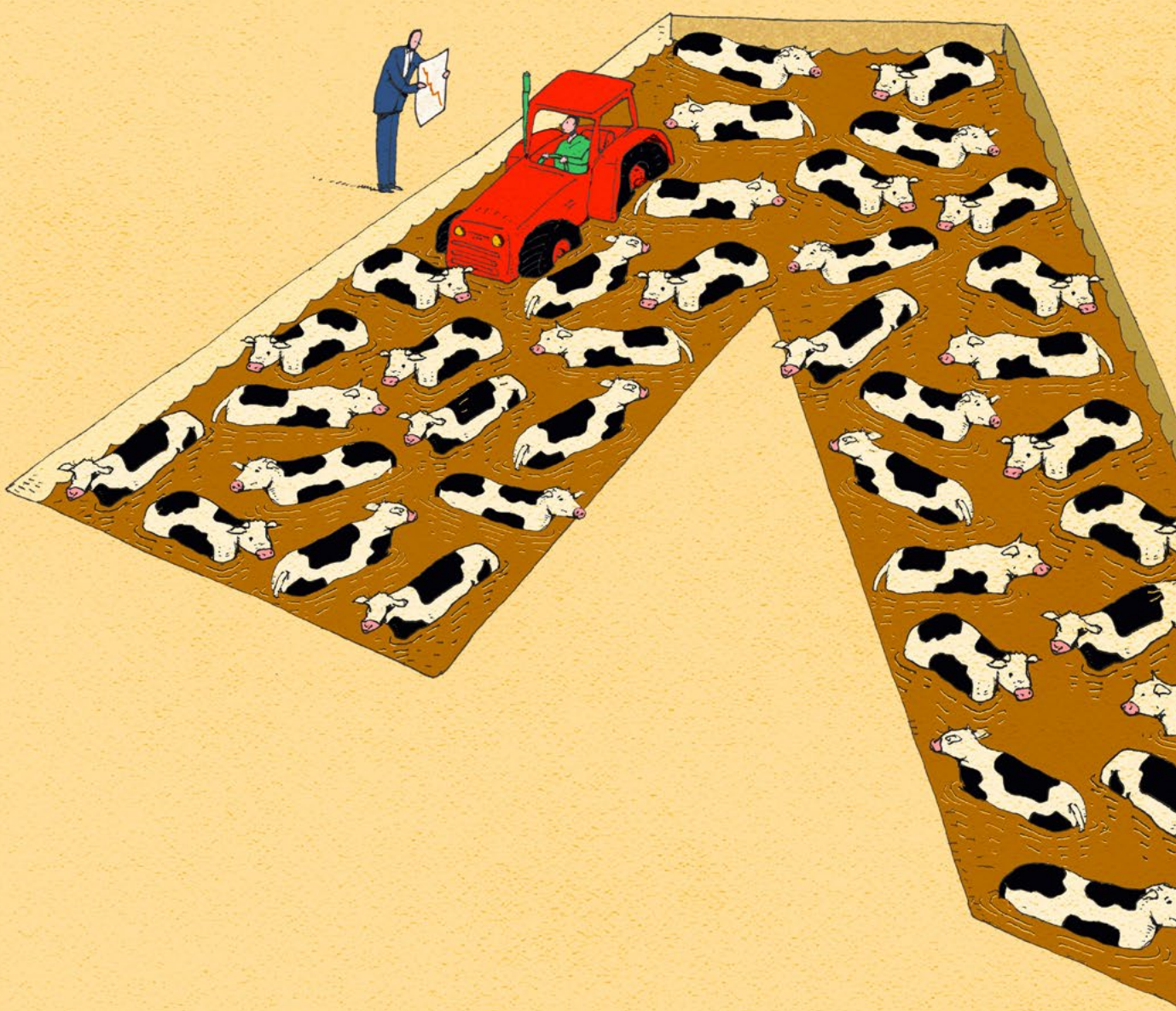
PHOTO SHUTTERSTOCK

How do we solve the nitrogen crisis?



Dutch agriculture is facing a serious challenge: its nitrogen emissions have got to be reduced. What does that mean for livestock numbers and housing systems, manure, and feed? And how do you turn it into policy? Three Wageningen scientists on ways out of the nitrogen quagmire.

TEXT ALBERT SIKKEMA **ILLUSTRATIONS** RHONALD BLOMMESTIJN

‘The government is in a hurry and farmers are digging their heels in’

Creating clarity was the aim when Minister of Nature and Nitrogen, Christianne van der Wal published a map of the Netherlands just before the summer holidays, showing the target nitrogen reduction percentages for each region of the Netherlands by 2030. But that was not the kind of clarity Dutch farmers wanted, says researcher Edo Gies, regional development specialist at Wageningen Environmental Research. In the farmers’ eyes, the high reduction percentages on the map spelled the end of agriculture and therefore sparked protests. ‘Farmers want to know what they have to comply with to be able to continue farming, and they are asking for supportive policies that will help them,’ says Gies. ‘There is currently no clear prospect of that.’

EDO GIES
regional development specialist at Wageningen Environmental Research

‘The farmers want to know what they’ve got to comply with’

CONSTRUCTION HALTED

The Netherlands is not achieving its nature objectives, based on European regulations, because farmers emit too much ammonia and companies and traffic too much harmful nitrogen oxide pollution. The policy pursued so far has not led to a reduction in nitrogen emissions. In response, in 2019, the highest Dutch court banned all construction activities that could cause more nitrogen emissions.
So now the government wants to halve the ammonia emissions from the Dutch livestock sector. But nitrogen is volatile and invisible, so what does this target mean for livestock numbers and housing systems, manure and feed at the farm level?
Gies thinks that the Ministry of Agriculture, Nature and Food Quality should draw up benchmarks that farms must meet by 2030. For example: the Ministry of Agriculture sees ‘extensification’ as the way for farmers to meet the nitrogen and climate requirements. Gies: ‘But what does that mean at the farm level? Fewer animals per hectare or reduced emissions per hectare? That is what farmers want the Ministry to tell them. In the first case, the farmer must maintain his income with fewer cows or buy more land; in the second case, he can reduce emissions using technical measures and the right management.’

CLIMATE AND WATER

The idea now is for the provinces to elaborate the government’s nitrogen targets in ‘area-specific policy’. They are expected not only to meet the nitrogen targets but also to observe climate and water directives. The Netherlands does not currently comply with the EU directive on water quality because too much nitrate leaches into the groundwater. And its agriculture produces too many greenhouse gases, partly because cows emit methane, and because a lot of nitrous oxide and CO_2 is released from the soil in the peatland areas. The cabinet will present further climate guidelines for agriculture this autumn.
Nitrogen professor Wim de Vries at the Environmental Systems Analysis chair group has just completed a study on how farmers can meet the government’s nitrogen and climate targets. His research group has developed a model that calculates all the nitrogen compound and greenhouse gas emissions from agriculture, and has catalogued the measures farmers can take. They reviewed many technical measures such as reducing the nitrogen in livestock feeds, manure separation, low-emission barns, and putting a stop to ploughing. The result was a table of emissions reduction figures, and De Vries also assessed the interactions between different measures. As an example: putting more cows out to grass cuts ammonia emissions, but increases greenhouse gases.
His first scenario, called ‘Everything possible’, makes it clear that farmers cannot achieve their nitrogen and climate targets with technical measures alone. While these would indeed halve nitrogen emissions, their contribution to the climate targets are disappointing: around 25 per cent. That is ample for the climate target for 2030, but is only half the agreed reduction of 50 per cent by 2050. Moreover, De Vries bases this scenario on optimistic estimates from the suppliers of the technologies. In practice, the professor says, the equipment doesn’t work quite so well and not all farmers will be investing

in low-emission techniques before 2030, certainly not if they are expensive. So he also developed a second scenario with more realistic figures. In this scenario, he estimates that technical measures can reduce nitrogen emissions by about 30 per cent, and greenhouse gases by only 15 per cent.

THE TJEERD DE GROOT VARIANT

So the model calculations show that the livestock numbers must be reduced, but that this measure would not make as much difference as its proponents expect. In the 'Tjeerd de Groot variant' – named after the MP from the D66 party who advocated it – the livestock population is halved, which only results in a 35 per cent reduction in nitrogen and a 21 per cent reduction in greenhouse gases. This is partly because the Netherlands exports manure. If the national herd is halved, this will no longer happen, which means that the reduction in manure and the nitrogen advantage for the Netherlands will be smaller too. Secondly, with fewer dairy cows, the emission of greenhouse gases in areas with peaty soils will continue, as the peat in the soil goes on oxidizing. And thirdly, halving livestock numbers would change the land use: pasture land would become arable land and crop cultivation would increase CO_2 emissions. De Vries's favourite scenario is the combination of feasible technical measures and a 25 per cent reduction in livestock. 'I think this is the most realistic combination, and it's what the Ministry of Agriculture has in mind too.' This variant cuts ammonia emissions by 50 per cent and greenhouse gases by 25 per cent. That brings agriculture close to the ammonia target and achieves the climate target for 2030, but is only halfway to the 50 per cent climate challenge for 2050. Even if we halve livestock numbers in combination with technical measures, we will not achieve the 50 per cent reduction in greenhouse gases in 2050, thinks De Vries.

De Vries did not calculate how the government can reach the goals for water quality as well. His colleague Edo Gies has been doing that over recent months. Gies investigated for the Ministry of Agriculture which packages of measures would enable the provinces to achieve the water targets as well as those for nitrogen and the climate. He cannot go into detail yet, but he agrees with De Vries's overall conclusions. With a package of technical measures, farmers can reduce nitrogen emissions by about a quarter. If the livestock population is reduced by a quarter as well, the target of halving nitrogen emissions comes within reach. But the climate challenge is trickier.

Gies: 'Our study gives an idea of the options and their feasibility for the provinces, but the next question is: how are we going to put this policy into effect?' Farmers can limit nitrogen losses by having new low-emission barns built, but they will only do so if the Ministry adjusts the emissions >

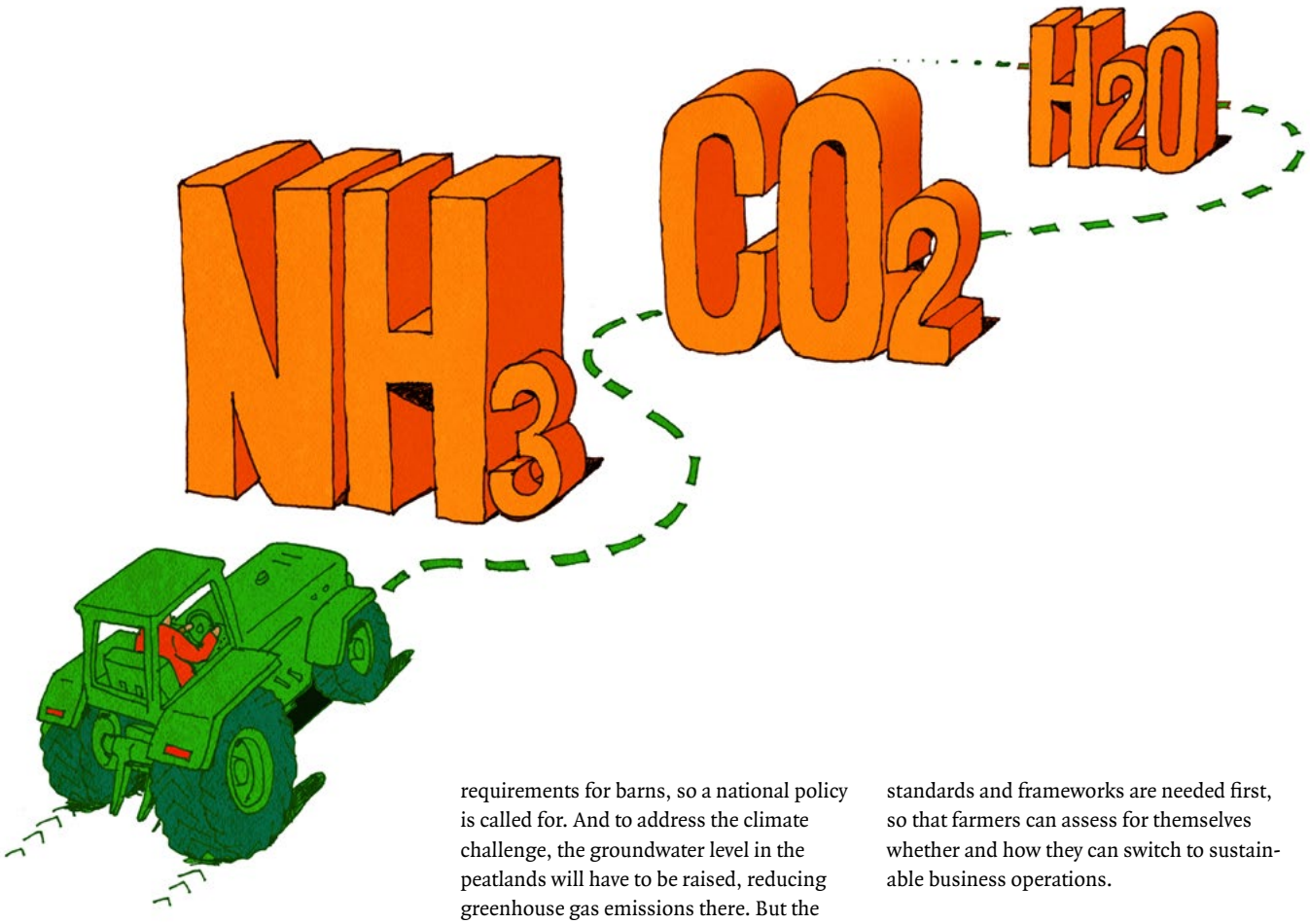


PHOTO CHRSTIAAN KROUWELS

KATRIEN TERMEER
professor of Business Administration

‘Polarization is making the transition to sustainable agriculture increasingly difficult’

requirements for barns, so a national policy is called for. And to address the climate challenge, the groundwater level in the peatlands will have to be raised, reducing greenhouse gas emissions there. But the power to do that lies with the provinces and water boards. Clearly, national and regional government bodies are going to have to co-ordinate their policies very well.
If that happens, Gies foresees a varied picture for Dutch livestock farmers. Many farmers on clay soils can meet the targets with technical measures and ‘low nitrogen’ farm management. Dairy farmers in peatland areas will need to switch to more extensive farming too, with fewer animals per hectare. ‘Farmers need to know what standards they are required to meet. For example, we are running a project with farmers in peatland areas who have already extensified their farms, to see if that is enough.’

NO INTENSIVE LIVESTOCK FARMING

The task is hardest for farmers on sandy soils near nature reserves and stream valleys. If they are to meet the nitrogen and water targets, intensive livestock and crop farming are no longer possible there, Gies thinks. Government buy-outs are one option, but standards and frameworks are needed first, so that farmers can assess for themselves whether and how they can switch to sustainable business operations.

STANDARDS AND FRAMEWORKS

Both De Vries and Gies think that standards and frameworks for achieving the goals should be drawn up by the provinces, because conditions – such as soil types and the presence or absence of nature areas – differ per area. The farmers and provinces should discuss this with other stakeholders such as nature organizations and water boards.
Gies also recommends a particular approach to finding solutions, known as reflexive interactive design. This approach was developed by researcher Bram Bos of Wageningen Livestock Research. He brought farmers and critical organizations together to design new barn systems, such as the Rondeel poultry barn. This brought several objectives together: less environmental pollution, better animal welfare, health benefits and a good business model. Gies: ‘The participants in the discussion have to think about how they can combine several competing objectives with new ideas. He believes that the method could also be used in local planning, and

PHOTO HUIBERT VAN ROSSUM

WIM DE VRIES
personal professor of Integral Nitrogen Impact Analysis

'I think a 25 per cent reduction in the livestock population combined with technical measures is the most realistic'

he thinks farmers are capable of doing that. 'They know the area, they know what goes on there, and they are enterprising.'

RESTORING TRUST

Katrien Termeer, professor of Public Administration in Wageningen, is another advocate of meticulous processes, both at national and regional levels. Restoring trust and social dialogue are important preconditions, she says. 'The polarization is making the transition to sustainable agriculture increasingly difficult. The government is in a hurry and farmers are digging their heels in. That is not a good basis for restoring trust.' That is why Termeer advocates a two-stage plan. First, the government must tackle the extremely urgent nitrogen problem, so that houses can be built again, says Termeer. Following Belgium's example, the government can buy up a number of the most polluting farms near nature reserves to bring ammonia emissions down quickly. 'This proposal is included in the plan that the farmers' interest group LTO Nederland made last year with the employers' organization VNO-NCW and the Nature and Environment Foundation. Some provinces had already made good progress with this. That takes some of the pressure off.'

The next stage is for the government to work with all the relevant parties on the transition to future-proof sustainable agriculture. This is not just a question of tackling nitrogen; it is an integral process in which all agricultural entrepreneurs, including farmers and horticulturalists, make their production processes sustainable. This means a largely emission-neutral agriculture with a positive impact on nature, climate, water quality, animal welfare, public health and the farmer's own prosperity. Ultimately, the changes are more far-reaching than the current standards and will take more than a generation to put in place, says Termeer. 'The direction of travel is clear and there are already a great many farmers who are conducting their business in this sustainable manner.'

In this context, it is important that the ambitious nitrogen and climate targets are non-negotiable, in Termeer's view. 'You have to meet those targets, otherwise farmers will continue to face lawsuits and legal restrictions, and that creates uncertainty. Of course, farmers will all have to get their own transitions going, but the government can offer a more coherent policy and more scope for action than it does now. It could for example get rid of restrictive legislation, make new business models possible with funding from the European Agricultural Policy, adjust land use policy and make better use of the competition rules for sustainable entrepreneurship. Supply chain parties such as banks, feed suppliers and supermarkets must also contribute to the transition. We cannot place all the burden on the farmers' shoulders.'

SEVEN TRANSITION PATHS

Last year, Termeer wrote the SER advisory report 'Towards sustainable future perspectives for agriculture', in which she advocates an agriculture agreement focusing on seven transition paths towards sustainable agriculture. These include paths leading to highly productive high-tech agricultural systems that minimize emissions through precision technology, energy generation and recycling principles, as well as a transition path towards further growth in organic farming and routes towards multifunctional farms that provide care, recreation or ecosystem services as well as food. And the last transition path named in the SER advisory report is 'respectful closure'.

To make each transition path feasible and attractive, precise agreements must be made about policy, financing, knowledge, innovation and monitoring, says the professor. 'It needs to be possible to earn a decent living whichever path you take, but they each require support from different parties, varying from banks to energy companies and nature organizations. An emissions-neutral high-tech farmer needs different knowledge and funding from a farmer who wants to become a nature manager on the side. For extensive circular agriculture, for example, the legislation on manure needs adjusting. Such overarching agreements are best made at the national level. The provinces can then determine what is best to do and where, through area consultations.'

TIME IS NEEDED

She also calls for time. 'Really radical changes can't be implemented overnight. A transition cannot be fast, profound and system-wide at the same time. That is why I am in favour of starting with small wins: tangible and meaningful initiatives that make for significant change on a small scale. Take businesses such as the poultry company Kipster or Herenboeren, in which citizens club together to produce sustainable food. Such initiatives have the potential to spread and both broaden their reach and go deeper. The Vegetarian Butcher started out small too. Fortunately, these kinds of initiatives are becoming more visible, including in nationwide debates.' ■

www.wur.eu/nitrogen

SJOUKJE HEIMOVAARA:

‘Our independence is our biggest asset’

WUR’s new president Sjoukje Heimovaara loves doing research, but always ends up in a management position. That is the common thread running through her career. ‘I’ll see the potential for change, and be told: “So why don’t you do it?”’

TEXT WILLEM ANDRÉE **PHOTOGRAPHY** DUNCAN DE FEY

The room vacated by her predecessor Louise Fresco is full of cardboard boxes. Its new occupant Sjoukje Heimovaara (1965) is starting her WUR presidency by unpacking, putting things away and arranging the furniture – a parallel process to the way she is shaping her ideas about the years ahead. She shares her thoughts freely. ‘I’ve just had a conversation about online meetings. A meeting in New York? Join online. We mustn’t fly to Bogota or Beijing for two days just for a meeting. There’s no need for that.’ This is typical of her way of thinking and working, as becomes clear as the conversation progresses. If she thinks things can or should be done differently, she has to make sure that happens.
Heimovaara studied Plant Sciences in Wageningen and worked for 17 years for the plant breeding company Royal Van Zanten, most of them as Director of Research & Development. She is a member of the Advisory Council for Science, Technology and Innovation (AWTI) - ‘a job on the side that I cherish’ - and knows the plant and research world inside out. In the last two years, as director of the Agrotechnology & Food Sciences Group (AFSG) in Wageningen, she has also become familiar with the world of food. On 1 July, WUR announced that she would succeed Louise Fresco as President of the Executive Board. ‘I am of course honoured by the new job, but it is a pity that I have to leave AFSG already, as I don’t generally move on so fast. I like to build.’

From your CV, it seems that you always end up in a management position.

‘Yes,’ she laughs. ‘It is a common thread in my working life: I’ll be working somewhere and I’ll see the potential for change. Then someone will say: “So why don’t you do it?”’

And where did the ambition to become President of the Board at Wageningen come from?

‘Wageningen is very dear to me: an amazing, unique and important institute. Our planet is facing so many challenges where we can and must make a contribution and I think about that all the time. I did have my doubts about the idea of being President, though. Mainly because Louise Fresco was such a strong figurehead and did so much for us. With me, Wageningen gets someone will a different profile. I had to get used to that idea. As a manager, I am more of a facilitator.’
‘What interests me is the big picture. Which direction should we go in, and how? A few years ago, together with the AWTI, I wrote an advisory report for the Dutch government and parliament about the future of higher education in the Netherlands. In it, we stated that universities, including the >

SJOUKJE HEIMOVAARA

President of the Executive Board of WUR
Higher Education:
WUR Plant Breeding 1989, PhD Leiden University, cell biology 1995
Career:
1989-2003 TNO
2003-2020 Royal Van Zanten
2020-2022 Managing director of AFSG (WUR)
Current board positions:
Member of AWTI, Top Women, NWO KIC, Supervisory Board of the Institute for Sustainable Process Technology, Top Institute Food and Nutrition, Carbohydrate Competence Centre

applied science universities, should present a clearer identity, and that the government should exercise more control over the effectiveness and coherence of the entire research and education system'.

And where should Wageningen be heading?

'Wageningen should devote everything it has to working out how we can continue to inhabit our planet sustainably, in the broadest sense of the word. In the debates here in the Netherlands on climate, water and nitrogen, you can see different camps emerging. One group wants to solve the problems with technology, while another wants nature conservation, less livestock and organic and eco-friendly farming methods. I'm exaggerating deliberately here, but this is really happening. If there is one institute that can help bridge that divide, it is WUR. And then, how do we get people to actually use the solutions we come up with? We must also get the Netherlands out of the regional mindset and into the global mindset. There is no other university in the Netherlands that is such a global player as Wageningen.'

Should WUR speak out more on societal issues?

'We must definitely share our knowledge and scenarios in public debates. But that does not mean we have to speak with one voice. We just don't all agree with each other here, and that's only natural. Someone who looks at things from the "organic" angle will see things differently to someone who thinks in technological terms. What's important to me is that people in Wageningen who seriously disagree should talk to each other here on campus, not only in the newspapers, and get to understand each other's point of view better. And I would like it if people only did that in the areas they know about. If I am asked questions about nitrogen, I can take part in the discussion but ultimately I will refer the person to our experts, such as Wim de Vries.'

Heimovaara started studying Plant Breeding in Wageningen in 1983. She was interested in social issues, she says, but her choice of degree was for academic reasons. 'I was really thrilled by plants and genetics. I liked genetics best, but I also remember a practical class in which we had to estimate the yields of fields and one in which you had to identify the variety of potatoes. Fantastic. And going into nature areas with Jan Just Bos to identify plants with *Heukels' Flora*. I was good at it, and I knew them all, because my father dragged me around nature areas all through my childhood. He was a plastic surgeon, but he also knew loads about birds and plants. So as we walked, he would ask "What is this? We are going to identify that". I got fed up with it, because he already knew what it was!'
'My husband studied here too, Soil Science. I met him during the introduction camp for my degree programme. He "borrowed" my bike, but I didn't realize that at the time, ha ha. He only told me later. We are a real Wageningen family, so my daughters didn't want to study in Wageningen. I think that's a real pity, I would have liked it very much. But I think I wanted it *too* much'.
After her studies in Wageningen, Heimovaara worked at TNO for 14 years. She started with barley genetics and got her PhD for a study of the signal transduction of abscisic acid in barley. 'In the end, I increasingly shifted towards biochemistry, working more and more for companies, and getting involved in management. And so I kept ending up in a leadership position, because I would have a strong opinion about something. Then I wanted to go back into research again so I went to Van Zanten. But there too, I became more and more of a manager and worked as director general for more than two years. That is a bit of a common thread running through my career.'

> ‘How do we get people to actually use the solutions we come up with?’

Is the application of knowledge your main passion?

‘No, fundamental research is just as important. You can’t have one without the other. I am not particularly worried about too little attention being paid to applications. What I do worry about is that there is enough money for independent, excellent research. Without that, we will dry up; it lays the foundation for applications. That money has to come from The Hague. They say that industry must invest more in research, but you can hardly ask companies that have to cover their costs to invest in something that probably won’t earn them anything. There are highly knowledge-intensive companies, such as pharmaceutical firms and breeding companies, that are quite prepared to co-invest in fundamental research. In the Dutch Research Council programmes, for example, in which companies contribute about 10 per cent. They do this even though they know that their chances of making a profit on it are zero. In that case, an investment of about 10 per cent, like it is now, is the most you can ask for.’

How do you view collaboration with the private sector?

‘If we want to have maximum global impact, we’ve got to collaborate with the private sector. There is a lot of black-and-white thinking about this. Of course, we have to think about who we want to work with to pursue our mission, and there are certainly dilemmas; it is important that we are transparent about this, and share the issues at stake.’

‘At the same time, WUR really needs to pay attention to our independence. Everyone is dependent – on grants, bringing in projects, bringing in funding. It is difficult to stand firm if a client says: “Are you really going to write that?” And we do sometimes come under that kind of pressure. Or the report is ready, but we are asked to put it aside for another three weeks. That happens.’

Putting a report aside for three weeks?

‘It happens that the results of a study are not convenient for a client at that moment and that they want to shelve the report. The Royal Netherlands Academy of Arts and Sciences (KNAW) did a study of the influence of clients: one quarter of researchers in the Netherlands experience this pressure. In at least half of the cases, it comes from the government, but it also comes from other clients. And Wageningen has had its share of cases, and of course we are opposed to this. At the same time, in many cases a condition for submitting a project for approval is that the researcher seeks a company that will support the research. This can put pressure on the researcher to answer certain research questions and not others. That is a grey area that cannot be resolved just like that. We need to be able to say: “We don’t want this”. And we can do so, but it needs to be more widely felt and supported. Our independence - together with our creativity and intellect - is our biggest asset.’ ■

Food from the printer

Printing food sounds futuristic, but that future is approaching fast. And Wageningen is at the forefront; the latest success is a 3D plant-based 'meat' printer. 'The world of food is going to look very different in 10 years' time.'

TEXT ROELOF KLEIS **PHOTOGRAPHY** ERIC SCHOLTEN

In the process hall of the Axis campus building stands 3D printer PSP. The abbreviation stands for Protein Structuring Printer; a machine that prints plant-based 'meat' – one of the first in the world. This fulfils the wish of an anonymous donor who gave WUR one million euros to develop the machine nearly two years ago. The generous donor's assignment was clear: design a 3D printer that can make a vegetarian burger with better sensory properties than those that are currently on the market.

> 'It's striking a balance between printability and the right bite and taste'

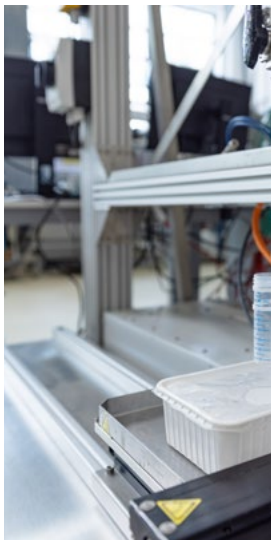
FIBROUS STRUCTURES

And can this printer do that? A cautious 'yes' is the answer from project leader Laurice Pouvreau of Wageningen Food & Biobased Research. 'We have made progress insofar as we can make fibrous structures from plant-based material with a 3D printer. And from these fibrous structure, we can make threads with which shapes can be printed.' And yes, it has really been used to print a burger. A colleague of Pouvreau even used the product in a meal, and apparently it tasted good. But it is not as though the printer has already gone into mass production of veggie burgers in the process hall. In fact, the apparatus looks a bit forlorn there. To put it more positively, let's say she is awaiting further developments. The private funding is finished and a proposal for follow up is in progress. Pouvreau believes there is every reason to take the project further as a great deal has been achieved in a short time. Printed vegetarian meat is still in its infancy. The Israeli company Redefine Meat was first past the post last autumn. Recently, their product has been on the menu at several branches of the Dutch restaurant chain Loetje under the name Biefstuk Bali 0.0. (The 0.0 is a nod to alcohol-free beer.) This development in Israel took the Wageningen researchers by surprise, says food technologist Martijn Noort. He coordinates the 3D activities of the Digital Food Processing Initiative, a collaboration between WUR, TNO and TU/e, which has been working on food printing technologies, including the Protein Structuring Printer, since 2018. 'It's a pleasant surprise, though. Ultimately, it is our mission to en-

The 3D printer PSP prints a plant-based burger made up of several layers to give it a good 'bite'.

sure such things come into existence.'
How Redefine Meat makes the meat is not clear. According to Noort, the company is approaching printing from the medical angle. 'There is more than one road that leads to Rome. Many innovations in 3D printing come from tissue culture, so they involve printing ears and other organs. If you can print an ear, you can also print a piece of meat. Even if the raw materials used for it are not edible. We approach 3D printing from a food technology perspective.'
Pouvreau cannot go into detail about Wageningen's route to Rome because of patent applications. That is also the reason why the printer is still being kept out of the limelight. The basic steps, however, are comparable with techniques such as extrusion and shear cell technology- a process from Wageningen – for making fibrous structures from plant protein ingredients.
'It is a combination of heating and cooling,' Pouvreau explains. 'You have to heat the material to unfold the proteins and create the fibrous structure. Then you have to cool it down to fixate that structure. What we have fine-tuned is the time the material spends being heated and cooled, which is less than a minute in our process. That is very short compared to an extruder (three to five minutes) or a shear cell (up to 20 minutes).'
So far, the printer has mainly been working with bean protein ingredients. This is pushed under pressure through a narrow tube of a few millimetres in diameter, and then heated and cooled. This process produces printable threads. Pressure and temperature have to be adjusted very precisely, says Pouvreau. 'The range within which the fibrous structures are created with printable threads is very narrow. To print, you need a very flexible thread, but as soon as the >



The soft dough of plant-based proteins is inserted into the printer using a 'sausage stuffer'. Processing conditions, such as the temperature, duration and cooling, can be adjusted to change such characteristics of the burger as the firmness, bite and flavour.

'Personalized food doesn't need a supermarket'

fibre structure is created, the threads become less flexible. You have to strike a balance between printability and the right bite and flavour.'

As far as flavour is concerned, the printing process has a surprise up its sleeve. What comes out of the printer turned out to taste a lot better than expected. Pouvreau: 'Beans that come out of an extruder do not taste very nice without any added flavouring. Post-processing is needed to make a palatable meat substitute. With our printer, that is not necessary; you don't get much of a beany taste.' It's not clear yet whether this is a general principle or only works for beans. To find that out, more ingredients need to be tested first.

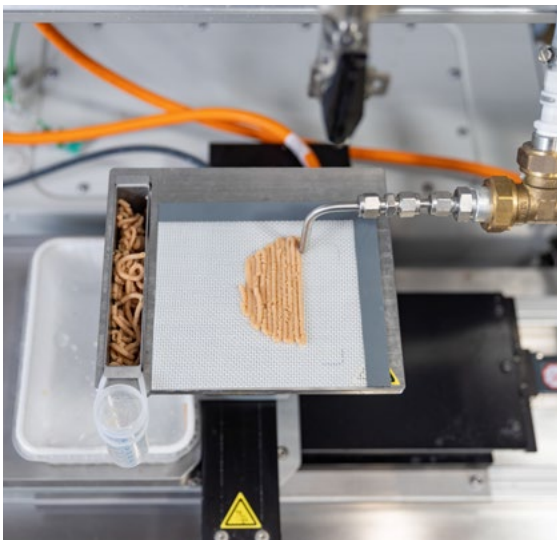
Nor is it clear why the printing process improves the flavour. 'It probably has something to do with heat transfer and the short time period,' says Pouvreau. 'We push the protein through a very narrow tube. That ensures efficient heat transfer so the fibrous structure is created in a short period of time. How a product tastes is closely related to its texture. The texture we create is probably different from what an extruder or shear cell delivers thanks to that short heating time.'

MAKING MEAT JUICIER

Crucial factors for the flavour of meat are its bite and its juiciness. Current veggie burgers are often no match for meat when it comes to these qualities. The Wageningen solution to that lies in a 'coaxial' printing method. 'That means we insert the juice into the printing thread,' explains Pouvreau. 'In effect, we print two things at once: a firm exterior resulting in the bite experience, based on protein, and a soft interior, based on an emulsion. This makes the product juicier and more appetizing once it's cooked, so it is more like beef and pork. If you cut into the thread, you can see the emulsion. It looks like spaghetti with a filling inside it. We still have to optimize the process, but we have demonstrated that it is possible.'

It is this last development in particular that Pouvreau and her colleagues are keen to research further with new funding. And as far as she is concerned, the development should not stop with vegetarian burgers that imitate meat. 'Actually, I want to get away from the idea that the end product must taste like meat. It should taste like something plant-based. Plant protein is different from animal protein, so why would we want to imitate that? It will take some time to convince consumers that plant-based products are good in themselves. It will need a new generation. Veggie burgers are an intermediate step: they look like something the consumer is familiar with. Hopefully we can then move on to plant-based food with a niche of its own on the market'.

Noort too sees plenty of scope for 3D-printed food. Consumers have a growing wish for more choice and control over their own food, he says. 'Just look at all those powders used by sportspeople, and the products for people who do not want gela-



tine, chemical additives, gluten, colourings or whatever. The diversification is increasing all the time. With smart technology and advancing digitalization, product development is booming.'

IMMEDIATE CONSUMPTION

We won't find printed food on the supermarket shelves yet, though. And the question is whether that will happen at all. The Wageningen printer was initially intended to produce food for immediate consumption. 'The aim was to create something that can be eaten immediately,' says Pouvreau. 'So you get personalized food, with a short path between production and consumption'. Noort: 'The most interesting and intriguing feature of 3D printing is that it has been a disruptive technology right from the start. 3D printing disrupts the usual way of doing things. I always compare it to the rise of Uber and Airbnb. Who invented Uber? Not the taxi companies. Who invented Airbnb? Not the Hilton. Similarly, supermarkets are not behind the development of printed food. Personalized food doesn't need the supermarket. The world of food is going to look very different in 10 years' time.' ■

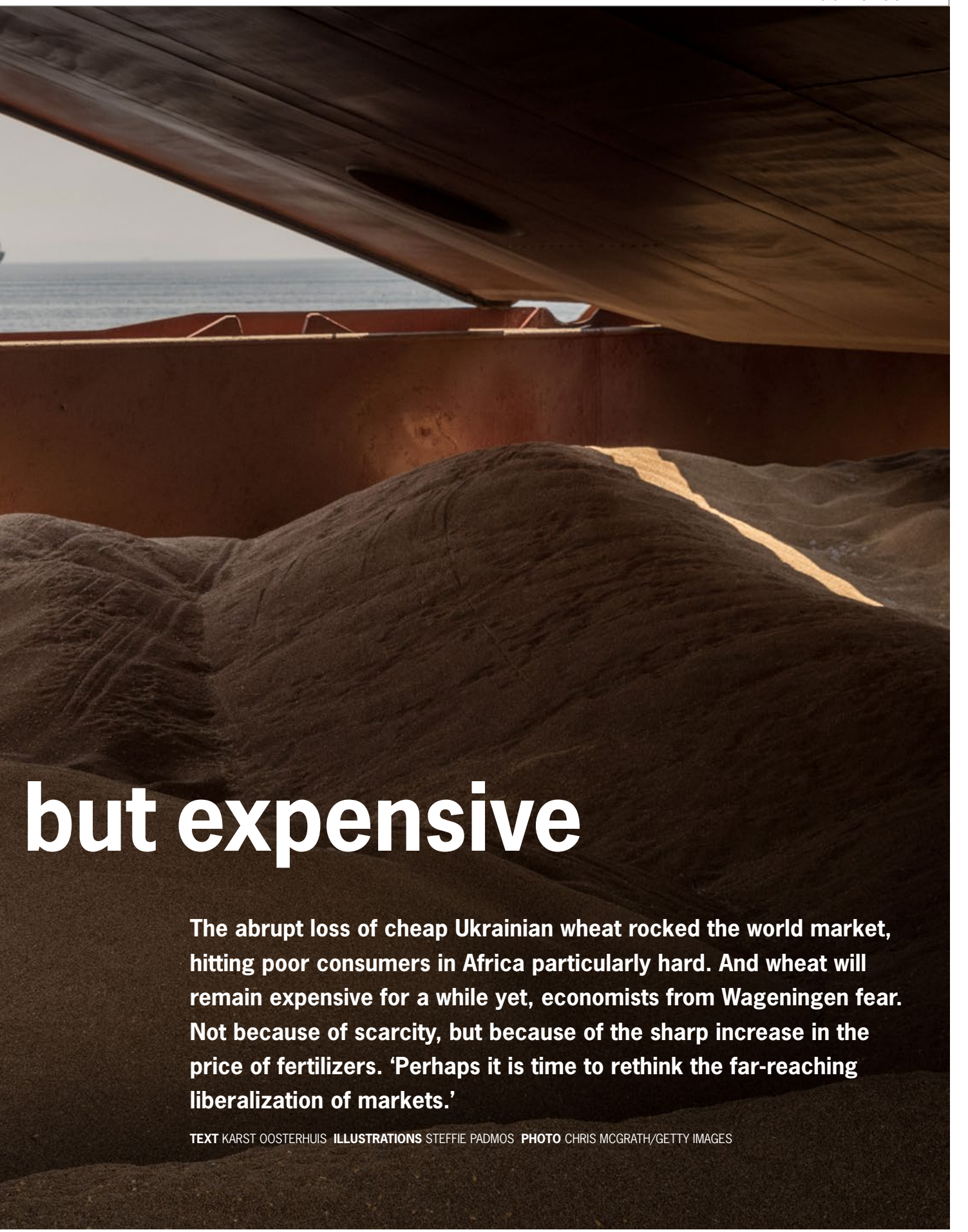
www.digitalfoodprocessing.com

PRODUCTS FOR LUNG PATIENTS AND SOLDIERS

The Digital Food Processing Initiative (DFPI), a collaboration between WUR, the Netherlands Organization for Applied Science (TNO) and Eindhoven University of Technology (TU/e) was set up in 2018. The 3D burger printer is the latest success story, which was preceded by a chocolate printer for Cadbury and a pasta printer for Barilla. And there is more in the pipeline. Together with industry, researchers at the DFPI are developing a printer that will make customized products for military personnel and COPD patients, tailored to the health status and needs of the individual. Wageningen will take care of the food technology and social aspects of this project (Imagine). Food technologist Martijn Noort: 'Which ingredients should be in the product, how do you go about it, how do you make it tasty, how do you incorporate the consumer's preferences, and what requirements must the technology meet so that the consumer will use it properly?' In addition to this applied project, the Dutch Research Council is funding the fundamental research project Print Your Food. In this project, WUR and TU/e are developing a so-called digital twin of the printing system. That is a mathematical model that covers all aspects of the 3D printing process. The software can be used to predict whether certain recipes are printable and will yield the desired structure. A third line of research is the processing of residual streams in 3D printers, but this is still in its infancy.

FOOD PRICES WILL REMAIN HIGH

Wheat is not scarce



but expensive

The abrupt loss of cheap Ukrainian wheat rocked the world market, hitting poor consumers in Africa particularly hard. And wheat will remain expensive for a while yet, economists from Wageningen fear. Not because of scarcity, but because of the sharp increase in the price of fertilizers. 'Perhaps it is time to rethink the far-reaching liberalization of markets.'

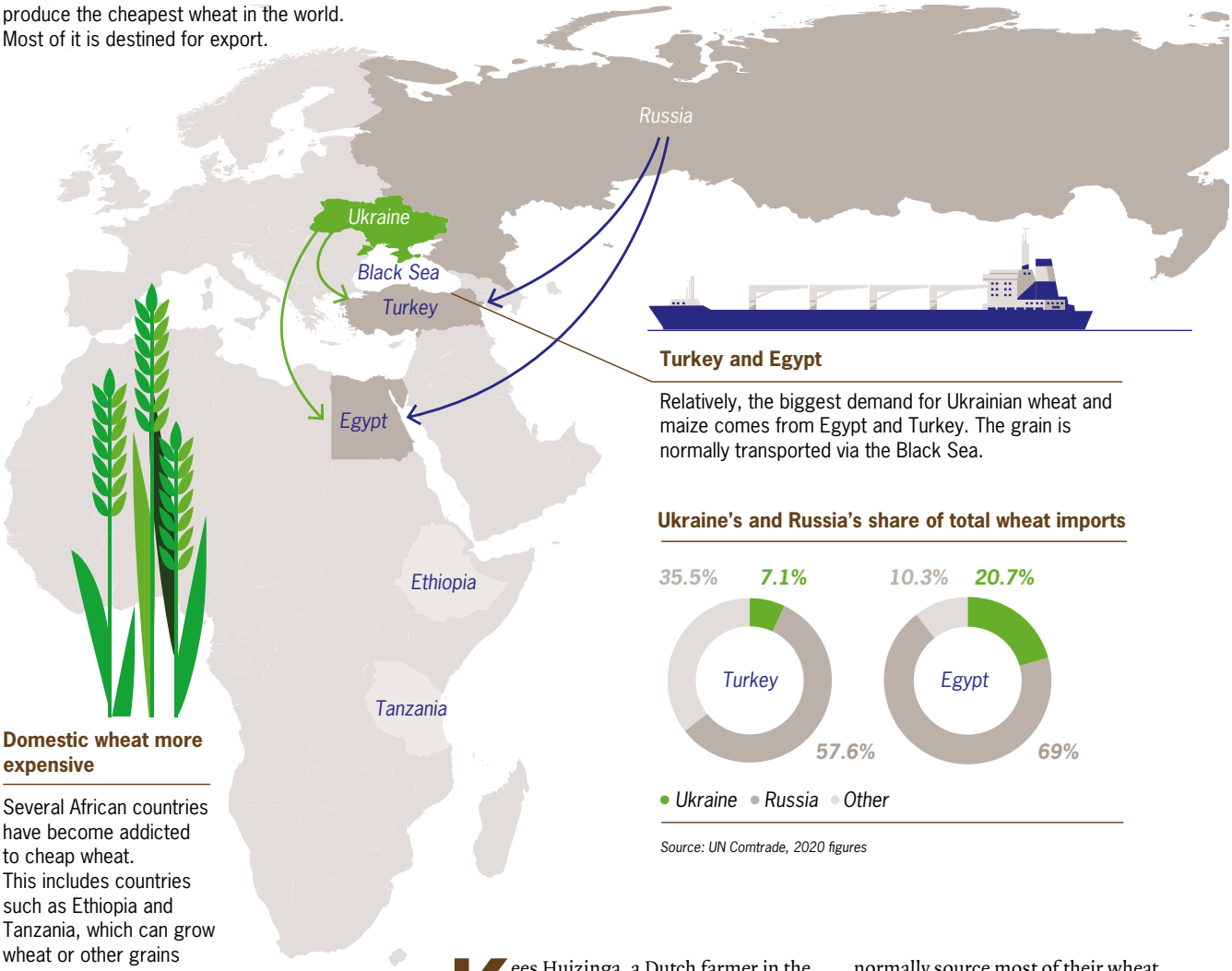
TEXT KARST OOSTERHUIS **ILLUSTRATIONS** STEFFIE PADMOS **PHOTO** CHRIS MCGRATH/GETTY IMAGES

DEPENDENT ON CHEAP GRAIN

Cheapest wheat in the world

Ukraine has very fertile soils and low fertilizer and energy prices, which enables the country to produce the cheapest wheat in the world. Most of it is destined for export.

Countries in the Middle East and North Africa get most of their wheat from Russia and Ukraine.



Turkey and Egypt

Relatively, the biggest demand for Ukrainian wheat and maize comes from Egypt and Turkey. The grain is normally transported via the Black Sea.

Ukraine's and Russia's share of total wheat imports

Source: UN Comtrade, 2020 figures

Domestic wheat more expensive

Several African countries have become addicted to cheap wheat. This includes countries such as Ethiopia and Tanzania, which can grow wheat or other grains themselves, only their own grain is more expensive.

Kees Huizinga, a Dutch farmer in the Ukraine, has been a frequent guest on talk shows, where he has expressed his concern about the impact of the war on the food supply. The country is often described as a 'breadbasket', and yet Ukraine's share of the world wheat market is limited, says economist Petra Berkhout of Wageningen Economic Research. 'Things like weather conditions cause annual fluctuations in global wheat production, and in some years these fluctuations are much bigger than the Ukrainian yield. So this is not about the availability of wheat, but its affordability.' The high price of wheat has particularly serious consequences for countries in the Middle East and North Africa that normally source most of their wheat from Russia and Ukraine. Ukraine has very fertile soil and low fertilizer and energy prices, enabling it to produce the cheapest wheat in the world, most of which is destined for export. 'This makes it possible to supply the urban population in Africa with cheap wheat,' explains Bart de Steenhuijsen Piters, who also works at Wageningen Economic Research. 'Several African countries have become addicted to it. These include countries such as Ethiopia and Tanzania, which can grow wheat or other grains themselves. It's just that their own grain is more expensive.' Most of the concern is focused on wheat, and yet Ukrainian exports of sunflower oil and maize are hampered too. According to

> ‘This is not about the availability of wheat but its affordability’

the researchers, this does not have a major impact on food security in the Netherlands because there are enough alternatives available for both crops. Other oils such as rapeseed oil are an adequate substitute for sunflower oil. Maize is mainly used as cattle feed and can be replaced by soya, among other things.

MORE EXPENSIVE BREAD

Egypt and Turkey are the most dependent on Ukrainian wheat, which is normally transported via the Black Sea. Turkey has been facing high food prices for a while, partly due to the fall of the lira, the national currency. And now the price of bread has risen even further. In Egypt, where bread is heavily subsidized and rationed by the state, the search is on for alternatives to Ukrainian wheat. The country placed a large order for wheat from France, for example, and wheat flour is being mixed with starch from sweet potatoes.

But according to De Steenhuijsen Piters, a much more worrying situation is currently developing in the Horn of Africa, where extreme drought has caused crop failures. ‘The United Nations World Food Programme is distributing wheat, but the high prices mean that the aid organizations can only buy half what they would normally. Emergency aid has become too expensive,’ explains De Steenhuijsen Piters. He describes the plight of African city dwellers as less acute, but just as dire, as they often spend more than 60 per cent of their income on food. This makes city dwellers extremely vulnerable to price increases, says De Steenhuijsen Piters. He helped with the analysis for a study among 26,000 urban households in Benin. ‘If you look at their food situation, you get quite a shock. Local food prices fluctuate with the international markets. As soon as food prices go up, there is no money left for school or clothes.’ Like Berkhout, he does not talk in terms of a food shortage, but of a lack of purchasing power which makes food too expensive for the poorest.

Over the past decade, average global food prices actually fell, but the onset of the Covid-19 pandemic was a turning point, after which prices rose rapidly. The virus made trade more difficult and energy prices, which are a big factor in fertilizer prices too, rose. The war in Ukraine came on top of that, Berkhout says. ‘Normally, as an economist, I would say that a high price stimulates an increase in production, which then leads to a fall in prices. Now I am doubtful because of the increased prices of fertilizer and energy, which are a big factor in the price of food. There are a lot of uncertainties and no one knows how long this conflict will last.’

CREATING SCARCITY

In particular, the price of fertilizer may remain high for a long time, with consequences more far-reaching than the loss of Ukrainian wheat. An important component of fertilizer is potash, which is mainly mined in Russia and Belarus. Both these countries could create a lasting scarcity. High prices wouldn’t stop farmers in Europe from spreading fertilizer, but it’s a different matter in Africa, says Berkhout. ‘Farmers there have fewer liquid assets, so they tell us they are going to use less fertilizer.’ >

PHOTO GUY ACKTERMANS

BART DE STEENHUIJSEN PITERS,
Food Systems and Food Security researcher at Wageningen Economic Research

> ‘A tax break on wheat makes no sense in countries where most local businesses don’t pay any sales tax at all’

PETRA BERKHOUT,
Agricultural economist at Wageningen Economic Research

If African farmers use less fertilizer, their yields will lag behind and they will become even more dependent on food grown abroad, say the two scientists. De Steenhuijsen Piters sees the war in Ukraine as exposing the way a free world market jeopardizes food security. ‘The cheapest food of all goes to the poorest consumers. Their wheat is sourced from the Ukraine, but in West Africa they also eat chicken wings from the EU. That can work well for a long time, until something happens to disrupt the system.’

LOCAL PRODUCTION

The way to reduce vulnerability to disruption, according to De Steenhuijsen Piters, is to diversify food sources, getting some wheat and other food crops from the region and some from various countries further away. Wheat, for example, can also be sourced from Canada, albeit at a slightly higher cost. Increasing local production is also key to increasing food security, says De Steenhuijsen Piters. Powerful instruments for this, in his view, are subsidizing fertilizers and fuel, and imposing an import tax on wheat.
Even if, say, yields in Africa are successfully boosted through fertilizer subsidies, it is by no means a foregone conclusion that farmers will then produce more wheat. Whereas food production is highly regulated in Europe, in Africa more than 80 per cent of all food is traded through informal businesses, he explains. ‘So governments have very limited control over what is produced. There is no point in a government deciding to give a tax break on wheat, because most businesses don’t pay any sales tax.’

It is generally traders who decide which crops farmers will sow. They do not see food security as their task and they go for the most lucrative crops. These might be cash crops like cotton or cocoa, which do not contribute to greater self-sufficiency. To get a better grip on food production, says De Steenhuijsen Piters, it is important to gain a real understanding of the informal economy.
So he and his local partners - mostly Wageningen alumni – are going to talk to informal traders. The researchers hope these interviews will give them an insight into the traders’ network and the considerations at play in in their decision-making.
De Steenhuijsen Piters: ‘We always think in terms of formal measures such as tax benefits, but we are now increasingly realizing that our conventional tools are not working. It’s important to recognize that and to get round the table with traders. Just ask the question: what would it take for you to target other objectives, such as food security?’

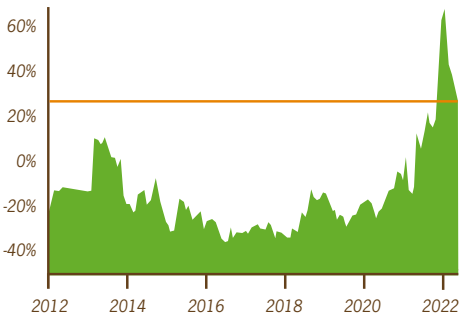
BECOMING SELF-SUFFICIENT

Even if they increase local wheat production, self-sufficiency is not feasible for many countries, Berkhout says. Political instability gets in the way, but in numerous countries it is technically impossible too: ‘Egypt, for example, couldn’t do it because it has too little agricultural land. And lots of countries can switch to local grain varieties such as sorghum or millet, but these grains can’t compete with cheap and efficiently produced wheat from elsewhere.’
Now that the market has recovered from

WORLD FOOD PRICES

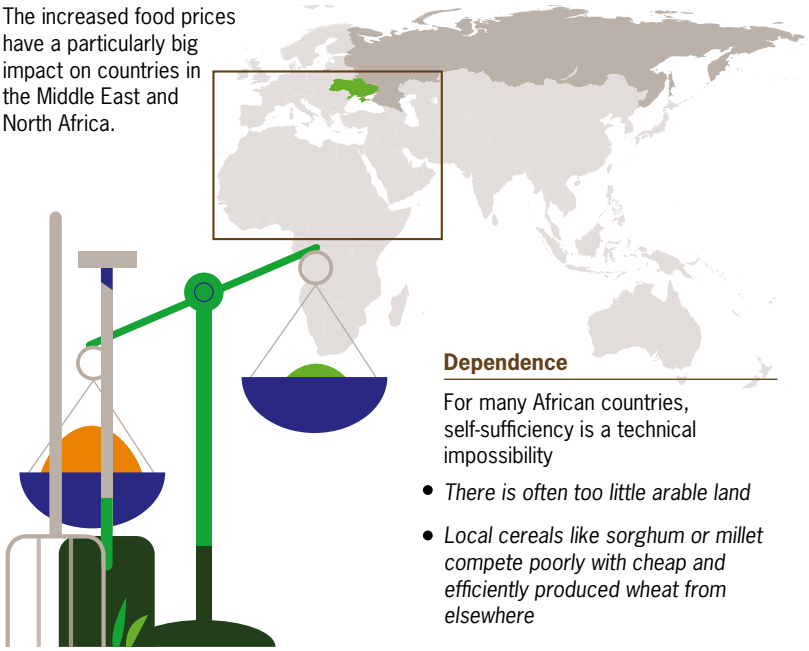
Over the past decade, global average food prices have been falling, but the Covid-19 pandemic has made free trade more difficult and energy prices, which are also a major determinant of fertilizer prices, have been rising. The war in Ukraine came on top of this.

Wheat prices



After a peak of 66% above the pre-war level, the price is now 20-30% higher than it was then.

The increased food prices have a particularly big impact on countries in the Middle East and North Africa.



Dependence

For many African countries, self-sufficiency is a technical impossibility

- *There is often too little arable land*
- *Local cereals like sorghum or millet compete poorly with cheap and efficiently produced wheat from elsewhere*

the initial panic after the war broke out, wheat prices have dropped from a peak of 66 per cent above pre-war levels last summer to 20 per cent above pre-war prices. Both researchers believe that other countries will increase their wheat production next year, which will normalize the price. But they do expect that the high energy and fertilizer prices, along with the impact of the serious droughts now affecting several regions, will keep food prices in general high for the coming years.

According to De Steenhuijsen Piters, the short-term solution is simple: more money must be allocated to emergency aid so that more food can be distributed in regions suffering from severe drought. In areas where local stakeholders are in trouble because of high food prices, he says, the most effective approach is to provide financial support in the form of cash transfers for vulnerable households. In the longer term, he argues for sourcing food more diversely and stimulating local food production. 'This requires forms of subsidy or even import levies so producers can compete with imported food. And that is controversial because it goes against the principles of free trade. Perhaps it is time to rethink the far-reaching liberalization of markets'.

FOOD, FEED OR FUEL

Berkhout points out that food crops are currently also used for cattle feed and biofuel. In the EU, for example, two-thirds of the grain grown, including maize, is used for livestock feed: 'If food becomes so expensive, you have to consider whether to grow crops for food, feed or fuel.'

De Steenhuijsen Piters hopes the war will rekindle the debate on international food markets and food security in Africa. He sees the National Food Dialogues, held worldwide in the run-up to the first UN Food Systems Summit in 2021, as a good start. 'Until now, there has been too much emphasis on cheap calories. Food security and food diversity are equally important yardsticks. We need to go on talking to all the important stakeholders. I think the war has increased the support base for that discussion.' ■

www.wur.eu/ukraine-food-security

LEARNING TO READ THE LANDSCAPE

How could it go so wrong in Limburg?

In the part of Limburg province that was hit by floods last year, first-year students are studying the landscape. What went wrong and how can the region prepare better for extreme weather? 'When you see the damage with your own eyes, you know why you are doing this degree.'

TEXT LUUK ZEGERS

The van slows down and comes to a stop on a dirt road running past a field of sugar beets. Course coordinator Teun Vogel and teacher Katinka van Buuren get out of the van. The Canadian exchange student Katie and her Dutch teammate are crossing the sloping field with a 50-metre tape measure. In the middle of the field is a strip of bushes: a 'graft' in Dutch.

This kind of 'graft' can be found on many sloping fields in Limburg. They have multiple functions, such as counteracting erosion and stimulating biodiversity. The students halt their measuring activities for a brief consultation with their teachers. Katie: 'We are looking at whether grafften mitigate the effect of flooding.' Van Buuren: 'What do you think the answer is?' Katie: 'I would say yes. If the water infiltrates the ground there, that slows down the flooding and reduces the amount of water that ends up in the streams and creeks.'

Back in the bus, Vogel tells us that 11 years ago, he too went along to South Limburg as a student. 'At that time, it was still a shorter excursion of five days, and the focus was on taking measurements. We didn't have to do any research yet; it was more about learning to measure.' Over the years, the course grew into 10 days of fieldwork in which students had to formulate a research question and conduct research themselves, Vogel explains. 'Some first-year students find it quite difficult to come up with a good research question. Last year there was flooding here and the team of teachers knew at once that we should relate the course to that.'

RAGING TORRENTS

In the summer of 2021, after days of extreme rainfall, disaster struck in Germany, >

Students study the soil composition in South Limburg.

‘This was a tsunami of rainwater’

PHOTO JEROEN POELERT

‘The soil was waterlogged; the basins were full. Then when the water starts moving, there’s no stopping it’

PHOTO LUUK ZEGERS

PHOTO JEROEN POELERT

PHOTO JEROEN POELERT

PHOTO LUUK ZEGERS

Belgium and the south of Limburg in the Netherlands. Rivers and streams were transformed into raging torrents that took the lives of more than 200 people and caused tens of billions of euros worth of damage. Miraculously, there were no fatalities in the Netherlands, but here too, fear is now rife. How could it go so wrong? Where are the bottlenecks? And what measures can be taken to ensure that every drop of water that falls or flows stays within the banks of the rivers?

At the invitation of the mayor of Valkenburg aan de Geul – the worst-affected municipality in the Netherlands – 63 first-year students set about tackling these questions. In the process, they get to apply pretty much everything they learned in their first year. They do research in an assigned area upstream of Valkenburg. Among the things they examine is the impact of agriculture, nature conservation and landscape design on the soil and water.

MAKING TRANSECTS

The students take measurements, talk to stakeholders, ‘read’ the landscape and make transects. ‘A transect is a cross-section of the area, the aim of which is to understand it better,’ says Vogel from behind the steering wheel as he and Van Buuren drive through the rolling Limburg landscape to check in with the groups of students in the field. ‘With a transect you can map how steep the hills are, what is growing where, whether the soil structure changes with your altitude in the area, and so on. You can take measurements along a transect and see, for example, where water infiltrates better or how people living in different places in the area think the landscape should be managed. It is a nice way of making your research more tangible and getting it across to people.’

IN THE BATHTUB

A little later, we are driving through one of the longest valleys in the Netherlands. ‘This is one big bathtub, really,’ says Vogel. ‘We are high up on the side of the bathtub now. When it pours with rain here, all the water runs downhill. That is why there are basins all along the road to catch the water. They are meant to slow the water down. Only there were too few of them, because if it rains hard for too long, the basins overflow and the water just pours downhill like crazy.’ He points out a cycle path under construction. ‘You can see that they are building a drain next to it. It’s important to give a lot of thought to how to collect water. After a short pause: ‘This is the purpose of the course, really: to get students looking around them like this. So that they ask themselves how high the highest point is and how low the lowest point, which direction the water flows and what interventions might be possible to slow that water down.’

Vogel and Van Buuren leave by bus for the meeting point to pick up students for the afternoon programme in Valkenburg. Along the way, we regularly encounter groups of young people cycling with one hand on the handlebars and the other holding an auger, a tape measure, or ranging rods (red and white measuring sticks), pedalling fast to reach the agreed location on time.

LITTLE STREAM

That afternoon, Mayor Daan Prevoo led a sizeable delegation of WUR students and

PHOTO BERT JANSSEN

The temporary bridge over the Geul in Valkenburg

lecturers through his town. He showed them the places that were the hardest hit, such as the houses with low-lying back yards where the water forced its way in with great violence, and one of the listed buildings where a fire broke out due to a short circuit. Shocking, says student Emiel. 'It's amazing to see how high the water was. If you look at the Geul now, it's just a little stream.' Emiel enjoys doing research in small groups. 'Because you actually go into the field with measuring instruments and your own research question.' It's not all plain sailing, though. 'We assumed we would be able to take water samples, but it has been dry for a long time now. We are hoping for rain. The forecast is for rain today and tomorrow, which would be good for our research. And for me personally too, because I'm hot.'

The group arrives at the Geul. Where the historic Emma Bridge stood until last year, there is now a temporary bridge made of steel tubing. The stone bridge was not strong enough to withstand the force of the water. While the mayor is talking about this, dark clouds are gathering. Suddenly, a strong wind blows up and it starts to rain. The group quickly retreats into a passageway in an apartment block. After a short break, they attempt to resume the tour, but the thunderstorm soon breaks and the rain comes down in torrents, with a deafening clatter. Those who do not find shelter are completely soaked in a matter of seconds. Chaos ensues: students and teachers start hurrying, one group tries to take shelter under a roof, others run for it. After a while, the sheltering students give up and start running too, the mayor leading the way and shouting: 'Back to the town hall!'

PEOPLE SCREAMING

As the storm rages outside, the sodden group trickles into the council chamber with squeaky shoes. 'Just imagine what you have just experienced, but going on for days on end,' says Prevoo. 'And in the middle of the night, things go wrong: the water comes pouring in non-stop, in some houses up to a height of 1.80 metres. There is no light because the power is out. You are standing there in cold water up to chest height. You can hear the roar of the water and people screaming and shouting.' There are rescue workers with post-traumatic stress from the experience, Prevoo says. 'There was a father standing in the water with a nine-month-old baby in his hands. He handed the baby to his partner and a few moments later he was knocked down by a scooter that was floating past. He survived, but imagine if he had still been holding his baby when he was pulled underwater.'

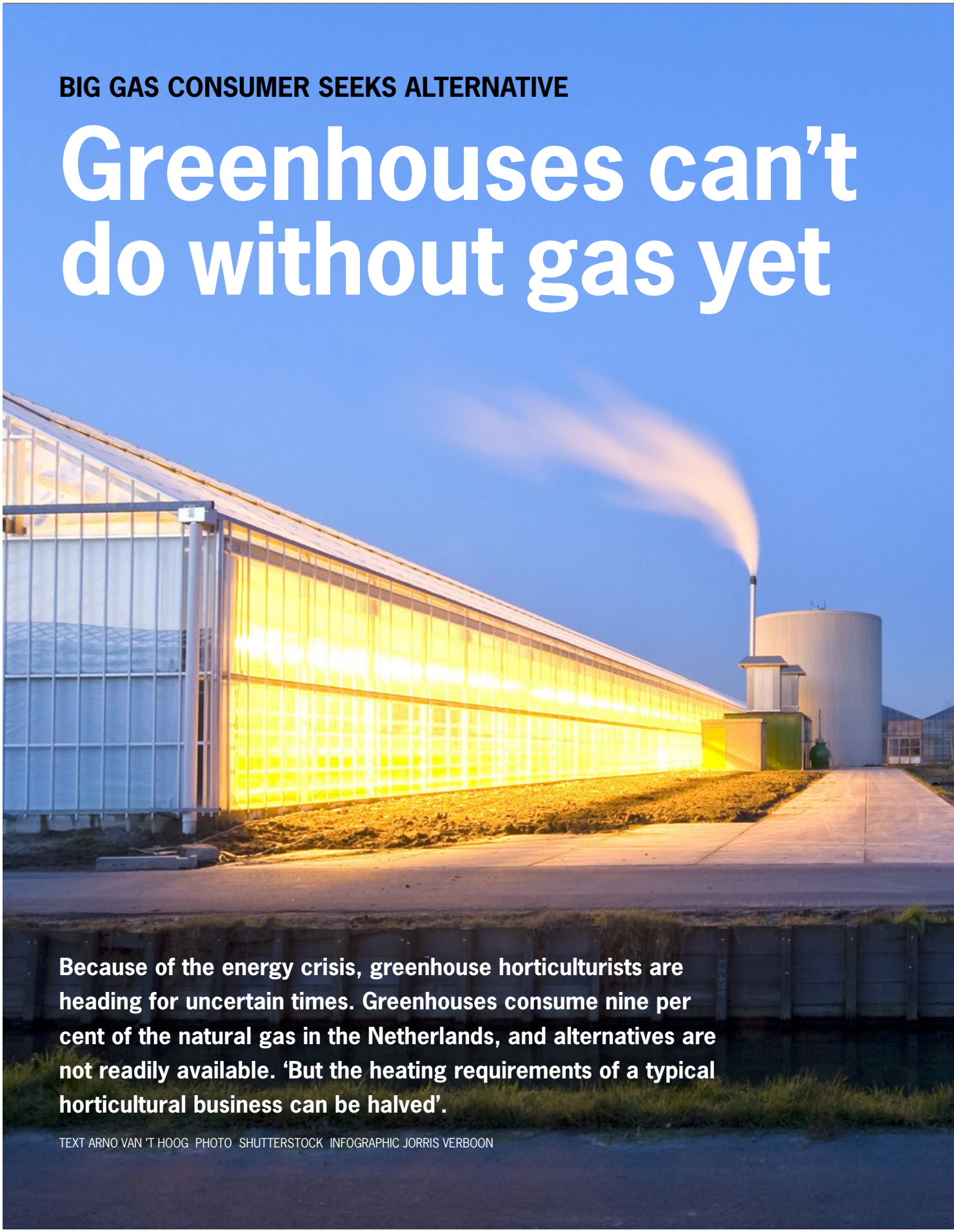
All things considered, it is a miracle there were no fatalities, says Prevoo. 'The stories just say that the Geul flooded, but this was an absolute tsunami of rainwater from a very large area. The soil was waterlogged; the basins were full. Once the water starts moving, there's no stopping it.' He calls the extreme weather a consequence of climate change. 'Can we still prevent that? No. But with the right measures in the landscape, we can manage the consequences better.'

WITH YOUR OWN EYES

The tour and the mayor's story made a big impression on student Youssef. 'You can read about it in books, but when you see the damage with your own eyes, like the fact that the bridge is no longer there and how high the water came up in the houses, then you know why you are doing this degree.' He can see himself working in this field later. 'Here the problem is water, elsewhere it might be drought or food shortages. I think it would be great to be able to do my bit to prevent problems like this.' ■

BIG GAS CONSUMER SEEKS ALTERNATIVE

Greenhouses can't do without gas yet



Because of the energy crisis, greenhouse horticulturists are heading for uncertain times. Greenhouses consume nine per cent of the natural gas in the Netherlands, and alternatives are not readily available. 'But the heating requirements of a typical horticultural business can be halved'.

TEXT ARNO VAN 'T HOOG PHOTO SHUTTERSTOCK INFOGRAPHIC JORRIS VERBOON

Growers of tomatoes, cut flowers and pot plants are no different from the average household; their greenhouses use a lot of gas and electricity, especially in winter, for heating and lighting the plants. Prices have recently risen rapidly, especially since the outbreak of the war in Ukraine and the reduction in gas supplies from Russia. Whether or not this will put horticulturalists in the red depends mainly on how long this energy crisis lasts, according to a survey by greenhouse horticulture organization Glastuinbouw Nederland. Before 2022, 75 per cent of the greenhouse horticulture companies had fixed the price for at least some of their energy in longer-term contracts with energy providers. Nevertheless, 38 per cent of greenhouse horticulturalists expect to have difficulty paying their bills by the end of 2022. Some growers decided last winter to heat less, switch off the lights or not to use all their greenhouses.

> ‘Once the plants are in place, you can’t just turn off the heat’

WINTER BREAK OR NOT

Many more may do this next winter. The Ministry of Economic Affairs and Climate Policy is working on a shutdown plan for Dutch businesses, should real shortages occur. The plan includes compensation for greenhouse horticulture companies that voluntarily reduce their energy consumption. This will enable growers to assess what would be the most economically sound course of action: to continue growing plants through the winter or to take a break.

‘That is the kind of thing entrepreneurs are wondering about under the present circumstances,’ says Frank Kempkes, a researcher in Energy and Greenhouse Climate at Wageningen University & Research in Bleiswijk. He is the project leader of a number of demonstration greenhouses showcasing how greenhouse horticulture can be more energy efficient. ‘At the current gas price of around two euros per cubic metre, you can’t really break even anymore. There have already been rose growers who turned off the heat in their greenhouses last winter. Roses can withstand such a period perfectly well, but other types of cut flowers cannot. Potted plants can be kept a little cooler for a few months, but you can’t turn the heat off completely. And it will delay growth and mess up the company’s planning.’

Growers have to decide far in advance what risks they want to take with a crop, says Kempkes. ‘For an illuminated tomato crop, the young plants are moved into the greenhouse at the beginning of August and harvesting starts early October. Once the plants are established, and you have been investing in substrate, fertilization and care for months, you cannot just turn off the heat when the price of gas goes up. You will suffer massive losses if you do.’

The demonstration greenhouses in Bleiswijk have shown in the past few years that considerable energy savings are possible in, for example, the cultivation of strawberries, gerbera, freesia and pot anthurium. Experience has been gained with better insulation, heat pumps, efficient LED lighting, dehumidification and precision climate control. One of the challenges of optimum insulation with little ventilation is air humidity, which can cause fungal infections if it gets too high.

‘For the freesias, we have adjusted the lighting better to the growth stage,’ says Kempkes. ‘A young plant gets little light, and a big one more, up to a certain maximum. By doing that, we have significantly reduced electricity consumption for the lamps, and growers have become more aware that more light is often pointless.’

GREEN ELECTRICITY

The demonstration greenhouses do not use gas: their heating and lighting are electric. And that is the way to go, Kempkes thinks. ‘Preferably on green electricity, but that is either not available or not affordable yet, and it is impossible for individual growers to organize it with wind turbines and solar panels on their own land. Hydrogen is an option as a fuel, but that is still a distant prospect. And in a lot of future scenarios, hydrogen is seen as primarily an energy source for >

> ‘With the current price of gas, you really can’t break even anymore’

industries that work with very high temperatures, such as the chemical, glass and steel industries.’
Greenhouse horticulture has made great strides in energy saving over the past 20 years. More is being produced per square metre using less energy. But there are even more possibilities, says Kempkes. ‘When you add it all up, the heating requirements of a typical horticultural firm can be halved with insulation, heat recovery and smarter cultivation. Storing heat in the ground can also yield savings, because this technology uses the heat surplus in summer to make up for the shortage in winter.’
A few pioneers have already switched from gas to heat storage. Orchid grower Van der Hoorn in Ter Aar had 15,000 square metres of gas-free greenhouse built in 2006, with lighting provided by green electricity. The cultivation of butterfly orchids takes a year, six months of which are spent at a tropical temperature of 28 degrees and six months at 19 degrees to stimulate flower formation. During the cold period, the greenhouse is heated by means of a heat pump, and the resulting cold is stored in the soil to be used in the summer to cool the greenhouse.
Kempkes: ‘In the Netherlands, the sun provides the equivalent in energy of 100 cubic metres of natural gas per square metre. Growers consume an average of 30 cubic metres per square metre each year, so the sun supplies much more than the horticultural sector needs. Sadly, it is all concentrated in the summer months.’

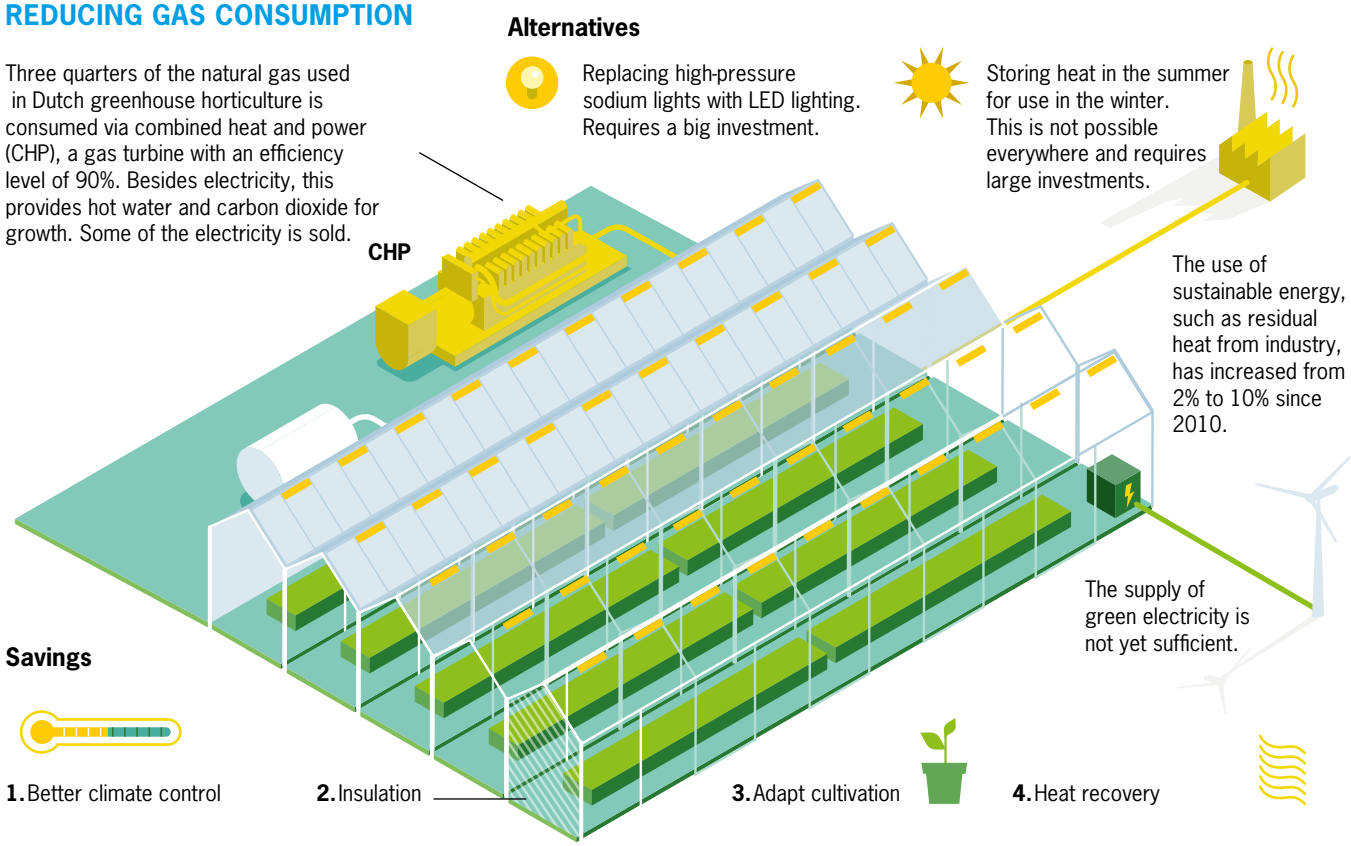
SEASONAL HEAT STORAGE

Storing summer heat sounds like the perfect solution, but to Kempkes it is just one of the options for saving energy. ‘It will be a long time before seasonal storage of heat is standard practice, and it requires big investments in equipment and construction. Storage takes place in aquifers in the soil, but you can’t do that everywhere, because the groundwater is sometimes too deep or too fast-flowing, or you are not allowed to used it.’
Heating is just one of the things growers need to make crops grow and flower properly; artificial lighting is at least as important for many crops. The standard lighting in the greenhouse is a variant of old-fashioned street lighting: the high-pressure sodium lamp. This produces bright orange-yellow light but also a lot of heat, so it is not very efficient. Kempkes: "Modern LED lighting can halve electricity consumption, but it also means a big investment.’
Finally, greenhouse farmers can consider turning the thermostat down a few degrees, or switching between crops: growing pot plants in winter and peppers in summer, for example. Kempkes: ‘You can grow many crops at colder temperatures, but it also slows their growth, and lowers both yields and quality. The consumer won’t like that. We switch crops in our demo greenhouse, but in daily practice that is not easy. Pot plants are often grown on concrete floors and sometimes even on tables. Taking out all the tables for six months is a big job, besides the extra investment.’

COPING WITH SETBACKS

Investing in glasshouse horticulture presents entrepreneurs with difficult choices, says Pepijn Smit, a researcher at Wageningen Economic Research and author and project leader of the annual Energy Monitor for Dutch Greenhouse Horticulture. ‘On the one hand, the sector wants to stop being dependent on natural gas as soon as possible. On the other hand, that first has to be feasible, not least financially. There are dark clouds hanging over the sector’s future. Growers don’t know what will happen this winter, let alone in the next two years. Some companies still have reserves for coping with setbacks, but they are not inexhaustible either.’ And that is in spite of the fact that the sector has developed well, says Smit. ‘The upscaling and professionalization of recent years have made it possible to invest in sustainable solutions.’
The Energy Monitor for Dutch Greenhouse Horticulture provides an annual overview of the energy accounts of Dutch greenhouse horticulture and the energy sources it uses. Smit: ‘The use of sustainable energy has grown steadily, as has the purchase of en-

REDUCING GAS CONSUMPTION



ergy such as residual heat from industry, which means the greenhouses do not themselves emit CO_2.' Since 2010, the proportion of energy that is sustainable has increased from 2 to 10 per cent. 'If you want that proportion to grow even further, you need alternatives that are available and affordable. Affordable sustainable electricity should be one of them.'

According to Smit, the role of electricity is sometimes forgotten in discussions about greenhouses and gas consumption. Lighting is essential for year-round production. Growers use combined heat and power (CHP) for this purpose: a mini power station with an efficient gas turbine that produces electricity, hot water and carbon dioxide for the growth, all of which benefit production. In addition, a significant amount of the electricity produced by CHP is sold for use by other energy consumers in the Netherlands.

SELLING ELECTRICITY

In terms of energy consumption and costs – 1.3 billion euros annually – the greenhouse horticulture sector is up there with the chemical industry and oil refineries, writes the ABN AMRO bank in a recent report. Greenhouse horticulture is a major consumer, accounting for nine per cent of the natural gas in the Netherlands. Three-quarters of that gas fuels combined heat and power plants, which cover no less than 11 per cent of the country's electricity needs. Smit: 'The greenhouse horticulture sector sells more electricity than it uses itself, particularly at times of peak demand in the network, for example on winter mornings or when there is less wind or solar power available. CHP plants can respond very fast to changes in electricity consumption, much faster than a coal-fired plant.'

That is food for thought, says Smit: if you get the greenhouse horticulture sector off the gas, growers will have to source their electricity, heat and carbon dioxide for growth elsewhere. 'If electricity from a power station is expensive, it may be more attractive to buy expensive natural gas and convert it into heat and electricity in CHP plants. Cogeneration (CHP) in greenhouse horticulture is remarkably efficient, with a utilization rate of over 90 per cent.'

At present, cogeneration, combining heat and power, has several commercial advantages, says Smit. If gas consumption and emissions in greenhouse horticulture are to be reduced, more sustainable electricity, heat and CO_2 must become available. 'Once there are affordable alternatives, growers will be happy to switch to them and reduce their gas and CHP consumption.' ■

www.wur.eu/greenhouse2030

Using crushed minerals to combat climate change

Can minerals help extract the greenhouse gas CO_2 from the air? PhD student Emily te Pas is investigating the potential of spreading crushed silicate minerals on agricultural land. 'This is still pioneering at this stage. It is important to collect data: does it work and is it safe?"

TEXT RIK NIJLAND **PHOTOGRAPHY** MARCEL VAN DEN BERGH

At a testing site in Renkum, PhD student Emily te Pas is investigating whether the greenhouse gas CO_2 can be extracted from the air by adding silicate minerals to agricultural soil. The underlying principle is literally as old as the hills. Silicate rocks react with dissolved CO_2 to bind this gas to bicarbonate, which can precipitate in the soil in the form of lime. When this happens naturally, it goes at a geological snail's pace. But if you ground the minerals into grit, thought Utrecht geologist Olaf Schuiling 15 years ago, that weathering would take place within years or decades. Schuiling predicted that you could use olivine, the most reactive silicate and one of the most common minerals on earth, to extract CO_2 from the air on a large scale and deploy it in the fight against climate change.

ENHANCED WEATHERING

'I encountered the concept of enhanced weathering when I was doing my MSc degree in Climate Studies in Wageningen,' says Te Pas. 'A lot of research is being done on how big the problem of climate change is. Personally, my main aim is to work on solutions, and enhanced weathering is one example. That's what I wanted to focus on in my Master's thesis.' That led her to Mathilde Hagens of the Soil Chemistry and Chemical Soil Quality Group, who is now her co-supervisor. She conducted a laboratory experiment with different silicate minerals to get an initial idea of the effect of adding them to the soil on the soil chemistry. She received the 2020 Hissink Award from the Dutch Soil Science Association for best thesis of the year.

BENEFITS FOR THE FARMER

Te Pas declines to offer a back-of-a-beermat estimate of the quantities of the mineral you would need to sequester, say, the annual CO_2 emissions from road traffic in the Netherlands. 'The margins in the calculations vary enormously. What is certain is that you need to apply such minerals on a large scale; in the sea perhaps, or on large areas of land. My research focuses on their use in arable farming, which is a huge surface area worldwide.'

So Te Pas is also looking at the possible advantages for the farmer, such as improving soil fertility. The conversion of CO_2 to bicarbonate and lime, for example, increases the pH of the soil, which can be beneficial to crops.

At a testing site near Renkum, PhD student Emily de Pas studies how adding silicate minerals to farmland impacts CO_2 sequestration, soil chemistry and crops.

But there are also risks. As the mineral olivine weathers, for example, it releases the potentially dangerous nickel. One research question is: does that nickel run off into the groundwater, is it taken up by the crop or does it remain bound to soil particles?

NATURAL CONDITIONS

After her Master's thesis, Te Pas wrote her own research proposal, and since then her research has outgrown the laboratory. At the testing site, a trial was recently started in 'lysimeters', which are concrete containers in the ground with equipment for measuring the soil hydrology. In this case, the concrete pits contain plastic containers filled with soil into which different types of minerals are mixed, and on which maize is grown. Next to the lysimeters are white buckets with equipment for tapping moisture from the soil at various depths. Water that seeps right through the soil is collected in barrels lower down. Over the course of several years, Te Pas wants to determine how much CO_2 is sequestered, which chemical substances are formed, whether they leach out, and how the crop reacts to all this. 'The focus is on the chemical soil processes, but I also want to look at the link with agriculture. This is a trial under reasonably natural conditions, where we can monitor and control what happens in the soil.'

LIFE CYCLE ASSESSMENTS

For the time being, there are still many unanswered questions, the PhD student emphasizes. 'This is still pioneering at this stage. It is important to collect data: does it work and is it safe? I mainly focus on soil chemistry, but there are many other questions. Elsewhere, for example, work is being done on life cycle assessments: what are the real benefits of this? Minerals have to be mined, transported and crushed, for example, which causes CO_2 emissions too. And yet enhanced weathering also provides opportunities to use waste streams from mines, which in turn contributes to circularity.' According to Te Pas, the latest IPCC report makes it clear that we are not going to achieve the Paris Agreement targets without techniques such as this, not even if we manage to significantly reduce greenhouse gas emissions. 'Besides reducing emissions, we need new techniques as well, to combat climate change. For me, that is one of the main reasons for working on this.'

LOBBYING FOR AID AND WEAPONS

Commuting between the Netherlands and Ukraine

Putin must be stopped at all costs. That is the message that Ukrainian farmer Kees Huizinga and his wife Emmeke Vierhout, both Wageningen alumni, have been communicating tirelessly in the media since March. 'Many countries in the Middle East and Africa aren't getting grain anymore; that will lead to famine and new influxes of refugees.'

TEXT RENÉ DIDDE **PHOTO** GENYA SAVILOV / ANP

His arable farm is doing well, in agricultural terms. The crops have been sown, planted out on time, and harvested, and no bombs have fallen on the fields. But that is as far as it goes. The grain silos are full and exports are virtually at a standstill. Russia's invasion of Ukraine has well and truly turned the lives of Kees Huizinga and Emmeke Vierhout upside down since the end of February.
Huizinga has been running an arable farm for nearly 20 years in Kischenzi, a village in the middle of nowhere, 200 kilometres south of Kyiv. It is a huge farm of 15,000 hectares, 'You've got to picture an area

about one third of the size of the north-east polder,' says Huizinga, an Agricultural Engineering alumnus (2002). He grows grain for export and sugar beet and vegetables for regional consumption. He also keeps 2000 dairy cows and 400 pigs. The milk and meat are processed and sold regionally, while the grain used to be shipped to Africa and the Middle East via Odessa.
On 24 February, straight after the invasion, Emmeke, a Tropical Land Use alumna (2001), left with their two daughters aged 11 and 12 and drove to the Netherlands via Romania. 'Using an app, I could find out where the ammunition and weapons depots were, and which places the Russians were firing missiles at, so Emmeke could drive around them,' says Huizinga. He stayed behind to manage his 350-strong workforce, to reassure them and to keep the farm going as well as he could.
He joined his family for a month from mid-March. Since then, he has been commuting back and forth regularly. 'I was asked by the Ukrainian farmers' network to talk to politicians in the Netherlands, Germany and the UK to garner more support,' says Huizinga. 'Seeking humanitarian support and asylum for people from Ukraine, as well as lobbying for weapons.' Since then, the couple have been frequent guests on current affairs programmes and TV talk shows.

FAMINE

They arrived in Emmen at the end of June, where they had kept a house throughout their time in Ukraine. 'But our house had been under renovation for some time,' says Vierhout. 'I was on Jinek's talk show at the beginning of March and talked about the fact that we had no house at that point. A viewer got in touch and offered us the house of his deceased parents, free of charge, for six months. That was great.'
Four months on, the panic of late February >

‘I see so many opportunities for Ukraine. But a lot of money goes to the bank and the bureaucracy’

KEES HUIZINGA (47)

Arable farmer on 15,000 hectares in Kichenzi, Ukraine
Wageningen degree:
Agricultural Engineering, 2002

EMMEKE VIERHOUT (44)

Ex-journalist and since the war emergency aid worker for Ukraine. Currently studying: Master’s degree in Philosophy, University of Wales
Wageningen degree:
Tropical Land Use, 2001

has given way to relief and anger. Relief because Kyiv has not been taken, there have been no casualties in their immediate vicinity, and the fighting is mainly concentrated in the v. Anger because Putin invaded Ukraine with the aim of colonizing the country. ‘He is aiming for a new tsarist empire, which of course has been on the cards since the annexation of Crimea in 2014,’ says Emmeke. ‘Putin is now creating a world food crisis and helping to destroy Ukrainian agriculture,’ Kees argues. ‘Many countries in the Middle East and Africa are no longer getting any grain, because Russia itself is also sitting on a huge mountain of grain. That will lead to famine, starting in the refugee camps. In Lebanon, for example, where there are 1.5 million Syrians, and in Egypt and Libya as well. Those people will have no food and will flee again.’

AID ORGANIZATION

That is what we can expect in the autumn. Meanwhile, after four months of war, Ukraine is running out of fuel so yesterday Huizinga and Vierhout were loading 150 second-hand bicycles into a truck to provide a form of local transport. Since early March, the couple from Wageningen and their aid organization The Leeuw Kyiv Foundation have driven at least 100 trucks with a total of three million euros’ worth of aid to Ukraine. ‘The money is nearly gone now.’

They have been amazed by all the help and support, especially from their university town, Wageningen. ‘There is incredible commitment, including from people we never see these days. A lot of alumni have done well for themselves and donate generously,’ says Vierhout. ‘I was a fanatical rower with Argo and I was club chair for a year,’ says Huizinga. ‘Through the rowing network, goods were stored in Argo’s boathouse and taken to Bennekom for transport to Ukraine. I also have contacts from my student house H6.’ They both see Wageningen alumni as committed and concerned about the state of the world, but down-to-earth at the same time. Huizinga: ‘Wageningen folk care passionately about both their scientific field and people, and money is not their main motive.’

MOPEDS AND CARBIDE

Huizinga and Vierhout met each other at the bar at student society Ceres. Doing a degree at Wageningen was a fairly obvious choice for both of them. Kees Huizinga’s grandfather was a farmer in Groningen, and his uncle studied in Wageningen. ‘My father is a GP in the Groningen countryside and I always worked for a farmer, tinkering with mopeds and carbide cans’. Emmeke Vierhout is the daughter of two doctors who worked in Uganda in the 1970s. ‘It is a miracle that I was born in the Netherlands,’ she says. ‘Three of my uncles studied in Wageningen and when I saw all the pictures of tropical countries on an information day, I knew that I wanted to study here and work in a hot country far away.’

Ukraine was not on her wish list, but Kees, meanwhile, had been fascinated by the large-scale opportunities in Eastern European countries ever since he was a student. ‘Just several kilometres of oil seed rape stretching as far as the eye can see, beautiful. That is an efficient way of working,’ says Huizinga. It sounds like Groningen province scaled up. ‘Yes, that sums it up very well.’ He started with 1000 hectares leasehold and grew to 15,000 hectares of very fertile ‘black

PHOTO MICHIEL DRIEBERGEN

soil'. 'All the land here is leased by members of a privatized kolkhoz. Each villager has half a hectare of land to live off, and the employees of the kolkhoz received a share of about three hectares from the kolkhoz after the fall of the Soviet Union. That is the land we are now leasing.' So Huizinga has an incredible 5000 leases, which he pays to 5000 families every year.
Because of the efficient production conditions, he works his land with only 13 tractors. 'A Dutch farmer can cultivate 150 hectares with four tractors. For my land in the Netherlands, you would need 400 tractors, 30 times more than I am using now.'

Have you found what you were looking for in Ukraine?

Emmeke: 'You'll have to ask Kees, because it is his farm.' Kees: 'But you are my – er – moral compass. Yes, I have found what I wanted, but it has been a lot of bother.' Emmeke: 'You enjoy that too, though.' Kees: 'My business has grown quickly, and yet things generally go so slowly. I see so much potential for this country. I could create so many jobs and so much added value by processing the milk, for example, and that would contribute to sustainability too. With one hectare of solar panels I can produce electricity and therefore hydrogen to enable tractors to work 1000 hectares without emissions and noise. But a lot of money goes to the bank and the bureaucracy.'
Emmeke: 'Unlike in the Netherlands, there is plenty of space in Ukraine. But I shall nevertheless be staying in the Netherlands for the time being, and soon in our renovated house. Our daughters will go to secondary school here in Emmen. We had already decided on that before the war broke out. In Ukraine they would have had to go to Kyiv, 200 kilometres away. I can finish my philosophy degree in peace here in Emmen, unlike in Ukraine. After that I'll see; I don't look far ahead. At the moment I am looking for funding for 10,000 water filters for Ukraine. The filters are being supplied by Nazava, a company owned by two Wageningen alumni. The first thousand filters are already on the way. I'll be coming to talk about this project at the Alumni Day in Wageningen on 8 october.'
Kees: 'There are so many interesting things going on in the world, and so many opportunities. Congo could feed the whole of Africa. In Uganda, where Emmeke's parents lived for a long time, they have three harvests a year, but their maize varieties are very outdated. I think it would be great to work on improving that.' Emmeke: 'Oh, I'd happily go along to Uganda, but I'd prefer to go to South America.'

Are there classes you took in Wageningen that are still of use to you now?

Kees: 'The big one for me was "Introducing Opti", a course about optimizing technology. It's maths, really, but philosophy as well. Because it boils down to the fact that finding an ideal solution takes longer than implementing suboptimal solutions, which turns it into a suboptimal solution too.'
Emmeke: 'I agree. Not quite perfect is cool. I learned from Wageningen that reality is always more complicated and subtle than the textbooks tell you. Sometimes it can almost drive you to despair. With our The Leeuw Kyiv foundation, we collect a lot of aid, but you have to be careful not to destroy local initiatives with it.' ■

Kees and Emmeke can be followed on www.deleeuwkyiv.nl, via Twitter @A Dutch farmer in Ukraine. Kees vlogs every week on the website of the agricultural magazine Nieuwe Oogst.

Classes at the zoo on biodiversity

A lesson at the zoo can help children to understand what biodiversity is and to what they can do to help, research shows. 'Active preparation in class generates understanding and commitment among the pupils.'

TEXT TESSA LOUWERENS

'The best bit was observing the animals in the zoo,' says Fiene (13). 'And it was different because I'd been taught about biodiversity and I had a booklet with me that teaches you a new way of looking at animals.' Fiene and her class took part in a three-year study on teaching children about biodiversity, which WUR conducted in collaboration with zoos and schools.

'A lot of children have heard of biodiversity, but research shows that often neither teachers nor pupils really understand what it is,' says Rebekah Tauritz, a researcher in Education and Learning Sciences at WUR. How can you expand children's understanding of biodiversity and what it means, so they realize how important it is to protect biodiversity, and what they can do to help? The study, which ran from 2019 to 2022, involved 695 pupils from the top three classes at 19 primary schools in the area around Ouwehands Zoo in Rhenen. Some followed a course that included a lesson at the zoo, while others only had lessons at school. Otherwise, the curriculum was almost identical. There were also four control classes that went to the zoo but didn't get any lessons on biodiversity. After the course was over, the pupils were asked to explain in their own words what biodiversity is, why it is important, what is threatening it and what they could do about it. The preliminary results of the study show that it is important that the session at the zoo is part of a course of lessons. A visit to the zoo is not enough by itself. Tauritz: 'It is the active preparation in class that generates understanding and commitment among the pupils.'

THE GIANT PANDA

The essential elements in this were stories, videos and images of eight endangered species including, of course, the giant panda (whose arrival in Rhenen prompted the instigation of the project in the first place.) The pupils came up with several key criteria for deciding whether they wanted to go into action on behalf of a species. Among them were its inclusion on the Red List of endangered species, their knowledge of the animal's role in the ecosystem, and interesting facts about the animal.

In the event, it was not the giant panda but the axolotl that fascinated the pupils most. This salamander is on the Red List of severely endangered species. It is only found in one lake in Mexico, which has been heavily polluted by humans. The axolotl's superpowers include being able to regenerate its limbs, organs and even its brain. It is not just the pupils who are impressed. Medical science is taking an interest too, because the axolotl is also particularly resistant to cancer.

LEARNING PROCESS

But the animals were not the only focus of Tauritz's research. Another finding was that visitors to the zoo have a part to play in the children's learning process too. 'The pupils asked the visitors whether they thought zoos should contribute to the protection of biodiversity,' says Tauritz. 'They often had to explain what biodiversity meant before the visitor could answer the

PHOTO GUY ACKERMANS

PHOTO SVEVA DIEKER

PHOTO GUY ACKERMANS

question. That is a terrific form of learning that can sometimes occur spontaneously. In short, zoos provide extensive opportunities for supplementary experiential learning.'

INTO ACTION

After the lessons, the pupils were more eager to take action for biodiversity, even if they didn't always know how to go about it. 'That is precisely why we include how to draw up a simple action plan in the lessons,' says Tauritz. 'A lot of pupils say that thinking about such a plan helped them to see what they could do for biodiversity.' For example, after finding lots of dead bumblebees in their school playground, children from one of the schools made flyers about the effect of pesticides.

The course (Bio-diversi-WHAT?!) was offered to all the members of the Dutch Association of Zoos and to Dutch nature and environmental education centres just before the summer holidays. 'The zoos are free to adapt the course materials to the endangered species that they have themselves,' says Tauritz. 'As long as they stick to the core material in the curriculum.' ■

DONATIONS

This study was funded by University Fund Wageningen (UFW), with donations from the Zabawas Foundation and the Ouwehand Zoo Foundation. The Ouwehand Zoo Foundation asked WUR to research the possible added value of lessons at the zoo for teaching primary school pupils about biodiversity. UFW ensured that the donations went where they were intended to go. The researchers formulated the specific research questions for 'Bio-diversi-WHAT?!' and designed the research.
www.universityfundwageningen.eu/research

Meet alumni on 8 October in Wageningen!

Once a 'Wageninger', always a Wageninger. If you have studied in Wageningen, you have the Wageningen DNA, which connects people from all over the world. At the Wageningen Experience Day on 8 October, alumni from the Netherlands and abroad will get the chance to meet, catch up and immerse themselves in the themes that are central to Wageningen University & Research. These themes include biodiversity, the circular economy, climate change and the protein transition: subjects that are more topical than ever. The focus will be on the international impact of Wageningen's expertise. International Wageningen alumni will showcase their projects and work, and discuss them with fellow alumni. One of the alumni attending is Emmeke Vierhout, whose organization De Leeuw Kyiv is collecting relief goods worth millions for Ukraine, the country where she lived in for years with her husband Kees Huizinga and their two children (see also the interview on page 40).

The Experience Day will be a hybrid event, so participants can either roam around Wageningen in person or visit the online digital campus, which will be full of interesting stories. In the Forum building, there will be an extensive social wall, where alumni can share memories, in the form of a story or a photo from their student days, for example.
Info: www.wur.eu/wed

Aula leaves town centre

PHOTO MARTE HOFSTEENGE

The Aula in Wageningen town centre closed for good in April after hosting more than 8000 PhD ceremonies and seeing over 50,000 degree certificates handed out. From now on, academic ceremonies will be held on campus.

'We are moving to Omnia, a new building on the campus. I have mixed feelings about that,' says beadle Lily Kroon. 'New is neither worse nor better, but it is different. We shall lose our link with the town. This is the last university building left in the town and I think that's a shame.'

On 15 September 1926, the former minister Folkert Posthuma, chair of the committee for the commemoration of the 50th anniversary of agricultural education in Wageningen, donated an auditorium. It was precisely 50 years since the foundation of the college for agriculture, horticulture and forestry, the university's predecessor. The idea behind the donation was that the college could do with a prestigious building.

Tradition has it that the gift was paid mainly by former students of tropical forestry who had made a fortune in the colonies. They apparently raised 55,000 guilders as a sign of gratitude for their education. The stained glass windows at the front containing the coats of arms of Batavia (now Jakarta) and Suriname bear witness to this history.

On 5 April 1935, the building was officially opened by Queen Wilhelmina. It took nine years for the Aula to be built due to disagreements about the design and location. The college directors thought the chosen location between a hotel and a fraternity house – now Ceres – was too hectic. In their opinion the Aula belonged in a calm spot, preferably in the countryside.

A competition was organized for the design in early 1928. The winner was the Haarlem architect Henry Timo Zwiers. But his concept 'How it grew' was never built because the municipality objected. A second design did get the go-ahead. Construction started in 1933 and two years later the college got its prestigious building.

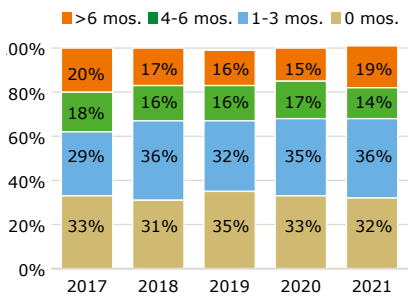
The Aula is now being converted into a cinema, as part of the Heerenstraat Theater.

JOB MARKET

Finding first job takes three months

Unemployment figures for recent WUR graduates have barely changed in the past five years. The rate has fluctuated between 6 and 8 per cent, compared with 13 per cent eight years ago. It takes WUR alumni an average of 3.4 months to find paid work. The national average is 3.1 months.

These findings come from the National Alumni Survey (NAE), a survey among all graduates who recently obtained a Master's from a Dutch university. The survey is carried out by DESAN on behalf of the association of Dutch universities (VSNU). A total of 388 WUR alumni completed the questionnaire. A majority of the respondents, 69 per cent, were Dutch nationals. Most of the alumni said the Covid pandemic had made it harder to find a job.



Months between graduation and first job

The survey shows that unemployment among Wageningen graduates is higher than the national average: the figure for graduates of all universities is 4 per cent. The study also reveals that Wageningen alumni were more likely to have had an internship during their degree (90 per cent) than other graduates (60 per cent). That means Wageningen students get experience in the labour market while still at university. On average it takes WUR alumni three months to find paid work, and 93 per cent find a job for at least 12 hours a week. Non-Dutch alumni take one month longer on average to find work. Over a quarter of WUR graduates work abroad.

When asked about the scientific skills they acquired during their degree programme, 83 per cent of WUR alumni say they are satisfied. That is less than the national average of 90 per cent. Even so, a relatively high proportion decide to go on to do a PhD: 16 per cent compared with the national average of 13 per cent.

Info: silvia.blok@wur.nl

NETWORK

South Netherlands alumni discuss nitrogen

On 20 June, the South Netherlands WUR alumni group organized an event to discuss the nitrogen problem in the Netherlands. It included a visit to the Leemkuilen area in Udenhout and the former brick factory D'n Oven, which was purchased by the nature organization Het Brabants Landschap and has now been turned into a wildlife corridor. Alumnus Ernst-Jan van Haaften of Het Brabants Landschap talked about the impact of the nitrogen policy in practice. Wim de Vries, professor of Integrated Nitrogen Impact Analysis, spoke about the scientific aspects and the solution options. It was a full house in Brabant, with 50 enthusiastic participants.

CONNECT!

Keep in touch

As a Wageningen alumnus, you are part of a global network of nearly 60,000 graduates and PhD holders. You can keep in touch via the LinkedIn group for alumni: *www.linkedin.com/groups/39958/*.

Help new students

WUR is looking for alumni who want to help future students choose the right degree programme. Share your personal story about your choice of degree subject, your studies, student life and your experience of the labour market. Hermien Miltenburg can write up your story. You can reach her at +31 (0)317-484455 or hermien.miltenburg@wur.nl.

Wanted: Environment alumni

The study association Aktief Slip (for the BES, MES, MUE and MCL tracks, formerly Environmental Health) is expanding its alumni database. Foreign alumni in particular are not always properly registered. Are you one of those alumni? Then contact Aktief Slip at *aktief.slip@wur.nl*.

25th and 50th anniversaries

Did you start your degree in Wageningen 25 years or 50 years ago? If so, you can meet your fellow alumni this year at the Wageningen Experience Day 8 October 2022. Alumni who started in 1997 and 1972 will get together on campus. *www.wur.nl/alumni*

WUR CONNECT

For activities, career opportunities and your Wageningen contemporaries all around the world, visit www.wurconnect.nl

Ton van Arnhem MSc, Horticulture 1986, has been appointed Agricultural Counsellor to the Dutch embassy in Washington. Van Arnhem was director of the National Plant Protection Organization at the Food and Consumer Product Safety Authority (NVWA). 23 March 2022.

Miguel Calvo-Agudo PhD, Plant Sciences 2017, won the Hugo de Vries prize for the best botanical PhD thesis. He described the route taken by insecticides from the plant via aphids to useful insects. 28 June 2022.

Ernst-Jan Eggers PhD, Plant Sciences 2017, received the University Fund Wageningen Research Award 2022 for his research on the Sli gene in breeding diploid potatoes. 9 March 2022.

Prof. Louise O. Fresco, Rural Sociology of the Non-Western Regions 1976, received the royal honour of Commander of the Order of the Netherlands Lion to mark her departure as President of the Executive Board of WUR. Fresco also received the Norman E. Borlaug Medallion from the World Food Prize Foundation. 1 June 2022.

Sebastian de Groot BSc, International Development Studies 2019, won the AtlasInvest Entrepreneurship Grant Impact Award of 15,000 euros for his company Urban Funghi, which grows oyster mushrooms in empty buildings. 18 May 2022.

Sjoukje Heimovaara PhD, Plant Breeding 1989, has been appointed President of the Executive Board of WUR. She was managing director of the Agrotechnology & Food Sciences Group, and succeeds Louise O. Fresco. 1 July 2022.

Prof. Thea Hilhorst, Rural Sociology of the Non-Western Regions 1988, professor of Humanitarian Studies at the International Institute of Social Studies (ISS), will receive the Spinoza Prize of 2.5 million euros in October for exceptional research and application of knowledge. The prize is the highest distinction in the Dutch academic world. 17 June 2022.

Emma Hinderink PhD, Food Technology 2016, won the WURCS prize for the best chemistry PhD thesis. She did basic research on oil-in-water emulsions. 25 February 2022.

Prof. Wybe Kuitert,
Landscape management 1982, received an imperial honour from Japan in recognition of his work 'in the promotion of Japanese culture and the understanding of Japan through the study of landscape architecture in and beyond the Netherlands'. 14 June 2022.

Charudutt Mishra PhD, Ecology and Natural Resource Conservation 2001, won the Whitley Gold Award, worth 100,000 pounds, for his work in the protection of the snow leopard. He also won the prize in 2005. 28 April 2022.

Saptarshi Mukhopadhyay MSc, Biotechnology 2019, won the AtlasInvest Entrepreneurship Grant Start-Up Award, worth 35,000 euros, for his company LumiNose. 18 May 2022.

H6 cycles for Ukraine

Willem Jan Bosma PhD, Soil Science 1990, and **Erwin Bonarius MSc,** Agricultural Plant Breeding 1991, organized a bike ride on 12 March to raise money for NTC De Leeuw Kiev, a foundation set up by **Kees Huizinga MSc,** Farming Technology 2001, their former housemate in student house H6 in Wageningen. 'A lot of money is needed to keep up food production for the people of Ukraine, and Kees is working to achieve this,' says Bonarius. Ten former housemates cycled to Wageningen from the towns where they now live. Together, they raised over 22,000 euros.

Gerhard van den Top PhD, Tropical Land Development 1988, has been inaugurated as mayor of Hilversum. 17 February 2022.

Cees Veerman PhD, (WUR PhD 1983) former Minister of Agriculture and former President of the Executive Board of WUR, and **Max H. Slingenberg MSc,** (Agrarian Economics 1977) former member of the Ministry of Agriculture Council in Vietnam, received honorary medals from the Vietnamese ambassador to the Netherlands, Pham Viet Anh, for helping develop Vietnamese agriculture and encourage long-term contacts between the Netherlands and Vietnam. 24 June 2022.

Annemiek van Vleuten MSc, Animal Sciences 2007, won the Giro D'Italia Donne for the third time. She was also victorious this summer in the Tour de France Femmes and in the challenge at La Vuelta. summer 2022.

Thesis Award

Corentin Bisot MSc, Earth and Environment 2021, won the University Fund Wageningen (UFW) Thesis Award for outstanding Master's theses this year for his thesis on the growth behaviour of soil fungi. In addition to the overall winner Bisot, there were also prizes for **Selena Koene MSc,** Plant Biotechnology and Molecular Life Science 2021, **Carolina Sarzana MSc,** Organic Agriculture 2021 and Plant Biotechnology 2021. 17 June 2022.

PHOTO GUY ACKERMANS

Cycling 7000 kilometres to Tanzania

PHOTO ROEL RIPHAGEN

Aisha Hassan MSc, International Development Studies 2021, and **Lukas Paltanavicius MSc,** Biobased Sciences 2021, got on their bikes in Wageningen in May and set off for Tanzania, over 7000 kilometres away. 'In 10 months' time, we aim to have visited 10 farms that practise regenerative agriculture and to have made 10 mini-documentaries,' explains Paltanavicius. The two cyclists are using their savings and donations to fund the trip. Go to cycletofarms.com to follow their progress.

Godwit!

The film *Grutto!* (godwit) premiered in Pathé XL in Ede on 7 July 2022. It is the latest nature documentary by Golden Calf winner **Ruben Smit MSc,** Forestry 1996, known for his films *WAD* and *De Nieuwe Wildernis*. The crew, including cameraman **Melchert Meijer Zu Schlochtern MSc,** Forestry 1996, follow the godwit on its journey round the world to the Netherlands. This intimate documentary shows the bird trying to survive in an ever-changing world.

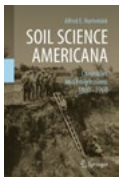
IN MEMORIAM

Alumni and current and former employees of Wageningen University & Research who have recently passed away.

Mr L. Bannink MSc, Tropical Plant Breeding 1953. 21 March 2022.
Ms S.J. van Beeck Calkoen MSc, Horticulture 1958. 7 March 2022.
Ms M.L. Bijlsma MSc, Human Nutrition 1987. 1 March 2022.
Mr W.M.J. den Boer MSc, Forestry 1978. 12 September 2021.
Mr J.R.M. Bogaers MSc, Biology 1988. 31 March 2022.
Ms S.J. ter Borg PhD, Biology 1962. 6 February 2022.
Mr B. Deinum PhD, Agricultural Plant Breeding 1960. 10 May 2022.
Mr J. Dogterom MSc, Plant Breeding 1983. 7 March 2022.
Ms B.H.M. Elands PhD, Land Development 1990. 3 February 2022.
Prof. G.J. Fleer, emeritus professor of Physical Chemistry and Soft Matter. 27 February 2022.
Ms P.B. Floor MSc, Biology 1996. 12 July 2022.
Mr J.G. Hanstede MSc, Biology 1979. 22 January 2022.
Mr H.V.F.M. van Hapert MSc, Tropical Rural Economics 1952. 8 March 2022.
Mr A.F. Hartman MSc, Landscape Architecture 1965. 22 July 2022.
Mr P.G.M. Hebinck PhD, associate professor of Sociology of Development and Change. 20 June 2022.
Mr P. Hekstra MSc, Tropical Land Development 1966. 19 April 2022.
Mr H.M. Heybroek MSc, Tropical Forestry 1953. 13 June 2022.
Mr F.P. Huibers PhD, Tropical Land Development 1976. 9 July 2022.
Ms M.H.W. Huijberts-van Oers MSc, Tropical Domestic Science 1963. 13 May 2022.
Ms N. Kijlstra-van Albada MSc, Tropical Domestic Science 1961. 6 March 2022.
Mr H.A. Krabbenborg MSc, Zootechnics 1968. 27 April 2022.
Mr B.R.J. Kramer MSc, Land Development 1972. 12 March 2022.
Mr J.G. Kroes PhD, Soil and Water 1995. 10 March 2022.
Mr C.J. de Lange MSc, Tropical Forestry 1964. 13 March 2022.
Mr W.J.A. Lauwerijssen MSc, Domestic Science 1972. 4 April 2022.
Mr W.H.R. Leemhuis MSc, Rural Economics 1974. January 2022.
Mr D. Luteijn MSc, Rural Economics 1968. 13 April 2022.
Mr B.B. Luuring MSc, Phytopathology 1973. 8 November 2021.
Mr K. 't Mannetje MSc, Agricultural Plant Breeding 1968. 14 April 2022.
Mr A.A.J. Mutsaers MSc, Tropical Plant Breeding 1989. 30 December 2021.
Mr J. Nieuwenhuize MSc, Agrarian Economics 1976. 26 March 2022.
Mr K. Nijenhuis MSc, Zootechnics 1959. 15 December 2021.
Mr J.G. Oordijk MSc, Food Technology 1968. 24 April 2022.
Ms J.E. Oosterbaan-Loot MSc, Landscape Architecture 1974. 23 February 2022.
Prof. J.W.M. Osse, emeritus professor of General Animal Science. 31 March 2022.
Mr B. Prins MSc, Biology 1984. 11 June 2021.
Mr J.J. de Punder MSc, Zootechnics 1973. 4 March 2022.
Ms G.D. Roskam MSc, Environmental Protection (Water Purification) 1999. 2 November 2021.
Mr J. van der Sar MSc, Environmental Protection (Water Purification) 1976. 11 March 2022.
Mr J.T. Smit MSc, Farming Technology 1974. 10 April 2022.
Mr J. Sonneveld MSc, Rural Economics 1962. 2 August 2022.
Mr H. Temmink PhD, Environmental Protection (Water Purification) 1988. 8 April 2022.
Mr J. Vis MSc, Rural Economics 1960. 3 December 2021.
Mr G.J. Vrencken MSc, Land Development A 1978. 23 February 2022.
Mr A.F.J. de Vries MSc, Forestry 1972. 18 November 2021.
Mr P. de Vries MSc, Agricultural Plant Breeding 1965. 18 April 2022.
Mr G. Weststeijn PhD, Plant Breeding 1959. 21 September 2021.
Mr J. Woets MSc, Horticulture 1971. 16 December 2021.
Mr F.W. Zwietering MSc, Land Development B 1980. 1 March 2022.

If you would like to inform us of the death of a fellow former student or relative, you can email alumni@wur.nl or send a death announcement to the Alumni Department, Wageningen University & Research, Droevendaalsesteeg 4, 6708 PB Wageningen,The Netherlands

Soil Science Americana



Alfred Hartemink, Soil and Water 1994, professor of Soil Science at the University of Wisconsin-Madison in America, describes how the study of soils became a science and became institutionalized in the US between 1860 and 1960. At the same time, he tells the story of two farm boys who grew up in the Mid-West and who communicated the importance of soil science.
Springer, 43.59 euros (e-book 32.09)

Optimistic polar bears

Koen Arts, Forest and Nature Conservation 2007, thinks the Earth is not going to be saved by ringing the alarm bells even more, or singing the praises of nature more loudly. 'In this book, I try to tackle tricky issues with optimism or humour. My aim is to get a sharper picture of the huge challenges.'
Noordboek en Sterck & De Vreese, 19.90 euros

Farming among thatch, peat and nobility

Henk de Zeeuw, Rural Sociology of the Western Regions 1975, wrote a book about the history of the Land van Vollenhove, a region in Overijssel, from the tenth century to the present day from the perspective of the farmers.
Libris, 35.00 euros

The fascinating life of reptiles

Brothers that protect their sisters, couples that stay together for life and baby snakes that communicate with one another in the egg via their heart rate. In this book, **Sterrin Smalbrugge,** Forest and Nature Conservation 2018, reveals the hidden side of reptiles.
Fontaine, 24.99 euros (e-book 9.99)

Benefits of nature

Forest ranger **Marieke Schatteleijn,** Forest and Nature Conservation 2009, known from the Dutch TV lifestyle programme *BinnensteBuiten*, explains why nature makes you happier, healthier and more creative. She looks for explanations in science and links that knowledge to what she personally experiences when outdoors.
Kosmos, 22.50 euros (e-book 12.99)

Farmers, fields, forests and fauna in the Barony of Breda

Christ Buiks, Zootechnics 1971, spent 30 years studying toponyms – place names that often date back centuries – in the area around Breda. They tell the story of the landscape, the fauna and flora and the agriculture seen through the eyes of the inhabitants of the past. *Eburon, 49.50 euros*

Planet Zazo and five other stories for children

Willy Chin Joe, Tropical Land Development 1974, has written an imaginative collection of children's stories. The stories are very varied: they include one set in a spaceship travelling to the planet Zazo, one about dinosaurs that are still alive, and one about a sailing trip to an island with mysterious caves.
Boekscout, 16.50 euros

Technology and tulips

Eric van Heck, Land Development 1985, professor of Information Management and Markets at Erasmus University in Rotterdam, introduces readers to the global flower trade and discusses the factors that helped Dutch businesses become world leaders in floriculture. *Mediawerf, 29.50 euros*

Towards sustainable agriculture by 2040

Based on extensive research, **Meino Smit,** Land Use Planning and Water Management 1975, shows what inputs Dutch agriculture requires in terms of land, energy and raw materials in order to function. Is Dutch agriculture as efficient, productive and profitable as is generally assumed? *Nearchus, 34.50 euros*

Should we still be eating meat?

Livestock farming is contributing to the climate crisis and loss of biodiversity. So should we all go vegan? This book by professor of Livestock and Sustainable Food Systems **Imke de Boer,** Zootechnics 1989, takes the reader on a personal journey, considering this and similar issues and providing the scientific basis for answers. *Noordboek, 19.90 euros*

Carolien Beekman, fashion designer

BSc Health and Society 2012

'I had never imagined I would become a fashion designer. When I was at secondary school, I was a horsey girl. I didn't know what subject I wanted to study and I started a degree in Nutrition at WUR. Then I switched to Health and Society later. While I was at university, I took sewing lessons and thought it was great fun! Sitting with my head in a book turned out not to be my thing. After I graduated, I went to the fashion school in Arnhem. As soon as I arrived there, I knew I was in the right place.

'When I started out, I didn't know whether I would be good at it, because I had never done anything creative. I knew I enjoyed it and that I was technically good, but would people want to wear what I made? And now I have my own fashion line. It happened very gradually. People asked me about the clothes I was wearing, and that got the ball rolling. The clothes I make include outfits for weddings or PhD ceremonies, and business wear for women.

'I like to use beautiful fabrics, and my designs are quite simple and unfussy. I enjoy the interaction with customers and I like it when I can be of help to women, so that they feel beautiful on a big day. I think you should always pursue your passion: do what you're good at and what makes you happy.'

www.carolinfashion.nl

'People asked me about the clothes I was wearing'

PHOTO HARMEN DE JONG

PHOTO JOEP DE LEEUW

Collecting seabird poop to monitor climate change

He first had to check whether there were any polar bears roaming around, and whether the guard's rifle was loaded. Only then could Joep de Leeuw of Wageningen Marine Research go ashore on Spitsbergen. He was there in July to research whether seabirds react to changes in the food supply. Climate change is causing more and more southern species of krill, plankton and fish to come to the Arctic region. In Kongsfjorden and on the Spitsbergen scientific expedition aboard the research ship Ortelius, De Leeuw collected the poop of three seabird species this summer: the kittiwake, the little auk and the short-beaked guillemot. The DNA in the faeces should provide a decisive answer to the question of what marine creatures the birds eat. This analysis will take place next month. It may be possible to link the data with the degree of breeding success. Collecting poop from the kittiwakes was the easiest, says De Leeuw. 'We laid out a piece of plastic under an overhanging cliff with about 20 nests. It didn't take long before the first droppings fell on it. We had enough material after 15 minutes.'

The researcher hopes that collecting poop will provide a fast, robust method of monitoring changes caused by climate change in the seas around Spitsbergen. 'We can't do extensive research every year, there isn't the funding for that, but a researcher or volunteer on board a tourist boat could collect poop now and then.'

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