WAGENINGEN WORLD

MAGAZINE OF WAGENINGEN UNIVERSITY & RESEARCH ABOUT CONTRIBUTING TO THE QUALITY OF LIFE

no.4 2020

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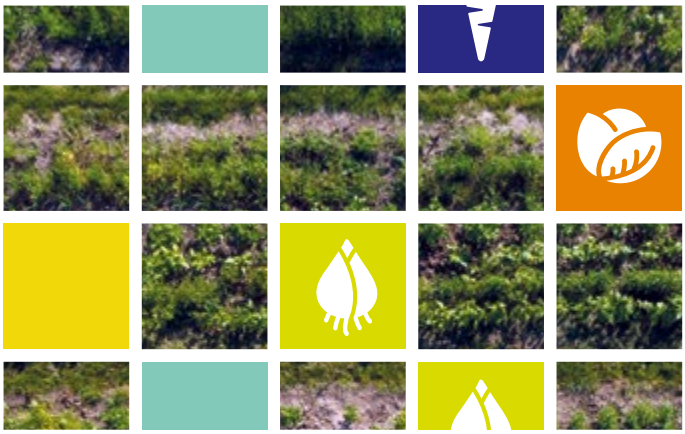

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WAGENINGEN UNIVERSITY & RESEARCH

The mission of Wageningen University and 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, 6,500 employees (5,500 fte) and 12,500 students, 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.

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FEATURES

PHOTO GUY ACKERMANS

Vitamin D and the coronavirus

'It's not a miracle cure but under the current circumstances, with the coronavirus circulating, I would say: let's all take vitamin D. Taking a supplement reduces your risk of getting infected and the seriousness of your symptoms. So why wouldn't you take vitamin D?

'Our skin makes vitamin D when we are outside. Because many people stay indoors more in winter, a vitamin D deficiency can arise in some groups of the Dutch population. The Health Council advises vulnerable groups such as the elderly, pregnant women, people who cover their faces and dark-skinned people, to take 10 micrograms a day. Now that a lot of people are working at home and much of our social life has ground to a halt, we are spending even more time indoors. So taking vitamin D is a good idea every winter and especially so in these times of Covid-19.

'There is a lot of evidence that people suffer worse symptoms from a coronavirus infection if they have a vitamin D deficiency. The vitamin has been proven to help fight pulmonary infections. And a study in a Spanish hospital has now shown that vitamin D can help make a bout of Covid-19 less serious. Of a group of 26 people who were not given vitamin D, two patients died and 13 ended up in intensive care. Of the group of 50 patients who did take vitamin D, no one died and only one person needed intensive care.

'Of course, this is an extremely small study with no placebo group. Several comparable clinical studies are going on right now to see whether the effect is significant. But that could easily take a few years. Meanwhile, people will be coming into the IC units and may die. So I say: let's start taking it already.'

Huub Savelkoul, professor of immunology at Wageningen

CORONAVIRUS

SARS-CoV 2 antibodies found in mothers' milk

The mother's milk of women who have been infected with the coronavirus contains important antibodies against the virus. They remain present even after the milk has undergone high-pressure processing to make it safe for consumption, according to a Wageningen study. This may mean the mother's milk could be used as a preventive treatment for the coronavirus. Researchers at the Amsterdam University Medical Centre announced this in August. In this research project, Wageningen scientists in the Food Quality & Design chair group studied how best to treat the milk without damaging the antibodies.
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PHOTO SHUTTERSTCOK

EDUCATION AND RESEARCH

WUR once again the best Dutch university

Wageningen University & Research is once again the highest-ranked Dutch university in the reputable Times Higher Education (THE) ranking, which lists more than 1500 universities. WUR did drop from position 59 to 62. THE assesses universities in five categories with differing weights: education, research, citations, international outlook and income from industry. Wageningen has been the best Dutch university in the list for years.
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TECHNOLOGY

PHOTO SHUTTERSTCOK

Protein drink from the breweries

Wageningen researchers have developed a process to extract food proteins from a waste stream of the brewing industry. The proteins will be used to make a protein-rich drink.

The Dutch brewing industry produces around 500,000 tons a year of brewer's grains, a waste stream that to date has mainly been turned into animal feed. Proteins make up 30 per cent of brewer's grains.
Thanks to a new process that Wageningen Food & Biobased Research developed in partnership with the brewer Heineken and the animal feed producer Duynie, the protein fraction can now be used for human consumption. As a result, the proteins will be worth seven times as much. Duynie will be making a protein-rich drink from the food proteins.

The biggest challenge was to isolate the proteins in brewer's grains, say researchers Carl Safi and Wim Mulder. Most of the proteins are attached to insoluble fibres such as cellulose, lignin and hemicellulose. The researchers came up with a method for cutting those proteins into pieces, which lets them get hold of 90 per cent of the proteins. They also developed a filtration process to purify the protein extract.
The project will run until the end of 2022. It is financed by the Agri & Food Top Sector and the participating companies.
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ECOLOGY

Bumblebees migrate long distances

Bumblebee queens cover distances of hundreds of kilometres, pollination researcher Thijs Fijen discovered with the help of observant birdwatchers.
During bird counts, the birdwatchers were struck by the large numbers of bumblebees they saw flying by, and they decided to count them. On peak days in the spring, over 11,000 bumble bee queens flew past at an estimated speed of 30 kilometres an hour.

'Bumblebees don't migrate in groups like birds,' says Fijen. That explains why biologists didn't discover this phenomenon earlier, although British, French, Swedish and Finnish researchers did count migrating bumblebees in the 1950s and 1970s. Of all bumblebees, only the queens survive the winter. Why so many of them then migrate in the spring remains a mystery.
Fijen published his findings in the *Journal of Applied Ecology*.
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VIROLOGY

West Nile virus is now in the Netherlands

PHOTO SHUTTERSTOCK

For the first time, someone in the Netherlands has become infected with the West Nile virus. The National Institute for Public Health (RIVM) reported the case in mid-October. The infected man may have caught the virus from a mosquito in the Utrecht region.

A further six reports of infections were made to the European Centre for Disease Prevention and Control (ECDC) between 30 October and 11 November, five in Utrecht and one in the Arnhem region.
Wageningen Bioveterinary Research and its partners in the One Health Pact are studying the spread of the disease.
The virus was initially only found in Africa but has spread in recent decades via birds. It was seen for the first time in the United States in 1999 and spread rapidly across the continent in the years that followed. There have been increasing numbers of reported infections in southern Europe since 2000, also moving further and further north.
The first known occurrence of the West Nile virus in the Netherlands was back in September in a common whitethroat. Wageningen and its partners then captured mosquitoes in the same area, which were also found to have the virus.
The virus reproduces in various species of mosquito and in many animal species. Mosquitoes can transmit the virus, which also spreads via infected birds. Infected mammals are 'dead-end hosts', meaning they do not spread the disease further. Horses can become seriously ill. In humans, 10 to 20 per cent of the infections result in flu-like symptoms. Only a small proportion (1 per cent) involve more severe symptoms such as meningitis.
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FOOD SECURITY

Ten billion people

The book *Tien miljard monden* ('Ten billion mouths') presents 41 innovative ideas for healthy, sustainable food in the future from 80 Wageningen academics working in various disciplines. The book was compiled by university lecturers Jeroen Candel (Public Administration and Policy) and Ingrid de Zwarte (Rural and Environmental History). The ideas range from eating algae and insects to reducing food waste, and from making better choices in supermarkets to combating hunger in developing countries. 'This book has confirmed our impression that there is no simple solution to the global food problem. Neither can we delegate this problem to one particular group within the food supply chain. We need a fundamental redesign of the entire food system,' says De Zwarte. The book (available in Dutch only) is published by Prometheus (24.99 euros).
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WAGENINGEN ACADEMY

Executive MBA in Food & Agribusiness

A new cohort of students embarked in September on the Executive MBA programme offered by Wageningen and TIAS Business School. What motivates professionals to do a Master's of Business Administration in Food and Agribusiness? In the 'Meet our students' series, Wageningen Academy shares participants' experiences during and after the programme. All the students have their own personal goals but there are also shared expectations, such as 'participating in a close community', 'getting to grips with complex issues' and' finding solutions through collaborative approaches'. EMBA graduates agree that the Food & Agribusiness content lends added value to the programme in combination with the general business modules. As Academic Director Professor Hans van Trijp puts it, 'Food and agribusiness is not run-of-the-mill business'. Interested in reading more about this? *www.wur.eu/mba*

PLANT SCIENCES

Big increase possible in Chinese potato harvests

Chinese potato growers could increase yields by more than 60 per cent by implementing improvements in farming methods and by using less fertilizer, concludes PhD candidate Na Wang.

China is the world's biggest producer of potatoes. Na Wang investigated the options for sustainable intensification of that potato production in the three main potato-growing regions in northern China. Current production is far from optimal. For instance, the seed material is poor quality. That issue could be tackled using regulations and a label for healthy, vital seed material. There is also limited rainwater available in northern China. Drip irrigation resolves that problem without wasting too much water, concludes Wang. Another problem is that most Chinese potato growers currently use too much fertilizer. The excess doses of nitrogen result in soil and water contamination and curb production. Fertilization can be reduced by phasing out fertilizer subsidies and restricting the use of nitrogen, says the PhD student. Na Wang received her doctorate on 25 August; her supervisor was Martin van Ittersum, professor holding a personal chair in Plant Production Systems.
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PHOTO SHUTTERSTOCK

ENVIRONMENT

Waste in the Wadden Sea is from consumers and fisheries

Litter in the Wadden Sea is mainly waste from consumers and the fishing industry. Most comes from the Netherlands. These findings are from a study by Wouter Jan Strietman of Wageningen Economic Research.

Last year, Strietman analysed 340 kilos of litter that had been collected on the uninhabited Wadden island of Griend by volunteers for the nature society Natuurmonumenten. Strietmen and a team of locals and experts sorted through 3700 items of waste. It was soon clear which kinds of litter dominated: consumer waste such as sweet wrappers, balloons and coke bottles, and fishing industry litter such as ropes and fragments of fishing nets.
The researchers were able to determine the country of origin by examining the external characteristics and texts. Strietman: 'Many food products have texts and shelf life data — take sweet wrappers or margarine tubs, for example. The analysis of fishing nets also revealed information about where they came from. This let us determine that 80 per cent of the waste with an identifiable origin came from the Netherlands. Most of the remaining 20 per cent came from the UK and France, probably carried to Griend by the sea currents.'
More insight into the sources of marine waste is important in curbing that waste. The research was commissioned by the Northern Netherlands branch of the Directorate-General for Public Works and partly funded by the Ministry of Agriculture.
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PHOTO WOUTER JAN STRIETMAN

INNOVATION

Grants for ground-breaking research

Researchers Marnix Medema and Daan Swarts have received grants of 1.5 million euros each from the European Research Council (ERC) for outstanding ground-breaking research.

Bioinformatics specialist Medema studies the chemical language that bacteria use to communicate. He will spend the grant money on developing new bio-informatics software for mapping and understanding that bacterial language. He wants to detect genes that are responsible for chemical interactions between bacteria, work out how they are switched on and off, and figure out the chemical structures and functions of the underlying molecules. That knowledge may then let him redesign bacterial communities, for example to tackle metabolic disorders.
Biochemist Swarts studies the defence systems bacteria use against viruses. He wants to use part of the grant to create 3D models of the bacterial defence systems with X-ray crystallography. This will let him investigate how viruses are recognized and infections stopped. He may be able to find defence systems that he can isolate and reprogram in order to rapidly detect certain viruses.
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PHYTOPATHOLOGY

PHOTO ALAMY

New boost for development of resistant bananas

Wageningen and the plant breeding company KeyGene will help develop banana varieties for East Africa that are resistant to the notorious Panama disease.

The Bill & Melinda Gates Foundation is funding WUR and KeyGene to take part in the international research programme 'Accelerated Breeding of Better Bananas' at the International Institute of Tropical Agriculture in Nigeria. That will be a new boost for the research of Wageningen phytopathologist Gert Kema into resistant banana varieties.

Bananas are an important food source in local African diets, but this source is threatened by the Panama disease, which is caused by a *Fusarium* fungus called Tropical Race 4 (TR4). The fungus is fatal for many banana genotypes, including the Cavendish banana, the most commonly cultivated banana throughout the world. The Panama disease is spreading fast, just like the Race 1 epidemic in the 1950s in Central America, which wiped out plantations of the Gros Michel banana, the most popular variety at that time.

The WUR-KeyGene team will start by developing a rapid method to determine whether a plant is resistant to TR4 or Race 1. This will help breeders select the right plants and thereby improve the efficacy of plant breeding programmes. The team will then identify the genes that make the banana plants resistant to TR4 and Race 1, a requirement for new banana varieties. The molecular markers for these genes – 'signposts' in the chromosome map – are indispensable for speeding up the breeding process.

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NUTRITION AND AGRICULTURE

Dutch diets healthier due to coronavirus

Covid-19 has affected our diets, according to the biennial Agrifoodmonitor, a survey carried out by Wageningen Economic Research. Respondents said they were eating less pork and more fruit and vegetables for health reasons. People who were already concentrating on their health are now eating even more healthily. The pandemic has made people attach greater importance to basic needs such as food safety and stability. They also appreciate Dutch produce more.

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EVOLUTION

Crickets first to make sounds on Earth

The cricket was probably the first species to produce sound, some 300 million years ago. This finding comes from an international research team led by Sabrina Simon of Wageningen and Hojun Song of Texas A&M University.

The researchers used a large dataset to compile a family tree and analyse how the *Orthoptera* order of insects, which includes crickets and grasshoppers, developed the ability to hear and produce sound. The study showed that the insects were already able to produce sound 300 million years ago, which has not been demonstrated for any other species of animal.

For crickets and the like, sound was originally a way of fending off enemies, startling them by the vibrations in their mouth. Later, the ability to make sounds acquired a new role in evolution, as chirping male crickets were more likely to be found by females. The research was published in *Nature Communications* in October.

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PHOTO SHUTTERSTOCK

BIOCHEMISTRY

Forces measured in plant cell

Wageningen researchers have managed to measure and reveal minuscule forces in plant cells. This breakthrough is the result of collaboration between Joris Sprakel (Physical Chemistry and Soft Matter) and Dolf Weijers (Biochemistry). It resulted in a new microscopic technique that can reveal the mechanical forces in living plant cells and even in parts of cells. This is done by inserting small, water-soluble molecules into the plant cell.

Revealing and measuring these mechanical forces is important because together with chemical reactions, they steer biological processes. For example, they help the plant keep the stem rigid and they determine the shape of the plant and the direction it grows in.

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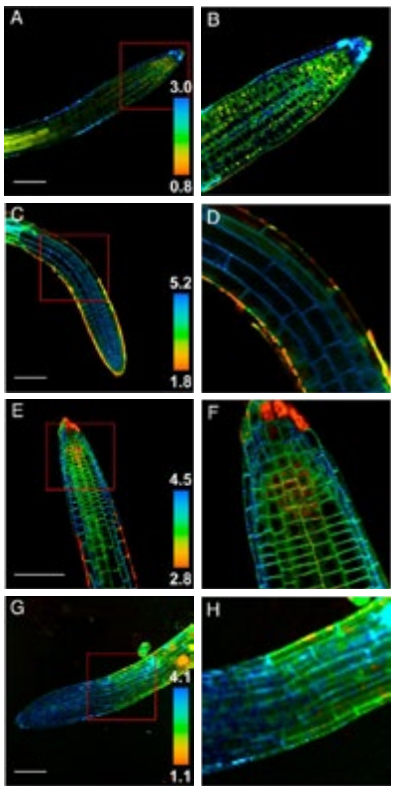

PHOTO DR. VERA GORELOVA

Forces in *Arabidopsis* root made visible with staining.

NATURE

Secondary channels need maintenance

PHOTO ALAMY

Nature restoration efforts in the major rivers lose their effectiveness after about 15 years. This is shown by a Wageningen study in collaboration with the Directorate-General for Public Works. Secondary channels therefore need to be dredged regularly.

River fish breed in the secondary channels and the young fish grow to maturity there, says PhD candidate Twan Stoffers. However, the channels gradually fill up with silt, which slows the currents and negatively affects the quality as a habitat for river fish. Stoffers concludes that the channels need to be dredged every 15 years on average. 'After building secondary channels, we are seeing typical river fish such as the common nase and the barbel again but we now know we also need to maintain these breeding grounds.' The study was published in October in *Science of the Total Environment*.

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SCIENCE

Wageningen climate research is often cited

Wageningen climate research is often cited by fellow scientists, according to an Elsevier report. The United Nations announced its sustainable development goals (SDGs) five years ago. Since then, 4.1 million articles have been published worldwide on issues relating to these goals. The biggest category is publications on how to improve health, followed by articles on sustainable energy and combating climate change. Elsevier concludes that Dutch SDG research is influential as it is often cited by other scientists. Wageningen articles on climate change are in fact cited over twice as often as the global average in that field.

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FOOD TECHNOLOGY

Juice with less sugar and acid can still taste good

Wageningen researchers have developed a technique for making healthier fruit and vegetable juices by removing sugars and acid while retaining the aroma and flavour.

Juices often contain a lot of natural sugars and acids, which lead to high calorie intakes and are bad for your teeth. Existing membrane separation technology is not suitable for reducing the sugar and acid content as it also separates out the aroma and flavour compounds.
So researchers Paul Bussman and Ronald Vroon of Wageningen Food & Biobased Research developed a separation process that passes the juice through a series of columns containing resin beads that selectively adsorb sugars and acids while leaving aroma and flavour compounds untouched. The ratio of sugars to acids remains balanced too. The fibres are removed first to make sure the columns don't clog up; they can be added back at the end.
Lab tests in which the juice was manufactured 24 hours a day for a whole week were successful, says Bussman. He explains scaling up to the industrial scale will be relatively straightforward. 'All you need to do is increase the diameter of the columns.'
A bigger problem is contamination of the columns. The adsorbed sugars and acids are rinsed off with water but some components stick to the columns and are not rinsed away, reducing the separation performance. That issue requires further attention, says Bussman.
According to the programme manager Joost Blankestijn, eight manufacturers of juices and smoothies have expressed an interest in the new separation technology. 'We want to improve and scale up this process in partnership with several parties.'
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PHOTO VERSE BEELDWAREN

ENVIRONMENT

Plastic additives leach into fulmars' stomachs

Additives from plastics such as plasticizers and UV stabilizers leach into the layer of oil in the paunch of the Northern fulmar. Certain UV stabilizers and phthalates, which are plasticizers, can disturb the hormone system.
These findings are from a study by Wageningen Marine Research and SINTEF Oceans in Norway. The researchers added a mixture of ground plastic to stomach oil taken from birds caught on the Faroe Islands. The plastic came from the beaches of Texel. For 90 days, the researchers monitored whether 15 additives ended up in the stomach juices. The leaching process starts immediately for some compounds, says researcher Susanne Kühn. So even plastic that is only briefly inside the bird can still cause damage. It is known that Northern fulmars consume a lot of plastic. The results were published in August in *Frontiers in Environmental Science*.
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NUTRITION AND BEHAVIOUR

We are better at locating high-calorie food sources

People subconsciously remember locations of high-calorie food better than of low-calorie food, according to a Wageningen study.

At the Lowlands music festival in 2018, people were able to taste eight different kinds of food, including apples, crisps, cucumber and brownies, in halls around the grounds. Once outside again and without warning, they were asked to pinpoint the products on a map. The participants did this 27 per cent more accurately for the high-calorie food compared with the low-calorie products, regardless of how much they liked the taste, whether they wanted to eat more of that product or how familiar they were with it. The researchers suspect that our spatial memory evolved to prioritize high-calorie food; that would have helped our hunter-gatherer ancestors to survive. The research by PhD candidate Rachelle de Vries was published in October in the *Scientific Reports* of Nature Research.
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What is the role in transmitting

How easily does the coronavirus jump from minks and other animals to humans? Researchers are working hard to figure out how the virus functions. Part of the answer lies in the ACE receptor. 'We suspect that that receptor in minks resembles the one in humans.'

TEXT NIENKE BEINTEMA **PHOTO** VIDIPHOTO / ANP **INFOGRAPHIC** STEFFIE PADMOS

# of animals Covid-19?

Piles of animal carcasses on concrete floors, and people in protective clothing shovelling them into large bins... Such images remind us of the outbreaks of bird flu, swine fever, Q fever and foot-and-mouth disease that are still in our collective memory. This time it is minks that are being culled. This has happened on over half of all Dutch mink farms since April. The animals have proven capable of transmitting the coronavirus SARS-CoV-2, both to each other and to humans. This makes them a public health risk.

'We already knew that mustelids (such as weasels, martens and minks) are susceptible to the virus,' says special professor Wim van der Poel, who researches Emerging and Zoonotic Viruses at Wageningen Bioveterinary Research (WBVR). 'When the virus turned up on mink farms, we went into action straightaway.'

Wageningen consulted its partner institutes and the Ministry of Agriculture, Nature and Food Quality (LNV) in a teleconference. 'We agreed that large-scale research was needed. How many animals are affected, how susceptible are they to the virus, and how easily can they pass it on to each other and to humans?'

> 'We know that the virus is not primarily spread via aerosols'

THE VIRUS MUTATES

WNVR and several partners are now doing surveillance research at mink farms and research on the virus's RNA. 'There are minor variations in the virus's RNA sequence,' says Van der Poel, 'because the virus mutates all the time. That enables us to see how the different virus strains in circulation are related. We could see, for instance, that an employee on a mink farm was infected with the same coronavirus variant that had been identified in the minks on that farm. A variant that we hadn't seen before in the human population.'

Meanwhile, several employees on mink farms have become infected with the mink strain. Yet the researchers did not find that strain among people living near the infected farms, so the mink variant did not seem to have spread beyond the farms yet. But to prevent that happening in future, the ministry announced that it would speed up the planned phasing out of the sector. All mink farms were already expected to close by 2024, because of public opposition to fur farms. That deadline has now been brought forward to 1 January 2021. Infected farms are being closed down immediately, while a scheme for closing down the remaining farms with financial compensation is being introduced.

HOW DANGEROUS?

'We are now studying whether there are differences in the genetic building blocks and biological traits between those mink variants and the variants we have identified so far in humans,' explains Van der Poel. 'On the basis of the genetic structure, we distinguish five clusters of virus variants on the mink farms. What causes these variants to spread very fast among minks on some farms, but without giving them many symptoms? And how dangerous are they for the human population compared with the other variants? How easily do they penetrate the cells of the host, and do they easily jump from one individual to another?'

Knowing this could help us come up with useful measures to stop the virus spreading, and to develop effective vaccines and drugs. Researchers still know relatively little about how the coronavirus functions biologically. What is known is that receptors on the outside of cells play a role in their susceptibility to the virus. A receptor is a protein of a particular shape that the virus is able to latch onto, like a key fitting into a slot.

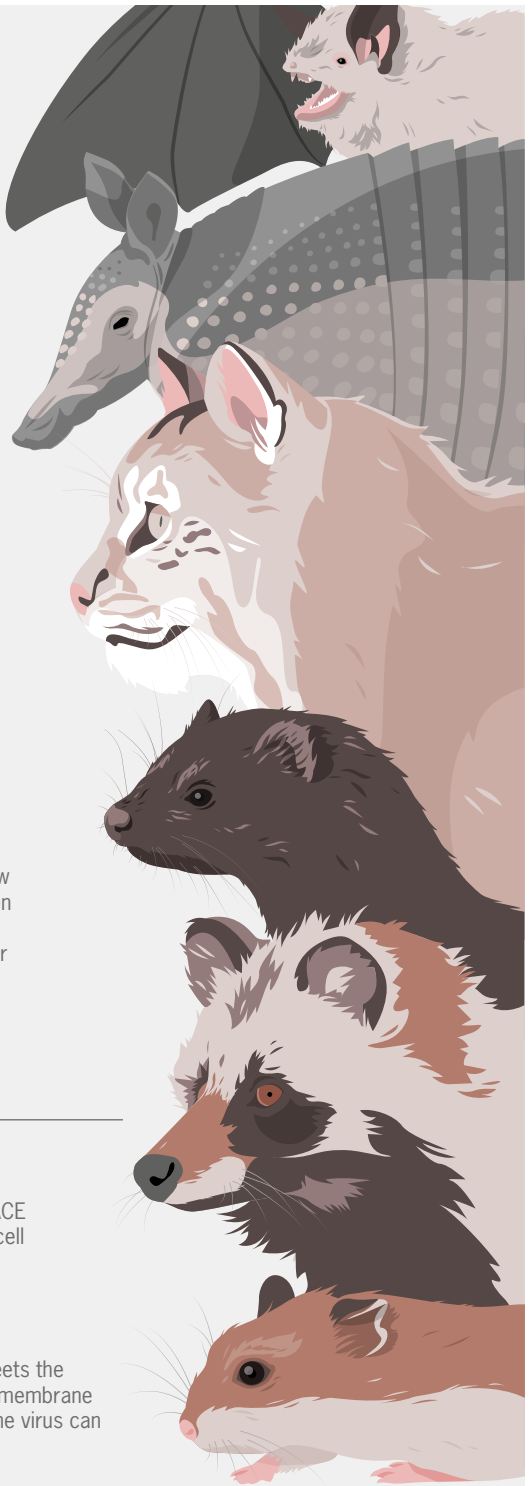
A virus needs such a receptor to penetrate the host cell. 'Research has already shown that the ACE receptor is an important factor in infections with the new virus,' says Van der Poel. When the two meet, the cell membrane changes in a way that allows the virus to pass through it. >

ORIGINS OF SARS-COV-2 UNCERTAIN

The new coronavirus SARS-CoV-2 first appeared in China. It was thought to have jumped from a wild animal – possibly a horseshoe bat – to a person, perhaps through an interim host in which the virus could mutate into a strain that is infectious for humans. At first all the signs seemed to point at the market in the city of Wuhan, where a wide range of live wild animals are traded in pretty unhygienic conditions. But experts think that conclusion is premature: a direct causal link between the market and the virus has yet to be found. The new coronavirus has never been found in an animal that was for sale at that market. The market might just have served as a 'superspreader' event: a large gathering of people where the virus could spread like wildfire. In the case of SARS a direct link with a 'wet market' was proven, but only in 2018 – 15 years after that epidemic.

WHICH ANIMALS CAN SPREAD COVID-19?

There have been reports from several countries that the coronavirus SARS-CoV-2 can infect animals as well as humans. Scientists around the world are doing research on which animals could spread the coronavirus.



Bats
Coronaviruses are common among horseshoe bats. Scientists found a coronavirus that closely resembled SARS-CoV-2 in this species. The virus has not yet been found in other bat species. Wageningen is involved in a study of the droppings of Dutch bats.

Mustelids (including minks)
Chinese model studies suggest that the pattern of virus spreading among martens and bats closely resembles the pattern of SARS-CoV-2. The outbreaks on Dutch mink farms confirm that impression. Minks are very vulnerable to the new coronavirus. Wild mustelids such as stone martens and polecats often frequent farmyards and could pick up the virus on mink farms.

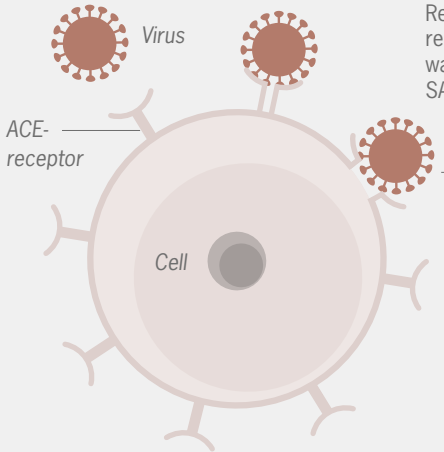
Raccoon dogs
Raccoon dogs are farmed in China for their fur. It has been proven that they can be infected with SARS-CoV-2 and can spread the virus. Infections have not yet been reported, however.

Armadillos
A virus strain similar to SARS-CoV-2 is found among armadillos, which are apparently often for sale at the market in Wuhan. But the coronavirus strain that infected the first Chinese patients has never been found in an armadillo.

The cat family
Domestic cats, feral cats and tigers in a zoo have been proven to be infected with the coronavirus. Scientists are studying how the virus gets passed on.

Rodents
The only rodents which we know can become infected – and even become sick – are hamsters. Research is ongoing on whether other rodents spread the coronavirus, on mink farms for instance.

THE ROLE OF THE ACE RECEPTOR



Research has proven that the ACE receptor on the outside of the cell wall is key to infections with SARS-CoV-2.

When the virus meets the receptor, the cell membrane changes so that the virus can pass through it.

It is thought that the ACE receptor in minks may resemble the one in humans. Pigs have a similar ACE receptor too, but are not susceptible to the virus.

PHOTO JOKO P. / SHUTTERSTOCK

Stray cat being fed in Indonesia.

'We suspect that the ACE receptor in minks is very similar to that in humans,' says Van der Poel. WUR is researching this now in another new project – 'Covid-19 in animals' – started by the Netherlands Centre for One Health (NCOH).

COUGHING TIGERS

It is already known that pigs have a comparable ACE receptor, but are nevertheless not susceptible to the virus. Monkeys do get infected by the virus, but do not display any symptoms – unlike minks – although they can spread the virus further. Cats and, to a lesser extent, dogs do not seem to get sick either, but infected tigers at the zoo in New York did suffer from a dry cough and loss of appetite. 'We haven't yet seen clear patterns in which animals show symptoms and which don't, and which animals can play a role in spreading the virus,' says Van der Poel. 'That makes it difficult to do efficient tests on animals yet. The only animals of which we know for sure that they get really ill from the virus are hamsters. That offers potential for studies contributing to the development of vaccines.'

By this, Van der Poel is referring not just to fundamental research on the virus's functional mechanisms, but also to trials of candidate vaccines being developed in the Netherlands and abroad. 'We are trying to minimize animal testing of course, but candidate vaccines are still being tested on animals first. You can't get around that. But when you do it, you must make sure you keep such testing as targeted and efficient as possible.'

CANDIDATE VACCINS

This research is being done in Wageningen and was commissioned by the Coalition of Epidemic Preparedness Innovations (CEPI), an international organization that seeks to get new vaccines on the market as soon as possible. CEPI gets financial support from many governments. Van der Poel is not free to disclose how far the research has got, exactly, or which candidate vaccines are being developed. 'But there are certainly two or three that are producing promising results.'

> **'Transmission between cats is probably just as effective as between humans'**

Mart de Jong, professor of Quantitative Veterinary Epidemiology at Wageningen, leads a team that models and quantifies the transmission of infectious diseases between different animals. 'We are looking for the factors that influence that transmission,' he says. 'We are studying the underlying mechanisms of transmission with a combination of mathematical models, observations and experiments. Once we understand those mechanisms better, we can get better at predicting, measuring and extrapolating the effect of measures for preventing the spread of the virus.'

The group gained a lot of experience during earlier national crises concerning the bird flu and swine fever. 'From comparisons with other diseases, we know that SARS-CoV-2 is not primarily spread via aerosols. If that was the case, the reproduction factor (the R value) would be much higher than it is. My guess is that transmission on mink farms mainly occurs via mucus in the nose or dust particles from the cages.'

The main thrust in De Jong's account of the state of play is that the details are not clear yet. For example, we still don't know exactly how long the virus can remain infectious under different circumstance. Tests on cages which have housed infectious animals for some time could cast some light on this.

The fact that domestic pets can get infected means they too can play a role in spreading the virus. There is no evidence of this yet, but the researchers are highly alert to it. De Jong's group is using modelling and data analysis in a large-scale study of infections among the dogs and cats of coronavirus patients. A similar study has already been done in Italy, where about three to four per cent of the dogs and cats turned out to have antibodies to the coronavirus. As a rule, people who are infected with the virus are advised not to cuddle their pets, especially if the pet roams freely out of doors, and could therefore spread the virus further. So De Jong and his colleagues are also modelling the role of cats in the transmission of the virus. They combine the models with experiments and observations in households with the coronavirus, in collaboration with Utrecht University.

EFFECTIVE TRANSMISSION

'Transmission between cats is probably just as effective as it is between people, but they don't fall ill,' says the professor. 'So the question is whether they can pass it on to people just as easily. We don't know the answer to that yet. We are studying whether, from the epidemiological angle, you can see a cat as an extra member of the household with its own social network outside the home. Except of course that the cat doesn't go on holiday abroad.'

Data from stray cats is being included in the research as well. The data are being collected by teams which were already at work catching and sterilizing stray cats in the countryside. 'They are doing that even more intensively now around mink farms,' says De Jong, 'to help prevent the virus from spreading. And to collect data. There haven't been many infections among stray cats up to now, but there have been some.'

VIRUS RESERVOIR

De Jong has been following the vaccine development closely. 'A lot will depend on which vaccine wins the race in the end,' he says. 'Will it only prevent you from having symptoms, or also from becoming infected? There is a difference between these two. If a vaccine doesn't prevent you from getting infected, the virus will go on multiplying and spreading. And then there is a reservoir of the virus present, which makes us much more vulnerable.'

Wim van der Poel is also thinking about a reservoir of the virus that could hang around after we've got a working vaccine. 'Among people, but out in the wild too,' he says. 'Among cats, martens, bats... The truth is that we just don't know yet to what extent a reservoir could develop.'

The danger is that new variants will emerge in that reservoir that are more dangerous, or that more easily make the jump between different animal species, and between people. This is a familiar phenomenon in flu viruses: many strains of flu are mild, but now and then a strain crops up which is highly dangerous or infectious, like the Spanish flu. That unpredictability is the reason why vulnerable groups in the Netherlands are offered an annual flu vaccination. A new vaccine is offered every year, which provides protection against the cocktail of flu strains that are dominant at that point in time. 'There is a risk that we'll have to do something of the sort with a coronavirus vaccine,' says Van der Poel. 'In other words, that it won't provide protection for very long because the virus changes too fast. The question is what role is played by reservoirs in animals. Yes, this issue is going to keep us busy for a while.'

SWINE FLU

De Jong mentions a further concern: 'This is now a single virus that has the world in its grip. But we have seen before that it can happen with other animal diseases too, as is the case now with the West Nile virus, for instance,' he says. 'People blame this pandemic on China, but it could have happened here. If a dangerous strain of flu starts spreading among pigs here, and jumps to humans, it will spread around the world in no time and we won't be able to do much about it. Just as happened with the swine flu.'

The good news, De Jong notes, is that researchers are getting better and better at detecting and characterizing pathogens, and that doctors and nurses are getting better and better at treating infection diseases. But: 'This risk continues to exist because contact between humans and animals is simply part of our way of life. That underlines all the more the importance of good research to help us understand that transmission.' ■

www.wur.eu/covid19inanimals

CONSORTIA FOR CORONAVIRUS RESEARCH

When the coronavirus turned up on mink farms, several parties went into concerted action without delay. WNVR joined forces with the Animal Health Service, Utrecht University and the Erasmus Medical Centre in Rotterdam to conduct an extensive survey of mink farms and research on virus variants and transmission, at the behest of the ministry of Agriculture, Nature and Food Quality (LNV). They are also researching the RNA of the virus strains to identify relationships between the different strains.

The Netherlands Centre for One Health, meanwhile, has started work on the 'Covid-19 in animals' project commissioned by the ministry of LNV. Utrecht University and Erasmus University Rotterdam are working with WUR on this project, which will look at the role of domestic cats and wild animals in spreading the coronavirus. The research makes use of modelling, experiments and observations.

Micro-organisms m

A Wageningen research team has made mayonnaise with the help of yeast, moulds and bacteria. Although the researchers say the product tastes good, it is not necessarily destined for the market. The main aim is to get the food industry interested in replacing plant and animal protein with microbial protein.

TEXT KENNETH VAN ZIJL **ILLUSTRATION** KAY COENEN

'We are trying to use bacteria, moulds and yeasts to make foods that are very similar – or maybe even identical – to existing food,' says Jeroen Hugenholtz, who leads the Fermentation expertise group at Wageningen Food & Biobased Research, and is also special professor of Industrial Molecular Microbiology at the University of Amsterdam.
Foodstuffs that contain animal proteins are of particular interest, says Hugenholtz, in view of the rising global demand for animal protein. 'To show that it's possible, we started with a simple product that consists mainly of oil and protein and a little acid, namely mayonnaise.'
The Wageningen research team made the ingredients using fermentation, a sophisticated rotting process in which bacteria, yeasts and moulds convert raw materials such as sugars or cellulose into other substances such as oil, alcohol or organic acids. 'It is not a new discovery that you can make oil and other substances in this way. What is new, and a challenge, is that you can use various fermentation processes to make tasty products with the right nutritional value.'

OIL, PROTEIN AND ACIDITY

For the oil component of the microbial mayonnaise, the team used *Yarrowia*, a yeast that makes oil that resembles palm oil. Several different micro-organisms can help produce the protein, including the bacterium *Bacillus subtilis*, yeasts such as *Yarrowia* and *Pichia pastoris*, and the mould *Penicillium roqueforti*. The acid component comes from bacteria that produce lactic acid. 'At present we still have to make the three components in separate fermentations and then combine and mix them. But we might find fermentation processes with which we can produce all three components in one go.'
Although the microbial mayonnaise tastes pretty good in Hugenholtz's opinion, it won't be found on the supermarket shelves. Nor will test panels be asked to subject the mayonnaise to taste testing. 'That's not what it's all about for us. Our aim is to show the food industry what the possibilities are for using microbial food components created through fermentation, and that these are affordable pro-

ake mayonnaise

cedures.' One option is to grow the micro-organisms on cheap waste streams: household waste, compostable waste, potato peelings, the waste products from the paper industry, or surface water from sewerage systems. There are loads of options. As long as it contains sugars, or carbohydrates, cellulose, or organic acids such as butyric and acetic acid.'

COMPETING WITH MEAT

Microbial mayonnaise is all very well, but Hugenholtz's real aim is to make products that can compete with meat for nutritional value and taste. There are already quite a lot of meat substitutes available, but the protein in them usually comes from plants. 'We want to show that you can use micro-organisms for that too. We always check which micro-organisms grow best on which material, which ones produce the best protein for the intended purpose, and which protein is the easiest to isolate.'

Hugenholtz expects that bacteria, moulds and yeasts will play a crucial role in meeting the increasing demand for protein. A 2019 report by the United Nations predicts that we shall have 10 billion mouths to feed in 2050. There will not then be enough of the major sources of protein –meat, fish and dairy products – to meet the global demand for safe, high-quality protein-rich food. 'We've got to start eating less meat and getting more of our food directly from plants, insects and micro-organisms. There are huge benefits to that in terms of sustainability,' says Hugenholtz. 'To me, that is the main reason to work on this.'

Nor is he afraid of competing with protein from plants. 'Plants are often seen as a source of protein, but they are a very inefficient one,' says Hugenholtz. 'You need an awful lot of plants to produce sufficient protein. And for that you need large areas of land. Or you source protein-rich ingredients such as soya from far away, but that is not very sustainable.'

Microbial production can be done anywhere, he explains. 'Cheap waste streams are available everywhere. By fermenting them, you produce the raw material you need. And given that we produce a lot of waste streams globally, the potential for microbial food components is huge. In Africa and Asia, where the demand for protein is biggest, there are also gigantic volumes of waste that are going unused at the moment.'

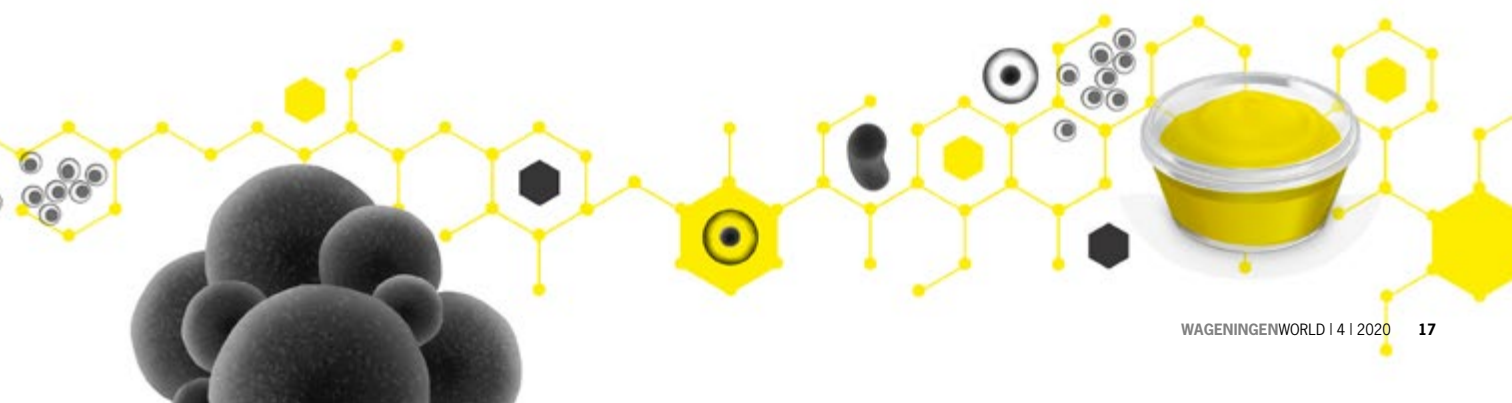
'We want to show the food industry what the possibilities are'

COMMERCIAL PARTNERS

Hugenholtz's lab pays attention to flavour too. Breakdown products of amino acids, for example, can be converted into flavour components using fermentation. 'We are working with several companies on using fermentation to develop flavourings for use in meat substitutes.'

Commercial partners are important to the Wageningen research team. 'We are brimming with ideas,' says Hugenholtz. 'We produce various kinds of oils and proteins and develop new fermentation products every day. But in the end you are dependent on having a client who can launch the products commercially.' ■

www.wur.eu/fermentation



LIESBETH BAKKER:

‘Nature is perfectly capable of taking care of itself’

Dutch nature policy is too focussed on maintaining the status quo, says professor of Rewilding Ecology Liesbeth Bakker. ‘There has to be room for change. That could be very beneficial in many areas.’

TEXT RIK NIJLAND **PHOTOGRAPHY** HARMEN DE JONG

‘I think it’s a great plan to plant climate forests,’ says Liesbeth Bakker, who was appointed Special Professor of Rewilding Ecology at Wageningen in February. ‘But the way we do it says a lot about how we treat nature. We decide which tree species we think suitable for the location and we go ahead and plant them. That makes me think: Keep off it, let it go, leave it to nature. It might take a little longer before you’ve got the forest you want, but you will get all kinds of interesting intermediate phases, with habitats that many species like to make use of. This is a golden opportunity to make the Netherlands a little bit more natural.’

Bakker’s new chair, the first in Europe (and probably in the world) that focusses on rewilding, is funded by the Netherlands Institute of Ecology and Rewilding Europe, an organization that targets large-scale nature development in Europe.

The word ‘rewilding’ usually conjures up images of wild cattle and horses in nature areas.

‘That is often what it is in practice, but its meaning is far broader. Rewilding aims at making room for natural processes, including abiotic ones, such as flooding, water level changes or drift sand. Then there is also the biotic side that you are referring to, “trophic rewilding”, which brings back important missing links in the food web. Sometimes that means predators, but in the Netherlands it often means large grazers. Since indigenous wild cattle and horses are extinct, this role is take by Scottish Highland cattle, Galloway cattle, Heck cattle, aurochs,

‘Keep off it, let it go, leave it to nature’

Konik horses and nowadays the European bison too.
‘The term rewilding came over from the US about 20 years ago, but we’ve been at it for 40 years in the Netherlands. Including in the Veluwezoom National Park in the early 1980s. But there was also Plan Ooievaar, a project that combined clay extraction with nature development in the water meadows of the major Dutch rivers. At locations such as the Blauwe Kamer nature reserve near Wageningen, the summer dyke was breached and Koniks and Galloways were introduced to restore the riverine landscape and its dynamics.’

With the aim of bringing back pristine nature?
‘What we set in motion will definitely not be pristine nature. The fact is that the starting point in the delta is a landscape featuring dykes and dams, so it is dominated by humans. Nature should be given free rein wherever possible, rewilders believe, but of course we can never recreate an unspoiled wilderness in Europe anymore. The point is a change of attitude.
‘Dutch nature policy has historically been dominated by the idea that humans are essential as managers if biodiversity is to be maintained. But of course, that biodiversity was there long before human beings put their stamp on it. And even now, nature can still take care of itself very well. What is lacking is the space to do so.’

Have we got that space in the overcrowded Dutch delta?
‘The larger an area and the less that has been done to it by humans, the more promising the starting point. A small area often doesn’t have enough heterogeneity to accommodate much biodiversity, but even in the Netherlands opportunities arise to give natural processes a chance to varying degrees. On former agricultural land, for example. But it’s also a matter of changing our attitude.’ >

> 'Heather plants really don't disappear if the heath gets overgrown'

Can you give an example?

'At the moment, the Markermeer lake is actually just a bathtub surrounded by dykes. Fishers complain that the fish stocks have collapsed. Our research on and around the Markermeer clearly shows how incredibly important shallows and wet zones along the shore are for birds and for breeding and young fish. Bringing back natural land-water transition zones such as marshy banks and inundated grasslands is crucial to how well the lake functions. I see that as rewilding too. How to put that into practice and what conditions apply will be one of the main topics of my research.'

Isn't nature management a job for people too, in practice? Heathland has to be kept clear, pools have to be deepened for amphibians? Isn't it better if we maintain nature ourselves?

'What is better? Of course, we can maintain fantastic vegetation and keep animals happy, but those species had a place in the landscape before we started uprooting trees or deepening pools. Heather plants really don't disappear if the heath gets overgrown: heather seeds stay viable for more than 100 years. In an area that we leave to nature, they will reappear at some point, maybe when an open space is formed. Even if it's not on the same scale as a large heath.'

So no more purple moorland?

'I love the sight of it too, but nature management is too focussed on maintaining the status quo: moorland on the left, woods on the right, and it must never change. That's not how nature works; nature is dynamic. There has to be room for change. In times of climate change especially, nature should be given the chance to adapt. Our management is all about trying to stop change.

'If deer graze on newly planted trees or wild boar make a mess, we say there are too many deer or boar and we must shoot them to protect the forest. And at the same time, we uproot trees on the heath to prevent it from getting overgrown. A lot of animal species like a half-open landscape with a mix of copses and open land. That is a rarity in our static nature.

'In the Onlanden, a water storage area of 2500 hectares with large grazers in Groningen province, there is a half-open landscape like that on some higher ground. There are now 20 pairs of whinchats brooding there. They are a rare bird that hardly ever finds a suitable habitat in the Netherlands. Through rewilding you get more variety, which benefits species like that.'

And does biodiversity as a whole benefit?

'Everyone sees the spectacular results, such as the return of iconic species like the sea eagle and the fish eagle, but it is hard to give a simple answer. There are also places where large grazers have wreaked havoc with the habitat of a rare plant.

'An important motive for me is: create more clarity. Most of the literature about rewilding consists of opinion papers, and there are very few solid studies that delve into the results: what happens if I do this or that? And the Dutch contribution to the literature is negligible, even though we are pioneers of rewilding. There is a lot of data on monitoring and from grazing experiments. Nature managers and scientists need to join forces to make better use of those data. Then we can show, at home and abroad, what we have achieved in the Netherlands.'

LIESBETH BAKKER

Liesbeth Bakker (47) studied Biology at Groningen University and got her PhD in 2003 in Wageningen on the impact of cattle, rabbits and field mice on vegetation. She is currently working as lead researcher in the Aquatic Ecology department at the Netherlands Institute for Ecology (NIOO-KNAW). She leads a joint research project by several universities on the developing food web on and around the new artificial islands called the Marker Wadden. Bakker was appointed Special Professor of Rewilding Ecology at Wageningen in February. This chair is funded by the NIOO and Rewilding Europe, an organization that targets large-scale nature development in Europe.

Is there still a place for classic Wageningen-style nature management?
'Grazing research has been done in Wageningen for a long time, and the results of that are very applicable in rewilding. And there is a lot of experience with the ecology of large herbivores on the African savannas. In that sense, this is very compatible with Wageningen. But that doesn't rule out other forms of nature management. The biodiversity problem is big enough for us all to have a role.
'In these times of surplus nitrogen, nature managers who work themselves into the ground to save threatened species are the superheroes of the day. And I'm not suggesting putting a herd of Scottish Highland cattle in grassland that is a little floral gem amidst farmland, but there are plenty of areas of the Netherlands that are not little gems, and a lot can be done there.
'I see rewilding as a different approach to making our degraded landscape more beautiful. We shall need to totally rethink both our water management and our agriculture in the future, and that means rethinking our land use too. There are great opportunities there for more nature inclusivity.'

'Rewilding is an action plan for making the landscape wilder and more natural'

Is there public support for that? The Oostvaardersplassen have been controversial for years. Last winter, activists threw bales of hay over the fence to feed starving large grazers.
'To me, the Oostvaardersplassen are not the best example of rewilding. The large grazers there are not managed, so their numbers have got out of hand and the amount of food available is a limiting factor. A different approach is taken elsewhere in the Netherlands, in which people limit the number of animals through herd management. The reason for that is that the ecosystem is incomplete. Apart from a handful of wolves, there are no predators here who affect the behaviour of the large grazers and regulate their numbers. So as long as there's a lack of predators, it's an option for humans to do the regulating.
'Rewilding is an action plan for making the landscape wilder and more natural. The question should always be: what steps can I take, given the physical and social context? If there is no popular support for letting the large grazers starve before our eyes, that's where the line is drawn now.' ■

www.wur.eu/rewilding

RESEARCH ON PIXEL AGRICULTURE

Harvesting by the square decimetre

There is a field on the Velhorst estate in the eastern Netherlands that looks like a colourful kitchen garden full of different crops. But this is a serious trial with a novel farming system and part of a Wageningen experiment with 'pixel agriculture'. The aim of this approach is to promote biodiversity and reduce pest pressure.

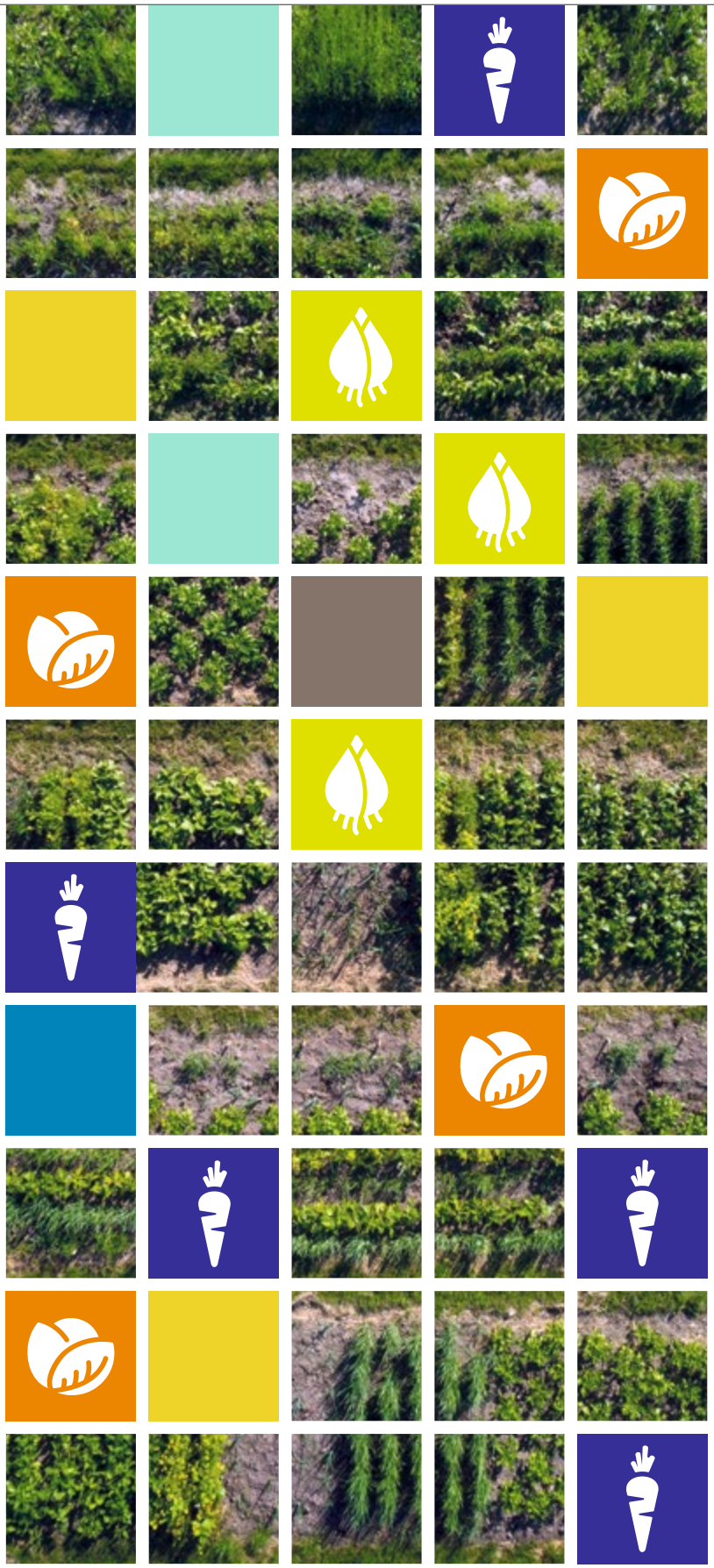
TEXT RENÉ DIDDE **ILLUSTRATION** WUR **PHOTO** GETTY

An extraordinary patchwork of cabbages, leeks and celeriac catches the eye on the Velhorst estate near Lochem in the east of the Netherlands. It is not so much the crops or the harvest that jump out at you, as the pattern they form – a bit like a chessboard, with the different winter vegetables growing in the squares. Each crop has its own bed measuring 1.5 by 1.5 metres, with a few beds of sage and parsley dotted among them.

'At the start of this season, there were 30 crops on this plot, including fennel, courgettes, pumpkins, endive, Savoy cabbages, cucumbers, beans and pak choi,' says farmer Arjen van Buuren as we survey this spectacular-looking experiment. Van Buuren is fascinated by this new form of agriculture, with a huge variety of crops grown in what looks like a vegetable patch. Pumpkins and courgettes are growing in individual squares, cabbage in clusters of four squares, onions in eight and leeks in ten squares. Van Buuren and his wife Winny have only been farming here in the Achterhoek region since the end of 2018, when they had the chance to lease 85 hectares of land designated for extensive farming from nature conservation organization Natuurmonumenten. Fifty hectares is grassland for cows, sheep and Bentheim black pied pigs, a rare breed that 'look like Dalmatians,' says Van Buuren.

STRIP-CROPPING

About 35 hectares of the land is used for arable and vegetable farming. On five hectares, the Van Buurens are practising strip cultivation, a relatively new phenomenon in the Netherlands, with different crops grown side by side in strips of between a few metres and 25 metres wide. The aim is to promote biodiversity and reduce pest pressure. Strip cultivation was developed on a large scale in the United States in the 1960s in response to eroding dust storms. Farmers in China have been practising strip cultivation for centuries. And on their last farm, the Van Buurens themselves got bigger yields from this form of cultivation. They saw an increase in the biodiversity on their farm and a decrease in crop damage by pest insects and mould. They also noted that spending less on pesticides improved not only the environmental balance on the farm but also the bank balance.



This year, on half a hectare, they are going a step further and experimenting with growing the crops in small patches in a chessboard pattern. Van Buuren heard about the 'chessboard concept' in November 2019 when he attended a study day about diversified cropping systems in Wageningen. 'We looked at a small trial plot in Wageningen. The researchers wanted to get some experience on a working farm so I offered a field,' says Van Buuren.

GOOD NEIGHBOURS

Thanks to his experience with strip cultivation, Van Buuren knew that grains and beans make good neighbours, for example, and so do oilseed rape and clover. This kind of helpful interaction that increases yields and biodiversity intrigues him. 'Scientists

> 'It was a joy to walk through the field this year'

don't know exactly what causes it.' The Van Buurens wanted to see what happens when crops have a lot more neighbours.
The Wageningen study day was led by agronomist Dirk van Apeldoorn and PhD researcher Lenora Ditzler. In the Farming Systems Ecology chair group, Van Apeldoorn is looking for farming systems that prioritize ecological concerns. 'From strip cultivation on about 40 farms in the Netherlands, as well as trials in Wageningen and the literature, we known that more biodiversity leads to fewer pests and higher yields.' And that can be explained: 'The roots of crops grown side by side work together to increase the resilience against soil diseases. With better root systems, the capacity to retain moisture improves and so does the nutrient uptake from the ground.'
With a view to further increasing biodiversity and studying the neighbourly >

‘The robot works overtime in order to learn’

PHOTO VRIENDEN VAN VELHORST

PHOTO ROBIN BRITSTRA

Arjen and Winnie van Buuren experiment with pixel agriculture on their estate, Velhorst, near Lochem. They have been testing a prototype weeding robot.

collaboration between crops, the researchers came up with the chessboard idea – or ‘pixel cropping’, as Van Apeldoorn calls it.

PERPLEXED

The name refers to the dots that make up a digital image. Different sizes of the patches in the field are being experimented with. They vary from over two square metres on Van Buuren’s farm to a quarter of a square metre on the Wageningen trial plots or patches of 10 by 10 centimetres on a farm in Almkerk – the scale of a pot of basil from the supermarket.

The choice of the pattern for the crops in Lochem was based on Arjen van Buuren’s experience. He knows from practising strip-cropping, for example, that onions and carrots make good neighbours. ‘The destructive carrot fly can’t stand the smell of onions, and the onion fly avoids the smell of carrots.’ Clover and white cabbage are good friends too. ‘Cabbage white butterflies were quite bewildered this year by the diversity of plants and the smell of the pixels with flowers.’

On the Wageningen trial plot, the planting and sowing of the pixels was done at random in order to see which crops benefitted the most from each other’s proximity. The Wageningen researchers count the moulds and pest insects in the pixels, as well as their natural enemies. They measure the harvest and its quality, looking at pest damage, dry matter volume and nutrients. They are going to compare the results of the Wageningen trial plot and the Van Buurens’ farm in Lochem. The other pixel farm, in Almkerk, will participate in the study too.

To get a broader perspective on the biodiversity at Velhorst than just the pest insects such as aphids and their natural enemies (such as ladybirds), researchers from the EIS research centre and Naturalis natural history museum in Leiden are also keeping a tally of the moths and wild bees. The local birdwatchers of Lochem are counting the meadow birds every week, while the soil life is a research topic for Wageningen students.

CHOOSING WHEN TO HARVEST

That yields are higher in the pixels comes as no surprise, actually. ‘One reason for that is that the crops are harvested at the most optimal moment, a bit like the way you work in your vegetable garden, taking the ripest tomatoes or the best potatoes for tonight’s supper,’ says Van Apeldoorn. On a large field with a monoculture of wheat, at some point the farmer just has to decide to get out the combine harvester and harvest it all at once. ‘But in such monocultures, about 20 per cent is not ripe yet at the point of harvest,’ says Van Apeldoorn. The farmers in Lochem confirm that. The Van Buurens say it has been ‘a joy’ to walk through the pixel field this year. ‘We are harvesting to order for restaurants and greengrocers, and we are gradually getting to know where we will find the ripest crops,’ says Arjen van Buuren.

But there is one major disadvantage to the kaleidoscopic chessboard of crops with different harvest times. In a hotchpotch of pixels, planting and sowing, weeding and harvesting become labour-intensive jobs that cannot be done by a machine.

If pixel farming is to break through to the mainstream, technical aids will be needed

to support the farmer and the ecology, says Van Apeldoorn. 'We could use drones,' he suggests, 'which monitor how the crops are doing using photos and films.' But the manual labour can only be replaced by intelligent machines. Wageningen is working with the farmers in Lochem and Almkerk on what is called 'soft robotics'. 'We are developing robots that can do both 'hard' and 'soft' work,' says Van Apeldoorn. 'They have to be able to lift potatoes and then pick raspberries.' They also have to be able to sow and plant and – above all – weed.

WEEDING ROBOT

A prototype could be seen in Lochem this year of a robot called Robotone, which weeded with its five arms around the edges of the pixels and cautiously inside them too, among the cabbages, pumpkins and cucumbers.

It was not a success, though, says Van Buuren. 'The machine had difficulty keeping on track, and was five centimetres off-target by the end of the field, so it started pulling out cabbages. But that is part of the development costs of the technology. The robot has to work overtime in order to learn.'

Van Apeldoorn, who collaborates with researchers from the Wageningen Farm Technology Group, has no idea when an all-round robot will be available. What is certain is that the robot's camera will have to store at least 50,000 images in its memory in order to be able to distinguish plants from each other and from weeds, and to recognize their growth stage and the moment of optimum ripeness.

Arjen van Buuren's chief hope is that robots will be able to sow and plant. 'This spring it took three of us a month to plant half a hectare of pixels. It was so much work that we didn't do the other half.'

But for now, pixel farming on that half a hectare is proving an interesting business model. This year 500 people are leasing one pixel for 10 euros. 'We harvest onions or courgettes from their beds for them all year,' says Van Buuren. And there were 2000 pixels left for selling to local restaurants and greengrocers. 'Okay, it's a niche market, but it is a lucrative business model. I don't think there's a farmer in the Netherlands who gets more than 5000 euros a year from half a hectare.' ■

www.wur.eu/pixel-agriculture

SEBASTIAN BERNARDY

Clemens Driessen (Cultural Geography) and Lenora Ditzler (Farming Systems Ecology) collaborated on the *Countryside, the Future exhibition* at the Guggenheim Museum in New York. The exhibition was curated by the architect Rem Koolhaas and featured pixel farming among its topics.

MATCHING NEIGHBOURS ON THE SCREEN

In order to develop pixel agriculture, scientists look for positive interactions between different crops with a view to getting a bigger and better harvest using as little pesticide and fertilizer as possible. This search for successful combinations takes place not just on trial plots, but also on Jochem Evers' computer. A researcher at the Centre for Crop Systems Analysis at Wageningen University, Evers develops models that simulate the growth of crops. 'We recreate crops in 3D, complete with their root architecture, stalks, branches and leaves. We place them at a given distance to each other, and we can create growing conditions with different parameters such as light, water and nutrients. The role of pest insects and – however limited – of moulds is also calculated into the model.' Evers hopes to discover combinations of plants that flower in succession, need water at different times, or can reuse each other's decomposition products.

This has not yet delivered specific results for pixel farming, but in the case of strip cultivation it has thrown up insights into the optimal width of the strips for grains such as wheat or maize and for legumes such as field beans and soya.

Wageningen Campus: education, research and enterprise

AURORA EDUCATION BUILDING

Because of the growth in student numbers, construction started in 2019 on a **third education building** on the campus (after Forum and Orion). It will be ready for use in September 2021.

PLUS ULTRA II

Plus Ultra II was completed in May 2020, complementing Plus Ultra I next door, built in 2015. Both these multi-tenant business hubs run by Kadans Science Partner offer facilities and guidance to knowledge-intensive start-ups in agro and food. **StartLife** and **StartHub**, the breeding grounds for start-ups, are housed here too.

One of the tenants in Plus Ultra II is **OnePlanet**, a joint venture by Wageningen, the Belgian company Imec, Radboud University Nijmegen and Radboud University Medical Centre. OnePlanet will develop chips and digital technologies for the life sciences.

UNILEVER

King Willem-Alexander opened HIVE in December 2019. This is Unilever's new **Foods Innovation Centre**, which replaces research locations in Vlaardingen, Poland and Germany.

Wageningen Campus continues to grow as a meeting place for researchers, students and businesses. It is now home to about 100 start-ups and other companies. The most recent developments are the arrival of a third education building, the completion of the business hub PlusUltra II, and plans to expand the campus at the Born-Oost location. For more information, see www.wageningencampus.eu

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TES

Much of the campus is going to be dug up for the expansion of the thermal energy storage (TES) system. The work will take until the summer of 2021.

THE DIALOGUE CENTRE

Work started in October 2020 on the dialogue centre, which will replace the Aula in the centre of Wageningen as the venue for PhD ceremonies and inaugurations. The building will be completed by the beginning of 2022.

BORN-OOST

Expansion location of the campus on the 10-hectare site of Born-Oost, for knowledge-intensive companies and student housing.

UPFIELD

Construction started in October 2020 on a new research centre for Upfield, formerly Unilever's margarine branch. The building is due for completion at the end of 2021.

1 **Nergena:** Unifarm experimental farm, AlgaePARC
2 **Droevendaal:** Organic experimental and education centre
3 **Radix:** Plant Sciences, Wageningen Plant Research, Wageningen Academy, Wageningen Centre for Development Innovation
4 **Axis:** Agrotechnology and Food Sciences, Wageningen Food & Biobased Research
5 **Phenomea:** research hall for post-harvest technology and robotics
6 **Carus:** Animal Sciences, Wageningen Livestock Research
7 **Innovatron:** Technical Development Studio
8 **Zodiac:** Animal Sciences, Wageningen Livestock Research
9 **Vitae:** Wageningen Food Safety Research, a merger (2019) of RIKILT and the research lab of the Netherlands Food and Consumer Product Safety Authority (NVWA)
10 **Actio:** Facilities & Services
11 **Helix:** Agrotechnology and Food Sciences
12 **Impulse:** meeting place next door to the Restaurant of the Future
13 **Nexus:** Idealis, student doctors, Expat Centre
14 **Campus Plaza:** Student housing, small shops and cafés, vaccination centre
15 **Plus Ultra I:** business hub
16 **Forum:** education building and library
17 **Orion:** education building with student café
18 **Lumen and Gaia:** Environmental Sciences, Wageningen Environmental Research, ISRIC and the World Soil Museum
19 **Atlas:** Management headquarters
20 **NIOO-KNAW**
21 **Aeres University of Applied Sciences**
22 **FrieslandCampina Innovation Centre**
23 **Sports Centre De Bongerd**
24 **De Leeuwenborch:** Social Sciences, Wageningen Economic Research

PHOTO AEROPHOTOSCHIPHOL

Log in to Wageningen

Thanks to the lockdown, digital education has come in for quite a boost in 2020. Online courses for professionals are booming business too. More and more people all around the world are logging in to learn about typical Wageningen themes such as food safety, plant breeding, animal behaviour and post-harvest technology. Not to mention the science of beer.

TEXT: MARIANNE WILSCHUT **PHOTOGRAPHY** ERIC SCHOLTEN

Horticulturalist Carl Kroon is used to early starts as general director of Fides Guatemala, one of ornamental plant-breeding company Dümmen Orange's farms. But in the past few weeks, his Fridays have started extremely early. He was at his laptop by four in the morning to follow the live Q&A session in the Wageningen online course on Postharvest Technology from Antigua, Guatemala.

'The sessions start at 12 noon Dutch time, so it is still night here, but luckily I'm not the only one who has to get up early. My coursemates come from all around the world, from Asia to South America. The guest course leader is at UC Davis in California, so for her it was three o'clock in the morning. Fortunately, it's just two hours and I can use the rest of the online learning materials at a time that's convenient for me.'

Kroon thinks it is worth sacrificing some sleep to do the course. 'On our farm, we produce cuttings of all sorts of ornamental plants, and sell them to professional plant growers, mainly in North America. Because the cuttings have a limited shelf life, postharvest technology is very important for us. It's quite a time since I studied horticulture at Wageningen; I was in the class of 1986. This course helps me brush up my knowledge and get up to date on new developments. I learn a lot, about ethylene inhibitors, for example, and about packing products in a controlled atmosphere. I've even got a separate appointment next week with a few experts from the course, and I'm very pleased about that.'

WATCHING SCIENCE CLIPS

The Postharvest Technology course is run by Wageningen Academy. 'A group of participants all start together and follow a programme over several weeks in which they watch previously recorded web lectures and short knowledge clips, and do assignments,' says Monique Tulp, a programme manager at Wageningen Academy. 'There is a live Q&A session every week at a fixed >

Professor Sander Kersten (Nutrition, Metabolism and Genomics) making a recording for a MOOC.

time, with interaction between the participants and the experts. Interaction is also possible through the discussion forum on the online learning platform.'
These are interesting courses for professionals who want to expand or brush up their knowledge, perhaps because they want to make a career switch. The prices vary: the Postharvest Technology course costs 1250 euros, while Refrigerated Transport Technology costs 575 euros.

> 'We try to plan live sessions at doable times in the different time zones'

Tulp: 'Some companies include our courses in their staff training programmes. Then we get some of their staff taking a course with us every year. And we run tailor-made courses, which can also be done online.'

A SUCCESS

Until recently, most of these courses for professionals were taught on the Wageningen campus. Because of the coronavirus crisis, many courses had to be rapidly moved online, just like the degree courses. Wageningen's extensive experience of running Massive Open Online Courses (MOOCs) came in handy when people had to make this switch. As the word 'massive' suggests, large numbers of students from around the world sign up – on the online platform EdX – for these online lectures. With the odd exception, the courses are free and participants can take them at their own pace. Wageningen launched its first MOOC in 2015, and there are now 43 WUR courses available online.
In August, the millionth participant embarked on a Wageningen MOOC, a milestone that was reached much earlier than expected thanks to the Covid-19 pandemic. 'There were two or three times more registrations than usual during the lockdown,' says Suzanne de Bruijn, Wageningen's business developer for lifelong learning. 'Some courses had up to 30 times more participants than usual.'

Thanks to the experience of making MOOCS, Wageningen did not find it too hard to switch to online education, says Ulrike Wild, director of online learning at WUR. 'Over the past five years we have built up the infrastructure, including a professional recording studio and ICT support.'

COVID CATALYST

Staff at the Wageningen Centre for Development Innovation (WCDI) even talk of a Covid catalyst that has accelerated their progress down the digital route they had already chosen. WCDI supports capacity development among professionals in developing countries. 'Professionals in the food sector can brush up their knowledge with us on subjects such as stakeholder management or climate change. We used to travel a lot to Ethiopia, Cambodia, Colombia and other countries to do that,' says Riti Hermán Mostert of WCDI. 'And participants came to the Netherlands for two-week courses. With sustainability in mind, we were already working on online learning materials. This year our team has gone all out to expand what we offer.'
Because most of the WCDI participants come from low and middle income countries where the internet is not always reliable, the course organizers had to be creative. 'We try and plan live sessions at times that are doable in the different time zones, and when the internet is usually stable for our course participants. We use learning materials and knowledge clips that are downloadable at low bandwidths and can be used offline. We also use WhatsApp to distribute information.'
Working online generates a lot of new possibilities, says Hermán Mostert. 'If I organize a meeting for former participants now, I can easily ask someone from India or Nigeria who took part last year to give a presentation. The budget I have wouldn't stretch to flying them over. And we can now spread fulltime courses that used to take two weeks over a longer period, and have smaller groups that get more coaching. That makes it easier to combine participation in the course with your work and your private life. We can also start offering short in-service courses now.'
All these advantages notwithstanding, Hermán Mostert does not expect all WCDI's educational work to stay online in the future. 'Sometimes we'll end up with a mix of online and on-campus. The obvious advantage of being on campus is that participants can expand their networks and can visit companies.'

The range of online courses for professionals offered by Wageningen Academy will go on growing too. Eelke Westra, who leads the course on Refrigerated Transport Technology, sees that as a good development. 'My colleagues and I provide training and consultancy to companies that request it from all over the world, from China to South America. If we can do that online too, it cuts down on travelling time and CO_2 emissions. Besides, I think universities should be making use of the technical possibilities that exist now. They greatly expand your reach.'

The first time Westra recorded his presentations, it took a bit of getting used to. 'You are looking at a camera instead of at a class that you're interacting with. The live Q&A sessions felt a bit strange at first too. I felt like a radio presenter.'

Westra's colleague Sanne Boesveldt, who teaches the online course Basic Principles in Sensory Science for Wageningen Academy, had a similar experience. 'I had to remake my first five videos of lectures four times each. Eventually you get the hang of it and start finding ways of livening up the classes. One of the topics on this course is the role of our senses in how we experience our food. So in one of the videos I take a mouthful of crisps to demonstrate that crunching on crisps is part of the experience. Interaction is harder to achieve online, but there are more possibilities for it than you imagine at first.'

So Boesveldt is enthusiastic too: 'The nice thing about online courses is that you can reach far more people with them. And because course participants can organize their time themselves, it is a good way for them to update their knowledge alongside their work. And I can use a lot of elements from the online course in my teaching on campus.'

HARD WORK

Sensory Science and other online courses from Wageningen Academy usually get positive evaluations from participants. Ahmed Ragab, a refrigerated transport specialist with Maersk shipping company in Cairo, Egypt, took Postharvest Technology and Refrigerated Transport Technology, and would give both courses 8 out of 10. 'It was hard work. I spent a lot of time studying every weekend, but I learned an awful lot. We transport goods, mainly fruit and vegetables, to countries such as Turkey, Ukraine, Lebanon and Syria. On the course, I learned how we can deliver the cargo in optimal condition. The knowledge was very detailed: we were taught about the molecular structure of fruit and vegetables, for instance. My background is commercial, so some of it was like rocket science to me, but I got a lot of support from the experts. Although some experts were easier to follow than others, and they could have facilitated more interaction between the course participants.'

> **'There were two or three times more registrations than usual during the lockdown'**

The free Wageningen MOOCs generally go down well, too. In fact, two of them – The Science of Beer and Sustainable Tourism – were rated among the top 10 EdX MOOCS in the world in 2019. These and other MOOCS on the open source platform EdX are used by universities worldwide. Suzanne de Bruijn thinks that is a great development: 'There are many global issues in the areas of sustainability, agriculture, climate and nutrition, in which Wageningen has a strong knowledge base. If we can spread that knowledge more widely, thus reaching more people, all the better.' ■

www.wur.eu/online-education

The logic of root shapes

A lot of scientists have pondered the question of what the logic is behind all those different shapes that plant roots can take. Why are some roots thicker and others thinner, for instance? Liesje Mommer was one of the scientists who cracked the code. 'It is as though you've discovered buried treasure.'

TEXT ROELOF KLEIS **PHOTOS** ISTOCK

Plants weigh up the economic pros and cons of their investments in their roots. We're talking here about investments of carbon and nutrients, explains Liesje Mommer, personal professor of Plant Ecology and Nature Management at Wageningen. 'Thin, fast-growing leaves that don't need big investments of much carbon soon die. Thick leaves that need a lot of carbon last longer.'

So plants choose between 'grow fast, live for a short time' strategies, adopted by *Lathyrus* flower species for example, and 'grow slowly, live long' strategies, as used by oak trees. Plants can be categorized by these differences. For a long time, it was assumed that roots obey the same principles, and that 'fast leaves' call for 'fast roots'. 'Lots of studies have tried to demonstrate that,' says Mommer, 'but they didn't manage. The surface per gram of leaf, for instance, did not really correlate with the length per gram of root. No one understood it.'

1800 SPECIES

So there had to be another logic at work than that of the division into fast and slow growers. An international research team of 20 scientists, led by Wageningen and the German Centre for Integrative Biodiversity Research, met in three workshops in Leipzig to get to the root of this mystery. The scientists used data on the roots of 1800 different species, which between them represented the large variety of climates and soil types on Earth, to figure out the relationships between root characteristics such as diameter, length per gram, tissue density and nitrogen levels.

The scientists also looked at the functions of the roots. 'You see, all leaves have to do is capture CO_2 and light,' says Mommer. 'But there are more functions in play underground. A root has to store not just easily absorbable nitrogen, but also strongly soil-bound phosphorus, 12 other essential nutrients and water.' A root also has to contend with the density of the soil. Thin roots cannot easily penetrate dense soils. And roots form a habitat for many micro-organisms, which can have their own interactions with the plant. There are roots, for example, that do not absorb nutrients directly from the soil, but via symbiotic fungi, mycorrhiza, in the soil around the root. The onion, for example, with its short and relatively thick roots, cooperates intensively with soil fungi, 'outsourcing' its absorption of nutrients in the soil to them.

EXCHANGE PROGRAMME

All the possible relations were examined. 'That was the strength of this research group,' says Mommer. 'We sat down and thought about it first. We hardly ever take the time for that because we're all busy, busy, busy. And when the term 'outsourcing' was introduced during the workshop as the driving principle, everything suddenly

> ‘Within an hour we heard: yes, it’s right’

fell into place. The data analysts on the research team looked for a link between the shape of a root and whether it outsourced the absorption of nutrients. ‘Within an hour we heard the people doing the calculations say “Yes, it’s right”,’ Mommer recalls. The ‘outsource or do-it-yourself’ principle seems to explain 77 per cent of the variation in root shapes.

Roots that collaborate with mycorrhiza fungi have to create space for the exchange of nutrients: sugars go from the plant to the fungi, and nutrients pass from the fungi to the plant root. ‘That exchange programme takes up space in the outer cells of the root, which are therefore thicker than those in the do-it-yourselfers,’ says Mommer.

The researchers published their findings in Science Advances, and the result is a new framework for explaining such variations in shape and function. Alongside the existing fast-slow spectrum there is now a second, independent, spectrum that is key to understanding the shape and functions of plant roots.

‘It’s as though you’ve dug up buried treasure,’ says Mommer.

Mommer’s colleague Thom Kuyper, personal professor of Soil Biology, was on the research team too. He tried some years ago to demonstrate the link between root shape and outsourcing – in vain. ‘At that time I focused too much on roots in temperate zones,’ he recalls. ‘Then you see too limited a range of root variation in nature, which puts you on the wrong track.’

STRIP CULTIVATION

When asked about possible applications of this new insight, Mommer speculates: ‘Understanding roots better could play a role in making farming systems more productive. We know that more biodiversity leads to higher production. Why is that? One idea is that it’s something to do with the root strategy. Maybe you need a good mix of do-it-yourselfers and outsourcers. That might apply to strip cultivation too. It is indisputable that mycorrhiza play a very big role, and we don’t fully understand that role yet.’

What counts most for Kuyper is ‘the pleasure of understanding it’. ‘To be able to explain 77 per cent of the variation is a lot in biology,’ says Kuyper. ‘There are about 300,000 species of plants. It is pleasing that nearly all the diversity can be explained with two principles. It gives you a kind of deep philosophical feeling that there is order in the world. There is aesthetic value to being able to understand nature with a couple of simple principles.’ ■

www.wur.eu/plantroot-variations

From aid to trade in Kenya

The Netherlands is phasing out its development aid to Kenya and wants to stimulate trade and investments. The assumption is that small farmers will benefit from that too. But research suggests that this cannot be taken for granted, partly because small farmers find it difficult to produce vegetables of the required quality. The 3R Kenya project revealed bottlenecks and instigated improvements.

TEXT JORIS TIELENS **PHOTO** BOEZIE/GETTY IMAGES

Kenya's economy has been growing at a rate of about six per cent for years now, though this year will see a dip because of the coronavirus. With a booming private sector, the country has become a hub for agricultural trade. Exports to the Netherlands of flowers, vegetables, fruit and large quantities of tea and coffee come to almost half a billion euros annually.

In Kenya itself, a growing middle class has more money to spend and is choosing to buy healthier food. That is creating opportunities, including for Dutch companies that want to invest in technology for food processing, seeds and greenhouses. As of 2014, the World Bank no longer classifies Kenya as a developing country. For the Dutch government, Kenya's development was reason to review its relationship with the country. The Netherlands is phasing out development aid and wants to stimulate trade and investment in Kenya by Dutch companies – the transition from aid to trade.

> 'Like a lot of Kenyans, I don't believe in aid'

COMMERCIALIZATION

'This is based on the assumption that you can promote growth and development through trade and business investments, and that poor farmers and small businesses benefit from that as well,' says Catherine Kilelu of the African Centre for Technology Studies (ACTS). Kilelu coordinated the 3R Kenya project from Nairobi. The project was tasked with drawing lessons from the development programmes funded by the Dutch embassy that aimed to improve food security and commercialize horticulture, dairy and aquaculture in Kenya.

'Researchers from Kenya and Wageningen did action research on the bottlenecks, together with stakeholders in the sector,' says Kilelu. 'The unusual thing about 3R is that it didn't stop at research. It was a sector development project too. We gained evidence from the research about which solutions work. We could use that to start a dialogue with companies, the government and others and persuade them to get to work.'

Kilelu led the project together with Simone van Vugt of Wageningen Centre for Development Innovation, and Ingrid Coninx of Wageningen Environmental Research. Also collaborating in the project were researchers from Egerton University, Jomo Kenyatta University of Agriculture and Technology, and the consultancy firm TradeCare Africa, along with several other researchers at Wageningen University & Research.

PESTICIDES

One of the sticking points for commercializing food production is food safety. 'The vegetables sold in the shops and on the streets here contain far too high levels of pesticides, heavy metals and microbial contamination due to poor hygiene and polluted water,' says consultant and businesswoman Joyce Gema. Gema has a consultancy in Nairobi and did research on horticulture within 3R, together with Wageningen.

Farmers who grow beans, sugar snap peas or mangetout for export to Europe have to conform to strict norms about residues of pesticides. But those rules do not apply to tomatoes or cabbage for the local market. 'That is a public health risk. And anyway,

CLIMATE ATLAS HELPS WITH ADAPTATION

Climate change has serious implications for agriculture in Kenya. Temperatures are rising and it is becoming too hot to grow tomatoes or maize in some districts. You can postpone planting until the weather is cooler but then it is too dry. In one of the studies within 3R, John Wesonga of Jomo Kenyatta University of Agriculture and Technology worked with Hasse Goosen of Wageningen Environmental Research to create a climate atlas. The online atlas provides local policymakers with useful information on the precise consequences of climate change. And it gives options for supporting the farmers in adapting to it. By adjusting farming methods, for instance, or by subsidizing irrigation.
http://www.climate-atlas.ke/

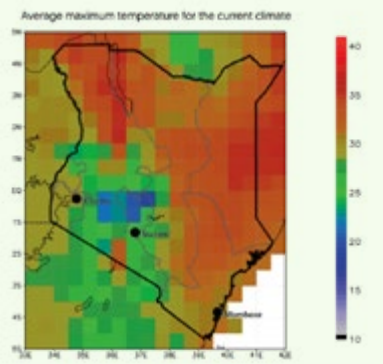


PHOTO SIMON MAINA/AFP/ANP

Small-scale farmers in Kenya feed their cows whatever is to hand.

if food is not good enough for export, why is it considered good enough for consumers here in Kenya?' asks Gema. She says farmers who grow food for the home market can learn from production for export. '3R research has shown that farmers who had training on export agriculture use that knowledge in the production of local vegetables as well.'

SAFE VEGETABLES

'There is rising demand for healthy, safe vegetables that people are willing to pay more for, as our research shows. Now is the time for farmers to seize that opportunity.' The action research also showed what it takes to grow those safe vegetables. It requires not just better farming techniques but also a well-organized production chain in which products are traceable. Farmers should use clean water for irrigation and cleaning products, and clean packaging materials. Gema: 'The government should regulate the home market just as it does the export market.'

Armed with the research results, Gema and her 3R colleagues entered into discussions with representatives of the sector and the government. 'Food safety is now on the government's agenda for the first time.' Personally, she has more faith in a local label for safe food. One component of 3R was a trial project in which hotels and restaurants in Nairobi bought vegetables with a 'Mazao Safi' label. 'Mazao Safi' means safe produce in Swahili. The label motivates farmers to focus more on the wishes of consumers. The label has not been rolled out on a large scale yet. Gema would like to do that and is looking for an investor.

The Mazao Safi label is an example of local innovation, says project leader Catherine Kilelu, who got a PhD at Wageningen in the Knowledge, Technology and Innovation chair group. Farmers cannot always meet the requirements of international labels >

PHOTO SOPA / GETTY IMAGES

UNDERSIZED FISH FOR KIBERA SLUM

Fish farmers in Nyeri, 150 kilometres north of Nairobi, have difficulty raising their fish to an adequate size. Some of the fish remain stunted because the fish farmers use poor quality fish feed. The soya and fishmeal used to make the feed has to be imported and is expensive. Fish farmers are therefore left with the undersized fish on their hands, as there is no demand for these in Nyeri. This problem was discussed in the stakeholder platform for fish farmers, community leaders, traders and researchers that was set up by 3R. The solution that emerged from these consultations, explains researcher Benson Obwanga of Laikipia University, was not to improve the methods of the fish farmers or to buy more fish feed. Instead, a market was found for the undersized fish in the Nairobi slum, Kibera. 'We killed two birds with one stone: a new market for the fish farmers, and an improved diet thanks to cheap protein for the people in Kibera.' Together with researchers from Wageningen Economic Research and Wageningen Marine Research, Obwanga figured out how the new production chain from Nyeri to Kibera would work. The plan was implemented by the chair of the cooperation of fish farmers and by women who sell fish in Kibera. Now one ton of fish goes from Nyeri to Kibera every week. The women who dry, fry and sell the fish in the slum now have a new source of income, and thousands of slum residents have a healthier diet.

such as the Rainforest Alliance or Fair Trade. 'Their requirements are too complicated. But the farmers can make a few simple changes so they qualify for the Mazao Safi label. Not too complicated, but still producing safe food.'

The 3R project concluded with an analysis of the food system in Kenya by Wageningen and Kenyan researchers, making recommendations for the sector and the government, explains Simone van Vugt of Wageningen Centre for Development Innovation. One of the recommendations is to pay more attention to local innovation. 'That makes it possible to lower the production costs, which is necessary to make the sector more competitive.' Another recommendation is that farmers and processing companies should be far more focused on what the consumer wants – safe food, for example. 'Consumers are asking for that, and increasingly, they are being heard.' And it is advisable to involve farmers and companies more in regulating the sector and in policymaking, says Van Vugt, by increasing the collaboration between the sector, the government and consumers.

A HIGHER PRICE FOR BETTER MILK

This kind of collaboration seems to be working in the Kenyan dairy sector, says professor of Livestock Systems Bockline Omedo Bebe, of Egerton University in Kenya, who obtained his Master's and, in 2003, his PhD in Wageningen. Together with researchers at Wageningen Livestock Research, Bebe conducted studies within 3R on different ways of improving milk quality. He explains that dairy farming is a major sector in Kenya, accounting for four per cent of the GDP. 'Kenyans love dairy products, they put milk in their tea and it is part of every meal. The demand is high in our neighbouring countries too. But to make yoghurt and other dairy products that keep for longer, the milk factories need better quality milk from the farmers.' Some farmers have just one or two cows,

which only produce five litres of milk each. It is not easy for these farmers to deliver the required quality. Bebe: 'Farmers feed the cows on whatever they have, like rotten maize waste, for instance.' This can lead to infections or aflatoxins in the milk, which is a big risk for public health. 'One of our studies showed that it helps if livestock feed is produced by specialized companies. They can produce it on a larger scale and therefore more cheaply.'
After working with dairy processors, consumer organizations, farmers and researchers, the government has drawn up a stricter policy on the quality of milk. If farmers supply better milk, they can charge more for it too. Experiments were conducted in one study by 3R in which farmers received a higher price for better quality milk. 'That model is still under development, but it is promising,' says Bebe. Here too, the search is on for a system that suits the Kenyan context. The quality of the milk that farmers supply must be measured, but measuring too many parameters makes it too expensive and unworkable.

> 'Farmers can't always meet the requirements of international labels'

INVESTING IN PEOPLE

So what is the conclusion about the transition from aid to trade in Kenya? 'We cannot assume that investments by the business world are the solution to all the problems we still face,' says Catherine Kilelu. 'Of course, agribusiness is growing fast in Kenya. But the vast majority of the farmers still have small farms of one hectare of land or less.' The government of Kenya should not stop at drawing up good legislation, in Kilelu's view, but should also support the sector. She gives the example of agricultural extension by companies. This may reach somewhat richer farmers, according to one 3R study, but not the poor farmers in remote areas. 'There lies a task for the government. And possibly also for countries wanting to give development support.'
Joyce Gema shares the view that a longer transition period is needed in which aid and trade go hand in hand, before development aid can be ended altogether. 'Just like many other Kenyans, I don't believe in aid. I don't like the word "aid". The point is to invest in people. We must give people the chance to stand on their own two feet.' There is a lot of entrepreneurship and a young and innovative professional population in Kenya, says Gema. 'But government regulation is needed on key issues such as food safety.'

IMPORTING TECHNOLOGY

'We funded this research to identify the lessons for us as an embassy,' says Rose Makenzi, policy officer for food security and water at the Dutch embassy in Nairobi. 'But also very much with the aim of bringing people in the sector together. And of involving the Kenyan government in that.' Makenzi is quite clear about the trade relationship: 'Kenya's export of high value crops and flowers to the Netherlands is flourishing. The real question is whether this can be the same for the export of technology from the Netherlands. Especially since this has to compete with similar technology from elsewhere where it's more affordable, such as from Asia. So it depends what Dutch companies have to offer us, and whether their technology is affordable and appropriate for the local situation.'
According to Makenzi, there won't be a vacuum if Dutch aid diminishes in the near future. 'There will be aid from other countries and NGOs, and overall aid to Kenya is not expected to dry up all at once. Yet it is all the more important that all those efforts are coordinated and that we learn from experience. The report with recommendations from 3R has been distributed. But the point is, we need to talk about it. We need a strategic discussion with the sector and the government about issues like food safety. And how to deal with climate change.'
So next year the embassy intends to organize a platform to initiate dialogue based on the findings and conclusions of 3R. 'Because the point is not to convince us as an embassy. The point is for the government and the companies in the sector to get to work.'
Action research combined with dialogue, as was done in 3R, could be of interest to other countries as well, concludes Ingrid Coninx. The Dutch government wants to stop providing aid to countries such as Ghana and Rwanda too, and to focus more on trade and investments. 'You can see our approach as a way to shape the exit strategy for development cooperation.' And agriculture in Kenya is also having to reckon with the impact of the coronavirus, plagues of locusts and climate change. 'Resilience is more crucial than ever.' ■

www.wur.eu/3r-kenya

COURSES

WCDI runs a range of courses on sustainable food systems, food safety and food security.
www.wur.eu/wcdi

‘An entrepreneur must be prepared to take risks’

Carlos Cabrera

He came to the Netherlands from Costa Rica to do a Master's in Biotechnology, and never left again. A passionate scientist, Carlos Cabrera went down the entrepreneurial route with his own technology for reusing valuable substances from waste streams. 'You've got to be prepared to take steps in a direction without knowing whether it's the right one.'

TEXT KENNETH VAN ZIJL **PHOTOGRAPHY** ERIC SCHOLTEN

His Dutch is good enough to have a chat with the neighbours but if he's going to talk about chemistry and his company, Greencovery, the Panamanian-born Costa Rican Carlos Cabrera would rather do so in English. The interview takes place in a small office on the Wageningen campus, hung with posters showing amino acids and a chart of flavour compounds. Cabrera talks fast and with verve. It was here in 2018 that he started Greencovery, a company that extracts useful components from the food industry's liquid side streams. 'With those components you can make products with a lower CO_2 footprint than you can with existing production techniques. What is more, you can reduce the waste streams like this.'

Cabrera picks up a tiny flask from his desk. A delicious smell of ripe bananas rises from it. 'We produced this aroma compound for a client who is looking for a more sustainable production process for a banana flavouring and aroma. We helped him by combining his side stream, excess alcohol, with a side stream from the vinegar industry. Then we used our own technology to produce the aroma, an ester called isoamyl acetate. Early this year, just before the lockdown, we produced and delivered the first kilograms of this banana essence.'

LICENCES

Cabrera is reluctant to say much about exactly what the company's own technology consists of. Laughing, he says: 'Let me say that we extract carboxylic acids from side streams by playing with the pH and CO_2. In collaboration with the university, we have also developed a process for separating amino acids from side streams.' He uses both the carboxylic acids and the amino acids to manufacture flavourings and nutritional supplements. Greencovery now has licensing agreements with various companies for a range of applications of the technology. Cabrera's young company also recently won the AtlasInvest Entrepreneurship grant, >

a start-up award of 35,000 euros for commercially promising companies. Five people now work for Greencovery, including the co-founder and commercial director, a financial manager and two Delft University-educated engineers. Cabrera is the managing director. On the side, for one day a week, he assists on the online course Chemistry and Technology for Sustainability run by the Biobased Chemistry & Technology chair group.
Even as a young student of Chemical Engineering in Costa Rica, Cabrera was already interested in the idea that waste streams contain a lot of useful components. 'I wanted to go abroad to learn more about how you can reuse side streams.' In 2009, Cabrera received a grant from Nuffic, the Dutch organization for internationalization in education, to do the Master's in Biotechnology at Wageningen.

'In my Master's I used the same equations as in chemistry, only now it was in relation to living micro-organisms. Ultimately, everything comes down to chemistry: humans,

'In Wageningen you are challenged to expand your horizons'

life. It was an eye-opener to me to see how these chemical principles can be applied to living organisms.'
His plan was to return to Costa Rica after two years. 'Now I've been living in Wageningen for over 11 years. When my daughter was born here, I even applied for Dutch citizenship. Not long ago, I officially became a Dutch citizen. I am very happy here.'

HAPPY PEOPLE

The Dutch mentality did take a bit of getting used to at first, though. 'The people of Costa Rica score high on the list of happy people. I think that has to do with Costa Rican people's attitude to things. They take life more as it comes. Whatever happens, you always try to look on the bright side. Even when there's a power cut, for instance

> ‘It was an eye-opener to me that chemical principles can be applied to living organisms’

– which happens often in Costa Rica. In the Netherlands people are a bit more blunt and uptight about things. Actually, I am only half Costa Rican. My father is Panamanian and my mother is Costa Rican. I was born and grew up in a border town in Panama.’

‘From the Dutch perspective, Costa Rica and Panama are probably similar countries,’ says Cabrera, ‘but when I was growing up they were totally different. Costa Rica had no army, while Panama was a military dictatorship led by the army chief Noriega. It was very dangerous to criticize the junta.’

‘I have a memory of fleeing to Costa Rica with my mother when I was five, because the Americans attacked Panama to take out Noriega. I think it taught me that a society is more fragile than we think in many ways, and that it doesn’t take much for everything to change.’

IMPOSTER SYNDROME

Cabrera comes across as a scientist at heart, which doesn’t make entrepreneurship an obvious choice. He admits that there is a big difference between a scientist and an entrepreneur. ‘If you go down the science route, you can map out a path from Bachelor’s to Master’s to your PhD. And when you’ve written four articles, you get your doctorate. As you do this, you really run no risks at all. As an entrepreneur it’s quite the opposite. You have to be prepared to take risks, and to set off in a direction without knowing if it’s the right one.’

In their attitudes too, scientists and entrepreneurs can be as different as chalk and cheese. ‘Many young scientists are plagued by imposter syndrome,’ says Cabrera. ‘The feeling that what you do isn’t really good enough, which makes you doubt your talent and your research work. I think everyone suffers from this to a greater or lesser extent. But an entrepreneur with imposter syndrome? That won’t work – you’ll just dig a hole for yourself to fall into.’

But Cabrera’s entrepreneurial spirit didn’t come out of nowhere. ‘My mother had 15 brothers and sisters, most of whom had shops, as did my grandfather. In fact, he also had a coffee plantation. I was telling friends recently how as a kid I used to sell the oranges that dropped from the trees in our garden.’

CARLOS CABRERA

Works: As founder of Greencovery, a company that reuses valuable substances from side-streams
And as a researcher and lecturer at WUR Biobased Chemistry & Technology
Studied: Licentiate in Chemical Engineering, University of Costa Rica, 2008
WUR MSc in Biotechnology, 2011
PhD: Bioprocess Engineering at TU Delft, 2017

CREATIVE

When he started Greencovery, Carlos Cabrera benefitted from the Wageningen ecosystem, as he calls it. ‘The university of course, but also the various companies here on the campus and in the Foodvalley. There are many places you can go to with your questions as a starter in business. And in the education and research at Wageningen you are challenged to be creative and expand your horizons. You learn to take your thinking one step further and to imagine new possibilities.’

But the most important places for Cabrera as a bright-eyed new entrepreneur were probably Startlife and Starthub, he says. These organizations support agrifood start-ups. ‘They help you with things like formulating your business plans as clearly as possible. They bring a lot of starting entrepreneurs together who are all working in the same field in different ways. And that is good for developing entrepreneurial skills.’ Cabrera compares the stimulating effect of this to what he saw happening in Costa Rica. ‘If someone starts a bookshop on the corner of a square, in no time a new bookshop opens next door to it. Because someone sees that the first bookshop is very successful, and thinks: why shouldn’t I be just as successful?’

So what if something like that happens in Wageningen? A start-up is set up that competes with Greencovery? For the first time during this conversation, Cabrera pauses for thought before answering. ‘Then we’ll have to be better, more innovative, more creative and faster than the competition.’ ■

MARCEL VAN POECKE:

‘New entrepreneurs nee

Alumnus Marcel van Poecke has created two awards with the aim of supporting enterprising students and researchers with starting capital for their start-ups. ‘Of course, I am hoping that some fantastic companies will have come out of it in a few years.’

TEXT ANJA JANSSEN

‘I myself went into business when I was about 30,’ says Marcel van Poecke, an investor in the energy sector. ‘At the start, you need a helping hand as an entrepreneur. A grant can be that helping hand.’ Van Poecke (WUR Forestry, 1985) and his daughter Heleen van Poecke want the AtlasInvest Entrepreneurship Grant to support start-ups working in the Wageningen domains. ‘I think we should do more to help start-ups in the Netherlands. They have a lot of added value for society,’ says Van Poecke.

PHOTO VAN POECKE

Alumnus Marcel van Poecke and his daughter Heleen van Poecke.

SUSTAINABILITY AWARD

His new grant covers two categories. One is for the best business idea and the other is for the best initiative targeting sustainability. The first Sustainability Award - in 2020 - went to Mylium, a company that develops leathery materials made out of fungal mycelia. The Start-up Award went to the Wageningen start-up Greencovery, whose founder Carlos Cabrera and his team won 35,000 euros. ‘We are going to use it to set up our own lab and buy a membrane separation unit,’ says Cabrera, who did the MSc in Biotechnology in Wageningen and got his PhD at Delft University. ‘We shall use that unit for a new application of our technology to extract food ingredients from pectin-rich waste streams such as orange peel. This way we can speed up our development and explore a new market at the same time.’

‘I am an active investor myself, partly through our investment company AtlasInvest,’ says Van Poecke. ‘So I see how important start-ups are for innovation.’ One of the problems for start-ups is getting hold of starting capital. ‘Often they can’t go to banks and there are very few venture capital funds for risky investments in new companies.’ But a grant isn’t all you need, Van Poecke stresses. For start-ups to find investors or partners, they also need to network and let people see what they do. That is why the selection process for this grant takes the form of a pitch competition.

It was Van Poecke’s daughter Heleen who came up with the idea of the competition.

d a helping hand'

'She saw this at Harvard Business School. When she told me about it, I said straightaway: wow, what a good idea.' Once Van Poecke had consulted University Fund Wageningen (UFW) about it, Heleen worked out the details together with UFW and StartHub, the organization that supports new entrepreneurs. Heleen is on the jury too.

> **'Start-ups have a lot of added value for society'**

IN THE OIL BUSINESS

Van Poecke went to Wageningen to study Forestry with the idea of becoming a forest manager. 'But the closer I got to graduating, the clearer it became that there were very few job opportunities.' So he specialized in business management and went on to do an MBA at Erasmus University in Rotterdam. 'I ended up in the oil industry, although I was totally unprepared for it. I got a job with Calpam as an assistant marketing manager. In the first year, I still wanted to go into forestry but there were no interesting openings there and I started to find the oil business more and more interesting. After that I never looked back.'

In 1993, Van Poecke established the refinery company Petroplus, together with Willem Willemstein, who he met on his MBA. Petroplus was highly successful. It went public and was sold in 2007 for 700 million dollars. In that same year, Van Poecke started AtlasInvest, which focussed on investments in the energy sector. 'And I have also been a partner at Carlyle in Washington for seven years now,' says Van Poecke, who invests billions for this investment company in energy companies worldwide outside the United States.

INTERNATIONAL TAKE

His Wageningen education laid the foundations, according to Van Poecke, for his entrepreneurial talent and his international take on society. 'Wageningen is very international. When I was a student, that was quite unique and it was a huge eye-opener for me. I did internships in Indonesia and Denmark, which was tremendously enriching.'

Van Poecke had long harboured a wish to support his alma mater, so he joined the Wageningen Ambassadors, a group of successful alumni with a soft spot for Wageningen. A few years ago he also financed a study through UFW, on the use of emissions rights to maintain the tropical rainforest in Congo-Brazzaville. With this new start-up competition too, Van Poecke seeks to give back to the university. 'I have much to thank Wageningen for. And the Wageningen issues, such as the food supply and sustainability, are becoming more and more important. As an investment company with a focus on the energy sector, we have put the energy transition and sustainability high on our agenda.'

Van Poecke was inspired by the first edition of the competition. 'This is just a start. If you want to have an effect, you have to do this over a longer period. Then it can grow. And I thoroughly enjoy seeing what sorts of good ideas emerge from it. Of course, I am hoping that some fantastic companies will have come out of it in a few years.' ■

PHOTO GUY ACKERMANS

ATLASINVEST ENTREPRENEURSHIP GRANT

The AtlasInvest Entrepreneurship Grant is one of University Fund Wageningen's named funds. With its Start-up Award, it supports entrepreneurs with commercially promising solutions to global challenges. The Impact Award rewards social and public initiatives by entrepreneurs related to the environment and sustainability.

www.universityfundwageningen.eu/aieg

‘KLV was the megaphone for agricultural science’

After 134 years, the curtain has fallen on the alumni network KLV. The farewell event on 3 October included the presentation of *Wageningers*, a book about the role the society played in agricultural science. The bold result of two alumni’s investigations into an dusty, incomplete archive.

The journal from 1894 of the Society of Former Students of the National Agricultural College, an early predecessor of KLV.

It all started during a festive meal in 1886, according to the book *Wageningers, de betekenis van 134 jaar Koninklijke Landbouwkundige Vereniging* (‘Wageningers: the significance of 134 years of KLV’). Joannes Sibinga Mulder, a student at what was then the State Agricultural College in Wageningen, suggested starting a society for former students. The book’s authors Martijn de Groot (WUR Rural Sociology, 1981) and Joost van Kasteren (WUR Molecular Sciences, 1975) ploughed through the society’s archives and publications, such as *Landbouwkundig Tijdschrift*, to find out more about the origins and history of KLV and its predecessors.
‘The archive goes back as far as 1886. We found handwritten letters by the first board members that you had to shake the dust off first,’ explains Martijn de Groot.
Student Sibinga Mulder’s proposal ‘met with a positive response’ at the time, according to the college director Luitje Broekema in a circular sent to all former students. Shortly after the festive meal, the Society of Former Students of the State Agricultural College was created. At the start of the 20th century, it turned into the Dutch Association and the Dutch Institute of Agricultural Scientists, both predecessors of KLV.

SPREADING KNOWLEDGE

The book discusses the main themes and stories in the society’s 134-year history. ‘The society saw itself as a kind of megaphone for science and wanted to spread scientific knowledge,’ says De Groot. ‘It had big ambitions. In 1912, it even gave comments on the agriculture budget.’ One of the society’s ambitious plans in the 1930s was to assess and summarize all the scientific publications in the field of agriculture. ‘The idea was to set up an office with 16 employees who would go through all the publications in specialized journals. The society’s generalist journal *Landbouwkundig Tijdschrift* would then publish abstracts of everything,’ says De Groot. The plan was rejected but it did eventually lead in 1957 to the Centre for Agricultural Publications and Agricultural Documentation (PUDOC) being created, which helped scientists publish and document their work.
The Agriculture Weeks were also important in spreading scientific knowledge. ‘They were well-attended meetings with the leading figures in agricultural science at that time,’ says De Groot. ‘Graduates from the Netherlands and abroad were brought up to date with the latest scientific developments. In the early days, people had to get there by horse and carriage or by train, which was a major operation. But they did it because it was important.’
Wageningers has been offered to KLV members as a farewell gift. The book, published by Van Gorcum, is also for sale in bookstores for 29.95 euros.
Info www.wur.nl/klv

PHOTO GUY ACKERMANS

KLV chair Han Swinkels talking to the host Simone Ritzer during the online farewell event on 3 October.

DONATIONS

Friends of UFW support students and young alumni

By becoming a 'Friend of UFW', alumni can support students and recent graduates. This new initiative was prompted by the demise of KLV.

Alumni society KLV used to support students and young alumni as they prepared for the jobs market. Now that KLV is no more, University Fund Wageningen (UFW) has been looking for a new format for continuing that support, explains UFW interim director Fusien Verloop. The Friends of UFW concept is designed to achieve this.
Alumni can pay a monthly donation to become a Friend of UFW. UFW will use that money to organize activities for students and young alumni such as prizes for outstanding Master's theses, student challenges, networking events and workshops. Former KLV members were informed of the initiative in a phone campaign this autumn; this resulted in over 600 Friends in just four weeks. 'We had already been thinking about how to get alumni who make occasional contributions for students and young alumni involved more systematically in our activities,' says Verloop. That is now possible by becoming a Friend of UFW.
Info: www.wur.nl/vriendenvanufw

PHOTO GUY ACKERMANS

Margaretha Antonia Veltman won the UFW thesis award in 2019 for the best Master's thesis. This is one of the initiatives supported by the Friends of UFW.

FUNDS

KLV fund set up

The remaining assets of the former Wageningen alumni society KLV have been placed in a KLV fund. The fund will support one-off alumni activities that complement WUR's existing alumni programme.
This could for instance include activities aimed at promoting public debate on topics in the Wageningen domains. The development of new kinds of alumni networks also fits the criteria, as do initiatives that encourage dialogue and collaboration within or between the Wageningen domains and existing study circles and networks. Money is also available for career development support. The applications will be assessed by a board of trustees consisting of Han Swinkels (chair), Paul den Besten, Gerrianne Jansen, Coen de Jong and Karin Schroën. The expectation is that applications can be submitted as of next year.
Info: www.wur.nl/klv-fonds

WUR CONNECT

Valuable memories

In the Join the Chain initiative, alumni created a chain of stories about what they gained from their time in Wageningen and their best memories. The value for Lina Ojeda, who graduated this year with a Master's in Biology, was in continually learning, developing and discovering.

Heading for 10,000

WUR Connect continues to grow and now has over 9400 members. Nutrition & Health alumni are the biggest group. The biggest cohort is people who started in 2014.

Country groups

A lot of alumni have their own country groups on WUR Connect. The Alumni Network China is by far the biggest group with 7643 members. Sixteen groups have around 800 members, including Nigeria, Sudan, Suriname, Poland, Switzerland, the Philippines and South Korea.

Jobs

If you are looking for a job, WUR Connect has opportunities for WUR alumni. For instance, the Good Food Institute Europe is looking for a corporate engagement manager.

Register now

If you too want to find former classmates and find out what they are doing now, or help fellow WUR students and alumni with expertise, a new job or an internship, then go to www.wurconnect.nl and register.

Lilian van den Aarsen PhD, WUR Biology 1986, is the director of the Delta Programme Commissioner's Staff as of 1 December at the ministry of Infrastructure and Water Management. Van den Aarsen was previously the director of Knowledge, Innovation and Strategy at the same ministry. 6 October 2020.

Joyce van Bree MSc, WUR Biotechnology 2020, PhD candidate at Wageningen's Laboratory of Virology, has won the biennial Rob Goldbach Virology MSc thesis prize for 2020 for the best Master's thesis at the Laboratory of Virology. The thesis is about the transmission of the Zika virus by mosquitoes. 18 October 2020.

Johan Burger MSc, WUR Land Development 1988, founder of Kuiper & Burger consultancy and engineering firm (now ATKB), has been appointed Knight of the Order of Orange-Nassau for his active services to society as an entrepreneur and as the chair and board member of various organizations. 14 October 2020.

Irene Camerlink PhD, WUR Animal Sciences 2009, university lecturer in the Department of Animal Behaviour at the Polish Institute of Genetics and Animal Biotechnology, has won the UFAW Young Animal Welfare Scientist of the Year Award. The animal welfare organization gave her the award for her contribution to improvements in the welfare of pigs. 30 June 2020.

Prof. Louise Fresco, WUR Rural Sociology of the Non-Western Regions 1976, has been appointed a member of the World Health Organization's new Pan-European Commission on Health and Sustainable Development. The commission will examine how various European countries tackled the Covid-19 pandemic and make recommendations for improving the resilience of healthcare and social care systems. 11 August 2020.

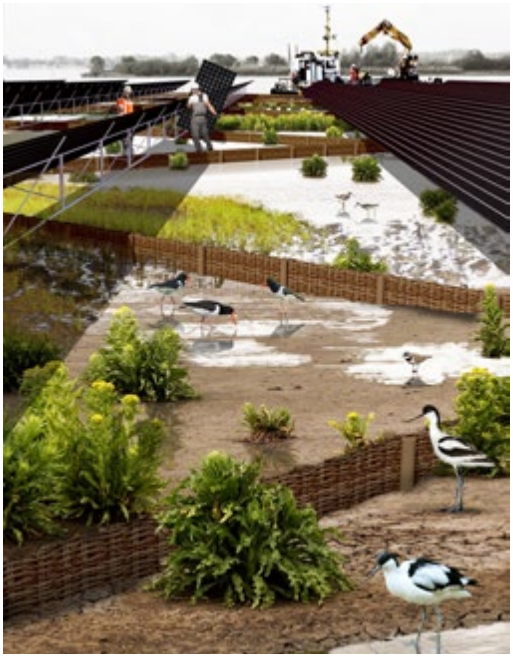
Karin de Galan MSc, WUR Human Nutrition 1991, has been chosen as Trainer of the Year 2020–2021 by NOBTRA, the Dutch association of professional trainers. According to the jury, De Galan was one of the first people in the Netherlands to develop a systematic method for training trainers. De Galan has been the owner of the School for Training since 2007. 30 October 2020.

Lennaert Haanstra MSc, WUR Agricultural and Bioresource Engineering 2013, arable farmer in Marknesse, has been appointed the chair of the youth council for the farming cooperative Agrifirm. 25 August 2020.

Martijn van der Heide PhD, WUR Economics of Agriculture and the Environment 1997, senior political adviser at the ministry of Agriculture, Nature and Food Quality, has been appointed professor by special appointment in nature-inclusive rural development at the University of Groningen. 1 September 2020.

Prof. Arthur Mol, WUR Environmental Protection 1985, rector magnificus of WUR, has been elected the chair of the Association for European Life Science Universities (ICA). The position as chair is for three years. 21 October 2020.

Generating energy and purifying water



David de Boer MSc, WUR Landscape Architecture and Planning 2020, won the IFLA Student Award 2020, a competition organized by the European branch of the International Federation of Landscape Architects, in October. De Boer came up with a modular system of reed dams secured in the river bed and solar panels sticking out above the water. This not only generates energy but also creates favourable conditions for plants and animals. The dams catch floating mud and sediment in their grids, which purifies the surrounding waters and makes the watercourse shallower. This results in more variation in the habitats for flora and fauna.

Ilse Geijzendorffer PhD, WUR Biology 2003, will become the director-board member of the Louis Bolk Institute on 1 January 2021. She is currently a team coordinator and senior researcher at the French research institute Tour du Valat. Geijzendorffer previously worked as a researcher at two other French research institutes (IMBE and IRSTEA) and before that as a team leader and project manager at Alterra. 22 October 2020.

‘I see other Anne van den Ban students as family’

Meilisa Margarita MSC, WUR Animal Sciences 2020, wants to set up a network of alumni who, like her, were able to study in Wageningen thanks to the Anne van den Ban Fund. The fund gives grants to high-potential students from developing countries to study at Wageningen.
While at the university, Margarita was in regular contact with other Anne van den Ban students. ‘I see them as my family,’ she says in an email from Indonesia. ‘Students from developing countries often face the same challenges. That was what gave me the idea to set up a network.’ Margarita wants to give them the opportunity to make contacts, share experiences and help one another. She also wants to give future students information about studying at Wageningen and life after graduation. She is initially focusing on a regional network for Asia with a social media platform or website, but she hopes the network will eventually be worldwide.

Testing coronavirus vaccine

Andrea Pruijssers PhD, WUR Biology 2003, currently a research assistant professor of Infectious Diseases at Vanderbilt University Medical Center in Nashville (US), is a lead scientist in the pharmaceutical firm Moderna’s coronavirus vaccine research.
After her MSc in Biology, Pruijssers left for the US to do a PhD at the University of Georgia. She has been working in Nashville since 2008. It was announced in mid-November that the Moderna vaccine appears to be 94.5 per cent effective. For the study, which is still ongoing, 30,000 people were vaccinated – half with the candidate vaccine and half with a placebo.

Greenest teacher starts a farm

Joanne Malotaux MSc, WUR Forest and Nature Conservation 2013, was chosen as the Netherlands’ most sustainable teacher this year. She recently started working on educational innovations at the experimental farm De Marke. Next summer, she will be leaving her job as a biology teacher at Pantarijn secondary school in Wageningen to start the farm De Patrijs in Vorden with her partner Johannes Regelink. ‘We want to start an agro-ecological farm open to the public to restore the connection between the general public and farmers. Everything we produce will be sold locally, and we will let local residents co-finance the venture,’ says Malotaux. The couple are taking over a conventional dairy farm owned by Regelink’s uncles and converting it into a mixed farm with cows, hens, vegetables and fruit and nut trees. ‘Our yardstick is the partridge: if it returns, we are doing well.’

PHOTO GUY ACKERMANS

‘If the partridge returns, we are doing the right thing’

IN MEMORIAM

Alumni, KLV members, staff and former employees of Wageningen University & Research who have recently passed away.

Mr C.P. van der Beek PhD.
WUR Phytopathology 1975.
9 September 2020.
Mr H. Breteler PhD.
WUR Soil & Fertilization Sciences 1970.
16 April 2020.
Prof. A. van Diest. WUR Tropical Plant Breeding 1953. 25 August 2020.
Mr J.W. de Groot MSc. WUR Food Technology 1968. 24 June 2020.
Mr R.J.I.M. van der Ham MSc.
WUR Landscape Architecture 1972.
25 April 2020.
Ms H.J.M. van der Hoeven MSc.
WUR Domestic Science 1975. 5 April 2020.
Ms C.B. de Jong MSc.
WUR Phytopathology 1970. 23 April 2020.
Ms L. Leffring PhD.
WUR Horticulture 1962. 3 August 2020.
Mr P.J. Melitz MSc.
WUR Soil & Fertilization Sciences 1970.
23 October 2020.
Mr A.D. Mulder MSc. WUR Plant Breeding 1970. 28 October 2020.
Mr L.T.W.H. Nieland MSc.
WUR Land Development 1965.
10 October 2019.
Mr S.H.W. Notermans PhD.
WUR Food Technology 1972.
5 September 2020.
Ms S.R. Timmer MSc. WUR Food Technology 2014. 29 June 2020.
Mr J. Vos MSc. WUR Environmental Protection (water purification) 1996.
21 September 2020.
Mr B. van de Weerd BSc.
WUR lecturer in Hydrogeology.
13 September 2020.
Mr R.T. Wiersinga MSc.
WUR Land Development 1966.
27 October 2020.

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, University Fund Wageningen, Droevendaalsesteeg 4, 6708 PB Wageningen, Netherlands.

Prof. Jantine Schuit, WUR Domestic and Consumer Studies 1990, has been appointed member of the executive board of Tilburg University and vice-rector magnificus. Since 2017, Schuit has been Dean of the School of Social and Behavioural Sciences and professor of Health, Behaviour and Society. 31 August 2020.

Dennis Oonincx PhD, WUR Animal Sciences 2008, researcher in the Animal Nutrition group at WUR, has received 50,000 euros from the Dutch Research Council to work out his idea for a company in more detail. Oonincx wants to reduce ammonia and methane emissions from cows by incorporating insects in their feed. 12 August 2020.

Charles Snijders PhD, WUR Plant Breeding 1985, has been appointed head of R&D at the vegetable and flower seed breeding company Takii Europe. Snijders was previously at Asur Plant Breeding, where he was responsible for the development of wheat and barley seeds. 9 October 2020.

Simon Vink has stepped down as spokesperson for the Executive Board of WUR. Vink came to Wageningen in 1974 to study Biology but never completed his degree. He became a journalist and later the editor-in-chief of the Wageningen University magazine and director of the publisher Cereales. Vink had been the spokesperson since 2000. September 2020.

Annemiek van Vleuten MSc, WUR Animal Sciences 2007, won the European Road Cycling Championship for women in Plouay (France). She also came first in the Clasica Femenina Navarra in Spain and the Strade Bianche in Italy. Van Vleuten came second in the World Championship women's road race in Italy. 28 August 2020.

Henny Wilpshaar MSc, WUR Zootechnics 2001, has become co-CEO of the biotechnology company KeyGene, with finance, value creation and business development as his portfolios. Wilpshaar was previously financial director of the Kennemervis Group. 1 September 2020.

BOOKS

Women in the frontline

Johan Kroes MSc, WUR Environmental Protection 2004, wrote the book *Vrouwen in de frontlinie* ('Women in the frontline'), with 50 stories about women soldiers in the Dutch armed forces. Kroes got the idea when he was a speechwriter for the Netherlands's first female Defence minister, Jeanine Hennis-Plasschaert. 'When Hennis was chosen as the most powerful woman in the Netherlands in 2015 by the feminist magazine *Opzij*, I had to write a speech and I delved into the subject of women in the military. I thought these were interesting stories that hadn't been told before.' 2019 — 75 years after the first woman joined the Dutch armed forces — was the right time to turn this into a book 'as a sign of appreciation for these brave pioneering women', says Kroes. The first edition was for the ministry of Defence and now there is an updated version for the general public. *Lux publishers, 21.95 euros, www.vrouwenindefrontlinie.nl*

Fighting for Eva

Joost Uitdehaag PhD, WUR Molecular Sciences 1995, has published the novel *Vechten voor Eva* ('Fighting for Eva'). This story of a terminally ill cancer patient is set in the medical research world of the old Organon labs in Oss, where Uitdehaag worked as a researcher from 2003 to 2011. 'I want to use this story to show how exciting and interesting the world of medicine development is,' says Uitdehaag, who now develops immunotherapeutic cancer medicines at Lava Therapeutics. He based the novel on a project by Organon (which was taken over by MSD in 2009) for cancer and the immune system. That research was initially archived unused, but eventually resulted in one of the best-selling cancer medicines today, pembrolizumab (Keytruda®). Vechten voor Eva is Uitdehaag's third book. *Nimisa Publishing House, 21.99 euros.*

Resilient plants

Peter Geelen MSc, WUR Horticulture 1985, is a co-author of the book *Plant Empowerment, de basisprincipes* ('Plant empowerment, the basic principles'). Geelen previously authored the English edition together with retired WUR researcher Peter van Weel BSc and Jan Voogt MSc. They are the brains behind Plant Empowerment, a cultivation method aimed at making plants strong and resilient so that they can cope with diseases and pests. In response to growing demand for translations, there is now a Dutch edition and a Spanish edition. *LetsGrow.com, 95 euros (excl. VAT).*

'I have no regrets that I didn't study medicine from the start'

Hilde Buiting, medical student

Nutrition and Health 2004

Hilda Buiting is about to start the final residencies of her fast-track medical degree in Utrecht. She did consider going into medicine when she went to university in 1999. 'I was definitely interested in health, but at the time I was torn between Health Sciences and Nutrition & Health. I chose Wageningen because it is small-scale and international, and the social engagement there appealed to me.' After graduating, she did a PhD in which she evaluated the euthanasia law for the Ministry of Health, Welfare and Sport. 'Not because I still wanted to go for a medical career, but primarily because I was interested in ethical dilemmas.' She then went on to do research among terminal patients. 'I found out that I really liked talking to patients. Increasingly, I was missing the practical element in my research. When I began to have more and more to do with oncology, I thought: now I should take the plunge and become a doctor.' In 2015, Buiting was accepted on the four-year Master's in Medicine and Clinical Research at Utrecht University. 'When I'm dealing with patients I notice that I find it rewarding and challenging work. I have no regrets that I didn't study medicine from the start, though. As a doctor, I will be able to draw on everything I've done and experienced.

PHOTO HARMEN DE JONG

PHOTO CAROLINE PENN / ALAMY

Drought-resistant wild coffee plants discovered in Uganda

The forests of Uganda are a reservoir of wild coffee plants, including drought-resistant variants, discovered Wageningen PhD student Catherine Kiwuka. This creates opportunities for making Uganda's vulnerable coffee sector more resilient to the effects of climate change.

Uganda is Africa's biggest coffee producer after Ethiopia. The country's mainly small-scale coffee growers are now facing rising temperatures and increasingly frequent droughts. Estimates suggest that climate change will cause a 50 per cent decline in coffee production worldwide. This prospect prompted Wageningen researchers, the Ugandan research organization NARO and the French development research institute IRD to embark on a quest for wild and naturalized coffee plants.

Kiwuka studied the genetic characteristics of the newly found plants and selected those with most drought tolerance. This led to the discovery of coffee plants with climate-proof characteristics. The varieties that cope with drought best can be used for breeding drought-resistant coffee cultivars. The most valuable material was found in the endangered Zoka forest in Northern Uganda, of which only about 10 square kilometres is left.

Catherine Kiwuka graduated in October with a PhD supervised by Niels Anten, professor of Crop and Weed Ecology.

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