WAGENINGEN WORLD

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‘The bulk of the plastic stays stuck in the river’

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West Nile virus has arrived

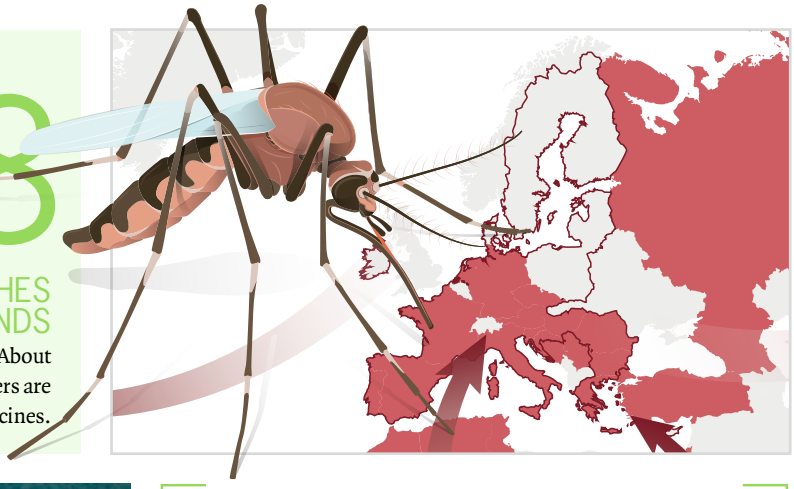
Researchers figure out transmission by mosquitoes, and design vaccines

The sea can’t feed the world

‘We are already reaching the limits, there is not much more to be gained’

Palm oil re-evaluated

‘We need to take a much better look at the impact of other oil crops’



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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 MATTY VAN WIJNBERGEN

Learning from Covid-19

'This pandemic has exposed all the weaknesses in the healthcare system, in the Netherlands and in the rest of the world. We can and must learn from that.

'The pandemic shows that countries need to invest more in disease prevention and safety, including early warning systems. Also, global threats call for a global approach, and it is imperative to support the more vulnerable countries. In the end, we are only as strong as our weakest link.

'In addition to new lessons from Covid-19, we are learning lessons that are comparable to earlier outbreaks. During the SARS epidemic of 2003, we learned that you must act fast when a new disease emerges. Prevention by means of testing and contact tracing is crucial for combatting a disease. Asian countries that were closely affected by the SARS epidemic – such as China, Taiwan, Singapore, Vietnam, Thailand and South Korea – invested in laboratories and better early-warning and information systems. That is paying off now with Covid-19. These countries detected the disease at an early stage, and acted fast, thus preventing a large-scale outbreak.

'Prevention is better than cure. When it comes to disease prevention, the Netherlands is lagging behind. We spend a lot on healthcare, more than 10 per cent of our GNP per year, but we spend very little on prevention and safety: only about 0.5 per cent of our GNP. The market doesn't work effectively on prevention and safety; the government needs to invest more in these areas.

'Wageningen also plays an important role in prevention, particularly through its research on zoonoses, the viruses that can jump from animals to humans. Intensive livestock farming creates certain risks for the emergence and transmission of these pathogens. We must do research on that, as well as on the impact of climate change, through which diseases can spread more easily via mosquitoes and other vectors.'

Henk Bekedam was a WHO advisor on the SARS epidemic in China and the coronavirus crisis in India. He chairs the expert group that will be advising the Dutch ministries of Health and Agriculture on being prepared for zoonoses in the health sector. Bekedam was the guest speaker at the dies natalis at WUR on 9 March.

THE ECONOMY

Limited impact of first Covid wave on agriculture

The impact of the first six months of the Covid crisis on the Dutch agriculture sector was less than had been feared, concludes Wageningen Economic Research based on monthly analyses.
This was mainly because the first lockdown did not last very long and because special green lanes were arranged for freight traffic in the EU, which kept trade moving.
There were sufficient workers, in part thanks to the initiatives in the sector to recruit more young people. Abattoirs in particular however suffered from staff shortages at the start of the pandemic because of staff off sick, social distancing rules and the loss of foreign employees.
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LIVESTOCK

Heat kills red mites

If dairy farmers heat their barns for at least 48 hours to at least 45°C before a new batch of laying hens arrives, that will kill off all the red mites and their eggs. This finding is from a study by Wageningen Livestock Research, which was published in *Veterinary Parasitology* in December 2020.
Red mite, also known as chicken mite, is the dominant pest affecting farms with laying hens.
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PHOTO DAKTARIDUDU

AGRICULTURE

PHOTO WUR

Trial with agroforestry in the polder

In January, a start was made on the first major Dutch research setup for agroforestry — a combination of agriculture and forestry.

1500 fast-growing trees such as elms and poplars have been planted on 15 hectares of arable land at the WUR site in Lelystad. In the autumn, 500 hazel trees will be planted too. The researchers will be growing crops including potatoes, winter wheat, carrots, cabbage and spinach in rotation.
The trees grow in six long rows in the field at varying distances from one another. 'We want to measure the effect of the rows of trees on the microclimate, such as wind speed, temperature and soil moisture content,' says research leader Maureen Schoutsen. 'We hypothesize that the rows of trees improve growing conditions and therefore increase yields.' They will also study the effect of the trees on plant diseases, soil fertility, biodiversity, CO_2 uptake and farmers' incomes.
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FOOD PRODUCTION

Prize for circular food system vision

The vision of a healthy and circular food system that Professor Imke de Boer and researchers Evelien de Olde and Kawire Gosselink came up with for the Rockefeller Foundation's Food System Vision Prize won them the accolade of one of the Top 10 Visionaries.

The Wageningen scientists developed a holistic blueprint for a healthy and circular food system for the Netherlands in 2050, in which healthy food is produced for everyone with respect for the planet and all forms of life. Arable farmers grow multiple crops in strips and pigs and chickens only eat biomass that is unfit for human consumption. Locally sourced and non-meat products play a bigger role in the Dutch diet.
Ten winners were selected from the over 1300 teams that competed for the prize. They had to produce an action plan and communication plan, for instance, to gain recognition as a Top Visionary and an award of 200,000 dollars.
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REMOTE SENSING

Radar flags up deforestation

A new Wageningen alarm system called RADD gives detailed information about tropical forest felling. It uses radar images from the European Sentinel-1 satellite to detect disturbances in Africa's tropical rainforest.

Radar can see through the clouds that often hang above the rainforest. That is a big advantage compared with the satellites that use visible light, which have been used to date to detect disturbances in the forest from space.
Illegal logging in the rainforest is a big problem in Africa, says RADD project manager Johannes Reiche of the Geolab at WUR. Certain hardwoods are selectively felled for the international market. 'There is also a lot of clearance for small-scale agriculture.'

The images have a resolution of 10 metres and are refreshed every 6 to 12 days. The app cannot see directly what kind of logging is involved or whether it is legal. 'That's the next step,' says Reiche. 'A PhD candidate is now working on that.' WUR developed RADD with the online platform Global Forest Watch. The app is implemented in Google Earth Engine and anyone can see the alerts. Reiche is working on rolling RADD out elsewhere too.
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PHOTO SHUTTERSTOCK

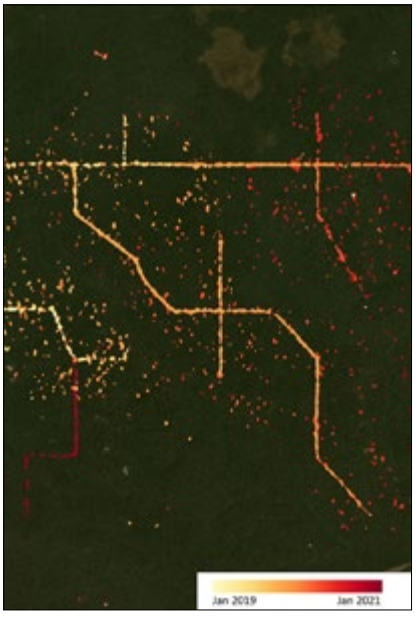
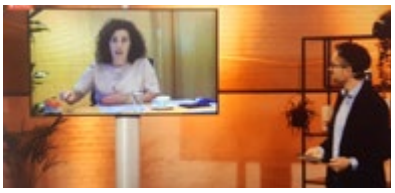


PHOTO WUR

COLLABORATION



Eindhoven, Utrecht and Wageningen in alliance

A scientific alliance between Eindhoven University of Technology, WUR, Utrecht University and UMC Utrecht was officially launched in December last year. One of the projects is the Centre for Unusual Collaborations, for innovative research involving young scientists.

The partners will invest 50 million euros over eight years in joint research and education projects in preventive healthcare, energy, food and sustainability. The plan is to double the funding through collaboration with external partners and funds. The launch took place during an online event with Education minister Ingrid van Engelshoven.
One of the alliance's first initiatives is to encourage innovative research by bringing together young scientists who would not normally collaborate in the new Centre for Unusual Collaborations (CUCo). Young researchers from the participating institutions will be allocated six million euros from the alliance's budget over the next four years.
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WAGENINGEN ACADEMY

Online Summer School: Insects as Food & Feed

There are many challenges in rearing insects and marketing them for human and animal consumption. What type of production design and facilities are needed to farm and process insects optimally? Is it an economically interesting option? Wageningen Academy offers an opportunity to explore these questions and the many interesting facets of this new alternative protein source in the Summer School on Insects as Food & Feed. In 2021, this will be offered as a fully online programme. In our two-week online course, we offer eight online live Q&A sessions with globally renowned experts, assignments to carry out with fellow attendees, and 20 hours of pre-recorded lectures that you can follow at your own pace.
Wageningen Academy runs a number of Summer School programmes; for a full overview, see: *www.wur.en/academy*

HORTICULTURE

Insect pollination replaces fertilizer

Market gardeners can reduce their use of fertilizers without loss of production by means of insect pollination and higher organic matter content in the soil, according to researchers in the Plant Ecology and Nature Conservation chair group. They grew raspberries under various conditions. Insect pollination increased yields by 33 per cent and led to raspberries that were 11 per cent heavier. Higher soil organic matter content attracted more insects and resulted in berries that were 20 per cent heavier but did not increase yields. The research was published in *Agriculture, Ecosystems & Environment*.
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CONSUMER BEHAVIOUR

Dutch want to eat less meat but aren't doing so yet

Increasing numbers of Dutch people want to cut down on meat and eat more alternative sources of protein. Consumption of alternatives to meat is not increasing, though.

In both 2015 and 2019, researchers at Wageningen Economic Research surveyed the protein consumption and underlying motivation of more than 2000 Dutch people. They found that more people now identify as vegetarians, vegans or flexitarians: 12.6 per cent in 2019 as opposed to 8.6 per cent in 2015. The group that did not accept these descriptions but said they were deliberately cutting down on meat has also grown, from 13.5 to 18.4 per cent. The number of people who saw themselves as typical carnivores fell from over 71 per cent in 2015 to over 61 per cent in 2019. The group of 'unconscious avoiders' – people who don't always eat meat but not as a deliberate choice – remained the same at about 8 per cent. Dutch people increasingly intend to opt for alternative protein sources, especially fish and pulses. However, consumption of alternative proteins for breakfast, lunch, dinner or snacks as reported by the research group did not increase. Red meat is still the main source of protein for most Dutch people by some distance and is eaten at least three times a week. Chicken is doing well and is eaten twice a week. The only alternative sources of protein to show a (slight) increase are meat substitutes, which are on the menu about once a week. Fish is also eaten about once a week. As in 2015, pulses were the most popular alternative protein sources in 2019 as well, and eaten at least twice a week. The discrepancy between people's intentions and consumption is called the intention-behaviour gap, says researcher Marleen Onwezen. 'It shows growing openness to alternative proteins, and behavioural changes will follow.'
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PHOTO ANP

WATER MANAGEMENT

PHOTO RIJKSWATERSTAAT

Longitudinal dams work better

Placing dams parallel to the direction of the current in Dutch rivers helps the discharge water flow and keeps shipping channels navigable while having no negative impact on the river bed. These findings come from the doctoral research of Timo de Ruijsscher in the Hydrology and Quantitative Water Management chair group.
De Ruijsscher investigated the effect of three longitudinal dams in the Waal, which were installed in 2015 as a trial by the Public Works Directorate. They replace the breakwaters, at right angles to the current, in the inside bends of the river. The dams split the river into a primary channel and a riverbank channel. That helps keep the river navigable when water levels are very high or very low. Ecological research by Radboud University showed that the flora and fauna in the riverbank channel benefit too.
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SOCIAL MEDIA

Anti-vax messages retweeted more than pro-vax messages

Negative messages about coronavirus vaccines are retweeted six times more often than positive ones, PhD candidate Jasmina Rüger of the Business Management & Organization group found.

PHOTO SATTPALAT PHUKKUM / SHUTTERSTOCK.COM

Rüger studies how ideas about health spread online. At the end of last year, she looked at over 50,000 tweets and retweets about coronavirus vaccines and analysed the differences between the tweeting behaviour of people in favour of vaccination and those opposed to it. 'We found that anti-vaccination messages were retweeted much more often,' says Rüger. 'There are fewer tweeters in this category, but there is a small core group retweeting very actively. As a result, this small group reaches as many people as the bigger pro-vax group.'

Rüger discovered that anti-vaxxers often retweet old information: 'They are mainly looking for messages that confirm their views. Because they retweet more intensively, these messages spread like wildfire.'

The researcher also saw differences in the sentiment and communication style of the two groups. 'Pro-vaxxers mainly use facts and scientific information. Anti-vaxxers focus more on emotion.' She says this is an important aspect of the communication. 'You can't respond with facts if someone says their child has become severely ill after a vaccination.' The government could use this knowledge in its information campaigns, thinks Rüger. 'You need to take these emotions into account. If you just present people with the facts and dismiss them as stupid and ill-informed, you will only increase their distrust of the government.'

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SUSTAINABILITY

70 per cent of plastic can be recycled

Up to 72 per cent of all plastic packaging in the Netherlands can be recycled if all the possible measures are implemented to improve the packaging design, collection, sorting and recycling. This figure was calculated by packaging researchers Marieke Brouwer and Ulphard Thoden van Velzen of Wageningen Food & Biobased Research, together with Ghent University and the University of Twente. They assumed the use of technology currently available or likely to be introduced in the next five years. The average polymer purity of the recycled plastic is then 97 per cent. According to the researchers, achieving this theoretical maximum requires 'a coordinated effort from all stakeholders with unprecedented investments'. Some of the recycled plastic will not be suitable for use as food packaging.

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PHOTO ANP

PLANT PATHOLOGY

Fungus gets inside plant by manipulating soil life

PHOTO HOWARD F. SCHWARTZ

The soil fungus *Verticillium dahliae* causes a wilting disease in crops including strawberries. The fungus attacks plants by eliminating microorganisms in and around the plant that protect it. The fungus uses 'effector proteins' to do this, discovered Nick Snelders, a PhD candidate at the Laboratory of Phytopathology.

Plants attract microorganisms around their roots to form part of what is known as the plant microbiome. The soil fungus *Verticillium dahliae* secretes effector proteins that attack the protective microorganisms, allowing the fungus to penetrate the plant. These proteins could potentially be used in antibiotics because of their antimicrobial effects. Snelders will be exploring this further as a postdoc at the University of Cologne.

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LIVESTOCK FARMING

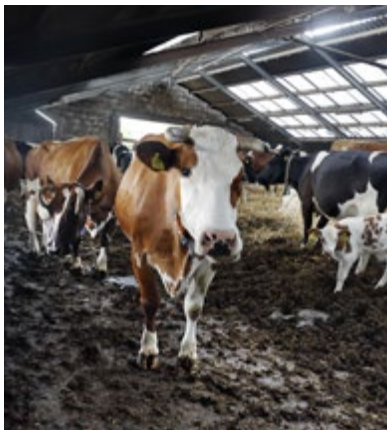

PHOTO ANP

Big difference between farms in methane emissions

There are big differences between livestock farms in their methane emissions, for example due to differences in the feed, barns and manure storage systems. Cows' methane emissions can also differ because of variations in their genetic makeup. Those variations could offer a way of reducing methane emissions. These findings are from a Wageningen study of 24 livestock farms and experimental farms. In follow-up research, the scientists want to explain the differences and develop practical measures for use by the various types of farm. That will let farmers adapt their farms to meet the challenges posed by the climate and nitrogen crisis while still remaining profitable. *Info: karin.groenestein@wur.nl*

NUTRITION AND HEALTH

Diet unaffected by loss of smell

Patients who have lost their sense of smell have just as healthy a diet as the average Dutch person, according to PhD research by Elbrich Postma.

Between 5 and 20 per cent of Dutch people have an impaired sense of smell or taste, for example because of a cold, the flu or ageing. Many Covid patients also lose their sense of smell and taste. Postma, of the Human Nutrition and Health group, investigated the effect of the loss of smell on eating behaviour.
Contrary to expectations, she found that patients without a sense of smell had diets as close to the Good Nutrition Guidelines as the average Dutch person. 'In addition to smell and taste, there are numerous factors that affect the actual food intake, such as the social situation in which you eat and the eating habits you have acquired,' explains Postma.
Additionally, Postma used MRI scans to look at what happens in the patients' brains. Although the patients said they could not smell anything, the MRI showed the brain responding to the odours they were given. 'The basic sense of smell was still there. And that is promising for the treatment of patients who have recently lost their sense of smell,' says Postma. This could for example involve smell training.
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PHOTO SHUTTERSTOCK

GLOBAL RANKING

Greenest university

WUR was ranked the most sustainable university in the world for the fourth successive time in Universitas Indonesia's GreenMetric ranking. 912 universities in 84 countries took part in the ranking, which was first published in 2010. The universities filled in an extensive questionnaire on how they deal with energy, the climate, waste, transport, water, biodiversity and infrastructure.
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NATIONAL SCIENCE AGENDA FUND

Making milk protein without a cow

Yeast can be genetically modified so that the microorganism makes the milk protein casein with the same three-dimensional structure as milk. Etske Bijl in Food Quality & Design was awarded 1.7 million euros for her research from the National Science Agenda fund.
Other Wageningen projects that received funding include research into making the sandy soil areas in the east and south of the country more climate-proof. Professor of Soil Geography and Landscape Jakob Wallinga received 1.9 million euros for this. He is also involved in a project aimed at improving the living environment for tigers in the Himalayas. Toxicologists are developing test methods that do not require lab animals, and Wageningen is collaborating in a study on the formation of the *Limes*, the border of the Roman Empire.
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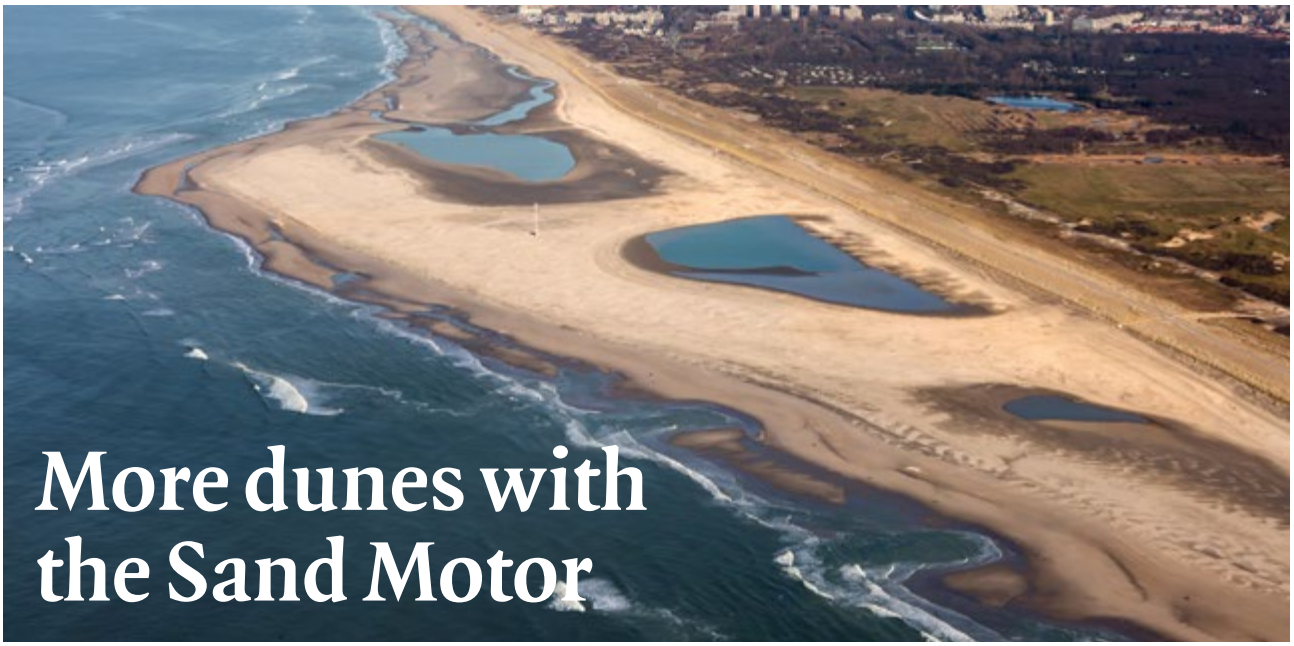
SOIL PHYSICS



More dunes with the Sand Motor

PHOTO RIJKSWATERSTAAT / JURRIAAN BROBBEL

The artificial peninsula near The Hague, the Sand Motor, is having the desired effect: it is stimulating dune growth and thereby protecting the coast. Marram grass speeds up that growth. These conclusions come from Corjan Nolet's doctoral research.

The Sand Motor was created 10 years ago as a natural alternative to the regular sand replenishment used to strengthen the dunes and protect the coast. 'Dune formation using this natural approach is comparable to other parts of the coast where sand is replenished artificially,' says Nolet, 'but more new dunes develop on the Sand Motor.' There is also now an attractive recreational area and the Sand Motor has a beneficial effect on nature development. For example, more organisms live in the shallow water of the tidal zones, while various forms of pioneer vegetation are appearing in the new dunes. This all combines to make it a successful experiment, says Nolet.

Marram grass is important for dune formation because it fixes the sand. Nolet has accurately documented that process with new measurements. With some colleagues, he developed a device to catch drift sand and linked the measurements to wind data and drone measurements of dune and vegetation growth. Marram grass needs sand in which to grow. Nolet came up with a formula for that relationship: marram grass grows fastest if about 30 centimetres of sand falls on the dune per season. According to Nolet, the safety of the Dutch coast depends to a large degree on that unique growth property.

Nolet obtained his PhD on 3 December 2020; his supervisor was Coen Ritsema, professor of Soil Physics and Land Management.

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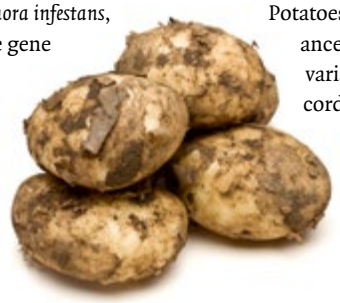
PLANT BREEDING

New gene for resistance to potato disease

An international team of researchers has found a new gene that makes potato plants resistant to the mould *Phytophthora infestans*, which causes potato blight. The gene is found in the plant *Solanum americanum*.

Numerous resistance genes for the disease have been isolated in wild potato species in recent decades. However, *Phytophthora* is easily able to breach that resistance.



Potatoes with the new resistance gene can resist 19 variants of *Phytophthora*, according to the Wageningen scientists taking part in the study. The expectation is that the mould will not be able to break down this resistance so easily.

The resistance gene can only be inserted in potatoes by transgenesis. That is why the development of such potatoes has come to a stop in the EU, but is continuing in other countries.

A publication on the new gene has appeared in *Nature Plants*.

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COLLECTING PLASTIC FOR SCIENCE

The river as a plastic reservoir

It is possible that a lot more plastic accumulates in and around rivers than in the sea, thinks Tim van Emmerik. He is doing research that he hopes will allow predictions of where that is likely to happen. 'Then it can be removed from those specific locations, instead of organizing expensive clean-up operations at sea.'

TEXT RENÉ DIDDE **PHOTOGRAPHY** MARCEL VAN DEN BERGH

‘The bulk of the plastic seems to stay stuck in the river system’

‘We still have far too little quantitative data about plastic in the water,’ says Tim van Emmerik, leaning on the railing of the bicycle bridge over the River Rhine (Waal in Dutch) at Nijmegen. ‘Many estimates are based on anecdotes and poor data that has not been collected in a consistent way.’ Van Emmerik, an assistant professor in the Wageningen Hydrology and Quantitative Water Management Group, is braving the elements on this rainy winter afternoon with five Master’s and PhD students to test new ways of measuring the quantity, type and origin of plastic in the river water.

The researchers are keeping a tally of plastic waste observed from the bridges over the Waal. Later that afternoon they go to the Rhine, and the next day they stroll along the banks of the Meuse, in search of plastic waste.

‘We are standing here near Nijmegen now, but we also do counts downstream in the direction of Rotterdam,’ says Van Emmerik, pointing at the chilly riverbank as he and the students gather up assorted bits of plastic as well as beer bottle tops and cigarette butts. All the anthropogenic waste is counted so as to be able to calculate the proportion of plastic waste relative to other kinds of waste. ‘We look near Westervoort, east of Arnhem where the IJssel river splits off from the Rhine, and we measure at Kampen, where the IJssel flows into the Ijsselmeer, a large lake.’

On other days they deliberately mark waste and then leave it in the water, hoping to find it further downstream. Some of the research consists of observations of plastic using cameras and drones. The testing sessions are part of the River Plastic Monitoring Project, for which Van Emmerik won a Veni grant in October from the Dutch Research Council (NWO). The goal is to develop a universally applicable monitoring framework with which to collect more consistent data about plastic waste in the rivers. That data should feed models to give a better picture of the distribution of the waste. The models can take into account the influence of dams, waterfalls and other things that affect the flow, not just in the Netherlands but in rivers around the world.

The researchers count and analyse the plastic that floats on the river surface or gets washed up along its banks. That provides a yardstick for the amount that is underwater. At the same time, they are working on improving the calculation models, by measuring the plastic underwater as well using sonar and fishing nets. Researchers hope thus to collect data with which they can calculate the mass balance of plastic: ‘how much plastic comes into the Netherlands via the rivers, and how much flows out of the country into the sea.’ Van Emmerik thinks the bulk of the plastic waste is not found in the sea. ‘We reckon that much more plastic stays on the riverbanks, on the riverbed, and in the floodplains than is widely believed,’ he says.

The plastic soup in the ocean is a theme that occupies young and old. Photos of a sea turtle with the plastic ring from a sixpack of beers around its neck, a cigarette lighter in a petrel’s stomach, and a seahorse with its tail wrapped around a cotton bud have aroused widespread indignation. But in spite of all the attention paid to the plastic soup, researchers still know precious little about it, says Van Emmerik. Until now most of the calculations done have been at the ‘back of an envelope’ level. Right from the start, for example, the suggestion has circulated that ‘80 per cent of the plastic soup in the sea comes from rivers or land.’ ‘It is totally unclear where these figures come from, exactly,’ he says.

STUDY OF THE SEINE

Van Emmerik’s guess that most plastic waste never reaches the sea is largely inspired by a systematic long-term study by researchers from the University of Paris-Est. They studied the River Seine at three locations for many years, looking both in the river and along the banks and water meadows, says Van Emmerik. One of their locations was upstream, one near Paris and one at the river mouth at Le Havre, where the Seine flows into the English Channel.

The French researchers saw an increase in plastic bags, bottles and packaging at Paris, but recorded hardly any plastic at Le Havre over a period of 10 years. The drew a radical conclusion. ‘The bulk of the plastic apparently stays stuck in the river system. It gets laid down along the way in the water meadows and even further inland, or festooned on the bushes along the riverbank like Christmas decorations,’ says Van Emmerik, who participated in the research on a regular basis. ‘Now and then, I stepped on plastic objects from the 1970s.’

The researcher expects to find equally old plastic in the Netherlands, possibly with the

TIM VAN EMMERIK,
a researcher and assistant professor in the Hydrology and Quantitative Water Management chair group

help of a mechanical digger. 'We're scratching around on the banks now, but later we will take samples from deeper in the soil of the riverbanks to analyse how much plastic waste is stored there,' says Van Emmerik. 'We hope to be able to forecast where the most plastic waste accumulates. That can then be removed from those specific locations instead of organizing expensive and complicated clean-up operations at sea.'

He hazards the hypothesis that 95 per cent of the plastic is absorbed by the river – in the sediment, in the riverbed, and along the banks.

This idea could have far-reaching consequences. Most researchers and NGOs have focused all efforts on the issue of the plastic soup in the seas and oceans, but perhaps most of it stays in river systems, which would make the quantity of plastic in the river system much bigger than that in the sea. 'That could explain the enormous gap in the mass balance between the amount of plastic produced and used in consumer products, and the amount at waste processing plants and municipal waste services,' says Van Emmerik. Student Yvette Mellink has written a PhD proposal for a similar plastic-monitoring study in the urban context. With this kind of research, the River Plastic Monitoring Project hopes to get a fuller picture of the plastic waste that ends up on the street, in the parks, and in the canals and waterways. In canals and waterways, large amounts of rubbish often accumulate at the same place, making clean-up operations easier. A similar thing happens at weirs and dams, causing damage to the pumps. Van Emmerik wants to find out what kinds of plastic waste pile up there. 'If it's plastic bags, for instance, that is an extra argument for policymakers to ban disposable plastic bags.'

> 'The river plastic could explain the enormous gap in the mass balance'

The researchers are taking a particular interest in the Biesbosch nature reserve, which resembles a plastic reservoir. Large quantities of rubbish are deposited on the banks and in the vegetation by the tidal currents that come this far inland.

Although Van Emmerik currently concentrates his measuring activities for this >

‘The ultimate goal is that no more plastic ends up in the environment’

Bits of plastic, beer bottle tops, cigarette butts and other anthropogenic waste accumulated on the river bank.

project in the Netherlands, he does want his system to be universally applicable. His team of PhD and MSc students do a lot of research in the deltas of Indonesia, Vietnam and Bangladesh. There are particularly large amounts of plastic circulating in the deltas of Asia due to their large populations and the poor waste disposal infrastructure. To take one example, Van Emmerik thinks the watershed of the Ciliwung river in Jakarta retains about 97 per cent of the waste deposited in it.

SHAMPOO FOR MEN

Meanwhile, at Wageningen Economic Research, Wouter Jan Strietman and his colleagues are working on a reliable method of identifying where plastic waste came from. Strietman mainly focuses on plastic in the sea, but also thinks the standard monitoring of shoreline waste does not give a full enough picture. ‘You tick an object off on the list, noting the quantity and the type of plastic,’ says the social geographer. ‘But this does not give you any idea about the origin and, more importantly, the possible links between waste streams.’

In the Litter-ID method he helped to develop, Strietman not only counts plastic waste, but also tries to identify its sources and the reason it has ended up where it is. To this end, he analyses whole containers full of plastic waste collected on a beach or even an island.

‘If you look at the fine print and other details of the plastic’s appearance, that helps you to detect patterns,’ says Strietman. ‘and that knowledge then helps you get a better idea of the sources and causes.’

On Spitsbergen, for example, Strietman and his colleagues found waste from net repairs on fishing trawlers that fish around the island. ‘We also found a lot of domestic waste with Russian writing on it, such as milk cartons and plastic shampoo bottles. We notice that nine out of 10 shampoo bottles were labelled “for men”. Who throws them in the sea? We suspect that the main source is the crew of Russian fishing boats.’

CRISP PACKETS

For Strietman, the participation of local groups such as shopkeepers, fisheries, environmental organizations and residents is important for the analysis. It has been very revealing at times. On the beaches of West Greenland, for example, a lot of packaging was found of the sort you take with you on a day trip, such as crisp packets. ‘At first, residents we spoke to there said, “that comes from elsewhere,” because, just like us, they thought it was all brought in from faraway on the ocean currents. But further research revealed that most of that stuff had been used by local residents, hunters and fishers, and had been bought locally. They make day trips by boat, and apparently they throw their snack packaging in the water.’

Strietman has an anecdote about a miniature boat his colleague Eelco Leemans found on the volcanic island of Jan Mayen, north of Iceland. The little toy turned out to be a free gift that came with packets of breakfast cereal in British supermarkets in the 1950s. Little ‘lobster tags’ with the codes of lobster pots found on the coast of Iceland, Scotland and even Zeeland in the Netherlands could be traced to fisheries in the north-eastern United States and Canada.

In short, plastic waste is a fingerprint of a community, which with Sherlock Holmes-like detective work can sometimes lead you to the source, as Strietman’s research has shown. ‘With our research, we squeeze out as much information as we can. And with all the new information that produces, we can now tackle the plastic problem at source in a far more precise way than was previously possible.’

Jeroen Dagevos, head of programmes at the Plastic Soup Foundation (PSF), has noticed that research in this field has progressed to a higher level. 'Fifteen years ago, pretty much all we said was: "all that plastic on the beach doesn't look very nice",' he recalls. 'Now we're finding out more and more about the plastic soup in the oceans, seas and rivers. And research is also being done on plastic in the air, in food and in the soil. We are gaining more and more knowledge about the fragmentation of pieces of macroplastics into smaller microplastics and even nanoplastics.'

PET BOTTLES

Dagevos thinks more precise and quantitative information is crucial if we are to be able to halt the flow of plastic pollution. 'A couple of years ago, during inventories we made with the North Sea Foundation and the IVN nature organization along the banks of the Meuse, we found more plastic granules the closer we got to Chemelot near Geleen. That was evidence that something was going badly wrong on that enormous industrial estate full of chemical companies,' says Dagevos. Research on plastic contributes to new measures, then. For many years the business world insisted that the number of plastic PET bottles littering the streets was not very high and that a deposit on such bottles was therefore unnecessary. 'It was very useful then that research proved that a deposit would keep up to six million bottles out of the litter in the Netherlands,' relates Dagevos. 'If in the near future we can forecast where and near which rivers the most plastic accumulates, then we can remove a lot more of it from the environment through targeted operations. But of course, the goal remains to ensure that eventually no more plastic ends up in the environment.'

www.wur.eu/river-plastics-analysis

PHOTO PETER VAN AALST

MODELLING A DISASTER AT SEA

'An experimental ecosystem,' is what Edwin Foekema calls the 30 tanks at the research location of Wageningen Marine Research in Den Helder. Each tank contains five cubic metres of water from the Wadden Sea, full of plankton, and a layer of sand with seabed fauna such as worms, shellfish and young sole. The researchers dub this kind of tank a 'mesocosm'. 'It's a representative model of the nursery that the Wadden Sea forms,' says Foekema.

In this mini-Wadden Sea, Wageningen Marine Research simulates the MS Zoe disaster, when the freighter of that name lost 300 containers on New Year's Day 2019. Apart from television sets, textiles and car parts, two kinds of intermediate plastic products ended up in the sea. 'Some of these were HDPE pellets of five millimetres in diameter, which are used to make things like lunch boxes.' These pellets float. The other pellets were much smaller polystyrene pellets (of 0.5 millimetres), which sink. Researchers put these plastic particles in the different tanks in varying concentrations. Then Foekema left these mesocosms undisturbed for eight weeks in the spring, which is when most marine fauna has a growth spurt. 'Larvae settle in, and reproduction is going on at full speed, so we expect that at least in the tanks with the highest concentrations, there will be subtle effects of the presence of plastic particles, such as a disturbance to the foraging behaviour of some species.'

The research, commissioned by the Dutch Public Works Directorate, is currently being reviewed. 'No very serious effects have been observed,' says Foekema. The experimental ecosystems lend themselves to research on other urgent matters as well, he believes, such as the effects of rising temperatures on the acidification of sea water.

Pecking at tasty larvae

If broiler chicks can peck at fly larvae, they display more natural foraging behaviour, are less anxious and stay healthier. And if the protein-rich larvae are bred on surplus manure, they also form a sustainable feed.

TEXT ANNE VAN KESSEL **PHOTO** ANP

Broiler chicks that are fed on live fly larvae move around more, and that improves their wellbeing, shows research by Allyson Ipema, a PhD student in the Adaptation Physiology chair group at Wageningen. 'Insects have been seen for a while as an interesting potential food source for chickens because they are a good source of fats and proteins. Only we didn't yet know so much about the effect of that, especially not in relation to animal welfare,' says Ipema.

So she used a grant from the Dutch Research Council (NWO) and investments by livestock feed manufacturer ForFarmers, chicken breeding company HatchTech and insect breeding company Bestico to study the health and behaviour of broiler chicks fed on the living larvae of the black soldier fly, as a supplement to their usual diet.

Fast-growing broiler chicks tend to get too little exercise and are often left in dirty bedding, which causes leg diseases. 'That might change if they can move around more, we thought,' Ipema explains.

'I started every day by going to the refrigerator, where I measured out the right quantity of larvae,' she says. She then brought the larvae to the barn for the first feeding time of the day. In between feeding times, she observed the behaviour of the chicks and monitored their health, by weighing them for instance.

SCRATCHING AND PECKING

The chicks did indeed become more mobile. The more often they were given larvae, the more active they became. 'They scratched and pecked around to find the larvae. If we gave them a little bit of feed seven times, instead of giving them more feed four times, they remained more active.' She found there was a maximum proportion of larvae in the feed for the chicks' health. 'If the insects made up 10 per cent of their diet, and they got this in two big portions, some of the chicks didn't grow as well. We think that was because they got a lot of fat and protein in one go, and therefore ate less of their usual food. Another explanation could be that the other nutrients don't then get absorbed as well in the intestines.'

In the study, which was published in *Applied Animal Behaviour Science*, Ipema noticed that the legs of the chicks fed on larvae were healthier than those of the control group. 'Fewer of them were lame, and fewer had skin infections on their heels.' Ipema thinks that is because the chicks move around more, which strengthens their legs and means they spend less time in contact with dirty bedding. It could also be because the chicks turn over the bedding in their search for insects, keeping it loose and aerated.

> **'The animals are displaying more natural foraging behaviour'**

NATURAL BEHAVIOUR

In a second study, some of the chicks were offered the larvae in a transparent tube with holes drilled into it. 'Those animals displayed even more natural behaviour. Getting the larvae out of the tube kept them occupied for most of the day. That closely resembles the natural context in which chickens might have to get insects out of a tree, for example.'

The chicks also exhibited less anxiety than the control group, showed one measurement. 'That's another indication of improved animal welfare,' says Ipema.

In this study, published in *Nature Scientific Reports*, she did not see the same improvement in leg health. 'That might be because in this study we wanted to simulate the conditions in commercial chick hatcheries, so we'd put more chicks together and they didn't have as much freedom to move around. This makes it clear that more research is needed before we can apply the finding on a commercial scale, where the chick density is often even higher.'

Nevertheless, Ipema thinks larvae can be a good addition to the diet of chicks in commercial barns. 'Those chicks often have nothing to do for six weeks. That changes when they go in search of larvae, which improves their welfare.'

At present the EU does not permit the addition of animal products to poultry feed, due to the risk of diseases. Insect protein or dead larvae cannot therefore be fed to chicks. 'You can feed them live larvae, because the legislation does not cover that.'

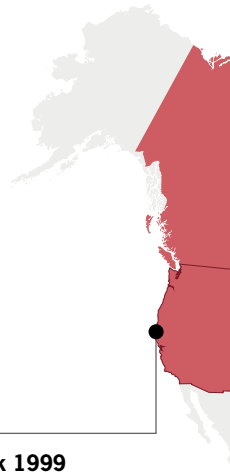
The PhD student has already had a few responses to her research. 'Amongst others, there was a farmer in Texas who was eager to try this.' She herself is going to research whether larvae could also be a sustainable source of feed for pigs, and whether that would improve the pigs' welfare too. ■

www.wur.eu/insects

CIRCULAR NUTRITION

Global demand for chicken is rising with the growth of the world population. This makes the quest for sustainable chickenfeed urgent. Larvae are potentially a sustainable and circular food source, Ipema and her colleagues believe. This is mainly because larvae are protein-rich and can be bred on manure, so that surplus manure can be converted into valuable protein. This is not yet allowed in the EU, partly because research needs to be done first to check that it doesn't raise the risk of diseases. Fellow researchers Alejandro Parodi and Imke de Boer are already investigating whether using larvae as a circular food source offers environmental benefits as well.

West Nile virus arrives in the Netherlands



New York 1999
The virus spread within four years from New York across the whole country. Now, 100 to 200 Americans die of it each year.

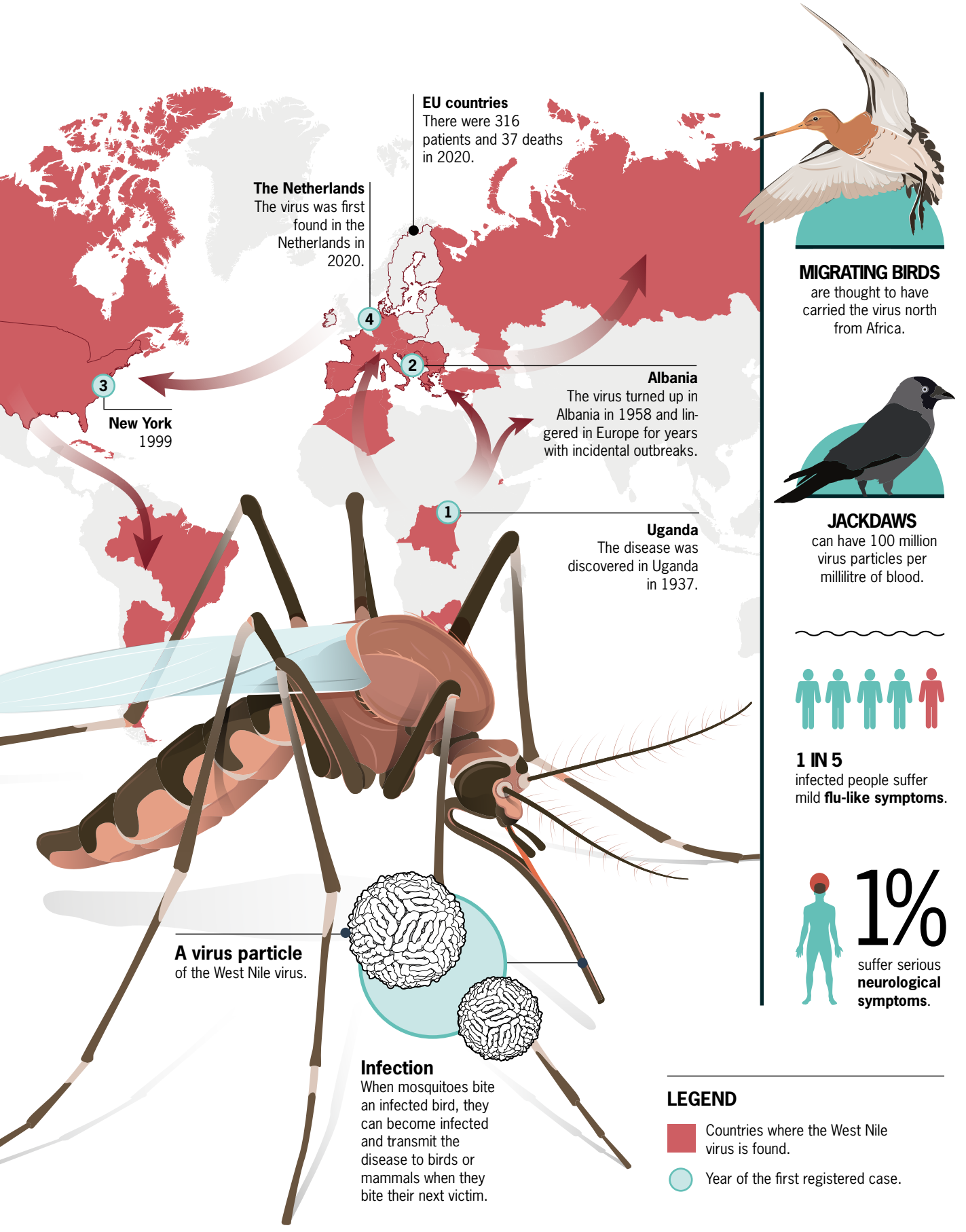
While we are preoccupied with the ravages of the coronavirus, the arrival of the West Nile virus in the Netherlands has gone almost unnoticed. Mosquitoes can transmit the virus to humans, some of whom become critically ill. Wageningen researchers are studying the spread of the new disease and designing vaccines.

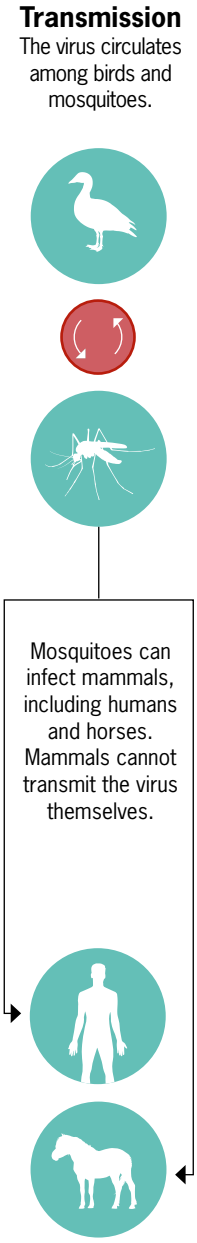
TEXT MARION DE BOO **INFOGRAPHIC** PIXELS&INKT

A pond in your back garden, a blocked gutter, a bird bath or a dish under a plant pot that is full of water: all these are breeding places for mosquitoes. That means the nuisance of nocturnal whining, and itching mosquito bites. But that is not all it means. Recently, some indigenous mosquitoes have proven to be infected with the originally African West Nile virus. In autumn 2020, for the first time seven Dutch people became seriously ill with this disease. 'I'm very worried about next summer,' says Gorben Pijlman of the Laboratory for Virology in Wageningen. Together with Sander Koenraadt of the Laboratory for Entomology, and with funding from the EU, he has been doing research for 10 years on how mosquitoes transmit various viral diseases. 'Seven patients might not sound like many, but no more than one per cent of people who get infected become seriously ill, so the number of infections is probably much higher. It is possible that about 1000 Dutch people were infected last year,' says Pijlman. 'It will be extremely difficult to stamp out the virus because it circulates in birds and mosquitoes – not creatures you can easily cull.' There are fluctuations in the incidence of the virus, however. These are partly a result of the increase in the number of mosquitoes in the summer. Infected birds that survive the disease have immunity, but when their young hatch out, the virus can circulate again.

MIGRATING BIRDS

It is thought that migrating birds originally carried the West Nile virus north. Koenraadt: 'When mosquitoes such as the common *Culex pipiens* bite an infected bird, they can become infected themselves and pass on the disease to the next human or animal they feed on.' Most people who contract the West Nile virus are not affected by it. One in five infected people get mild flu-like >


EU countries
There were 316 patients and 37 deaths in 2020.
The Netherlands
The virus was first found in the Netherlands in 2020.
4
2
3
New York
1999
Albania
The virus turned up in Albania in 1958 and lingered in Europe for years with incidental outbreaks.
1
Uganda
The disease was discovered in Uganda in 1937.
A virus particle
of the West Nile virus.
Infection
When mosquitoes bite an infected bird, they can become infected and transmit the disease to birds or mammals when they bite their next victim.
MIGRATING BIRDS
are thought to have carried the virus north from Africa.
JACKDAWS
can have 100 million virus particles per millilitre of blood.
1 IN 5
infected people suffer mild flu-like symptoms.
1%
suffer serious neurological symptoms.
LEGEND
Countries where the West Nile virus is found.
Year of the first registered case.



symptoms, such as feeling unwell, fever, headache, or muscle pain. But one per cent suffer serious neurological ailments, such as encephalitis or meningitis. These can be fatal, especially in the elderly and people with an immune disorder. Some people are left with permanent neurological damage.

The disease was discovered in Uganda in 1937, turned up in Albania in 1958 and lingered in Europe for years with incidental outbreaks. In 2018, 181 people died of the disease in southern Europe. In 2019, the European Centre for Disease Prevention and Control (ECDC) registered 410 patients and 50 deaths in the 27 EU countries; and in 2020, 316 patients and 37 deaths. The disease turned up in the US in 1999 and spread throughout the country from New York within four years. Now, between 100 and 200 Americans die of West Nile virus every year.

FAST SPREAD

Back in 2015, the Wageningen researchers proved that Dutch mosquitoes can transmit West Nile virus and warned hospitals to be alert to this when patients had symptoms such as fever and skin rashes. Now they are studying how the West Nile virus spreads, which species of mosquito are involved, and how the mosquitoes behave in relation to humans and birds.

The West Nile virus belongs to the family of flaviviruses, including dengue fever, yellow fever, the Zika virus, and the Usutu virus, which causes disease in blackbirds. Pijlman: 'In 2015, we predicted that the Usutu virus would reach our country, in 2016 the first blackbirds became sick, and in 2017 the disease had spread throughout the Netherlands. That suggests that the West Nile virus could spread equally fast.' Unlike the coronavirus, for instance, someone infected with the West Nile virus produces too few virus particles to pass on the disease. An infected human is an 'end host', as virologists call it. Transmission between humans is possible via blood donations, however, so blood banks started testing donor blood for this new disease last October. Anyone who has been to a region infected with West Nile virus cannot donate blood for a month. Organ donors are tested too.

> 'I'm very worried about next summer'

Pijlman: 'If a bird gets infected, the concentration of virus particles increases rapidly within a few days to a week. In jackdaws and crows, there can be up to 100 million virus particles per millilitre of blood.' Birds of prey and owls seem to be very susceptible too. At high concentrations it is very likely that mosquitoes that bite a sick bird will become infected themselves. Once the virus spreads from their stomach to their salivary glands, the mosquitoes can pass on the virus when they inject a tiny bit of saliva into the skin of their next victim. Koenraadt: 'We are investigating in the lab exactly how an infection by a mosquito like that happens, looking at things like the influence of the ambient temperature. Mosquitoes are cold-blooded animals and mosquito populations develop faster at high temperatures. But the virus develops faster in such conditions too. In a climate-controlled chamber, we saw that not many mosquitoes get infected at 18 degrees but at an ambient temperature above 25 degrees, about 30 per cent of the mosquitoes become infected and the virus multiplies much faster inside their bodies.'

The researchers are also placing mosquito traps in the field, looking for links between mosquito plagues and changes in the habitat, such as rewetting, the creation of new nature, urbanization or pesticide use. In reality, it actually turns out to be extremely difficult in practice to capture mosquitoes infected with West Nile virus, because even in large outbreaks of the disease, less than one per cent of the mosquitoes get infected.

VACCINES FROM THE COMPUTER

Meanwhile, the Wageningen experts have already developed several candidate vaccines which are being tested on mice this spring in collaboration with the Erasmus Medical Centre. Pijlman: 'We are working on a vaccine with live attenuated virus, just like the classic MMR vaccine for children against mumps, measles and rubella. We design the weakened virus on the computer. It does have to be able to multiply in the host so that it stimulates the host's immune system sufficiently, but it must no longer be pathogenic.'

Using the genetic code of the West Nile virus, the researchers tinker with their design for as long as it takes to programme the desired characteristics. Then they order the genetic code from a DNA synthesis company, and the virus genome is delivered to their door within a week. The researchers convert this to RNA, which is then introduced into insect or ape cells. These cells start producing the attenuated virus which can be used in a vaccine.

This is called synthetic virology. Pijlman: 'As far as I know, there is no vaccine of this type on the market yet.

> ‘We are working on a vaccine with live attenuated virus’

We hope our vaccine will provide long-lasting and maybe even lifelong protection, preferably with only one jab, just like the yellow fever vaccine.’

BED NETS AND WINDOW SCREENS

Meanwhile, the researchers recommend that people protect themselves during the mosquito season by using the insect deterrent DEET, wearing long sleeves and trousers in the evening, getting rid of stagnant water around the house, installing window screens and sleeping under a net.

Will there soon be West Nile virus infections on such a large scale that we will all be vaccinated against it? ‘Hard to say,’ says Pijlman. ‘It is still only a minor disease at present, even in the US, where a highly pathogenic variant of the virus is circulating. But besides the fatalities, there are also a lot of people every year who are left with long-term and sometimes permanent neurological damage. Some of those people may no longer be able to do their work properly. Altogether, the disease burden is considerable, and includes economic damage. So if you can design a vaccine relatively easily, why wouldn’t you do so? Why wait for a pandemic? If the results of animal testing are positive, our vaccine is ready to be taken further by a pharmaceutical company.

www.wur.eu/westnilevirus

VACCINES FOR HORSES

Horses are very vulnerable to the West Nile virus. In the US, about 15,000 horses had died from an infection with this virus by 2004. In that year, a vaccine for horses became available, which must be administered once a year. ‘Some horses in southern Europe have been infected with the West Nile virus too, but the disease has not yet been seen in horses in the Netherlands, although we’ve been expecting it here since the turn of the century,’ says Piet van Rijn, project leader for Viral Zoonoses and Insect-borne Veterinary Diseases at Wageningen Bioveterinary Research in Lelystad, and extraordinary professor at North-West University in Potchefstroom, South Africa.

‘We’ve been testing sick horses suspected of an infection with the West Nile virus for 10 years. And horses that are transported abroad are routinely tested for this viral disease,’ says Van Rijn. ‘It can be hard to diagnose sick horses correctly, because the symptoms of an infection with West Nile virus are very similar to those of other diseases, such as equine herpes.’

The vaccination rate of horses in the Netherlands is very low, says Van Rijn. ‘Leisure horse owners tend to think it’s too expensive. Commercial horse owners and breeders have been reluctant so far, or they only vaccinate very valuable horses. Now that the disease is moving northwards in Europe, after three successive hot summers with high night-time temperatures, people will become more aware of the risk of infection and might start vaccinating their horses.’

Velcro with little mush

Scientists have developed a material that sticks to a wide range of textiles without doing any damage. The work is done by miniscule 'mushrooms'. Inspiration for the design came from nature.

TEXT ROELOF KLEIS **PHOTOGRAPHY** ERIC SCHOLTEN

In the world of adhesives and fastenings there are various Velcro-like materials that work on the principle of mechanical adhesion, where two surfaces grip each other firmly. A disadvantage of such strong materials is that on removal, they can sometimes damage the surface they are stuck onto.

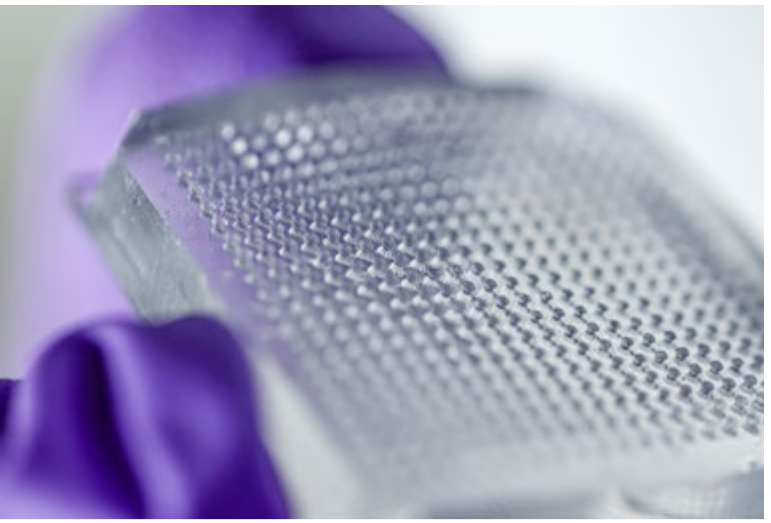
Researchers at the Wageningen chair groups Physical Chemistry and Soft Matter, and Bio-Nano Technology have come up with a solution, in collaboration with colleagues from Groningen. They found inspiration in nature's adhesive mechanisms. The gecko, for example, has a pattern of miniscule pillars under its feet, while in the plant kingdom, cleavers owe their name to tiny hooks on their leaves.

The researchers designed and studied several materials with such protrusions in different patterns, with a view to understanding the fundamental mechanisms underlying adhesion. That resulted in a flexible silicon rubber covered in miniscule mushroom-shaped pillars. When these 'mushrooms' touch rough pliable surfaces such as textiles, they attach themselves firmly by hooking onto the material's mesh. When they are pulled off again, the mushrooms release the fibres gently without damaging the material.

LESS STICKING POWER

The flexibility of the material prevents damage on removal, explains researcher Joshua Dijksman of Physical Chemistry and Soft Matter. 'The closer together the

rooms



Researcher Preeti Sharma demonstrates the sticking power of silicon rubber with mushroom-shaped protrusions.

mushrooms are, the better the adhesion,' he says, 'but at a higher density, the individual sticking power of the mushrooms goes down. And when you pull off a single mushroom, you pull off its neighbour too via the flexible surface. The mushrooms influence each other through the surface, communicating with each other.' This phenomenon creates scope for experimentation, says Dijksman. 'It gives you starting points for optimizing a product, depending on the goal of the adhesion.' With a newly developed measuring method, these forces can be measured in a standardized fashion. 'To change the degree of adhesion, you can alter the number of mushrooms or the hardness of the material.'

'To change the adhesiveness, you can alter the number of mushrooms'

The new material works well on rough surfaces. For smoother surfaces, experiments are being conducted with tiny suction cups instead of mushrooms. 'We are studying whether the communication principle applies there too,' says Dijksman.

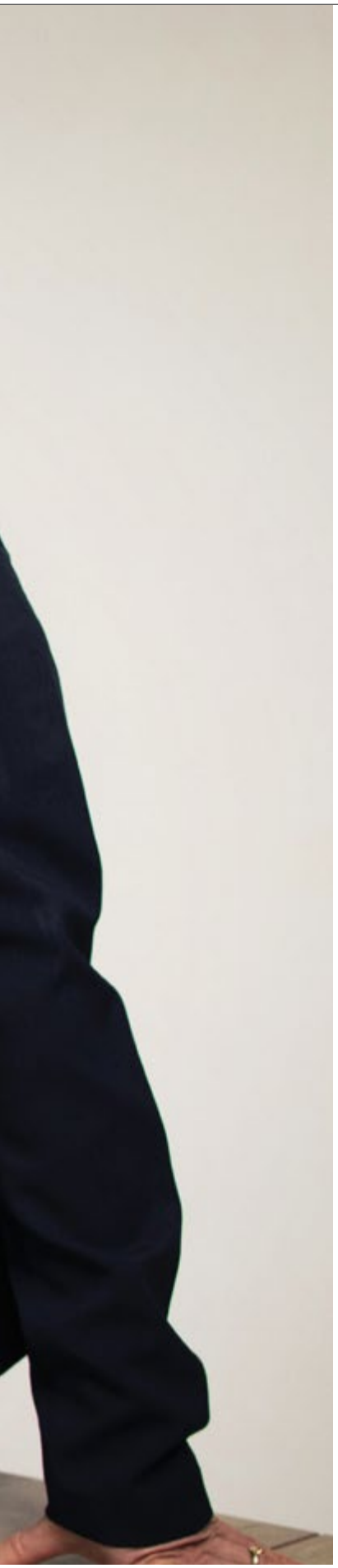
The production method for the soft 'Velcro' is new too. The cast used to produce the mushroom pattern is 3D-printed. It is then used to create a negative as the basis for a positive, using flexible silicon rubber. A patent for this method is pending.

The research is part of the Dutch 4TU Soft Robotics programme, which aims to produce flexible soft surfaces that can be used in robotics in contexts where a gentle touch is called for, such as in human interaction or in fruit-picking. The results were published in the scientific journal *Biointerphases*. ■

www.dutchsoftrobotics.nl

BIRGIT DE VOS:

‘Forced labour is used in the production of a lot of food’



Everyday products such as coffee, chocolate, sugar, and even fish and fruit leave a bad taste behind because of the likelihood that people have been exploited to produce them. Birgit de Vos studies human rights abuses in the food supply chain and helps companies find out what the risks of that are.

TEXT MARIANNE WILSCHUT **PHOTOGRAPHY** HARMEN DE JONG

Child labour, discrimination and exploitation are all in a day's work for Wageningen Economic Research scientist Birgit de Vos. As a social scientist, she studies labour conditions in the food supply chain in low-wage countries. She also represents WUR in The Sustainability Consortium, a global partnership on sustainability in the food supply chain between companies (such as Unilever and Walmart), NGOs and universities. Her recent achievements include Wageningen Humanity Views, an interactive world map which can show companies in which countries and sectors they run the risk of human rights abuses, such as modern slavery, child labour, and low wages in a specified supply chain.

I gather there's a lot of injustice on our plates. What goes wrong?

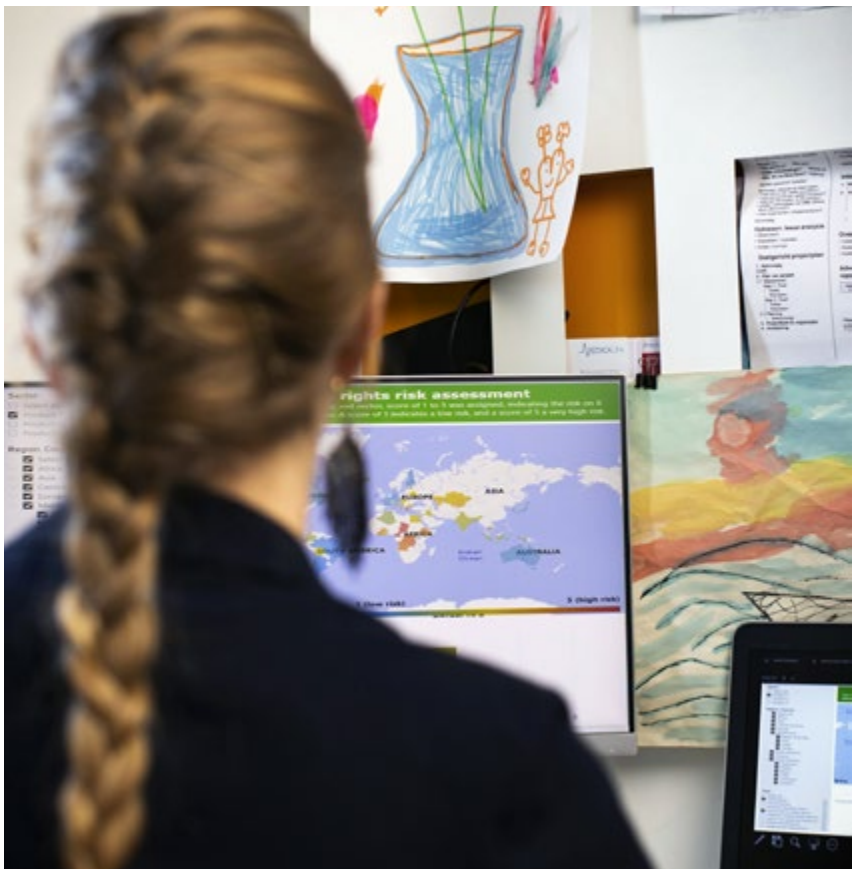
'Many of the products we consume daily, such as coffee, chocolate, nuts, spices, sugar, palm oil and rice, come from countries where there is a greater risk of the production involving child labour, or where matters such as safety, minimum wages, working hours and union rights are not regulated or are not well adhered to. And there are cases of forced labour – modern slavery. According to the United Nations' International Labour Organization, more than 16 million people are victims of forced labour in the private sector, including agriculture. It is expected that this problem has been worsened by the coronavirus crisis.'

Where are these problems concentrated?

'They are everywhere, from Africa and Asia to Latin America, and in south-eastern Europe as well. However, there are differences between countries and between sectors. Child labour is more common in the cocoa sector, for instance. In Ghana, 55 per cent of the small-scale cocoa farmers have to make use of their children's labour. In Ivory Coast, that figure is nearly 40 per cent. Most of those children work with pesticides, machetes and other dangerous tools without any protective clothing.

'In the coffee supply chain, indigenous communities in Latin America and Asia are at risk of being discriminated against, and there is forced labour. In most countries, women are paid less than men for the same work. Membership of an independent union is out of the question in countries such as China and Laos. And many countries have an official minimum wage, but often that doesn't apply to jobs in agriculture. Along with domestic work, manufacturing and construction, agriculture is one of the sectors where the risk of exploitation is greatest.' >

‘Agriculture is one of the sectors with a high risk of exploitation’



Researcher Birgit de Vos shows how the interactive tool Wageningen Humanity Views works.

Why do these abuses mainly occur in agriculture?

‘Agriculture is an informal sector, and a lot of children work on their parents’ land. It is also a labour-intensive sector in which not many labourers have a permanent contract. There is a lot of seasonal labour, for which mainly temporary workers, often internal and foreign migrants, are hired without a contract. They work long hours under dangerous conditions. For fear of being sacked or deported, these labourers just do what they are told. And many plantations are in remote areas, which makes it difficult to leave if you’re being exploited.’

And yet there are all sorts of fair-trade labels.

‘The countries where a lot of sustainability labels offer certification are those in which farmers and farm labourers are generally not protected or monitored by the local government. A certificate doesn’t change that overnight. To meet the label’s standards, farmers must invest, and those investments are often too high for them, and not feasible. Another point is that even with the certificate, companies often pay hardly any more for the product. Farmers try and negotiate a higher price, but they come off worst. A certificate might give you a purchase guarantee for the future, but if you need food on your plate tomorrow, you will benefit more from a higher price, access to supportive credit conditions, and health insurance.’

Is it all gloom and doom?

‘There are companies that are prepared to pay the farmers a premium themselves. One example is Tony Chocolonely. On the whole, companies with a shorter supply chain and a single type of product, such as chocolate, coffee or bananas, are more willing to pay extra. For companies with many products and middlemen, a higher price is not often on the table because of the competitive market in which they operate. Sadly, I still see a lot of gesture politics there, and yet those kinds of companies could have a big impact. They join a round table or sign an agreement and carry out a few pilot projects here or there, but it’s a drop in the ocean. For example, Unilever recently made a statement about a living wage for all the direct suppliers in its chain. That sounds great, but it is essential that it includes indirect suppliers too, as they are often the poorest and most vulnerable, such as small-scale farmers and agricultural labourers.

‘Reducing the risk of modern slavery in the supply chain starts with knowing who all the suppliers are, including the subcontractors. Many companies have no idea exactly what goes on further down the chain, and sometimes local companies withhold information about labour conditions.´

Does your Wageningen Humanity Views make a supply chain more transparent?

‘Absolutely. You can no longer hide behind the argument, “I buy through a trader and whatever went on with the product before that is not my business”. The tool that

> ‘I still see a lot of gesture politics in companies’

my colleagues at Wageningen Economic Research and I have developed is an interactive world map on which users can click on countries and products. It is an instrument for companies that makes it clear where problems with human rights occur along the production chain. It is a risk analysis, and we give a score of between one and five per country and per sector. Five is the worst score. We also distinguish between regions. In Brazil, India and Mexico, for example, there are big differences between regions in terms of decent labour conditions. We end up with an overall score that companies can use to see where child labour, modern slavery or discrimination take place. Once a company knows where the big risks lie, it can set up targeted programmes to reduce them. Or it might decide to change its sourcing policy. This tool makes it easier to set priorities.’

Have companies shown any interest yet?
‘We developed the scan and it was implemented for Olam, a major international player in the cultivation, trading and processing of agricultural products. But it could be used more broadly by companies, governments and NGOs, in fact by anyone who purchases coffee, cocoa, sugar, nuts, rubber, rice, cotton, dairy produce, chicken, timber and palm oil. Currently we have assessed more than 30 countries, and in future we aim to expand both the number of countries and the number of products.’

So this problem arises mainly in the agriculture and food sector, supremely Wageningen themes. Does Wageningen pay enough attention to human rights?
‘There is some action, but still not very much. My colleague Yuca Waarts, for example, does research on the living wage and incomes in developing countries. Nadia Bernaz, who works in the department of Social Sciences, studies international legislation in the field of labour law. And the Centre for Development Innovation does research on themes such as gender and youth. I’m also in a WUR-wide working group, which includes colleagues from Facilities and Services, looking at how we can make sure that WUR does not itself make use of modern slavery. You have to think in terms of the sourcing of fair-trade lab coats, electronics and food. That is the least we can do. Wageningen claims to stand for sustainability, but that is expressed primarily in research on boosting production and making it more efficient, responsible pesticide use, and combatting deforestation and food waste. There is not much attention to labour conditions, whereas human rights are surely very important if you’re talking about sustainability in agriculture.’

There are international rules for the safety of food and toys coming from non-Western countries. Does the will exist among companies and government bodies to really do something about child labour and social exploitation?
‘A lot of companies stay stuck at the level of philanthropy. And governments rely too heavily on voluntary agreements with companies. The success we’ve seen in establishing rules for food safety is because that affects the consumer directly. Companies and governments are afraid of food scandals, so you don’t want customers getting sick. But that the same consumer eats chocolate produced with child labour is no concern of theirs. Luckily there are more and more websites and apps with which consumers can find out what their brand does to prevent modern slavery and child labour. Tony Chocolonely is now the most popular brand of chocolate bars in the Netherlands, so the demand is real.’

Is your tool suitable for consumers as well?
‘Not at present, but my colleagues and I would like to develop something like it for the social impact of food products.’ ■

www.wur.eu/livelihood

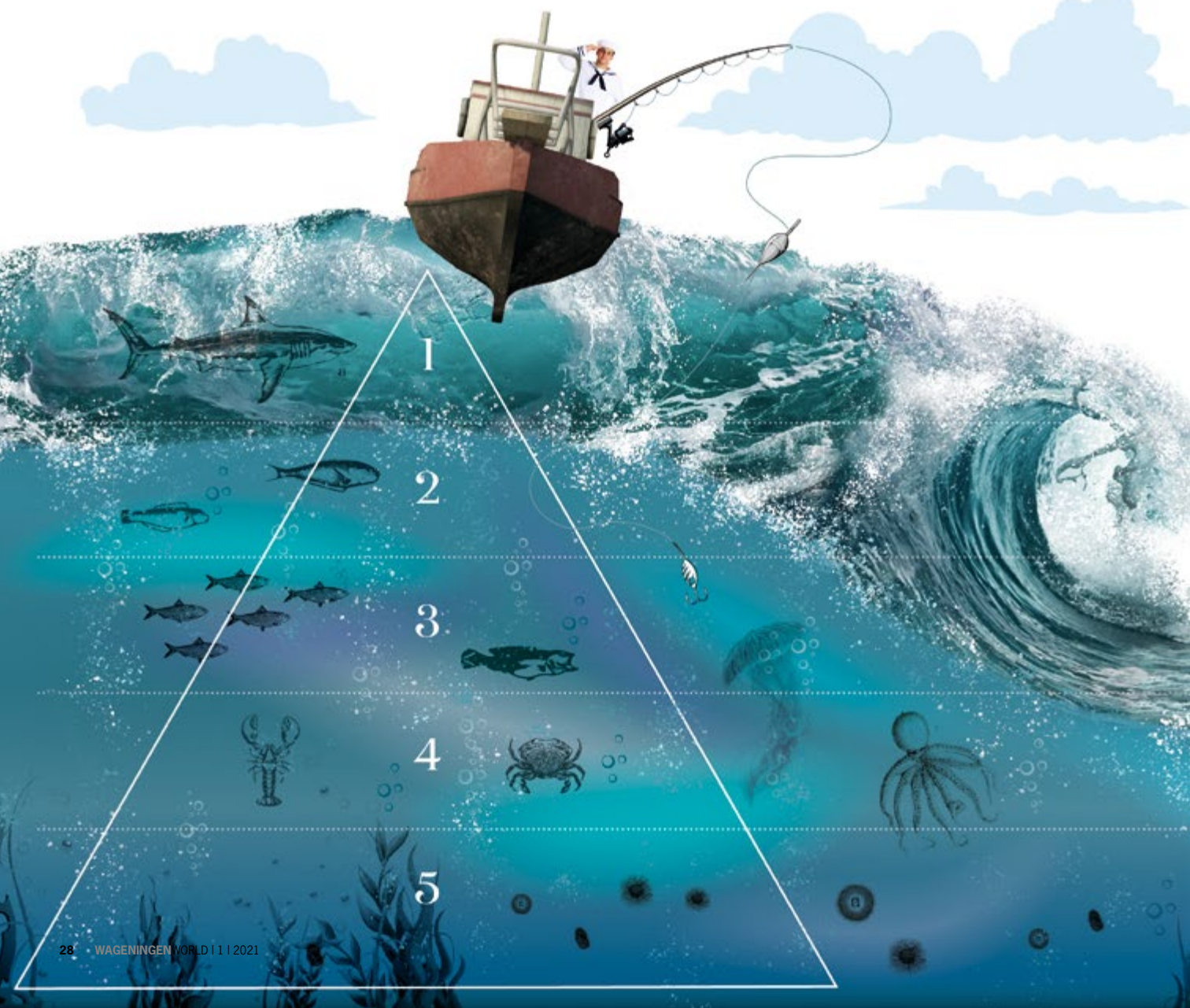
WAGENINGEN HUMANITY VIEWS

Wageningen Humanity Views is an interactive world map that reveals in which supply chains of products such as coffee, nuts, rice, timber and palm oil there is a risk of human rights abuses. Per product, the user can choose between one or more countries and eight types of human rights abuse, such as child labour, modern slavery or discrimination. The tool gives a score from 1 to 5 for each country and sector, with 5 as the worst score. The tool, which was developed by Wageningen Economic Research, is based on a large number of publicly available data sources that have been validated or adapted by means of a detailed literature study.

Food from the sea won

There are high hopes for the production of food in the sea. But its potential is limited, argues theoretical biologist Jaap van der Meer. 'We are already reaching the limits. There is not much more to be gained from it.'

TEXT NIENKE BEINTEMA **ILLUSTRATION** KAY COENEN



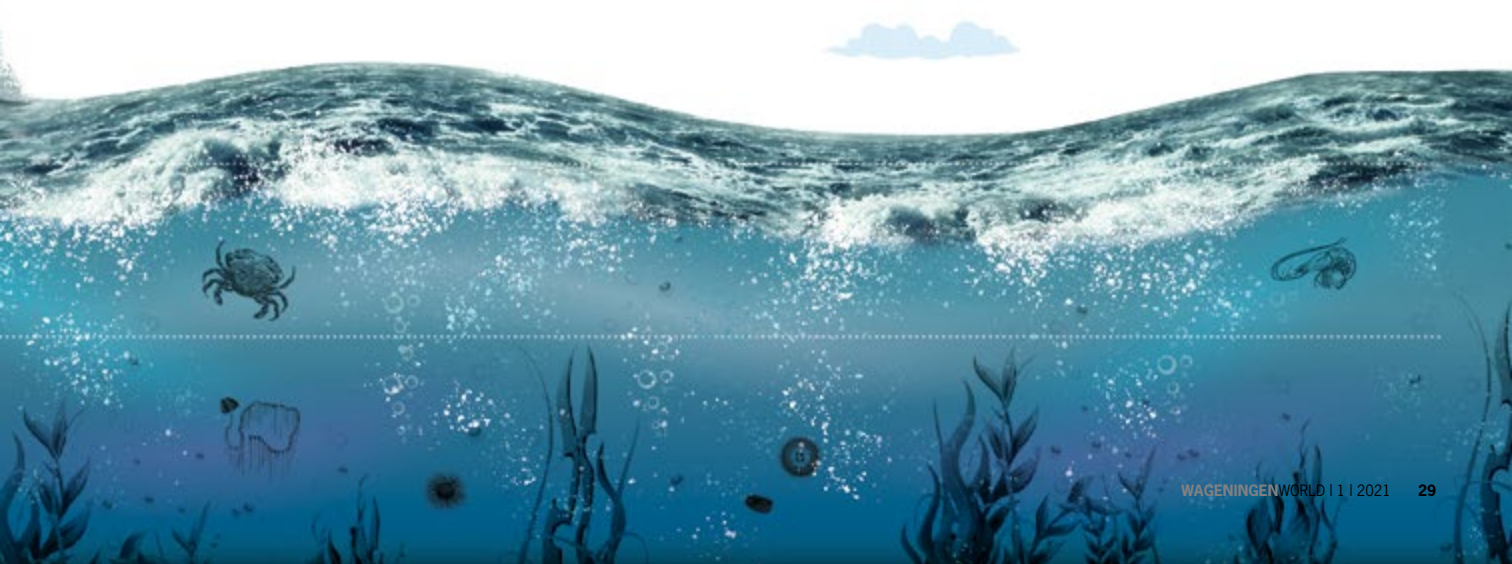
't feed many mouths

The challenge of feeding the growing world population is getting bigger all the time. Perhaps, suggest parties including the FAO, the European Commission, and scientists from Wageningen, we should look for the solution less on land and more at sea. The oceans cover about 70 per cent of the earth's surface but provide only one to two per cent of our food. That could be improved on, say proponents of the concept of 'Blue Growth', by means including developing more efficient mariculture – growing food in the sea.
'Unfortunately, it is not as easy as that,' says Jaap van der Meer, a researcher at Wageningen Marine Research and extraordinary professor of Sustainable Marine Food Production. In December he published a paper in the journal *Nature Food* which drew a lot of interest. 'The models we use are based on the available surface for mariculture, and not on the available nutrients or on the food pyramid in the sea.'
Van der Meer, who is also professor of Animal Ecology at VU University Amsterdam, is a theoretical biologist. He specializes in calculating the energy budgets of organisms and their populations. 'For the past 10 years, a lot of stories have been circulating about the potential of Blue Growth,' he says. 'But I began to wonder whether it was actually feasible. It turned out that no one had really done any calculations on it. That's why a great journal such as *Nature Food* was interested.'

FEW NUTRIENTS

The sea is a habitat full of contrasts. On the one hand, its primary production – the production of plant biomass – per surface unit is much lower than that of land. That is because seawater contains relatively few nutrients. 'In terms of nutrients you can compare large parts of the oceans with a desert,' states Van der Meer.
On the other hand, the efficiency with which that primary production is converted into animal biomass is much higher at sea than on land. On land, only 0.1 percent of plant matter ends up inside herbivores. 'In a forest, most of the biomass consists of trees,' explains Van der Meer, 'and they end up rotting on the forest floor. The main beneficiaries are fungi and bacteria, which hardly ever end up at the higher end of the food chain themselves.' Most of the plant biomass at sea consists of algae, about six per cent of which gets converted into the biomass of herbivores. That is still a low percentage, but it is 60 times higher than that on land. So the sea is a much more efficient production system than the land. Why is it, then, that at sea we got stuck at the hunter-gatherer stage – fishing wild schools of fish – whereas on land we have been domesticating plants and animals for thousands of years? 'The problem with that production at sea,' answers Van der Meer, 'is that the lowest two levels of the food pyramid, the plants and the herbivores, consist largely of single-cell algae and animal plankton that is no more than half a millimetre in size. We can't harvest those at all, not even with special nets. It would cost far too much energy to drag such nets through the water.'
So at sea, continues Van der Meer, we are left with the higher end of the food chain. Seals and whales form only a small niche; our main source of marine food is fish, which constitutes only a tiny proportion of the sea's food production. This is >

> 'In terms of fertility, the oceans are comparable to a desert'



because at each step along the food chain in the sea, 94 per cent of the energy gets lost, so after four or five steps, very little is left.

EATING SEAWEED

But what about larger seaweeds? Couldn't we eat a lot more of those? 'You rarely find those large varieties of seaweed out on the open sea,' answers Van der Meer. 'It only grows in a very narrow coastal zone, because seaweed has to attach itself to the seabed.' It is possible to grow them on the open sea, using floating installations for example. 'But that technique never really got off the ground,' says Van der Meer. 'It is expensive and technically difficult, which also makes it less feasible for poor countries. This is not something you can start rolling out on a large scale. What is more, large varieties of seaweed are difficult to harvest and they rot fast if you don't dry them straightaway. That makes them unsuitable as a staple food.'

But even in coastal seas such as the North Sea, only a limited number of mouths could be fed with seaweed, according to Van der Meer. 'There too, the limiting factor is nutrients. Even if you were to convert all the available nitrogen and phosphorus into seaweed, leaving nothing for other organisms, you would only have a very small yield per surface unit. Particularly in comparison with a crop like sugar beets.'

Fertilization is not an option. For one thing, it would change the balance of the different algae. 'We know from experience that that often benefits inedible species,' says Van der Meer. 'Species that contain a lot of defensive chemicals, for instance. You see this in coastal water that is polluted with wastewater too.' A further issue is that a lot of the nutrients you could use as fertilizer in the coastal zone end up in the soil. 'That's not the way to use scarce phosphorus. According to the forecasts, in 40 to 400 years we will have exhausted the phosphorus supplies. That is already a massive problem on land. So you're not going to start pouring that phosphorus into the sea as well.'

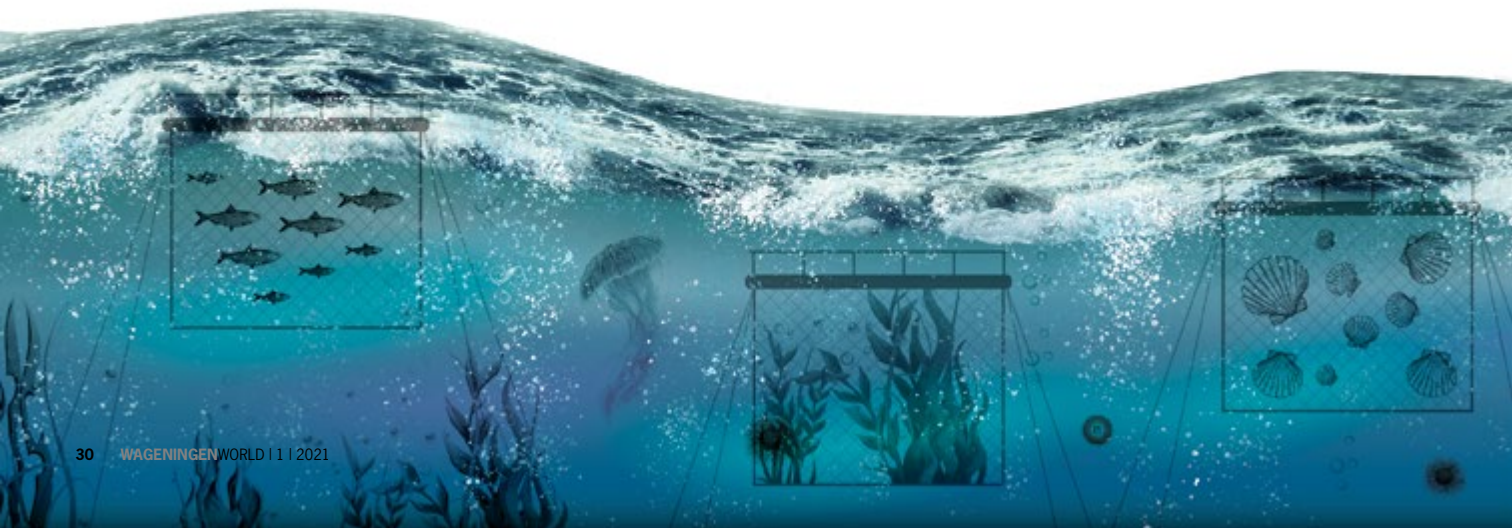
> **'You could farm seaweed on a vast scale in the South China Sea, thanks to the nutrient surplus'**

FARMING PREDATORY FISH

We are seeing another phenomenon in the coastal zone: the farming of predatory fish such as salmon in open-net pens. The salmon eat pellets that contain fish meal and fish oil that come from the sea. This form of agriculture is therefore no solution to the global food problem, according to Van der Meer. The fact is, we cannot expect to get more out of the marine system as a whole than we do already. To illustrate that, he makes the comparison with agriculture. The main advantage of livestock farming on land is that it provides a way of coping with scarcity in winter, which in nature is a limiting factor for the survival of mammals. Over the centuries, farmers have achieved this by replacing inefficient forests with grasslands on which they grow crops in the summer that they store for the winter. 'Like that, the natural efficiency with which plants are converted into animals gets boosted on land from 0.1 per cent to one per cent,' says Van der Meer. 'Ten times as much but still much less than the six per cent you get at sea.'

But what if you gave the salmon in those cages food that came from the land, like soya? 'That switch has indeed been made, but I don't call that marine production anymore,' answers Van der Meer. 'That is going back to a land-based system, using resources that are already scarce on land, and which bring their own problems with them. If you use soya, you might as well feed it to chickens. That's just as productive.'

So the conclusion is that because the efficiency at sea is already so high, there are few opportunities there for farming predatory



fish. Van der Meer: 'The best option then is to harvest lower down the food pyramid and catch or farm only herbivorous fish such as mullet. But they don't eat single-cell algae either. They eat plants growing on seaweed and rocks, dead plant matter and excreta – which are limited food sources too. What is more, the North Sea is too cold for them in winter.'

If you want to farm at sea, Van de Meer thinks the best bet is shellfish farming. Shellfish are low in the food chain but are very nutritious. Space is scarce in the coastal zone, while further offshore the costs and the technology are the limiting factors. 'You find the odd pilot project here or there, driven by subsidies. For example, the shellfish farming using floating constructions in the Voordelta, the shallow band of North Sea beyond the southwest delta. But those projects are not going to feed the world either.'

So should we bin the concept of Blue Growth? That's not the answer either, responds Marnix Poelman, Blue Growth team leader at Wageningen Marine Research. 'Let me start by saying that I agree with Jaap's viewpoint,' he says, 'certainly on the main points. But the question is: what do you do about it then? He thinks mainly on a global level. We try and look at it at a smaller scale. We can see that the agricultural pressure on land is too high. If that's the case, how can you establish production at sea at specific locations, that could be appropriate and complimentary?'

'Phosphorus is scarce so you don't just throw it in the sea'

CARBON SEQUESTRATION

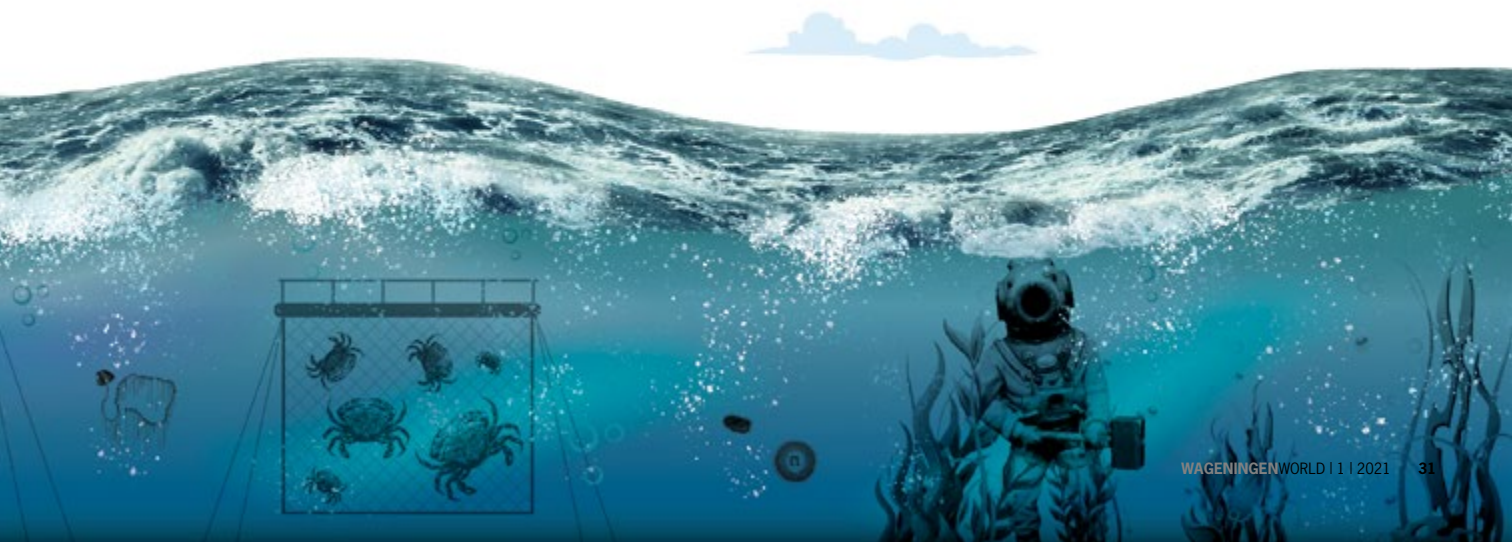
According to Poelman, there really are places where mariculture is feasible and of use. 'We should also consider other functions besides supplying food,' he comments, 'such as carbon sequestration and nutrient recycling in places where the marine environment has been disturbed. In the South China Sea, for example, you could farm seaweed on a vast scale thanks to the nutrient surplus there. This is already being done in Denmark on a smaller scale.'

Marine production could also contribute to making farming systems more efficient. Cows that eat seaweed-based products emit less methane, for example. Seaweed extracts make crops more resilient in the face of salt stress. And adding shellfish to fish feed improves the health of farmed fish. 'Applied research is being done on the use of such organisms from low in the food chain in a circular food system,' says Poelman. 'There truly is scope for marine farming in places where there are plenty of nutrients in the water, but we must go about it very carefully, take a very good look at the consequences for the whole system, and integrate the full picture into our decisions. In the North Sea, for example, you could never create a 10,000 square kilometre shellfish and seaweed farm, which was once the ambition. We've already scaled that down to 500 square kilometres. But we mustn't throw out the baby with the bath water: there are limits but there are definitely opportunities too.'

Van der Meer agrees. 'I'm not saying nothing can be done, just that we do need to keep a critical eye open. Blue Growth has become a kind of hype in recent years, and I'm trying to put that in perspective.' ■

www.wur.eu/limits-marine-food-production

JAAP VAN DER MEER, a researcher at Wageningen Marine Research and extraordinary professor of Sustainable Marine Food Production



Capturing a lot more mosquitoes

Florian Muijres studies flight movement, including that of insects. He put this fundamental science to use for improving a mosquito trap. Henry Fairbairn helped work on those improvements as a student at Delft University of Technology and is now launching the resulting new trap on the African market. He hopes this will contribute to the fight against malaria.

TEXT KOEN JANSSEN

Near the shore of the vast Lake Victoria lies the Kenyan island of Rusinga, where Wageningen researchers have for many years done research on the effectiveness of mosquito traps that make use of aroma baits rather than chemical pesticides. The results were promising: in one and a half years, malaria infections went down by 30 per cent. But there was still room for improvement. Florian Muijres used high-speed cameras to study the movements of insects around the trap. He found out that the vast majority of the mosquitoes that approached the trap flew off again. Ultimately, only three per cent of the mosquitoes were lured into the trap.

Muijres works in Wageningen's Experimental Zoology chair group, and uses cameras to study the flight movements of mosquitoes, fruit flies, birds and bats. In 2020, the Dutch Research Council (NWO) awarded him a Vidi grant of 800,000 euros for his research on two-winged insects. He gets three-dimensional footage of the flight movements of the insects using two sets of high-speed cameras, the more advanced of which can film 13,500 frames per second. This enables the research team to measure precisely how a wing moves. 'Mosquitoes create a kind of mini-tornado above their wing, which makes them fast and agile. In terms of aerodynamics, that wing movement is very interesting,' says Muijres. So this is fundamental research, but it is of importance for catching mosquitoes as well. 'How close do they get to the trap? And at what distance can they no longer escape? By understanding their flight mechanism, you can help in the effort to combat mosquitoes.'

THE SMELL OF SWEAT

With the camera images in mind, Muijres, PhD student Antoine Cribellier and other researchers from Wageningen and Delft

Universities set to work on improving the mosquito trap. In their search for victims, mosquitoes seek out the smell of sweat. Mosquito traps are geared to this and spread synthetic human aromas via a ventilator. As the insects get closer to their goal, however, they start to seek heat and humidity as well. So the researchers wondered if their trap would work better if it were able to generate more heat and moisture? 'We bumped up the temperature and humidity, and then we studied the effects,' says Muijres. 'That proved to be spot on.'

The MTego ('trap' in Swahili), as the trap is called, captured over four times more mosquitoes than the older model. Raising the temperature made the most difference: the camera images showed that the mosquitoes stayed in the vicinity for longer because of the heat, and came so close they could no longer get away and were sucked into the trap by a suction fan. The researchers published their findings in the *Malaria Journal* on 7 October 2020.

As a student on this project at Delft University, Henry Fairbairn worked on nine successive prototypes, and thought about how to make the trap accessible by making sure it was cheap and did not use too much electricity. This was where the combination of Wageningen entomological expertise and Fairbairn's technical know-how came into its own, says Muijres: 'Students of Industrial Design make actual products: water boilers, drills, cars. That's the kind of people you need.' Fairbairn: 'I hadn't done any biology since I was 17, and suddenly now I was surrounded by top scientists in that field. It was a mind-blowing experience.'

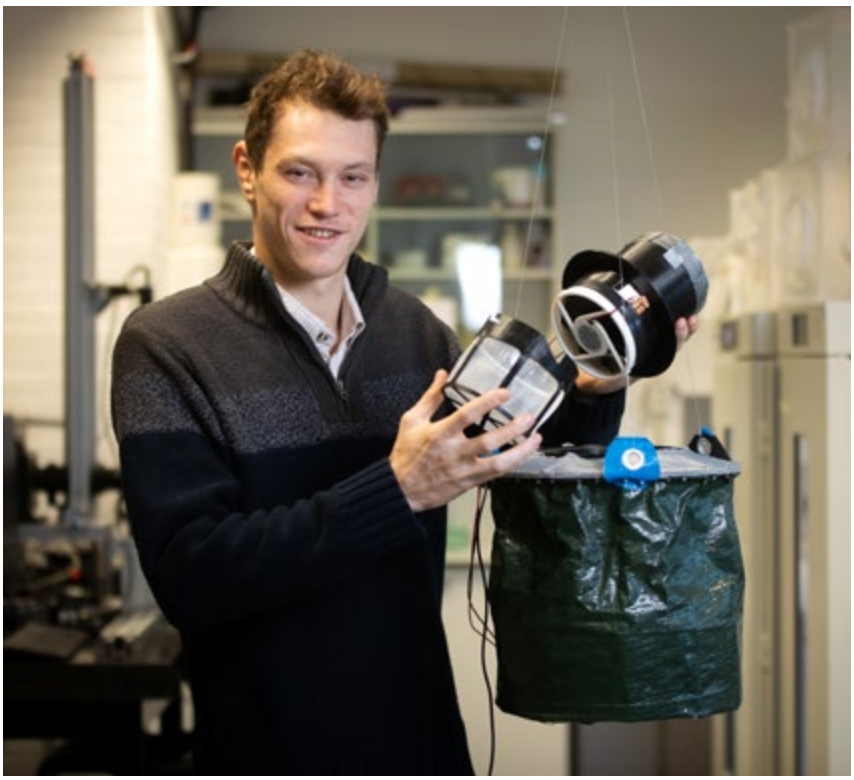


PHOTO SVEN MENSCHEL

Henry Fairbairn worked on nine successive prototypes of the mosquito trap.

> 'In terms of aerodynamics, the wing movement is very interesting'

ON THE AFRICAN MARKET

Besides mosquitoes, the mosquito trap captured Fairbairn's interest too. After graduating, he decided to set up a startup to market the MTego in Africa. To that end, he links up with existing distribution channels for solar panels. There are advantages to that: sales of solar panels for domestic use have really taken off in Africa in recent years, and MTego needs electricity to keep the suction fan going. Fairbairn called his startup PreMal, short for Preventing Malaria.

Mosquito traps are an important weapon in the battle against malaria. This disease is a stealth killer: according to the World Health Organization, more than 400,000 people die of malaria every year. Florian Muijres: 'That figure is comparable with the number of Europeans who died of the coronavirus in 2020. And that goes on year in, year out, and it includes young children. Just imagine if the coronavirus killed children! The scale of the problem is still gigantic.' So he is delighted that his ex-student is applying his knowledge for practical purposes. 'This is actually quite fundamental research. How wonderful that it might well save lives.' ■

www.wur.eu/malaria

EVALUATING VEGETABLE OIL

‘Palm oil’s image is very one-sided’

The world population consumes 205 million tons of vegetable oil per year, and that amount will increase by about 50 per cent by 2050. How are we going to produce such enormous quantities sustainably? Simply avoiding the much-criticized palm oil is not the solution, shows a review study. ‘We’ve really got to take a closer look at the impact of other oil crops.’

TEXT ARNO VAN ’T HOOG **PHOTO** GETTY **INFOGRAPHIC** STEFFIE PADMOS

‘There are far more hectares of peanuts and soya than of oil palms’

In Europe we consume about 25 litres of vegetable oil per person per year, 80 per cent of which comes from three crops: oil palm, soya and oilseed rape. We consume most of this oil almost without noticing it in cookies, breakfast cereals, chocolate paste and margarine. The rest of the oil we consume, such as sunflower and olive oil in the kitchen, adds up to less than 20 per cent of the total.

Of all the vegetable oils in use today, one source has been subject to discussion for years: the oil palm, which is at the top of the consumption statistics. This palm variety, which originates from tropical Africa, is a relatively easy crop that grows well on poor soils where other plants require artificial fertilizer and irrigation. Since the 1980s, the oil palm has spread fast through the tropics, becoming the world’s biggest oil crop. Production has tripled since 1980, and 40 per cent of the world’s vegetable oil now comes from oil palm plantations.

That expansion happened at the expense of tropical rainforest, especially in Borneo and Sumatra, where more than 90 per cent of the world’s oil palms are found: 19.5 million hectares, approximately five times the land surface of the Netherlands. Publicity and campaigns by nature and environmental organizations drawing attention to the problems this has caused have given palm oil an extremely negative image. In particular, the link between the planting of plantations, deforestation, and the disappearance of the endangered orangutan has inspired calls to avoid palm oil altogether or to boycott palm oil that is not sustainably produced. That social pressure has prompted No Deforestation declarations by a growing number of palm oil producers.

DOUGLAS SHEIL,
a professor of Forest Ecology and Forest Management in Wageningen

ILLEGAL DEFORESTATION

‘At some point, oil palm production was growing so fast that it became one of the main drivers of large-scale illegal deforestation, especially in Borneo,’ says Douglas Sheil, who became professor of Forest Ecology and Forest Management at Wageningen on 1 January. ‘That was a very harmful development, but not all producers or all countries are guilty of it. There are good guys and bad guys. If you boycott palm oil, you also affect the group that is operating legally, doesn’t cause any deforestation, and gives local communities opportunities for development.’

Research into compromises between nature conservation and human use is the theme running through Sheil’s scientific work. He was doing research 20 years ago on the preservation of biodiversity after selective felling of trees, as a strategy for protecting forests against clearcutting. ‘Tree felling and nature conservation was seen at the time as absolutely incompatible, whereas well-organized, selective felling is a much better option than deforestation.’

There is a similar polarization now around palm oil, says Sheil. ‘There is real cause for concern about tropical rainforests, but the image of palm oil in Europe is extremely one-sided. You get a different perspective on palm oil production if you do research locally, to the one you get from Europe if you are fed exclusively on pictures of clearcutting and orphaned baby orangutans.’

In December last year, Sheil and a team of 25 fellow researchers published a review in *Nature Plants* of the environmental impact of palm oil production. Dozens of previous studies were collated and analysed, and a comparison was made with what is known about the impact of other oil crops. The paper shows that between 1972 and 2015, 46 per cent of the new palm oil plantations were carved out of forest areas, while existing fields, meadows or previously cleared woodland were used for the rest. There is also a big difference between the large-scale creation of plantations by companies and that of small plantations managed by local farmers, which account for about 30 per cent of the entire surface.

Tropical rainforest is extremely rich in species, and it is logical that creating plantations causes a big drop in biodiversity. The number of plant species on plantations is 99 per cent lower on average, while the number of animal species falls by between 47 and 90 per cent. But there are big differences between countries, which depend largely on the presence of leftover patches of forest near plantations, and the amount of undergrowth under the palms. Some palm oil regions are still home to dozens of bird and animal species.

HABITAT FOR ORANGUTANS

‘Oil palm plantations are not a good habitat for orangutans, but they can live in the little patches of forest between the plantations,’ says Erik Meijaard of the University of Kent, >

VEGETABLE OIL

Consumption

205 million tons of vegetable oil are consumed per year.

That is expected to increase by 50% by 2050, to **310** million tons.

In Europe we eat about 25 litres of vegetable oil per person per year.

80% of our oil comes from three crops: oil palm, soya and oilseed rape. We eat much of it without noticing it in cookies, breakfast cereals, chocolate paste and margarine.

Oil palm

Land required for 1 ton of oil: **0.26** hectares

Land surface in use: **22.5** million hectares

Annual production: **84.8** million tons

Oilseed rape

Land required for 1 ton of oil: **1.25** hectares

Land surface in use: **35.5** million hectares

Annual production: **27.4** million tons

Soya

Land required for 1 ton of oil: **2.0** hectares

Land surface in use: **123.9** million hectares

Annual production: **57.2** million tons

Biodiversity

Oil palm, with crop cycles of 25 years, is grown in areas with large numbers of plant and animal species, many of which are threatened with extinction.

Oil production with annual crops such as soya and oilseed rape takes place in regions with fewer endangered species.

Wealth of species*

Oil palm **472**

Oilseed rape **227**

Soya **278**

** The number of species of amphibians, mammals and birds on the IUCN's Red List found in the area where the oil crop is grown*

> ‘If you don’t know anything, making decisions is quite dangerous’

one of Sheil’s co-authors and a frequent research collaborator over the years. Meijaard has published 30 articles about the developments threatening the orangutan. In 1997, he discovered a new orangutan species (*Pongo tapanuliensis*) in the forests of North Sumatra, and has spent years campaigning against the construction of a dam there that is a threat to this rare species. ‘The population is in decline everywhere, and the main factor is hunting. The orangutan disappeared decades ago in many parts of Sumatra, and yet the forest is still standing. Felling and plantations have barely played a role there. In places like Malaysia where orangutans are not shot at, they can survive and raise their young in the remaining forested areas between the plantations, even if the conditions are less than ideal.’

After his studies in Wageningen, Meijaard left for Indonesia in the 1990s and has worked there almost continuously ever since, both in academia and for companies and nature conservation organizations.

ERIK MEIJAARD,
Honorary professor of Conservation Science at the University of Kent and chair of the IUCN’s Oil Palm Task Force

Since 2017, he has chaired the Oil Palm Task Force of the International Union for Conservation of Nature (IUCN).

BLIND SPOT

According to Meijaard, all the public interest in palm oil has stimulated research enormously. We know where oil palms grow, what lives there, the ecological consequences, and the impact on poverty and social inequality. At the same time, there exists quite a blind spot regarding other crops. Take peanut and soya farming, for example. Species diversity on these farms may well be lower than on an oil palm plantation, while pesticide use may be higher, says Meijaard. There have been studies of deforestation at the local level but we are far from having the full picture.

Meijaard: ‘There are far more hectares of peanuts and soya in the world than of oil palms, but you can’t find a single study that tells you about their global effects on deforestation. If you don’t know anything, and yet you start taking decisions, that is quite dangerous. Because you might have the wrong end of the stick. We simply must take a much closer look at the impact of other oil crops.’

In spite of palm oil’s 40 per cent share in our oil consumption, the total surface used for it is one fifth of the 100 million hectares used to grow soya. Oil palms produce the biggest yield per hectare of any oil crop. Soya, however, is mainly used for livestock feed, and soya oil is a by-product, says Meijaard. ‘That soya serves more than one purpose is often used to invalidate comparisons, but the fact is there is a rising demand for vegetable oil, and all the sources are fairly interchangeable. So if global demand increases, production needs to go up. And then you have to decide which crops that should come from.’

According to Meijaard, forecasts suggest an increase by 105 million tons of vegetable oil to 310 million in 2050. ‘That oil has got to come from somewhere. Per hectare, palm oil produces a lot more oil than any other crop. You should take that into account. Because one of the scarce resources is agricultural land, which is needed for all crops. The question is where the balance lies, but the same goes for all food crops. People who worry about palm oil should actually stop drinking coffee and eating chocolate. They’re all in the same category so the question is how you can produce them in the best possible way. What we are actually saying in the review article is that we just don’t really know that yet.’

According to Meijaard, we have a general idea of where oil crops grow, but there has been hardly any research on the expansion of the area devoted to them over the past 20 to 30 years, and the local impact on nature. Meijaard divides his time between Brunei and Crete, a Greek island with a lot of olive trees. Olives are another oil crop that we don’t know much about, he says.

BIRDS KILLED

in 2019, Spanish researchers came out with the shocking estimate that the night-time harvesting of olives in Andalusia costs 2.6 million birds their lives every year. The birds are vacuumed up out of the trees in the dark while they rest there. ‘Spain is currently the biggest olive producer. Olive cultivation and processing on that large scale only developed after Spain joined the EU in 1986. The expansion is relatively modest compared with the palm oil industry, but there are parallels. There is very little undergrowth in olive plantations, the ground between the trees is ploughed, and there is very little space for nature. But all this has hardly been studied.’

The coconut palm is another oil crop with an unproblematic image, whereas the crea-

tion of plantations on some tropical islands has put pressure on various rare endemic species. But just like olive oil, coconut oil evokes green associations. 'Some of that is justified, and some of it is marketing,' says Meijaard. 'The same as with palm oil, but there the marketing is mainly negative. In all these discussions we'd like to see more nuance, more data and ultimately, a policy that benefits sustainability.'

NO POVERTY

Which source of oil to prioritize is not an easy question to answer at the moment. More research is needed on other sources of oil. The choice is complicated by the fact that it's not just about biodiversity and the environment, but also about the United Nations Sustainable Development Goals. No poverty, no hunger and good health are the top three on that list.

Meijaard: 'I once did ecological research in Papua. I had never seen such poverty, and I was shocked. People live in the forest, there are no roads, no electricity, nothing. The children have swollen bellies from malnutrition, and people are sick. That is not a pretty picture. What is to be done? I'm not saying: just put an oil palm plantation there and everything will be alright. We know it doesn't work like that, because there is social injustice around large oil palm plantations as well. But it does provide incomes and economic development, so you do need to look at that bigger picture.'

'People in Indonesia do have a right to have a say in things, just as they have a right to development,' says Sheil. 'It's not fair for them to stay poor and pay the whole price of the choices we impose on them. The costs of protecting biodiversity simply must be more fairly distributed. Otherwise it turns into a kind of colonial diktat. What is more, we've almost completely destroyed our own forests. And then we go and tell them how they should behave?'

Nature conservation doesn't always have to be about irreconcilable conflicts, says Sheil. There are labels that stimulate more sustainably produced palm oil, such as the Roundtable on Sustainable Palm Oil (RSPO), which sets standards for the creation and management of plantations, such as the conservation of a considerable percentage of the original forest. About 20 per cent of the palm oil produced has the RSPO label.

Sheil: 'We won't stop deforestation by making ourselves feel good by organizing a boycott. If Europe stops buying the oil, China and India will buy it. The crop itself is not the problem; the question is what it replaces and how it is produced. There are bad olive and coconut producers too. With research, you can identify good and bad developments, and then you can stimulate good practice. I believe consumers do want to make that distinction - just look at the success of fair-trade coffee. Most importantly, we should stick to the same standards for all oil crops, and not be too quick to make black-and-white judgements about how things are done far away.'' ■

www.wur.eu/palmoil

OIL FROM THE LAB

Certain microorganisms store oil and fat in times of plenty so that they are prepared for an unpredictable future. Such organisms can be an interesting alternative source of oil. The idea is simple: breed one of these organisms in a large fermenter, harvest the cells, isolate the lipids, and you will be less dependent on agricultural crops and a long growing season.

Dozens of fat-producing species of yeast have already been described. The job now is to find the right combination of organism, breeding method and purification system for practical application, says Matthijs van Lint, business development manager for Specialty Chemicals at Wageningen Food & Biobased Research. 'First you need to choose a feedstock on which the organism can grow. That could be acetic acid from sewerage purification. Then you need to develop a large-scale fermentation process. Things like the breeding temperature influence the fatty acid composition of the oil. Lastly, there is the purification: the separation of the fats from the rest of the cell.'

Van Lint sees producing oil with microbes as not unlike the fermentation processes that are already used on a large scale to produce lactic acid, amino acids and vitamins. 'Adding oils and fats just expands that repertoire.' Wageningen is currently looking for partners for projects to research various questions that arise for practical applications. Replacing vegetable oil in food is not the primary goal. The low cost of vegetable oil means that yeast oil is not a competitive option at this point, says Van Lint. 'In the first instance, you should think in terms of the raw materials for making soap, washing powders, cosmetics or paint.'

ANDREA PRUIJSSERS:

‘This really won’t be the last epidemic’

A phone call early in 2020 marked the start of a taxing year for Andrea Pruijssers in Nashville, Tennessee. She and her colleagues had to pull out all the stops to get blood analyses done for the first test phase of the Moderna vaccine. ‘We saw in May that the vaccine did activate antibodies that potently neutralized the coronavirus. Fantastic!’

TEXT RIK NIJLAND **PHOTOGRAPHY** MAX GUNTHER

It was the beginning of January 2020, and Andrea Pruijssers was out shopping with some girlfriends when her phone rang; it was her boss Mark Denison on the line with an alarming story: people were dying in China of what might be a novel coronavirus. He was about to join a conference call and asked her to come into the lab as soon as possible to make plans.

‘That was the first time I heard about SARS-CoV-2,’ says Andrea Pruijssers, research assistant professor at Vanderbilt University Medical Center in Nashville, Tennessee. ‘The research group I work for has been doing research on diseases such as SARS and MERS for a long time; coronaviruses are our specialism. When it became clear that this was serious again, we knew it was time to roll up our sleeves.’

That phone call heralded the start of a taxing 2020. During the first test phase of the Moderna vaccine developed in the US, Andrea and her colleague were responsible for the blood analyses. ‘From February through June, I worked seven days a week. There was a lot of pressure on us, the whole world was watching, and of course, with the pandemic going on there was no time to lose. At the same time, we had to work carefully: whether this vaccine could continue to the next phase depended partly on us; it was our job to establish whether the first 45 test subjects developed a strong neutralizing antibody response.’

> ‘There was a lot of pressure on us, the whole world was watching’

UNEXPECTED LEADING ROLE

Although it was hectic, she wouldn’t have missed that period for all the world. ‘It was a dream come true to work on something so important; that’s what all your training was for. Until then, my work on viruses was something that might possibly bear fruit one day; now the impact was enormous,’ she explains in mid-January, just as the first Moderna vaccines arrive in the Netherlands. From the lab – Tennessee is in lockdown too, but she gets to carry on her work – she describes the roundabout route that led her to this unexpected leading role.

At secondary school in Waalwijk in the Netherlands, Andrea only excelled in biology; even then, she was intrigued >

by viruses. ‘I read an article about Ebola; people in Africa were dying of something you couldn’t see; and it was also the period of avian flu outbreaks. I thought it would be incredibly interesting and important to do research on that.’
She had heard good things about Wageningen from a former schoolmate, so she came to an open day. ‘I was positive about VU Amsterdam University too, but I thought studying in Wageningen would be more fun. And I have fond memories of it: drinking beer at pavement cafes, dancing at Unitas, and of course, my degree programme too – I enjoyed that a lot as well. Zoology, plants: it was all equally interesting to me. For that reason, I found it hard to decide which direction to take, but in the end I chose Molecular Biology and eventually Virology.’

RESEARCH ON PARASITES

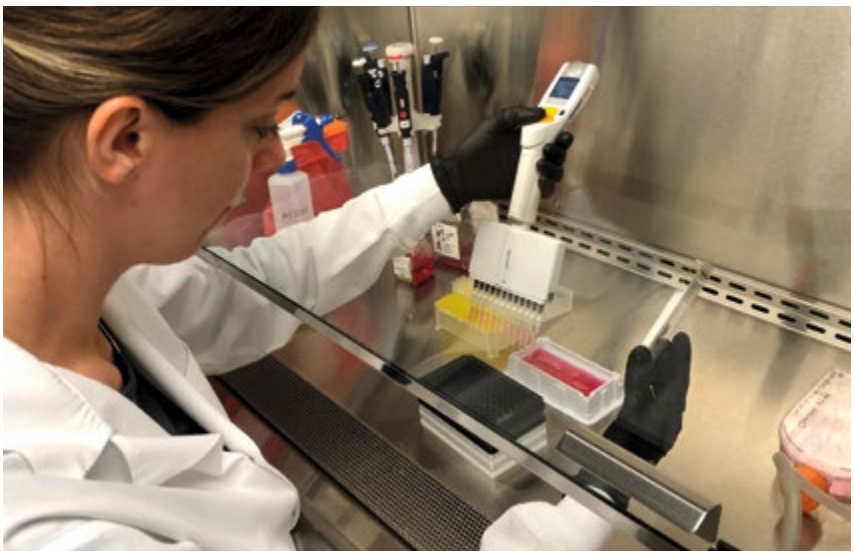
To get an internship she had to improvise. Her planned trip to South Africa to do research on the AIDS virus was cancelled at the last minute. Through contacts of someone in her student house – ‘Het Geflipte Heelal’ on Stationsstraat – She could get a place at the University of Georgia at short notice. ‘Not for research on viruses but on parasites. Oh well, I thought, they cause infectious diseases too.’

> ‘After MERS, our lab started developing antiviral drugs against coronaviruses’

‘Normally, you go back to the Netherlands after an internship to look for a job, but I was really enjoying life in Athens, and I felt at home socially too. I soon had a big group of friends and I loved the area. Because I had learned a lot about insect viruses from my thesis supervisor at Virology, Gorben Pijlman, I got to stay at Georgia for a PhD with Michael Strand, a big shot in Entomology.’ In Strand’s lab, she studied the pathogenesis of a polydnavirus, a virus that causes a kind of AIDS in insects. She also characterized a group of genes that code for the enzymes that make the insects sick.

BRAIN VIRUSES

Because her American boyfriend Max – a musician and PhD student of psychology and now her husband – was going to Nashville for an internship for a year, she decided to look for a job there after her PhD graduation in 2008. She became a postdoc at Vanderbilt University Medical Center (VUMC) tasked with studying how viruses infect the brain, in encephalitis, for example.



Andrea Pruijssers investigates the Moderna vaccine at Vanderbilt University Medical Center in Nashville, Tennessee.

'Because my team leader moved the research to Pittsburgh, and I wanted to stay in Nashville, I was then project manager for a year in an international consortium that seeks to accelerate the development of new vaccines, diagnostics, and treatments. That was interesting, but I was sitting at the computer all day telling people what they should do and how much money they could spend. In terms of the research itself, I was standing on the sideline, and I missed the lab work.' Until in 2017, Mark Denison of VUMC, an authority on coronaviruses for more than 30 years, asked her to take over the day-to-day management of his laboratory. This was a chance to combine laboratory work with project management.

REMDESIVIR

Drugs for controlling coronaviruses are a big priority. 'In the outbreak of MERS that started in 2012, the number of casualties remained limited,' says Andrea. 'It is true that one third of the hospitalized patients died, but the coronavirus that caused that disease was not easily transmitted from human to human. But Denison did wonder whether we would be so lucky next time. So our lab started then to develop antiviral drugs against coronaviruses. The first result was Remdesivir, which is now the only antiviral drug approved for use in Covid patients.'
A phase 2/3 trial is ongoing on a successor: Molnupiravir. This drug offers an important advantage, says Andrea. It can be taken orally while Remdesivir can only be administered through a drip, which means staying in hospital. 'You can take a pill when you've only just fallen ill, which is probably much more effective.'

Is there still any point in antiviral drugs now mass vaccination campaigns have started?

'It's going to take a long time still before there are no more Covid patients in hospital, so you do need drugs as well. Besides, research on antiviral drugs is an investment in the future. This really won't be the last epidemic of a novel coronavirus.'

How did you and your colleagues get involved in the research on the Moderna vaccine?

'Moderna is the manufacturer, and puts it on the market, but the vaccine was developed by the Vaccine Research Center (VRC), a government institution that we have worked with regularly. The VRC asked us to assist in the phase 1 trial: to find out if the vaccine was safe, what the right dose was, and whether the body developed a neutralizing immune response. Blood was taken regularly from the 45 test subjects, and one of my colleagues and I did the analyses.
'In May, we saw that the vaccine really did induce antibodies that neutralize the virus. Fantastic! We felt like shouting it from the rooftops, but everything was top secret. We had to stay out of the limelight and out of political debates, and avoid having the media descend on us.'

Last year you tweeted Dolly Parton, who is from the city where you live: 'I hope to give you a hug as soon as that is safe again!' Is country music the reason you live in Nashville?

'Oh no. Max is a musician, but country is not our taste in music. Dolly Parton donates a lot of money to charity, and at the start of the pandemic, a doctor from the hospital where I work put in a good word for our research. Dolly then donated one million US dollars to our institution. A lot of research is done with government financing, and then you are told exactly what you can spend the money on. In the case of this donation, we got to decide for ourselves how to spend it, so we could invest in for example the development of tests to demonstrate the presence of the new virus and trace antibodies. We needed those later for our own vaccine research too.'

Have you benefited personally from your research; have you already been vaccinated?

'When the call came for volunteers to take part in the phase 3 trial of the Moderna vaccine, I didn't hesitate for a moment. Because I was working in a hospital, I fulfilled the condition that you had to run a high risk of contracting the virus.
In the end 34,000 people took part. No, I didn't find it scary to be a guinea pig. I think the 45 people who participated in the phase 1 trial were the real heroes, because they didn't know whether there would be side effects. Of course, I didn't know whether I had received the vaccine or the placebo. When the vaccine proved to be 95 per cent effective, Moderna was obliged to tell the test subjects which group they were in, and give the placebo group the option of receiving the vaccine. I heard yesterday that I had in fact had the vaccine. Of course, it would have been dead easy to find that out in our lab by taking some blood, but I was reluctant to do that. It might sound odd for someone who does research on vaccines, but I'm not very keen on needles.' ■

ANDREA PRUIJSSERS

Research Assistant Professor at Vanderbilt University Medical Center in Nashville, Tennessee, US
Education: MSc in Biology from Wageningen University & Research, 2003
PhD in Entomology from the University of Georgia, US, 2008

EMERGENCY FUND FOR STUDENTS

‘I didn’t imagine I would ever not have enough money for food’

A crowdfunding campaign for students who run seriously short of money due to the coronavirus crisis has raised tens of thousands of euros. For international students especially, this support is a last-minute rescue operation that enables them to complete their degree.

TEXT ANJA JANSSEN

In spring 2020, when we realized that the pandemic was causing students to get into financial difficulties, University Fund Wageningen (UFW) launched a crowdfunding campaign to establish an emergency fund. Since then, nearly 830 WUR staff, alumni and students have donated money, and a total of 68,730 euros has been collected. Twenty-six students have already received support from the fund.

The beneficiaries of the fund include a Chinese MSc student of Nutrition and Health who prefers to remain anonymous, as do the other students mentioned in this article. ‘Like many Chinese students, I am supported entirely by my family,’ she says. Her family got into financial difficulty because of the pandemic. They earned less and had higher expenses because their daughter was going to have to take longer to complete her degree – an expensive affair with non-EU tuition fees set at around 17,000 euros a year. ‘I was doing an internship in a hospital in China when the Covid-19 outbreak started. The hospital was in disarray. I had to work online and my internship supervisor at the hospital had no time for me,’ says the student in explanation of her delay. The internship was ended early and she continued her studies in the Netherlands, where the coronavirus had not arrived yet. ‘When I started my degree, I didn’t imagine I would ever not have enough money for food,’ says the student. Going back to China was not an option for her. ‘I am under pressure from my family to come back with a degree.’ So the emergency fund was her last resort. ‘I was extremely relieved that my application was accepted,’ she sighs. The contribution she received for six weeks is enough for her to live off until she graduates.

NO GRADUATION

Similarly, a Biotechnology student from Ghana, who is studying on a government grant, would not have been able to complete his Master’s degree without money from the emergency fund. ‘I was doing laboratory research for my thesis when the first lockdown started. I had to change my plans suddenly and do a literature study instead,’ he says. Two months later, he could pick up his lab experiments again, but by then he was already running late. To make matters worse, the lab work for his second thesis got delayed, so he could not graduate on schedule. ‘Unfortunately, my grant was not extended and my savings didn’t run to tuition fees and living costs. So I had to apply to the emergency fund for help.’

It is mainly international students who apply to the fund, says Arianne van Ballegooij of UFW. It is so expensive for them to get an

EMERGENCY FUND FOR STUDENTS

UFW’s emergency fund for students helps students who have run into acute financial difficulty due to the coronavirus crisis, so that they can continue their studies. The support is for a stated period and is restricted to living expenses, rent and insurance costs to a maximum of 5000 euros. ‘Usually they have saved up enough to pay their tuition fees, or their family can just about afford to cover those, but then they have absolutely no money left to live off. They get that from the emergency fund,’ says Arianne van Ballegooij of UFW.

Only students with no other possible sources of support qualify. ‘Half the applications met the criteria and were accepted,’ says Van Ballegooij. ‘And now the emergency fund is almost empty. But we are still getting new applications from students whose studies are being delayed because the coronavirus crisis is going on so long.’ UFW is therefore raising funds again in March to be able help these students too. *To donate: crowdfunding.wur.nl*

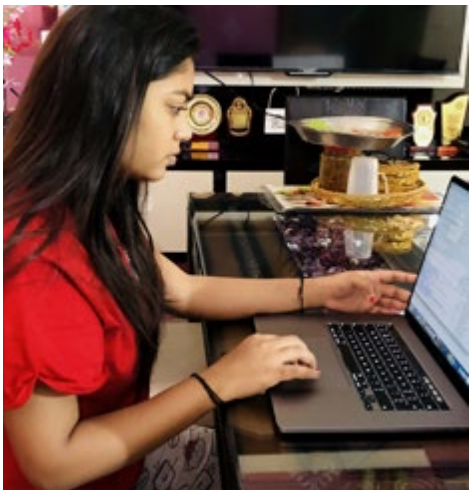


PHOTO ANNA DEN HARTOG

PHOTO GUY ACKERMAN

PHOTO MARTE HOFSTEENGE

Studying in Covid times.

extension that they can't make ends meet, and there is nowhere else they can go for help. Dutch students often have more options than international students, such as going back to live with their parents again or increasing their loan. But even they get into difficulty sometimes. A student from Amsterdam on the Master's in Metropolitan Analysis, Design and Engineering had to put his research on hold for months during the first school closures of 2020. 'I study eating habits among secondary school students, and to do that I needed to talk to students, observe what goes on in schools, and interview teachers. That wasn't possible.'
Only after the summer could he get going on his research, and then schools closed again in mid-December. He conducted the rest of his interviews online, but making that switch cost him another two months. 'I haven't had the right to financing since October, and I get a modest contribution from my parents. Luckily I've been given over 550 euros a month for five months out of the emergency fund. I was very touched by the fact that private individuals gave money. I won't forget that anytime soon. In the future I will definitely contribute to a fund of this sort.'

A QUESTION OF SOLIDARITY

Alumnus Jeroen Naaijkens (Garden and Landscape Architecture, 1974) felt it was practically his duty to help students out with a donation. 'It's partly a question of solidarity. And my own degree at Wageningen was crucial because of the good time I had there and the career opportunities it opened up for me. So I want to give something back to the university.'
Before he retired, Naaijkens was chair of the board at HAS University of Applied Sciences in Den Bosch. 'I saw there how important it is for students to know they don't have to face everything on their own but can ask for help. I've seen students run aground because the system of being funded by their family stops working due to a crisis. The university community has a responsibility towards them,' Naaijkens believes. 'So this emergency fund is a great initiative.' ■

‘It’s cool being part of this network for ambitious women’

Iris van der Meer and Iris van ’t Erve have been awarded grants for ‘talented female alumni’ from the Marina van Damme Fund. They each received 9000 euros to support them in the next step in their careers. One will be using the money for oncology, the other for nature conservation.

Iris van ’t Erve is in the final year of her PhD research at the Netherlands Cancer Institute in Amsterdam. ‘I study DNA that is secreted into the blood by tumours in the intestines. We use blood samples to try and get a picture of certain genetic changes, which will then let us select the right medication.’ She graduated in 2017 in Nutrition & Health and Molecular Sciences. After her PhD, she wants to continue in oncology as a postdoc. ‘I find it very valuable to be able to explore the possible applications for my findings.’

She will use the grant from the Marina van Damme Fund to broaden her knowledge by looking at the bioinformatics of DNA analyses. ‘Advanced techniques are used to analyse genome data. I want to learn more about this area, as this will hopefully let me extract more information out of my research data.’ Unfortunately for Van ‘t Erve, the course she wanted to use the grant for could not go ahead because of the coronavirus crisis. If it is cancelled in 2021 as well, she will look for an alternative.

‘I want to get more information out of my research data’

Iris van der Meer coordinates the World Wildlife Fund’s programme in Zambia. She graduated in 2014 in Forest & Nature Conservation. ‘I am an ecologist but my goal is to move up into senior management in the nature conservation sector,’ says Van der Meer. ‘I want to increase my impact.’ When searching for a suitable course, she came across the Conservation Leadership Master’s in Cambridge, which she started last October. ‘It is an expensive course and the fund’s financial support is very welcome.’ In the autumn, Van der Meer attended lectures and group sessions in Cambridge; she is doing the second term online from Zambia because of the coronavirus crisis. ‘We have a group of 19 students. The nice part is that we all come from different countries. That way, you learn a lot about nature conservation in other parts of the world.’

The two winners will become part of the Marina van Damme network. ‘I wasn’t really aware of that when I applied,’ says Van der Meer. ‘Now I realize it’s really cool to be part of this network of ambitious women who help one another.’

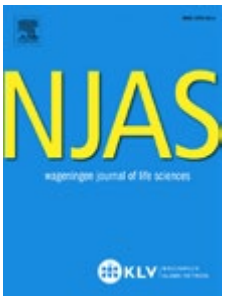
‘I would like to move up into senior management’

www.universityfundwageningen.eu/marinavandamme

SCIENCE

New future for KLV's academic journal

The publisher Taylor & Francis has taken over the journal *NJAS - Wageningen Journal of Life Sciences* from KLV. 'That guarantees the journal's future and its interdisciplinary scope,' says editor-in-chief Sietze Vellema.



Elsevier did not want to take ownership of NJAS over when KLV came to an end, explains Vellema. 'But the editorial board thought that it was worth continuing the journal, partly because it has been around since 1953 and documents the history of Wageningen research, and partly because it has developed into an interdisciplinary scientific journal. That is a unique niche. The publisher Taylor & Francis was interested in taking over an interdisciplinary journal and making it more international,' says Vellema, who is an associate professor in Knowledge, Technology & Innovation. Associate professor Jetse Stoorvogel (Soil Geography & Landscape) has joined Vellema as editor-in-chief.
If everything goes according to plan, the first articles with the new publisher will appear in March. They will be publicly available online immediately; with Elsevier, that was only the case after 12 months. The online archive with all the articles published since 1953 will remain accessible through WUR's library and Elsevier's Science Direct portal.
Info: sietze.vellema@wur.nl

FUNDS

Phone campaign yields nearly 1000 new UFW Friends

Phone calls were made to former KLV members to invite them to become 'Friends of UFW', supporting activities for students and young alumni. The phone campaign resulted in 970 Friends.

'About one in three former KLV members has become a Friend,' says fundraiser Arianne van Ballegooij of University Fund Wageningen (UFW). 'It's lovely to see this solidarity between different generations of alumni.'
Examples of activities that the Friends sponsor are the Thesis Award – a prize for students with a score of 9 out of 10 or more for their thesis – and the Young Alumni programme. 'In that programme, we keep in touch with younger alumni and organize activities for their careers and network,' explains Van Ballegooij.
There are now around 1200 Friends of UFW. You can be a Friend for as little as five euros a month.
Info: www.universiteitsfondswageningen.nl/vriendenvanufw


PHOTO SHUTTERSTOCK

SAVE THE DATE

Immersed in the world of Wageningen again

The first Wageningen Experience Day is due to take place on Saturday 2 October 2021. There will be a broad programme for Dutch and international alumni and other WUR relations, both on campus and online. 'It is a further extension of the Alumni Open Days that have been held since 2019,' says Denise Spiekerman of the Alumni Office, 'an event in which alumni are immersed in the world of Wageningen again for a day and can meet one another.' The programme includes talks, excursions and interactive sessions, plus a virtual meeting point, an information market and reunions for the alumni of 1971 and 1996. The programme has not yet been finalized.
Info: http://bit.ly/WEDNL2021

BOOK

Light on campus

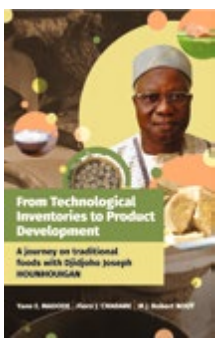
Photographer António Valente, IT officer at WUR, has produced the photo book Light on Campus. 'I am always chasing light. If I'm at home and I see the light looking lovely above Wageningen campus, I get on my bike. Or I get up at the crack of dawn to capture the morning mist on campus.' Proceeds from the book will go to the Anne van den Ban Fund.
Info: www.universityfundwageningen.eu/lightoncampus

Andre Arfman MSc, WUR Management, Economics and Consumer Studies 2007, business consultant and dairy farmer, has become chair of the cooperative De Marke. The cooperative will take over the experimental dairy farm De Marke from WUR this year. 1 December 2020.

Raoul Beunen PhD, WUR Land-Use Planning Sciences 2000, associate professor of Environmental Governance at the Open University of the Netherlands (OU), has won the annual OU Science Prize. 11 December 2020.

Chris Blok MSc, WUR Soil Science 1984, Greenhouse Horticulture project manager at WUR, has won the Bram Steiner Award 2020 for the best publication on substrate cultivation for his article 'Maximum plant uptakes for water, nutrients and oxygen are not always met by irrigation rate and distribution in water-based cultivation systems'. 17 December 2020.

Prof. Djidjoho Joseph Hounhouigan, WUR PhD 1994, has officially stepped down as dean of the Faculté de Sciences Agronomiques at the Université d'Abomey Calavi in Benin. At the ceremony, to mark his departure he was presented with the book *From technological inventories to product development – A journey on traditional foods with Djidjoho Joseph Hounhouigan.* 12 November 2020.



Liesbeth Bolhuis PhD, WUR Zootechnics 1997, associate professor in the Adaptation Physiology chair group, has won the 2020 ASG publication prize for her publications on behavioural research into adaptive responses in pigs. 24 December 2020.

Birgit Dekkers PhD, WUR Food Technology 2014, has won the Rabobank Sustainable Innovation Prize of 20,000 euros for the start-up Rival Foods, which she founded with Ernst Breel. The prize awarded by the general public also went to Rival Foods, which develops fibre-rich meat substitutes. 27 November 2020.

Prof. Alfred Hartemink, WUR Soil and Water 1994, professor and head of the Soil Science department at the University of Wisconsin-Madison, has been appointed an honorary member of the International Union of Soil Sciences. 4 December 2020.

Chiel van Heerwaarden PhD, WUR Meteorology and Air Quality 2006, assistant professor of Meteorology at WUR, is one of 10 researchers to be made new members of the Young Academy, the Royal Netherlands Academy of Arts and Sciences platform for high-achieving young researchers. 8 December 2020.

Rolf Heling MSc, WUR Management, Economics and Consumer Studies 2008, won the Sustainability Business Travel Award 2020, given by the travel management association NATM, for making Wageningen University's travel policy more sustainable. Heling is the contract manager for travel and the location manager. 17 December 2020.

Evert Jan van Nijen MSc, WUR Zootechnics 1990, is the new director of the Circular Friesland Society, a regional collaboration of businesspeople, governmental authorities, civil society organizations and education institutes. Van Nijen spent several years as commercial director of the engineering consultancy Sweco (previously Grontmij). 21 January 2021.

Heidi Renkema MSc, WUR Ecological Agriculture 2002, has been appointed director of the Museum on the A, the historical museum for the city and province of Groningen. Renkema was director of Museum Wierdenland in Ezinge. 27 November 2020.

Prof. Hussein Shimelis, WUR Crop Science 1996, has been voted one of the 20 most influential plant breeders in Africa in 2020 by the Southern African Plant Breeders Association (SAPBA). Shimelis is a professor of Plant Breeding at the University of KwaZulu-Natal in Durban, South Africa. 4 December 2020.

Prof. Remko Uijlenhoet, WUR Land Development 1990, has been elected a fellow of the American Geophysical Union (AGU), in recognition of his 'exceptional scientific contributions'. Uijlenhoet stepped down as professor of Hydrology and Quantitative Water Management in late October and is now professor of Hydrology at Delft University of Technology. 18 November 2020.

Yuanxu Xue MSc, WUR Animal Sciences 2019, PhD candidate at WUR Animal Breeding & Genomics, is one of the 13 winners of the Unilever research prize for her thesis on automatic phenotyping. 26 November 2020.

Seeds for creaminess

Dimitris Karefyllakis PhD, WUR Food Technology 2014, won the Best Place in Food competition for start-ups in the World Food Center in Ede. Karefyllakis, co-founder of the Time-travelling Milkman start-up, won the competition with an ingredient that makes vegan dairy substitutes creamy. The prize consists of free office space for a year in the ROOTS Innovation Hub of the World Food Center complex in Ede.

365 days outdoors

Koen Arts PhD, WUR Forest and Nature Conservation 2007, and his wife Gina spent at least half their time outdoors for a year to restore their bond with nature. Arts wanted to be a forester as a boy but as a Forest and Nature Conservation lecturer at WUR he spent most of his time on his laptop. 'That was a key reason for the experiment.' They slept in a tent — in the winter in a Swedish tepee with a stove. Living outdoors makes you realize the limitations of your own body, Arts discovered. 'You can no longer enjoy things when you are cold. Your first priority is warmth, which means a fire.' Arts wrote a book about it: *Wild Jaar (wild year), Noordboek, 22.50 euros*

ERC grants

Prof. Rutgerd Boelens, WUR Tropical Land Development 1990, and **Prof. Joris Sprakel**, WUR Food Technology 2005, have both secured grants of 2 million euros each from the European Research Council (ERC) for ground-breaking research. Professor of Water Resources Management Boelens studies the distribution of rights to river water around the world. Sprakel, professor of Physical Chemistry and Soft Matter, researches chemical bonds that become stronger when subjected to stress. 9 December 2020.

Farewell

Krijn Poppe MSc and **Prof. Ruerd Ruben** said farewell to Wageningen Economic Research in an online symposium. Poppe was also made an Officer in the Order of Orange-Nassau. He researched income development and policy effects, and later concentrated on policy advice. Ruben spent the last six years as a professor at WUR and research leader at Wageningen Economic Research on analyses of the impact of interventions in food systems.
4 November 2020.

IN MEMORIAM

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

Ms A.P. Alderwegen-de Vries MSc, WUR Phytopathology 1976. 25 October 2020.
Mr D.S.Y. Bakker MSc, WUR Landscape Architecture 1977. 21 August 2020.
Mr A.J. van den Bergh, WUR Rural Sociology of the Western Regions, start in 1964. 30 November 2020.
Mr F.W. Berkers MSc, WUR Aquaculture and Marine Resource Management 2014.
Mr P. Businger MSc, WUR Tropical Forestry 1956. 2 November 2020.
Prof. V.A. Curtis, WUR PhD 1998. 19 October 2020.
Mr W. van Densen PhD, former employee at Wageningen Marine Research. 4 July 2020.
Mr C.G. van Dongen PhD, WUR Zootechnics 1959. 18 November 2020.
Mr I.C.D. Duijnhouwer MSc, WUR Agricultural Plant Breeding 1984. 6 November 2020.
Mr K.G. Eveleens MSc, former WUR researcher of integrated crop protection. 14 April 2020.
Mr J.M. Geraedts MSc, WUR Land Development B 1983. 13 December 2020.
Mr J. de Jong MSc, WUR Dairy Production 1954. 21 November 2020.
Ms M.C.M. Nuijten PhD, WUR Rural Sociology of the Non-Western Regions 1988. 2 January 2021.
Mr K. Oostindië, former WUR employee in Soil Physics and Land Management. 9 January 2021.
Mr G.H. Scherings PhD, WUR Agricultural Plant Breeding 1975. 5 November 2020.
Mr R. Severens MSc, WUR Biology 2004. 29 October 2019.
Mr B.A. Uijtewaal PhD, WUR Plant Breeding 1983. 20 June 2020.
Mr B. Vrijhof MSc, WUR Horticulture 1947. 15 December 2020.
Mr Pieter de Waard PhD, WUR employee in Bionanotechnology. 30 April 2020.
Mr W.G. Werumeus Buning MSc, WUR Environmental Protection 1977. 1 November 2020.
Ms P. Wessel-Riemens MSc, WUR Horticulture 1959. 13 October 2020.
Mr F. Wiering MSc, WUR Farming Technology 2002. 10 January 2021.
Mr C. Zawe PhD, WUR Soil and Water 2000. 25 January 2021.

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.

Follow your nose in the arboretum

July Leesberg MSc, WUR Tropical Plant Breeding 1984, drew and penned the Flowering Calendar for the Belmonte Arboretum in Wageningen. The artist – who also went to art college – drew inspiration from the scents. 'If I'm strolling through a garden and I smell something, it changes the whole garden. I have to stand still and take in the scent.' Leesberg took the existing Arboretum Flowering Calendar as the basis and chose flowering plants from it – with her nose. The result is a booklet with 27 drawings of scented plants.The drawings are in black and white. 'I tried to reduce the plant to its essence and capture its life force.'
www.debloeikalender.nl, 19.95 euros

BOOKS

The cosmic comedy

Frank Westerman MSc, WUR Tropical Land Development 1989, author of *De graanrepubliek*, *Ingenieurs van de ziel* and *Een woord, een woord*, has written a new book. *De kosmische komedie* (the cosmic comedy) is a cinematic account of astronomy and space travel that takes us time-travelling through five centuries of horizons, from Eise Eisinga and Yuri Gagarin to beyond the Milky Way.
Querido Fosfor, 22.99 euros

Multicultural upbringing

Shakti Hannie Lieten MSc, WUR Bioprocess Technology 2005, has published *Colours of a Cultural Chameleon*. Lieten, who worked as an environmental consultant until early 2021, tells the story of Kamala, who grows up in Belgium, India and the Netherlands (including Wageningen) and discovers the world on her travels. Lieten: 'Kamala's motto is: trust a stranger and doors will open for you. In my view, this is an essential message in our multicultural and globalized society.'
Self-published, 13.38 euros

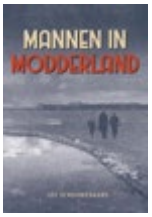
Lessons on leadership

Prof. Jan-Benedict Steenkamp, WUR Agrarian Economics 1983, professor of Marketing at the University of North Carolina and director of the institute for marketing knowledge AiMark, sets out what managers can learn from 16 great leaders in history in his latest book *Time to Lead*. Using leaders such as Charles de Gaulle, Alexander the Great, Nelson Mandela and Theodore Roosevelt as examples, Steenkamp shows how individuals take decisions based on seven leadership styles and four personality classifications.
Fast Company Press, 25.39 euros

The soul of Japan

Freek Vossenaar MSc, WUR Agrarian Economics 1985, is fascinated by Japan, which is the topic of his third book, *Kijken in de ziel van Japan* (looking into Japan's soul). Vossenaar spent two periods as an agricultural attaché at the Dutch embassy in Tokyo. He still regularly visits the country for the ministry of Agriculture. 'I wanted to review the situation on the eve of the Olympic Games,' says Vossenaar. 'What state is the country in after a nationalist prime minister tried to make it more self-confident and assertive internationally? Everyone thinks Japan is cool and hip but an ageing population, adherence to traditions and women's subordinate role are serious obstacles to innovation.' Vossenaar says the country has enormous trust in technological solutions, including for agriculture. 'Japan thinks the future lies in robotics, sensors and data management. It is no coincidence that Japan has appointed a liaison officer in Wageningen for its national research to set up collaborative ventures.'
Balans, 21.95 euros

Men in the mud



Jos Schouwenaars PhD, WUR Land Development 1978, international expert on water management in peatlands, gives a glimpse of the world of water managers and peatland reclamation in his novel *Mannen in Modderland* (men in the mud). He does this using a German and a Dutchman who went through some tough experiences during the war. In 1970, they get to know one another in a German-Dutch commission that is asked to advise on water management in a border area. The two protagonists are loosely based on two now deceased hydrologists and professors who Schouwenaars worked with: the German Rudolf Eggelsmann and the Dutchman Wiebe van der Molen.
Elikser, 18.50 euros

Martijn Buijsters MSc, professional guitarist and guitar teacher

Molecular Sciences, 2001

'Music is part of me. If I can't play for a few days, I get grumpy. You create your own world. I've been playing guitar since I was nine: classical and later also electric guitar. When I left secondary school, I had to choose between music and science. At that time, I felt I would like to go into the sciences first. Molecular Sciences interested me because they combine physics, chemistry, biology and maths.'

'I continued to play guitar seriously. That has an emotional side to it that is completely different to the abstract thinking of science. By the time I finished my studies I was missing that badly. So I made the switch and started at the academy of music: I wanted to explore that side of life too. I found myself in another world entirely, and I soaked it all up like a sponge. What I enjoy most now is to make my own CDs. It is a quest for something in myself. I try to express the feeling a piece gives me as well as I can through sound.'

'And yet I noticed that I can't be busy with music all the time. I need other interests as well. I read a lot, including scientific books, as science still fascinates me. I have thought about going back to university, perhaps to study geology. But that's not feasible at the moment. Really, I'd like to go on studying at an advanced level all my life.'

'Really, I'd like to go on studying at an advanced level all my life'

PHOTO HARMEN DE JONG

PHOTO FEE SMULDERS

Video footage shows how tourists influence sea turtles

Fee Smulders placed cameras with GPS on the backs of green sea turtles in the Bahamas to record their encounters with tourists. The green sea turtle is an endangered species due to loss of habitat and climate change. It is a herbivore and lives mainly on seagrass. The video footage shows how tourists feed the animals large portions of squid. This affects both the diet and the behaviour of the turtles, discovered Smulders, who is a PhD student in the Aquatic Ecology and Water Quality Management chair group. She and her fellow researcher Marjolijn Christianen did this research with Owen O'Shea of the Centre for Ocean Research and Education.

The researchers calculated that the sea turtles ate nearly six times less seagrass when there were tourists around. In the long term, their bodies will adapt to the new food source and they are likely to become dependent on fish, which is not always available. The scientists also observed that the normally calm marine animals behaved more aggressively towards each other and towards tourists. 'We show how harmful it is to feed wild animals,' says Smulders. 'To limit the damage and protect the turtles, we need to make the possible consequences of doing so clear to tourists worldwide.'

The researchers published their findings in *Global Ecology and Conservation*. The videos are included in the online paper.

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