



## 'The urge to root is still ingrained in pigs'

Amendment to the Animals Act , page 10

### The computer works it out

Trying out precision farming in the new national field lab

### More life in streams and ditches

But biodiversity in Dutch waters is not up to European standards

### Trained bees sniff out Covid

Fast Covid test: if the bee sticks out its tongue, you're infected



# 10

## AS LONG AS THEY'RE HAPPY

Cows, pigs and chickens in barns or pens should be able to display their natural behaviour, states the revised Animals Act in the Netherlands. But how do you decide what is natural behaviour and how can you create scope for it?

# 26

## THE COMPUTER WORKS IT OUT

Precision farmers can dose fertilizer, control diseases, irrigate crops and look after nature with greater precision, shows the National Field Lab for Precision Farming. We visit a precision arable farmer, a fruit grower and a dairy farmer.



# 34

## MORE LIFE IN STREAMS AND DITCHES

The fresh waters of the Netherlands are returning to a more natural state. And yet their biodiversity still fails to meet European norms, partly because of unnatural banks, as well as fertilizers and pesticides from agriculture.



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



*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, 6,800 employees (6,000 fte) and 12,900 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.*

**WAGENINGEN WORLD ONLINE**  
Wageningen World is also available online. All the editions can be found in browsable PDF form at [www.wur.eu/wageningen-world](http://www.wur.eu/wageningen-world).  
Subscribers can also opt for a digital subscription. Digital subscribers receive the magazine four times a year by email. Reading online is better for the environment and the climate. To switch from a paper to a digital subscription, go to: [www.wur.eu/ww-subscription](http://www.wur.eu/ww-subscription)





**4 UPDATE**

News in brief about research and developments at Wageningen University & Research.

**16 TRAINED BEES SNIFF OUT COVID**

A startup called InsectSense has developed a surprisingly quick and easy coronavirus test. You hold a throat swab in front of a bee. If it sticks out its tongue, you are infected.

**18 ‘SPLIT UP EXTENSIVE AND INTENSIVE AGRICULTURE’**

Create zones in the Dutch landscape for different kinds of farming, proposes Professor Martha Bakker in a controversial plan. ‘I think there is room in the Netherlands for all kinds of farms. But set strict conditions per area.’

**22 THE FUTURE OF OUR FOOD**

The way we produce, trade and consume food worldwide urgently needs to change if we want to reduce poverty, hunger, obesity and climate change. The key lies in diversity – in the way food is grown and traded, and in the food on our plates.

**32 NEW NAMES FOR THOUSANDS OF FUNGI**

Thanks to DNA technology, thousands of new fungi have been discovered over the past 20 years. Known fungi have turned out to belong to many different genera and families.

**FEATURES**

---

**40 ENVIRONMENTAL ACTIVIST NINE DE PATER**

In two years, Nine de Pater rose from doing voluntary work at Friends of the Earth to being the campaign leader for the court case against Shell’s climate policy. A unique case, internationally, which was won in May 2021.

**44 SUSTAINABLE FOOD PRODUCTION IN AFRICA**

In East Africa, local parties are developing new and sustainable food systems in a Wageningen project supported by the IKEA Foundation. ‘This could be the start of a long-term transition.’

**46 ALUMNI**

News for and about Wageningen alumni.

**48 PERSONALIA**

Information about the lives and careers of Wageningen graduates.

**51 THE SWITCH**

Alumni whose career took them outside the Wageningen domains.



PHOTO GUY ACKERMANS

**Working with nature instead of against it**

‘It’s a blind spot: the urgency of the loss of biodiversity for the survival of our planet. Or to be more precise, the survival of humanity – because the planet will keep going. After the floods and forest fires of this summer, most people have stopped thinking of climate change as something that only affects other people in faraway places. The loss of biodiversity is equally alarming, only it is less visible to us. We often only miss something once it has gone, and it is too late then.

‘Biodiversity is everywhere. It’s in the flowers, the bees, the birds, the bacteria in our guts, the coral reefs and the rainforests. It is fundamental to nature, and it ensures that ecosystems function well. If very many species disappear from ecosystems, those ecosystems lose their resilience and are much more vulnerable to situations like drought or diseases. Biodiversity is a kind of ‘insurance’ against extreme conditions.

‘As a scientist I feel it’s my moral duty to help flatten the alarming curve of biodiversity loss. There is no quick fix, and no cure-all solution. Biodiversity calls for a diversity of tailor-made regional solutions. To achieve that we need all the expertise in the Wageningen domain – from sociology to agronomy, from ecology to technology. We are already doing a lot of research into biodiversity, and now we are going to combine our expertise better to have more impact.

‘That’s why we started the Wageningen Biodiversity Initiative, a network of researchers that connects all the WUR science groups and inspires them to do their bit for biodiversity. But we need other relevant stakeholders besides scientists from the various disciplines. So we are inviting them all – policymakers, industry, farmers’ organizations and NGOs – to collaborate with us. Only if we all pull together now can we stop the loss of biodiversity.’

*Liesje Mommer, professor of Plant Ecology and Nature Conservation, and the driving force behind the Wageningen Biodiversity Initiative*

## RANKING

# Students say WUR is greenest

This year, students scored WUR as the most sustainable higher education institution in the Netherlands. In the SustainaBul ranking, Wageningen ranks just above Van Hall Larenstein – the winner in 2020 – and the University of Amsterdam. SustainaBul assesses the sustainability, social responsibility and transparency of academic and applied universities. The sustainability ranking for higher education was organized for the tenth year in succession.

Info: [vincent.koperdraat@wur.nl](mailto:vincent.koperdraat@wur.nl)

## GENETICS

# Onion genome fully deciphered

Wageningen researchers have sequenced the DNA of the onion genome. This will help plant breeders develop new varieties more quickly, for example with resistance to drought, and meet the growing global demand for onions. According to the plant breeding researcher Richard Finkers, figuring out the genetic makeup was quite a challenge. 'The onion genome is large, about 16 times bigger than the tomato genome and five times bigger than that of humans.'

Info: [richard.finkers@wur.nl](mailto:richard.finkers@wur.nl)



PHOTO SHUTTERSTOCK

## FORESTRY

# Enough wood in Europe

**European forests have enough wood to meet the increasing demand for the product, says professor of European Forests Gert-Jan Nabuurs. 'There is more wood in European forests than since the late Middle Ages.'**

'If Eastern European countries such as Ukraine and Belarus are included, wood stocks in Europe amount to nearly 35 billion cubic metres,' says Nabuurs. 'Growth is adding one billion cubic metres annually, whereas the harvest each year is just 600 million cubic metres.' Even so, global wood prices rose last year. Many Europeans have been doing up their houses since the Covid pandemic started, and new houses are being built. This is

part of the reason for the rising demand for wood, while sawmill capacity has failed to keep pace with demand for years, says Nabuurs. He expects processing capacity to increase in the next one to two years. In the long term, we will need to keep investing in new forests and sound forestry management. 'Wood will only become more important in a fossil-free world.'

Info: [gert-jan.nabuurs@wur.nl](mailto:gert-jan.nabuurs@wur.nl)



PHOTO SHUTTERSTOCK

## ENVIRONMENT

# Plastic packaging often not recyclable

Only 27 per cent of all plastic packaging can be recycled properly. That proportion has hardly changed in the past seven years. This is the conclusion of researchers at Wageningen Food & Biobased Research. 'The proportion of packaging that is properly recyclable should and could increase a lot,' says researcher Marieke Brouwer. As much as a further 29 per cent of plastic packaging could be made recyclable through simple alterations to labels, caps

or the adhesive. But about a quarter of the packaging cannot easily be improved: it is too small for the sorting process or there is no recyclable alternative that maintains the shelf life to the same extent. A further 18 per cent requires new sorting or recycling processes to be developed, for example for PET trays for meat and fish. These percentages do not reflect actual recycling practice.

Info: [marieke.brouwer@wur.nl](mailto:marieke.brouwer@wur.nl)

## PLANT ECOLOGY

## CHEMISTRY



PHOTO SHUTTERSTOCK

## New model shows effect of nitrogen deposition on nature

**Wageningen Environmental Research has developed a mathematical model to determine the effect of nitrogen deposition on plants and types of vegetation.**

Critical deposition values have already been calculated for each type of habitat that is sensitive to nitrogen, such as old oak forests or fen meadows. When nitrogen is deposited there, it causes deterioration in the nature quality. The new model calculations show the speed with which that happens. 'There turn out to be big differences between habitat types and plant species,' says the Wageningen ecologist Wieger Wamelink. The nature in some habitat types also seems to deteriorate before the critical deposition threshold is reached. That is only logical, says Wamelink, as the critical value is an average

and does not refer to the precise response of a particular plant species to nitrogen. Even so, he thinks it is too soon to use the model for policy decisions, for example about agriculture in a certain nature area. The model is not yet good enough for that, as was shown by a check using field data collected by the research centre B-Ware. Wamelink will therefore spend the next three years doing follow-up studies. 'We have already included the effect of temperature, precipitation and soil type in our model but we want to add factors like nature management.'  
Info: [wieger.wamelink@wur.nl](mailto:wieger.wamelink@wur.nl)

## Alternative found to aluminium in food foil

**Researchers may have found an alternative to the familiar aluminium coating in thin food wrapping: a mix of positively and negatively charged polymers that combine to form a protective layer against oxygen.**

The discovery was made within the Advanced Research Center for Chemical Building Blocks Consortium, a collaborative venture between chemicals companies and science institutions, including WUR. According to Jasper van der Gucht, professor of Physical Chemistry and Soft Matter at Wageningen, the discovery is an important step towards more sustainable food packaging. 'The gas barrier properties of these polymer-based coatings are at least as good as those of food packaging with vacuum-deposited aluminium. And there are potentially big gains for the environment too as the polymer packaging could be much easier to recycle.'

Info: [jasper.vandergucht@wur.nl](mailto:jasper.vandergucht@wur.nl)



PHOTO SHUTTERSTOCK

## WAGENINGEN ACADEMY

## Online course: Food Environments for Healthy Sustainable Diets

Imagine yourself at a bustling market in Bangkok. Will you wait in line for a fresh mango smoothie or buy the cheap bottle of soda right in front of you? This decision is influenced by interactions with your environment. How to utilize food environments to promote healthy diets in low- and middle-income countries is the focus of the new online course Food Environments for Healthy Sustainable Diets. The short course is part of the CGIAR Research Program

on Agriculture for Nutrition and Health (A4NH). It was developed by the Division of Human Nutrition & Health and the Professional Education Team at Wageningen University & Research, and the Montpellier Interdisciplinary centre on Sustainable Agri-food systems (UMR MOISA). As an extra incentive, the course is free in 2021.  
More information at: [www.wur.eu/academy](http://www.wur.eu/academy)



## Inbreeding not that bad

It was thought that animals avoid reproduction with family members where possible. But a new meta-study by researchers at Stockholm University and Wageningen found no proof for this widely believed assumption. The study was published in July in *Nature Ecology & Evolution*. Co-author Alexander Kotrschal of Behavioural Ecology has various explanations for why animals do not avoid inbreeding. The risks are not always that large, and sometimes inbreeding is the best option because not mating is the only alternative. 'Inbreeding can even be advantageous in certain cases, for example when animals are fully adapted to their local environment.'

Info: alexander.kotrschal@wur.nl

## LANDSCAPE

## Europe's longest orchard

Over the next few years, Europe's longest orchard will be planted along the A15 motorway between the Deil and Dodewaard junctions. It will extend 33 kilometres with 24,243 trees. Wageningen Environmental Research worked out two scenarios, and the initiators opted for the version with fruit, avenue and decorative trees typical of the Betuwe region. Those initiators include Caro Agterberg, the architect who came up with the idea, and the Directorate-General for Public Works, the Rivierenland water board and the local Security region. Agterberg won the 'Make Gelderland Prettier' competition in 2017 with her proposal. The first trees will be planted this year.

Info: fabrice.ottburg@wur.nl



PHOTO SHUTTERSTOCK

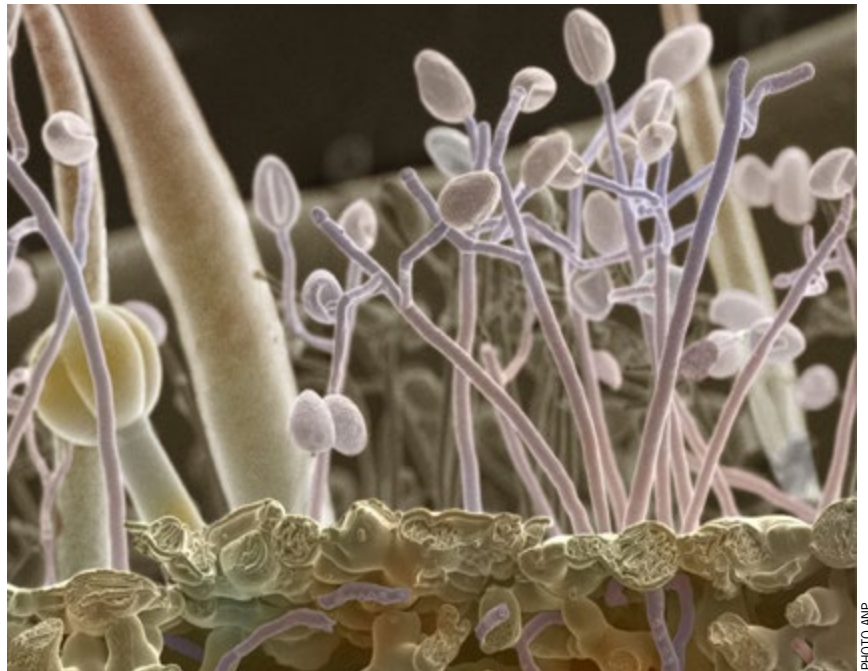


PHOTO ANP

## Phytophthora cuts plant open

***Phytophthora infestans*, which causes potato blight, uses sharp protrusions to cut a path through the protective layer of leaves in crops. This discovery by Wageningen offers potential new ways of combating the disease.**

Plants have a protective layer that is designed to keep invaders like *Phytophthora* at bay. Yet this pathogen is still able to break through that layer and infect plants. Scientists did not know how the fungus-like organism did this, despite decades of research. 'We have now discovered that *Phytophthora* uses smart tricks to sharpen the tube it uses to infect the plant, letting it cut through the plant's surface like a knife,' explains Joris Sprakel, professor of Physical Chemistry and Soft Matter at Wageningen. 'As a result, *Phytophthora* can infect its host without using brute force or expending much energy. This is the first time this mechanism has been revealed.'

The discovery was thanks to a collaboration between phytopathologists, cell biologists and physicists at Wageningen. Professor of Phytopathology Francine Govers sees

possibilities for new ways of combating *Phytophthora*. 'The laws of mechanics tell us that *Phytophthora* can't penetrate the plant until it has attached itself firmly to the leaf surface.' This may offer options for warding off the pathogen without using chemicals or plant breeding. The researchers have tested the theory by spraying the leaves of potato plants with a substance that obstructs the attachment process. This reduced infection levels by between 65 and almost 100 per cent. *Phytophthora* is a threat to potato yields throughout the world. The damage can be as much as six to seven billion euros a year. The pathogen also causes considerable damage to tomatoes, aubergines, cocoa, peppers, soya beans and palms. The researchers published their results in July in *Nature Microbiology*. Info: joris.sprakel@wur.nl

## AGRICULTURAL SYSTEMS

## Mechanization helps farmers and climate

**Using machinery for rice harvesting and threshing prevents food wastage among small-scale rice farmers in Nigeria. It lets farmers increase their incomes and also prevents greenhouse gas emissions. These findings come from trials at the company Olam International.**

In the study, rice yields using mechanized harvesting and threshing were compared with yields with harvesting and threshing done by hand. Local youngsters were trained to operate the machinery by Olam, a global food producer.

Mechanized harvesting and threshing prevents food waste of half a ton (479 kg) per hectare, giving yields that are around 14 per cent higher compared with working manually. This approach increases farmers' incomes by about 200 dollars per hectare. Thanks to the reduction in food wastage, mechaniza-



PHOTO ANP

tion prevents emissions equivalent to 1.7 tons of CO<sub>2</sub> per hectare even after fuel usage by harvesters and threshing machines is taken into account. So mechanization helps

combat climate change. The researchers conclude that mechanization should therefore be part of agricultural policy.

Info: [heike.axmann@wur.nl](mailto:heike.axmann@wur.nl)

## MARINE ECOLOGY

## Beeping bottle shows plastic route

**What route does plastic waste take when it ends up in the North Sea? You can see online by following a plastic capsule fitted with GPS.**

The floating capsule was thrown in the sea on 12 August about 200 kilometres north of Terschelling. The device sends a GPS signal once a day; a mini-solar panel provides the necessary electricity. The route can be followed live on [gps.verkis.is/pame/](https://gps.verkis.is/pame/). 'The launch is part of a broader communication project involving a variety of northern countries,' says Wageningen plastics researcher Wouter Jan Strietman. 'We want to show the general public where plastic

can drift to once it ends up in the sea.' The capsule was first launched off the west coast of Texel in late May. After travelling in a circle for 400 kilometres, a fierce northerly wind blew it onto the Terschelling coast. Strietman hopes the capsule will float further north on its second voyage. 'Many people don't know that floating waste from the Netherlands can reach the Arctic in about 18 months due to the wind and ocean currents. Huge volumes of waste wash up in that region and stay there.'

The capsule launch was organized by WUR and Leeways Marine, in partnership with PAME, an Arctic Council working group, and the Dutch government, which is paying for the capsule.

Info: [wouterjan.strietman@wur.nl](mailto:wouterjan.strietman@wur.nl)



PHOTO SHUTTERSTOCK

## FUNDAMENTAL RESEARCH

## Louise Fresco: 'More scope for serendipity'

'We in Wageningen do a lot of research in support of policymaking, and that is relevant to society. But we must make sure that fundamental research holds its own as well,' said Executive Board chair Louise Fresco at the opening of the academic year on Monday 6 September. Because groundbreaking discoveries certainly don't always come out of clear-cut research plans. For this reason, Fresco says we need to create more scope for serendipity – chance discoveries – and also for failures. 'We don't have an expression like "magnificent failures" for nothing. I see a future in which we bring together groups of scientists without an immediate research assignment. And why not get an art historian to help figure out how to combat a zoonosis, or a philosopher to ponder food security? That is the cross-fertilization I've been arguing in favour of for years.'

Info: [annet.blanken@wur.nl](mailto:annet.blanken@wur.nl)





## Growing rye in an underground bunker

This year, rye and peas were grown in an Arnhem bunker in replica Mars soil. LED panels simulated a day-night rhythm and produced heat. Although the temperature in the bunker was 12 degrees Celsius, the greenhouses insulated with polystyrene reached a growth-friendly 20 degrees. The trials are the latest stage in the Mars research of ecologist Wieger Wamelink of Wageningen Environmental Research. Wamelink is performing growth experiments in a bunker as life on Mars will need to be underground because of the radiation. 'It turns out to be more difficult than expected. It took a while to get the automatic water dosage system working properly, for example. The growth trials were to test whether we could get a functioning system, and we did in the end.'

Info: [wieger.wamelink@wur.nl](mailto:wieger.wamelink@wur.nl)

# Ocean plastic from 1000 rivers

**Over 1000 rivers are responsible for nearly 80 per cent of all the plastic waste in the sea, according to a study by The Ocean Cleanup together with WUR, Delft University of Technology, Utrecht University and the Helmholtz Centre for Environmental Research.**

Rivers are the main source of ocean plastic. Estimates from 2017 suggested that 10 of the largest rivers make the biggest contribution. The new model calculations look not only at the amount of plastic waste in a river basin but also at the probability of it drifting out to sea. That probability depends on factors such as precipitation, wind, land use and terrain gradient. This shows that plastic is in fact carried out to sea by a large number of small and medium-sized rivers. The Ocean Cleanup will use the new data to guide its cleanup activities.

'A little-known result is that less than two per cent of the plastic that ends up in the environment flows out to sea,' says researcher Tim van Emmerik of the Hydrology and Quantitative Water Management chair group. 'So most remains behind somewhere in the river systems. We are trying to figure out where all that plastic is.'

The study was published at the end of April in *Science Advances*.

Info: [tim.vanemmerik@wur.nl](mailto:tim.vanemmerik@wur.nl)



## Banana fungus is becoming resistant

**A leaf fungus feared by banana growers is becoming resistant to fungicides, shows a worldwide analysis of fungal variants by Wageningen scientists.**

The leaf fungus causes the disease Black Sigatoka and is found in banana plantations all over the world. The researchers carried out the first large-scale analysis of variants of the fungus to test their sensitivity to three commonly used fungicides in important banana-producing countries such as Colombia, Costa Rica, Ecuador, the Philippines, Martinique and Cameroon. Their research shows that the fungus is rapidly evolving to become unaffected by the

fungicides. That is due to the intensive use of crop protection agents. Research leader Gert Kema, professor of Phytopathology at Wageningen, concludes that banana producers need to break the vicious circle. He had been calling for the development of resistant banana varieties and alternative methods of combating disease for years. The research was published in March in *Pest Management Science*.

Info: [gert.kema@wur.nl](mailto:gert.kema@wur.nl)





## AGRICULTURAL ECONOMICS

## BEHAVIOURAL BIOLOGY



PHOTO MEHMETO / SHUTTERSTOCK.COM

## African economies barely benefit from each other

**Historian Ewout Frankema has secured a Vici grant to investigate why economic development has stagnated in Africa in the past 50 years, while that of Southeast Asia has flourished.**

While there are big differences between African countries, we can still see a general pattern in their faltering economic development, argues Frankema, who is professor of Rural and Environmental History. 'African economies do not seem to propel each other forwards. There is no mechanism making sure they can benefit from one another.' This is precisely what did happen in other parts of the world. He wants to use the Vici grant of 1.5 million euros to explore the underlying historical reasons for the explosive economic development in Southeast Asia since 1970, a period in which growth was sluggish in nearly all African countries. 'Remarkably, African countries export less than 10 per cent of their products to neighbouring countries, which is an extremely low percentage. In many cases,

regional trade was choked off during the colonial period.' He is also looking at migration patterns. 'That is a hugely underestimated factor. In Southeast Asia, large groups of labour migrants from China and India settled in tropical areas with a demand for labour from the mid-nineteenth century. They brought knowledge and set up businesses and commercial networks fed by their connections with their home country.' In contrast, many African countries expelled 'foreigners' after they gained independence. In Nigeria, for example, three million people left in the early 1980s. Uganda and Tanzania deported their Indian communities, who had played a key role in their economies. 'That did not help trade and development.' Frankema will soon be publishing a book on aspects of that migration history. Info: [ewout.frankema@wur.nl](mailto:ewout.frankema@wur.nl)

## Young birds help out at home

Young birds from a previous breeding season help their parents raise the new brood, defend the territory and protect the nest from predators, shows a bird study in Swaziland.

The limited availability of territory plays a key role in the social behaviour of the birds that were studied, which included the mousebird and the helmetshrike. 'If a young bird helps out with the nest and defence duties, that increases its chance of inheriting a high-quality territory,' says researcher Sjouke Kingma of Behavioural Ecology. The young birds also feed the chicks, sometimes even with their own food. Kingma: 'That social behaviour benefits them as once a bird inherits the territory, it will in turn get help from the younger birds it once helped raise.'

Info: [sjouke.kingma@wur.nl](mailto:sjouke.kingma@wur.nl)

## MARINE ECOLOGY

## Reef sharks like to roam

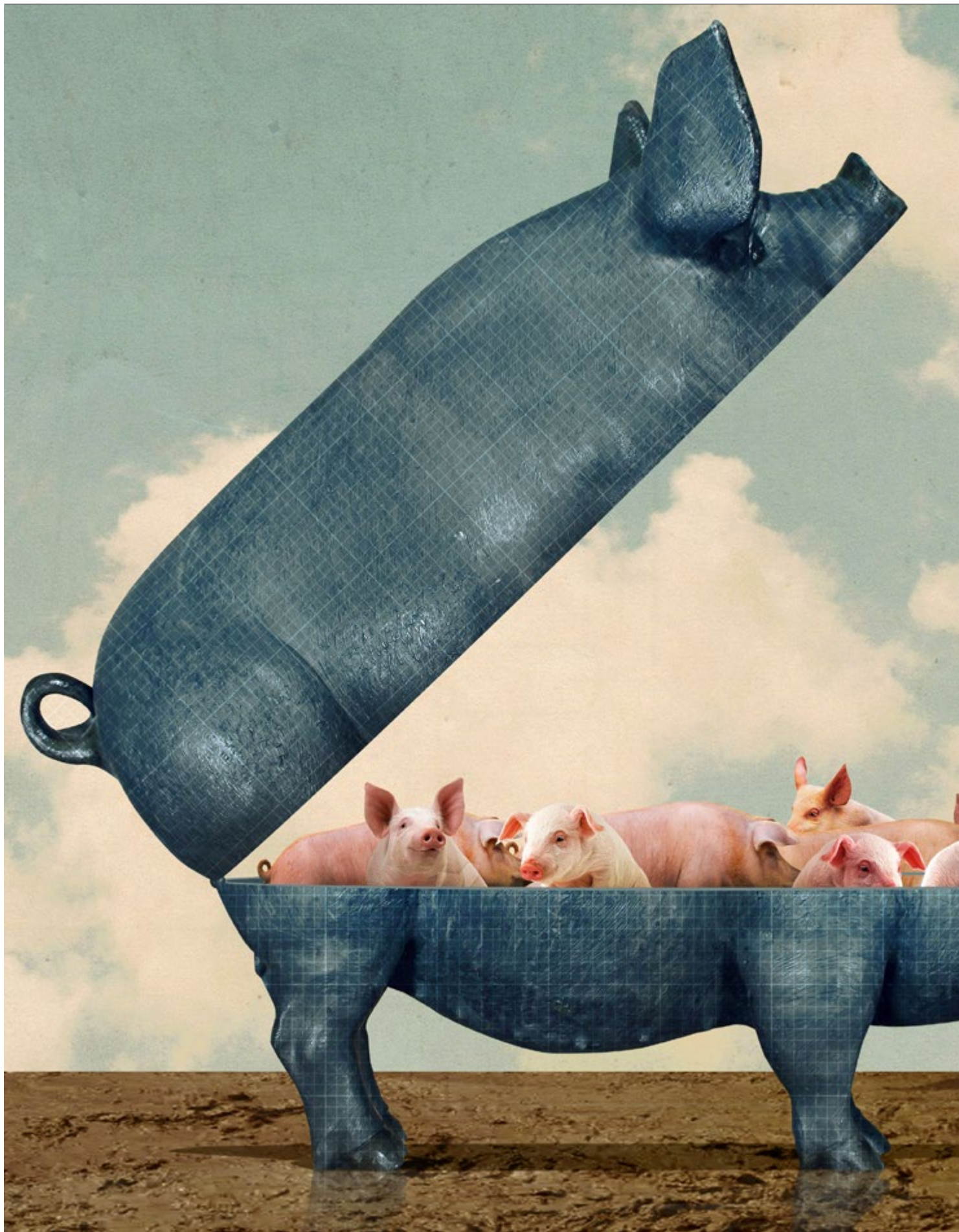
Reef sharks move from one habitat to another during various periods in their lives. This finding is from WUR research on two species of reef shark in the Caribbean Netherlands. The finding has consequences for the measures that are effective in protecting the endangered species. 'It shows it is important to focus not just on the shallow reefs but also on the somewhat deeper and more remote habitats,' says Leo Nagelkerke of Aquaculture and Fisheries. The study was published at the end of April in *Marine Ecology Progress Series*.

Info: [twan.stoffers@wur.nl](mailto:twan.stoffers@wur.nl)



PHOTO SHUTTERSTOCK





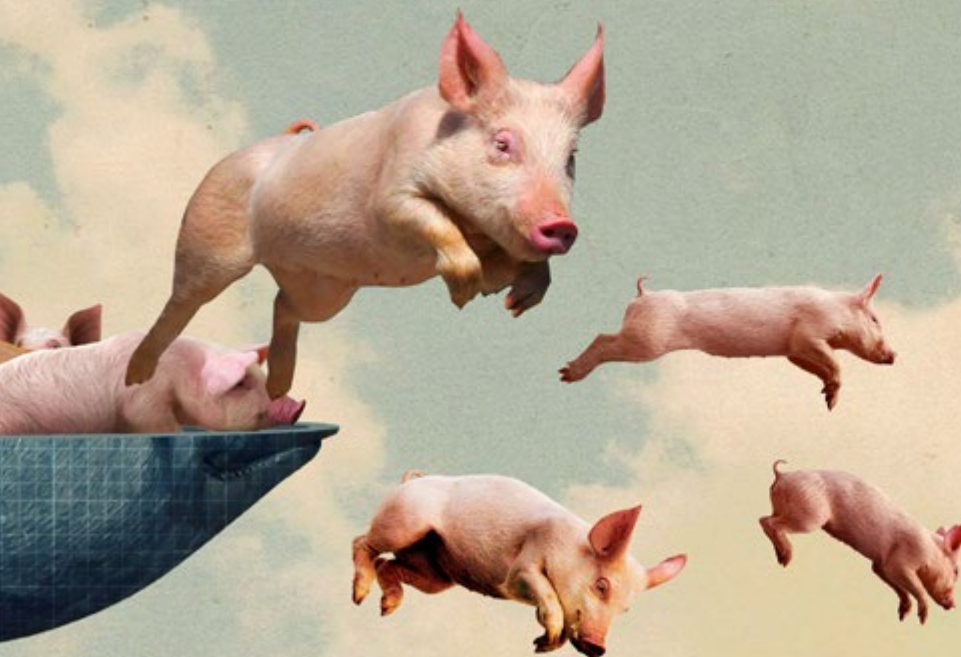


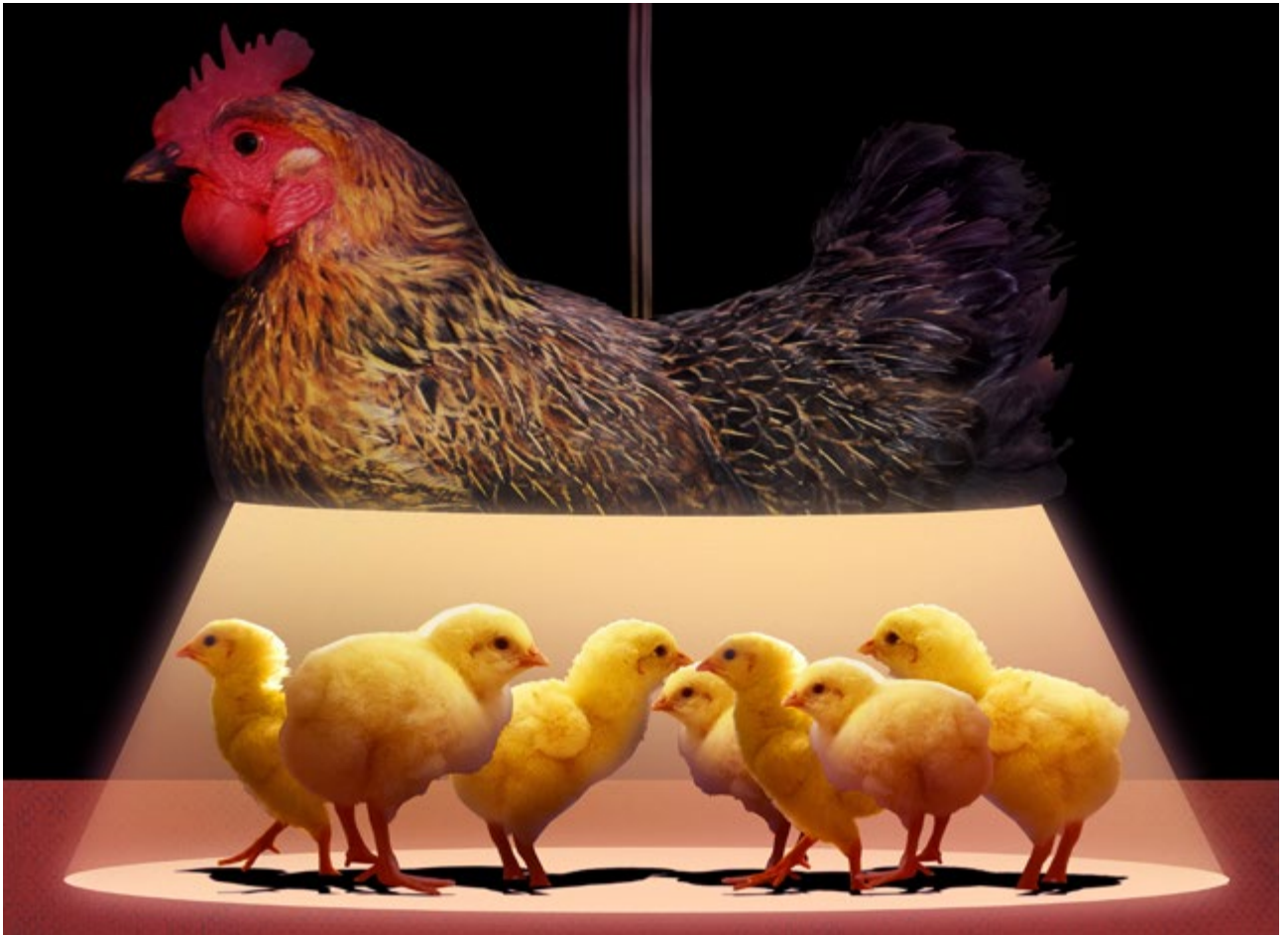
AMENDMENT TO THE ANIMALS ACT

# As long as they are happy

**Cows, pigs, chickens and other animals kept in barns or pens should be able to display their natural behaviour, states the revised Animals Act that comes into force in the Netherlands in 2023. But how do you decide what is natural behaviour and how you can create scope for it? 'There is a hefty price tag on some changes.'**

TEXT MARIANNE WILSCHUT ILLUSTRATIONS RHONALD BLOMMESTIJN





**A** newborn chick cannot keep itself warm yet, so the average temperature in a typical broiler barn is 34 degrees Celsius. But in one broiler barn in Raalte, in the eastern Netherlands, the thermostat has been turned down and the chicks seek heat under the ‘mother hen’, a hood that keeps them warm with infrared panels. ‘In a natural environment, newborn chicks stay under the mother hen’s wings for the first two weeks, so this is an alternative to that,’ says Ingrid de Jong, poultry welfare researcher at Wageningen. ‘We have seen that slightly older chicks like to make use of this surrogate for their mother’s protection too.’ For De Jong, this farm belonging to the Nijkamp family provides an example of an innovative barn that both saves energy and gives the chickens more scope for their natural behaviour. The chickens get straw bales to pick in, they have plenty of space in which to free-range and take a dust bath,

and there are roosting perches and raised platforms they can retreat to. The movement pressing for more attention to animal welfare on farms started years ago, and the era of rearing calves in crates, trimming chickens’ beaks and tying up sows is over. There are more cows grazing in the fields again, and more meat on the shelves that meets the criteria of the Better Life label. All chicken in Dutch supermarkets will have to carry that label from the end of 2023. Meanwhile, consumer demand for better animal welfare goes on growing. Increasingly, it is linked with animals being able to display their natural behaviour. A revision of the Animals Act was passed by both houses of the Dutch parliament this summer. This included an amendment proposed by the Party for Animals which states that animals’ housing must not hamper their natural behaviour. The animal rights party PvdD explains that this means

animals must not be permanently deprived of the opportunity to display their natural behaviour. The amended act will be in force from 1 January 2023, but it is not yet clear exactly how this amendment will be interpreted. Carola Schouten, outgoing minister of Agriculture and Nature, has commissioned research to find out how the amendment compares with European and international rules, and what the legal implications of that are. The minister also wants the Lower House of parliament to think about the practical implementation of the amendment, which is currently formulated very vaguely. After all, what constitutes natural behaviour, and how do you define it?

#### **WILD BOAR**

‘What we understand by natural behaviour is behaviour that an animal displays in the wild and that still occurs in domesticated



## ‘Life in the wild is not necessarily pleasant’

animals,’ says Liesbeth Bolhuis, associate professor of Animal Behaviour at Wageningen. ‘It is known, for instance, that pigs still display the same behaviour patterns as wild boar. We know that partly from research from Sweden in which pigs were released in large parks. Those pigs behaved just like their wild relatives.’ We also know that chickens in cages attempt to take dust baths even if there is no sand or coco peat to do so with. That is a clear sign that the animal is missing something. But for a pig that gets its food and drink served up by the pig farmer, is it still essential to be able to root? Bolhuis: ‘We know from research that rooting is still important to pigs, even when their food and drink is provided. There was a study, for example, on whether pigs are willing to “pay” for enrichment of their pen with straw or sand by pressing a button or pushing against a door. They proved very willing to do so. In the course of evolution, rooting has been crucial to the survival of the species. That urge is still ingrained in pigs and if they live in a bare pen without a suitable substrate, they start applying that rooting and chewing behaviour to the pen or to their companions’ tails and ears.’

### CALVES WITH THE COWS

With a view to catering for the natural behaviour of pigs, cows, chickens and other farm animals, various housing systems have been thought up in collaboration with Wageningen, and are now in use on some farms. One example is the family herd system in which, thanks to a smarter barn design, calves remain with their mothers and cows are not dehorned. For pigs too, barns have been designed that are based on their natural behaviour. These include the Family Pig barn and a group nursery system in which a group of sows

and their piglets can stay together, just as they do in the wild.

‘Anything is possible in theory, but when you are designing such systems you do run up against financial and practical challenges,’ says Karel de Greef, who does research in Wageningen into new housing designs for animals including rabbits. ‘You always have to find a balance between the interests of the farmer and of the animal, and between those of the consumer and of the animal. Working with the Dutch Society for the Protection of Animals, I have defined the criteria for the Better Life label for rabbit farms, and from the implementation of this it is obvious that society’s wish to let animals display more natural behaviour clashes with what is feasible in practice. Rabbits are group animals, for instance, and from the point of view of what’s natural, you would want to keep the does together. But sometimes they fight tooth and nail for the first few days. Try solving that one. Fights about the pecking order are normal and that is natural behaviour too.’

The jury is out, according to De Greef, as to how important natural behaviour is to domesticated animals. ‘If a rabbit can’t burrow, is its wellbeing affected? We don’t know. If you provide it with soil, it will start burrowing, but we don’t know whether you are depriving the animal if you don’t. You don’t see rabbits making digging movements the way the chickens do with dust baths.’

### WOLF IN THE BARN

Liesbeth Bolhuis agrees that it is not easy for the livestock sector to fulfil all society’s wishes. ‘Life in the wild is not necessarily pleasant,’ she says, to put the issue in perspective. ‘Out of doors, animals are exposed to big changes in temperature,



**INGRID DE JONG,**  
senior researcher into poultry welfare, Wageningen Livestock Research



PHOTO VAN ASSENDELFT FOTOGRAFIE

**LIESBETH BOLHUIS,**  
associate professor of Animal Behaviour, Adaptation Physiology chair group

## ‘Enable 14 million pigs to root?’ That’s never going to happen’



PHOTO GUY ACKERMANS

**KAREL DE GREEF,**  
researcher into housing  
concepts, Wageningen  
Livestock Research



PHOTO HEIN WALTER

**BRAM BOS,**  
researcher into system  
innovations Wageningen  
Livestock Research

and they face their natural enemies. I assume it’s not the idea to let wolves into barns.’ She understands that there are limits to the scope for enabling natural behaviour among farm animals as the amendment aims at.

‘There is a hefty price tag on some changes. It is therefore not realistic to expect that very big changes will be made before 2023, when the amendment to the Act comes into force. So I am very curious to see how that amendment will be implemented in practice. Farmers have already had to invest a lot in things like air filters, and they don’t get higher prices because of them. That is frustrating for a lot of farmers, of course. They are quite willing to invest in animal welfare, but at the same time they bear the brunt of the costs without getting higher profits as a result.’

The scope for investment varies per sector, says Bram Bos, senior researcher on system innovations at Wageningen Livestock Research. ‘Especially in the small sectors such as rabbit and duck farming, there is hardly any scope for investment, partly because not many big companies see new housing systems as lucrative. In the larger sectors such as the pig, cow and chicken sectors, a few manufacturers like Vencomatic, Schippers and Jansen Poultry are working on barn systems and technology such as robots, which they can export as well. That way they can recoup their research and development costs. Only then will it really take off.’

### **BETTER NURTURING BEHAVIOUR**

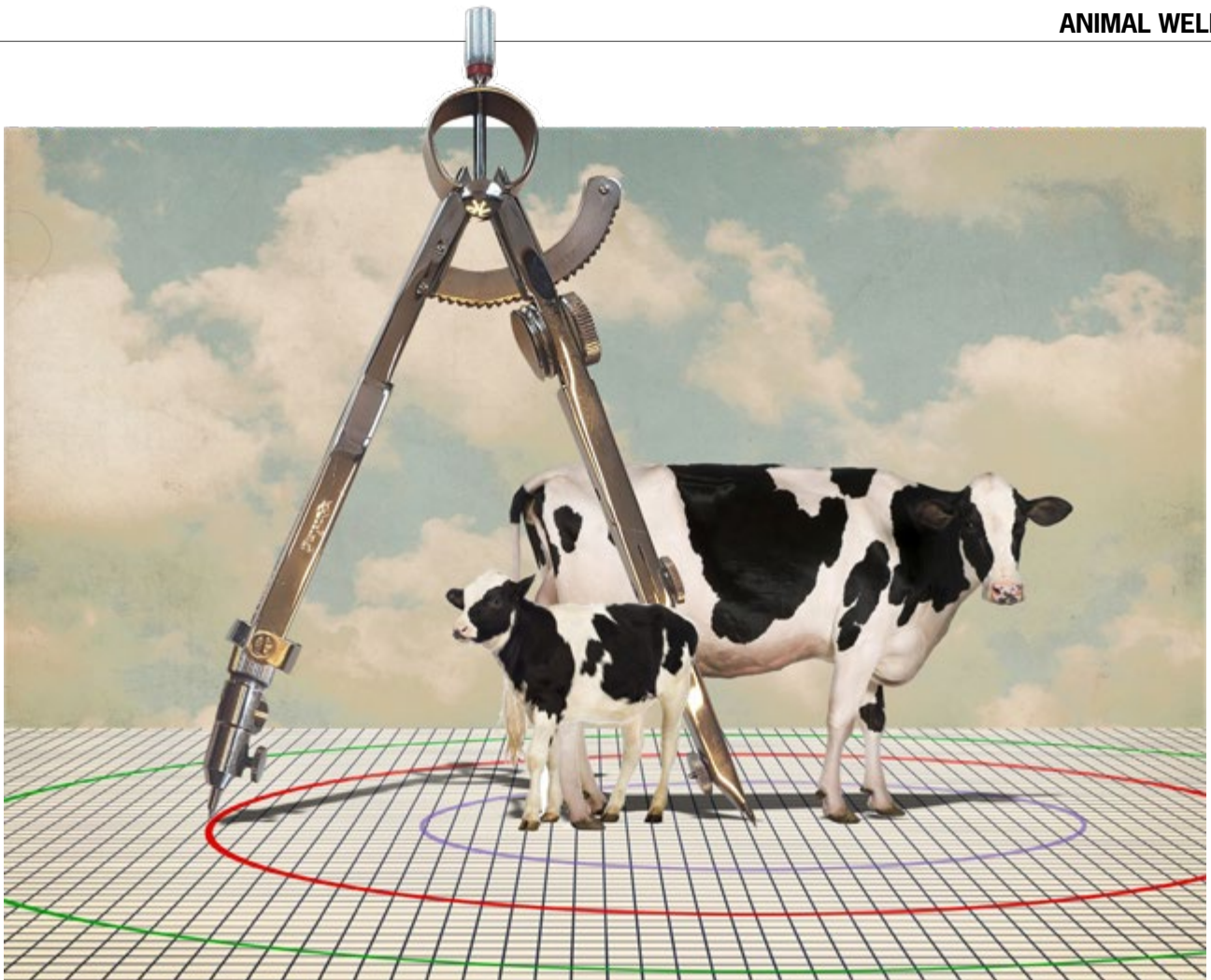
Yet Bolhuis believes more can be done within the existing system in the short term, even without major investments. ‘In the wild, pregnant sows make a nest. On intensive farms you could cater for that a little bit by giving them more space and

more materials to make a nest with. You notice the positive effects of that around the time they give birth. The sows are calmer and there is even evidence that they display better nurturing behaviour. You get the same effect to some extent if you give sows a jute sack. They can’t really make a nest with it, but they can fiddle around with it. That’s such a small thing but it can have a positive impact on that sow. Without any nesting material, she remains restless.’ Another adaptation that doesn’t require much of an investment, says Bolhuis, is providing piglets with play-feeders. ‘In the wild, piglets learn to eat from their mothers through play. And you can see that weaned piglets go through a growth dip. If you allow those piglets to eat with the mother, or give them a play-feeder containing some rooting and chewing material as well as larger chunks they can play with, they are less affected by that. And that benefits the pig farmer too. A recent paper by a colleague, from a study I worked on too, shows that pigs that grow up in a more natural fashion get ill less and recover faster from a lung infection. So this makes financial sense too.’

### **BIG BROTHER**

Key parties in the poultry sector, however, are actively investing in more animal welfare. For example, researcher Ingrid de Jong has received half a million dollars in research funding from the American Foundation for Food and Agriculture and McDonald’s for the Smart Broiler project, which aims at creating a kind of Big Brother for broiler chicks. De Jong is using the funding to develop a system for measuring animal welfare automatically in the barn. Her system works with 3D infrared cameras that monitor the behaviour of 20,000 broilers day and night.





De Jong: ‘This system ought to help poultry farmers to prevent health problems such as footpad lesions simply and relatively cheaply. We can also use it to measure whether the animals are displaying natural behaviour. We work with artificial intelligence and we have trained the software so that it can recognize whether the chicks are displaying natural behaviour, such as taking a dust bath, or whether they make use of the roosting perches or pick at the straw bales or other enrichment materials. Chickens are active and inquisitive animals and if they don’t behave in these ways, it can be a sign that they’ve got a health problem or that their needs are not being met properly. If the images show that they display little or none of this natural behaviour, the poultry farmer gets a signal to go and see what’s up.’

De Jong also expects to be able to use the system to get a better idea of animals’

needs. ‘Currently, many barns are artificially lit, but from a welfare point of view, that might not be what you should be giving a chicken at all. Maybe it likes to rest in a dark area and becomes more active in a well-lit space. And if you know that it rests in the dark, that might be where you should place the roosting perches. With this system we can measure that.’

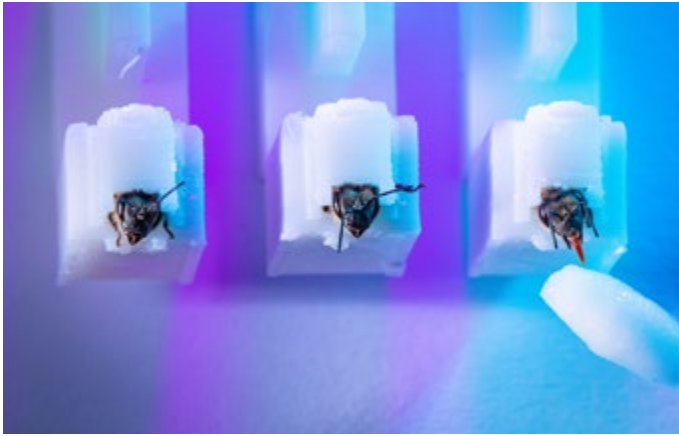
### BLOCKING ROADS

So animal welfare is work in progress. ‘A lot is possible, but it takes time and costs money,’ says Bram Bos. And even then, he doesn’t think it is possible to enable domesticated animals to display all their natural behaviour. ‘Enable 14 million pigs to root outdoors? That’s never going to happen. If you keep pigs on a large scale, it’s not a question of just opening the door.’ Even if you halve the number of pigs, you won’t manage it, he thinks.

‘Because if you have fewer animals, you have less earning capacity so you can’t invest in animal-friendlier options. Unless you can immediately ask higher prices because of them.’

He thinks it’s a good thing, though, that parliament has put these changes on the agenda through the act. ‘Pressure from society helps to get changes off the ground. Take the ban on beak-trimming, for instance: that was opposed by the sector for years, but it happened. So it’s not a bad thing for the Lower House to legislate on this. It’s just that the amendment is still too broadly formulated. Define natural behaviour clearly and come up with a realistic transition path. What the act now requires won’t be feasible before the end of 2022, and that is asking for legal battles and angry farmers blocking the roads with their tractors.’ ■

[www.wur.eu/animal-welfare](http://www.wur.eu/animal-welfare)



Bees are presented with cotton buds covered in saliva specimens with and without Covid. After the specimens with Covid they are offered sugar water. They stick out their tongues for the sugar water. And within a few minutes they start sticking out their tongues as soon as they smell Covid, with or without a reward.

# Trained bees sniff

**A startup called InsectSense has developed a surprisingly quick, non-invasive and easy coronavirus test. You hold a throat swab on a cotton bud in front of a trained bee. If the bee sticks its tongue out, you are infected. 'We train honeybees within minutes, after which they work accurately and at top speed.'**

TEXT MARION DE BOO PHOTOGRAPHY ERIC SCHOLTEN

Bees have a legendary sense of smell: they can smell a flower from kilometres away. 'A bee's detection capacity is one particle per billion, comparable to detecting a single odour molecule in 20 Olympic swimming pools. The sense of smell of insects beats our best technology, and there's enormous potential in that,' says Aria Samimi from Iran, founder of the start-up InsectSense. In Croatia, Samimi tapped into this potential by getting honeybees to detect landmines from a remote-controlled car he had built. Now his team is focussing on diagnosing diseases. Samimi: 'Saliva from coronavirus

patients acquires a particular odour due to subtle changes in the metabolism. Bees can learn to recognize that mix of volatile metabolites. They don't smell the virus itself, but the odours that are released from the saliva of an infected person.'

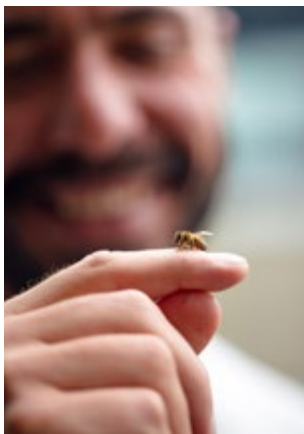
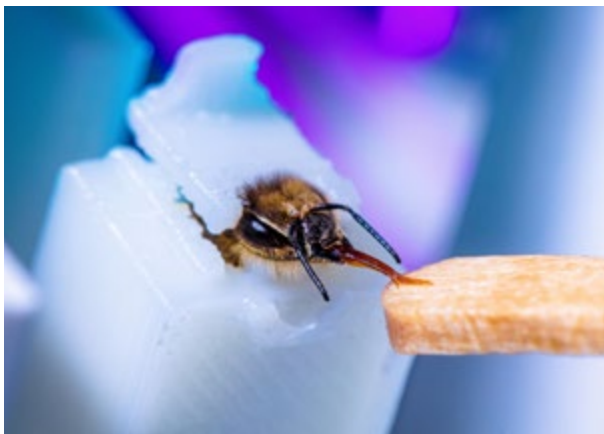
## LITTLE WHITE HARNESESSES

Founded last year, the company InsectSense is located in the StartHub, an incubator for startups and scale-ups at Wageningen University & Research. Here, Samimi and his business partner Leon Schipper built BeeSense, a piece of apparatus in which trained bees are

confined in little white harnesses. You can use it to train several bees at once to recognize new odours.

Samimi: 'First you give the bees various cotton bud samples to smell, some infected with coronavirus and some healthy. With all the samples with the virus on them, they get sugar water immediately afterwards and they stick out their tongues for that. Within a few minutes they are conditioned to stick out their tongues as soon as they smell Covid, even without a reward. A Pavlov reaction.'

The prototype of BeeSense is an apparent chaos of Lego bricks and cables. Three



‘Training bees takes a matter of minutes’

# out Covid

bees are lined up for a demonstration. Carefully, Samimi holds a cotton bud in front of them – for safety reasons, this one is not a Covid sample but is just soaked in sugar water. The bee promptly sticks out its long, pinkish-red proboscis. Later, when the job is done, the researcher releases his troops from their harnesses. In the doorway, the bees sit on his hand, a little dazed, before flying off to a nearby patch of chamomile.

## PLATFORM

In Iran, Samimi studied mining engineering and geology and worked in the marble quarries of the family business. He came to Wageningen University & Research in 2018 as a guest researcher. His research topic was generating electricity from plants. In 2020, he founded his own startup, InsectSense. The young company works closely together with the WUR Laboratory of Entomology and with Wageningen Bioveterinary Research (WBVR) in Lelystad. Testing Covid samples, for example, was done in a highly secure biosafety laboratory at WBVR, in collaboration with Professor Wim van

der Poel’s viral zoonoses group. A study was also conducted on the best method of training the bees. For how many seconds do you need to offer them the odour volatiles? Should the reward follow instantly or after a short interval? The Covid samples that were used came mostly from infected minks and later from people with Covid-19.

## DRUG DOGS

Samimi: ‘We know that dogs have a very good sense of smell too. There are drug dogs, bomb dogs and dogs that sniff out bank notes. But training a dog takes three to nine months, while training bees takes a matter of minutes. Besides, you always use just one dog. The charm of our method is that it is easy to scale up to do multiple testing. Our BeeSense set-up with 10 bees detects Covid with a sensitivity of 92 percent. What is more, bees are much cheaper to keep than dogs, and they definitely don’t get infected with the coronavirus themselves.’ Samimi expects BeeSense to be an option for developing countries with poorer infrastructure and less access to laboratory testing. Honeybees are available all over the

world, and you could test more than 100 patients an hour using a hand-held tool. The company wants to automatize the process more fully by capturing images on camera of the bees that stick out their tongues and converting them to digital signals. Samimi: ‘As well as Covid, you could also teach bees to detect diseases such as avian flu or various plant diseases at an early stage.’

In December last year, Samimi’s group was awarded a Take-off grant by the Dutch Research Council (NWO) to study the feasibility of using a biochip, LumiNose, with synthetic insect genes to detect volatile compounds. This follow-up study is being done in collaboration with the Bioscience researchers at Wageningen Plant Research. Virologist Van de Poel thinks it is very promising. ‘We could make a synthetic sensor based on bee cells that can automatically detect odour compounds, probably including other viral diseases in plants, animals and humans. We still have to figure out how specific it is.’ ■

[www.wur.eu/training-bees](http://www.wur.eu/training-bees)



A woman with blonde hair, wearing a dark blue textured blazer over a patterned top and dark trousers, stands in a lush green field. She is looking upwards and to the right with a slight smile. The background consists of tall grass and a line of trees under a cloudy sky.

PROFESSOR MARTHA BAKKER:

# ‘Split up extensive and intensive agriculture’

## Create zones in the Dutch landscape where all the farming is of the same type, proposes Professor Martha Bakker in a controversial plan. 'I think there is room in the Netherlands for all kinds of farms. But set strict conditions per area.'

TEXT RENÉ DIDDE PHOTOGRAPHY BRAM BELLONI

Look, over there you see extensive livestock farming with varied pastures with flowers in the grass,' points out Martha Bakker, professor of Land Use Planning at Wageningen. We are driving around the peatland area south of Amsterdam, which surrounds old villages that grew up here organically. The route takes winding roads alongside meandering peaty streams and past small fields, and the birdlife is plentiful. It is a popular area with walkers and cyclists from the capital city. 'Lovely, isn't it?' Bakker says frequently. Born and bred in Amsterdam, and trained as a physical geographer, she still lives in the city. 'But I am very fond of the countryside. The conflict between farmers and nature conservationists really pains me.' Bakker is referring not just to nitrogen emissions from agriculture in nature areas, but also the runoff of phosphate, the issues of surface water levels and of water quality, and the impact of gigantic barns and monocultures on the landscape. Now, in a cool, wet late June, the water is high in the rivers and ditches. 'That farmer over there won't mind that at all, because he obviously farms extensively,' says Bakker, pointing out fields of high grass separated by rows of trees, where a few cows are grazing. 'But his neighbour here would prefer a lower water level,' she adds, gesturing towards a large barn with a brand-

new house in front of it and neat, short grass all around it.

For Martha Bakker, there is more to this than a conflict between farmers and nature-lovers: she also points out the consequences of the differences in farming method. 'Ultimately, these two farmers get in each other's way. The intensive farmer wants a low water level for optimal grass growth and frequent mowing. For the other one, that high water level is beneficial for his herb-rich grassland and biodiversity.'

### STRIKING PROPOSAL

What we see here, 20 kilometres outside Amsterdam, is precisely the heart of the problem for which Bakker and her colleagues made a striking new proposal this spring. Separate out intensive and extensive farmers and create zones in the Dutch landscape where the same farming method is applied: that is Bakker's message. She distinguishes between three kinds of zone. The A zone is for intensive, field-based livestock farming and arable farming – broadly speaking, current conventional farming. In the B zone there is land-based extensive farming, which is not necessarily organic, while industrial agroparks with high-tech, super-intensive farming are located in the C zone. The intensive, land-based A-zone farming takes place in the coastal zones and the

Flevo polders, extensive B-zone agriculture is on the higher sandy soils, and C-zone agriculture is found in agroparks at 30 locations spread throughout the country. Bakker also proposes that other urgent claims to the scarce space in the Netherlands should be divided up according to the same three categories to some extent. Nature development and tree-planting, climate adaptation with water storage and anti-drought measures, and recreation could all take place in the B zone along with extensive agriculture. The energy transition facilities, with wind turbines and solar farms, should be located in the A and C zones. Housing fits in the B zone and would include 'tiny houses' and would make use of locations where farms are vacated.

***We've heard calls for zoning before. Back in the 1970s, there was talk of separating or interweaving agriculture and nature. WUR big shot Rudy Rabbinge argued in favour of an Agricultural Main Structure 30 years ago, and Johan Remkes published a report about the nitrogen problem just last year, entitled 'Not everything is possible everywhere'.***

'The Remkes Commission's buffer zones around nature areas, the zoning and extraction ban on water on dry sandy >



## ‘On sandy soils, agriculture faces multiple handicaps’

soils and reserving highly fertile land for agriculture, as proposed by the supporters of the Agricultural Main Structure, are all sectoral proposals. Each of them follows a different pattern. I am a generalist so using knowledge of many different disciplines, what I’ve come up with is a cross-sectoral zoning system, bringing together the many and rapidly increasing claims to the scarce space in the countryside. It is a pragmatic combination of separating land use types along broad lines, and interweaving functions within the clusters.’



**MARTHA BAKKER**

Professor of Land Use Planning in Wageningen

**Education:**

1996 MSc in Physical Geography at the University of Amsterdam

2005 PhD in Land Use and Soil Degradation, Université Catholique de Louvain la Neuve

### **What led you to the idea?**

‘In 2018 I was asked to look at the implications of climate change for the rural areas for the province of Noord-Brabant. That province is a pressure cooker for numerous problems such as the nitrogen issue, which are only being worsened by climate change and could explode. But there are also serious issues around water storage, carbon sequestration and the energy transition.’

‘I started with agriculture, which increasingly has two faces, with overly intensive farmers on the one hand, who are to blame for most of the environmental problems, and extensive farmers on the other hand, who provide a lovely landscape full of biodiversity. Partly thanks to a lack of political leadership, that dichotomy is becoming more and more polarized.’

### **Clustering highly intensive farms together means giving up on the landscape, a lot of people will think. After all, anything goes in those agroparks?**

‘Yes, I have heard that hardliners consider the C zone agriculture in agroparks and the land-based agriculture in the A zone a ‘dead zone’, but that is not true. Intensive farming there has to comply with the environmental norms. And that is possible with capital intensive technology such as precision farming and air filters.’

‘The agroparks of the C-zone agriculture are for pig farms, chicken farms, greenhouses and mushroom farms. There are local companies that supply the farms with waste materials, or that buy them from them. By locating an abattoir or a feed company there, you cut down on transport. You can also combine wind farms with solar farms. Greenhouses use the heat from data centres, as well as the CO<sub>2</sub> from industries. You don’t get protests from local residents, because

there are hardly any local residents. That also often means a better use is found for dying industrial estates.’

### **And on the extensive farms, the farmer jogs along on his horse and cart?**

‘Extensive farming makes full use of modern farm machinery, but uses artificial fertilizer and pesticides sparingly, and doesn’t mow the fields much. The big complication is that farmers in the B zone areas, especially on the higher sandy soils, have been advised for decades to solve their problems with capital-intensive technology. Manure digesters, air filters, separating urine from manure. That is the wrong advice. Because these areas face multiple handicaps. There are nitrogen emissions into the air here and phosphate runoff into the water, and increasingly there are irrigation bans during dry periods, health dangers posed by fine particles, and a landscape blighted by the dominance of huge barns. Not all these problems can be solved with technology, and even when that is possible, farmers can no longer afford it.’

### **But for several decades, farmers got loans from the Rabobank for things like expanding their dairy herds after the milk quotas were ended, but not for switching to extensive agriculture.**

‘That was due to a lack of an overall vision about the problems in the rural areas. Rabobank executives have since realized that wasn’t good. The problem is that many advisors at the local branches of the bank are still thinking along the same lines as 30 years ago and steering the farmers towards bulk production for the global food market. Whereas we are less and less competitive there compared with China and Latin American countries.’



### **How should the zoning and 'de-intensification' that you describe be done?**

'There are plenty of institutions that could buy up the land in the B-zone areas, such as pension funds, insurance companies, drinking water companies, water boards and nature organizations. They finance a land bank, a foundation that buys up land from farmers who want to stop. The bank leases the land at attractive rates under strict conditions regarding the number of cows, the water level and biodiversity. Farmers then get more land to graze their existing herds on and promote biodiversity without excess manure and nitrogen and phosphate problems.'

### **Does that give farmers a business model? And that land bank?**

'The land bank gets lease money from the farmers, entrance money from leisure-seekers and some income from modest building plots, such as for off-grid tiny houses. The farmers generate incomes from the currently developing trade in nitrogen and phosphate emissions, by selling rights to A and C agricultural zones. They also get European subsidies for agricultural nature management, hedgerows and

rural development. They can brand local products and get much better prices for their milk and cheese than they get from FrieslandCampina. And lastly, they save a lot on livestock feed, artificial fertilizer, pesticides and probably the vet, too.'

### **And the hundreds of millions the government is now allocating to buying out farmers?**

'Because the land has been earmarked for B-zone agriculture under strict conditions, it is not worth as much. That is going to cost the state money, but through the restrictions on agricultural land use, we'll get a lot of ecosystem services in return. An important point is that central government will control this zoning process. It needs to outline the larger plan for the countryside and work out which land use claims can be combined, and in which areas. I have suggested not locating energy transition initiatives in the extensive B-zone farming areas, nor water storage in the agroparks.

'The government should be at the wheel and should set conditions and map out the Netherlands of the future. At the moment, the government lacks vision, and spatial planning has been decentralized to make it easier, and for the sake of 'public support'.

In a way, it was a bit silly to shift those tasks to lower levels of government. At the same time, even with a national vision, the provinces are crucial to the implementation. They have more power in matters of spatial planning than they currently make use of. They often stay in the background. They need to take on their role and pick up speed.'

### **Farmers' organization LTO says it is not in favour of zoning. Farmers regularly drive their tractors around the Netherlands to protest against nitrogen measures.**

'The government is not clear at present and doesn't have appealing possibilities and alternatives to offer the farmers. So the farmers are closing ranks and it looks as though organizations like the Farmers Defence Force enjoy a lot of support. I think there is room for all kinds of farms in the Netherlands, but strict conditions apply per region. And one thing is certain: food production is no longer goal number one for agriculture, but will be in third or fourth place in many areas, after ecosystem services such as landscape management and recreation.' ■

[www.wur.eu/agriculture-future](http://www.wur.eu/agriculture-future)



# The future of our food

The way we produce, trade and consume food worldwide urgently needs to change if we are to succeed in reducing poverty, hunger, obesity and climate change. The key lies in diversity – in the way food is grown and traded, and in the food on our plates, say Wageningen researchers.

TEXT JORIS TIELENS ILLUSTRATIONS KAY COENEN

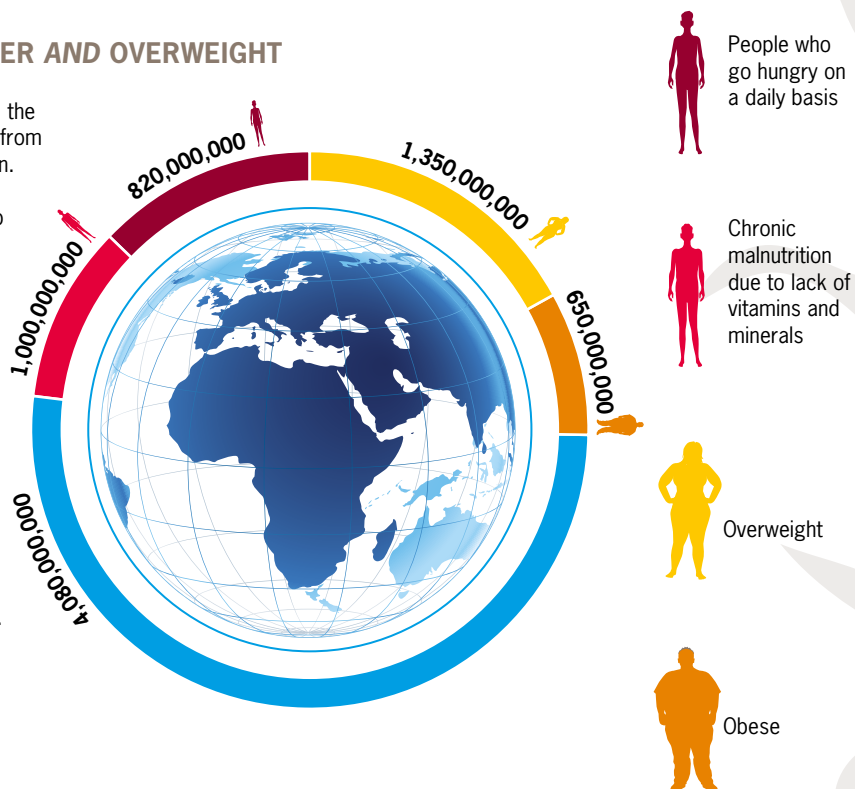
## WORLDWIDE HUNGER AND OVERWEIGHT

After falling for some years, the number of people suffering from hunger is now growing again. Worldwide, at present more than **820 million** people go hungry on a daily basis.

A further **one billion** people suffer from chronic malnutrition for lack of essential vitamins or minerals.

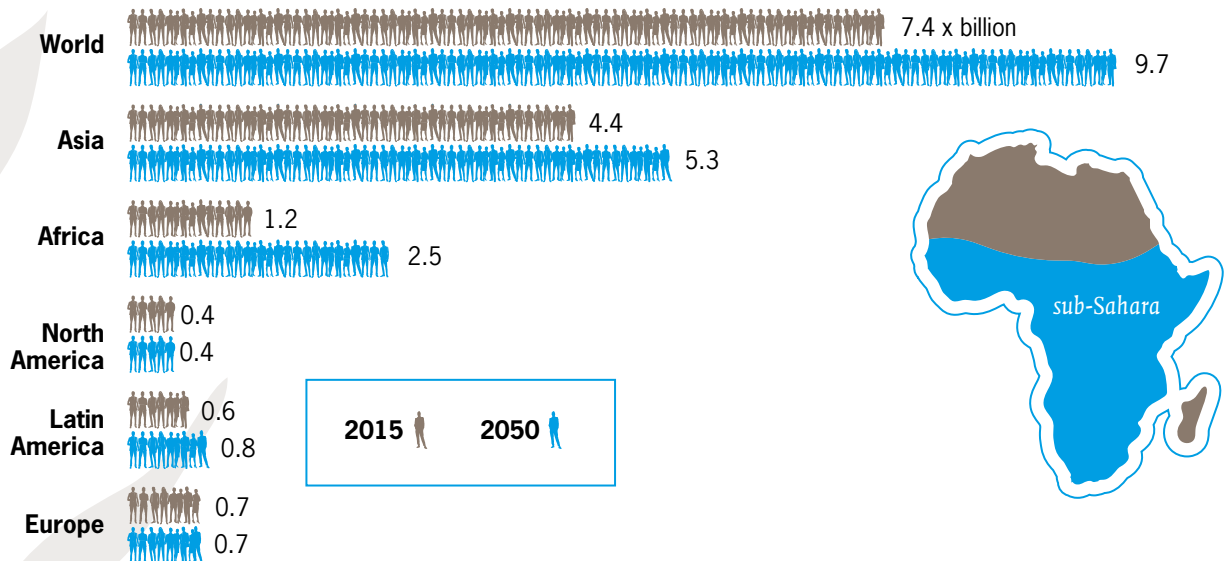
At the same time, nearly **two billion** people are overweight worldwide (**650 million** of these are obese).

The figure is expected to rise to **3.3 billion** by 2030.



## POPULATION GROWTH

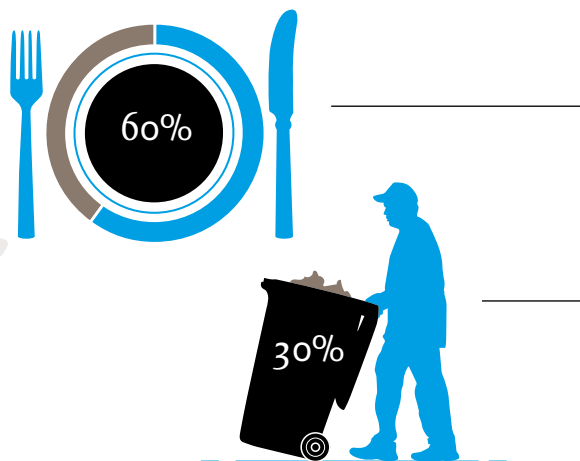
The world population is set to reach over **9 billion** in 2050, with the biggest increase in regions that lack food security, particularly sub-Saharan Africa.



## DEMAND FOR MORE FOOD

Global food production will have to increase by **40 to 60 per cent** to feed the growing world population in 2050. In sub-Saharan Africa, food production will need to triple.

To achieve that will take more than increasing food production through sustainable intensification. Eating more plant-based food will have to be encouraged as well. And food losses and waste will need to be cut: about **30 per cent** of the food that is produced gets lost, whether in the production chain (mainly in poor countries) or at the point of consumption (mainly in rich countries).



**‘W**e have got to realize that there’s a limit. We won’t be able to feed 10 billion people in 2050 with our current food system,’ says Eric Smaling, former professor of Soil Science and food security researcher at Wageningen Environmental Research. ‘We really won’t have got Mars ready for growing onions and sugar beets by then.’ Right now, 820 million people are going hungry, while 1.2 billion people suffer from chronic malnutrition. These numbers have increased because of the coronavirus crisis,

while at the same time, 2 billion people are overweight. It is true that a lot of people can buy tasty food at low prices these days, but more and more people are developing health problems caused by a diet with too much fat, too much salt or too little variety. At the same time, poverty is increasing in rural Africa and Asia, biodiversity is in decline worldwide, and the climate is changing, with drought and extreme weather changes as a result. The world population continues to grow. Because prosperity is increasing in much of the world, people are eating >





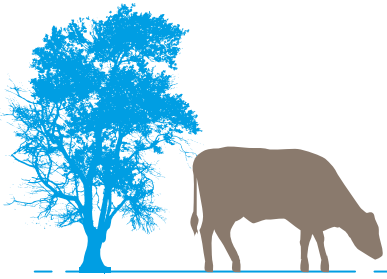


PHOTO ANP



ERIC SMALING

## ‘Growing soya in South America for the livestock in Europe is a thoroughly undesirable system’

more meat and dairy produce. Animal food production requires a lot of land and is one of the main causes of climate change.

For the past year and a half, in the runup to the UN’s Food Systems Summit 2021 this autumn, Smaling has been working with about 100 other scientists from Wageningen and elsewhere on a comprehensive report on hunger and poverty in the world, commissioned by the International Fund for Agricultural Development. They researched the ways food is grown, processed, traded and eaten, as components of a global food system. The current system brings enormous costs with it, claim the researchers. Damage to the environment, climate change and diet-related diseases lead to high costs, while worsening poverty can also lead to social and political unrest. ‘Doing nothing will cause those costs to rise too high. We can compare the current food system to a tanker that is on course for the cliffs. We’ve got to change this tanker’s course now to prevent a disaster.’



KEN GILLER

## ‘Most of the growth in production should take place in Africa’

The researchers looked at what works and what doesn’t for changing food systems. ‘There are a lot of options on the table,’ says Smaling. ‘The Green Revolution in Asia helped a lot, for example.’ Agricultural production was increased there in the 1960s and 70s through interventions like the introduction of new varieties and techniques, artificial fertilizer, and pesticides. ‘Something else that could help is a meat tax or a low VAT rate for fruit and vegetables.’ And as well as new regulations and laws, people can also be nudged to change their eating habits, perhaps by not allowing so many snack bars near schools, or through programmes providing young children with the right nutrition. ‘It remains very difficult to change habits. You have to use both sticks and carrots.’

### INTEGRATED FISH SYSTEMS

One of the authors’ conclusions is that agricultural production should become more circular. ‘Like many integrated fish systems in Asia, where waste from rice cultivation or animal and human excrement are reused in fishponds. But as for growing soya in South America for the livestock sector in China and Europe: that is actually a thoroughly undesirable system,’ says Smaling.

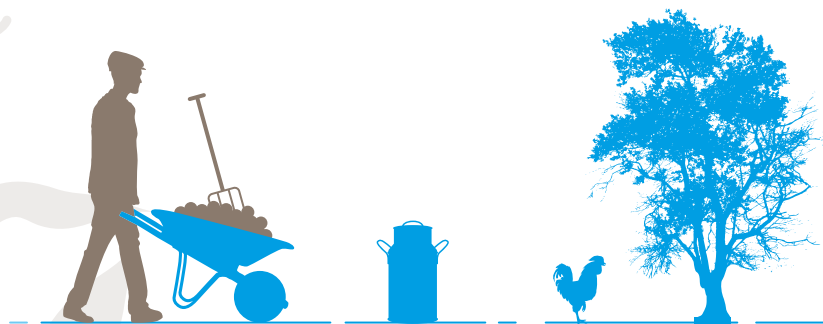
At the same time, food production must increase, says Ken Giller, professor of Plant Production Systems in Wageningen, who collaborated on the report. ‘Even if we assume that there will be less waste in future and that people in the West are going to cut down on meat, we shall still need 50 per cent more food in 2050, worldwide.’ Most of that growth in production should take place in Africa, says Giller, where the population is set to more than double by 2050.

The growth in production will have to take place on small-scale farms, adds Giller. Most farmers in Africa and much of Asia own less than one hectare of land. Agriculture is crucial for these farmers to be able to feed their own families properly, and it is also important for the food supply in the region. Research such as that done in the Wageningen research programme N2Africa has also shown that smallholder farmers are capable of increasing their output considerably. ‘But that in itself is not enough to lift them out of poverty,’ says Giller.

### LIVING OFF THE FARM

According to Giller, many of the farmers cannot live entirely off their farms, let alone earn enough from them to be able to invest in improving their agricultural production. ‘For a long time, we thought agriculture was the engine of development in low-income countries. But if you only look at the engine, you won’t get anywhere,’ says Giller.

Agricultural development must therefore go hand in hand with investments in food processing and logistics. Farmers can then find other sources of work and income. ‘It is very important to invest in agriculture,’ says Giller, ‘but agriculture alone cannot get Africa’s economic development going.’ The rapid population growth and the large young working population is a blessing on the one hand, because it provides a big market for the many smallholder farmers. But on the other hand, the population growth leads to ever more fragmentation of the small farms in the countryside. ‘There is an acute need for better policy to support this big group of smallholder farmers,’ says Giller. One of the issues is better protection against the vagaries



CEES LEEUWIS

## 'We should foster diversity and create alternatives'

in the supply of healthy vegetables and in the purchasing power of poor people to buy them – perhaps through social security payments – prevents people from eating unhealthy food and getting more diet-related illnesses. Such an investment is a lot cheaper than footing the soaring bill for health care.

There is no simple, straightforward solution to this, the researchers conclude. The key is precisely to stimulate diversity. Diversity in the way food is grown and traded, and diversity in the food on our plates. ■

[www.wur.eu/food-security](http://www.wur.eu/food-security)

## FOOD SYSTEMS?

There is more behind the food on our plates than growing crops or rearing animals. The production, processing, transportation and sale of food are all linked, and are influenced by factors such as climate change, trade and policy. Those links are expressed in the concept of a food system. A well-functioning food system is one that delivers sufficient, healthy food, and that does not damage the environment or the climate. It is also one in which the profits are fairly distributed among the people involved.

of the international market, he says. 'At the moment, it is not a level playing field. Farmers in Africa and Asia have to compete with farmers in Europe and the US who get up to 300 euros per hectare in subsidies. Many African and Asian farmers will never earn that much from their yields.'

In theory, world trade generates economic development and food security, says Sieman van Berkum, who uses economic models to research food systems and trade at Wageningen Economic Research. 'International trade increases the availability of food in regions where there is a shortage. That in turn increases the diversity of foodstuffs around the world.' But world trade can also have negative impacts. For poor countries, for example, that are dependent on food imports, or for countries that only export one or two products. 'These countries would be well advised to diversify their trade,' says Van Berkum. Countries whose scope for importing food depends on just one export product are very vulnerable.



SIEMAN VAN BERKUM

## 'Some countries would be well-advised to diversify their trade'

Secondly, the costs of environmental pollution should be included in the price of products to a greater extent than is currently the case, says Van Berkum. That can be done by agreeing in trade treaties that countries can tax imports of products that contribute to climate change, for example. But, says Van Berkum, 'just like other changes to the food system, that can require quite a lot of political change'

## VESTED INTERESTS

'We mustn't be naïve about the extent to which our food systems can be steered,' says Cees Leeuwis, professor of Knowledge, Technology and Innovation at Wageningen. 'There are vested interests that want to keep things as they are. The transformation of the food system is about changing the rules, and that entails social and political conflict.'

What is more, says the sociologist, social change is rarely brought about by design, planning or policy. It comes about through actions by and pressure from citizens, consumers or interest groups. That means that researchers need to collaborate with other stakeholders in the food system, says Leeuwis. 'To do that, it is smart not to opt for a single coalition, but to work in several different collaborative networks on different paths of transformation. We must foster diversity and create alternatives.' The researchers recommend establishing national food platforms in all countries, which are tasked with generating dialogue among citizens, farmers, scientists, businesses and policymakers so as to find solutions to the problems together. The idea is that by coming together, these parties will obtain an overview of the whole food system that will enable them to come up with smart options.

For example, sometimes it is smart to invest at one end of the food system in order to solve a problem at the other end. Investing







FIELD LAB FOR PRECISION FARMING

# The computer helps work it out

**Precision farmers can dose fertilizer, control diseases, irrigate crops and look after nature with greater precision, shows the National Field Lab for Precision Farming. We visit a precision arable farmer, a fruit grower and a dairy farmer. 'The nice thing about the Field Lab is being able to exchange knowledge in a network.'**

**TEXT** ALBERT SIKKEMA **PHOTO** THOMAS TRUTSCHEL / GETTY

## ‘With precision agriculture you regain an overview’

On Slichtenhorst estate just south of Nijkerk in the province of Gelderland, four woolly Hungarian Mangalica pigs are rooting around and basking in the sun. They keep the blackberry bushes short so the saplings can grow better. Someone from a nature organization is counting the herbs in the nearby arable fields to see whether the farmer on the estate qualifies for a grant for nature management. That farmer is Pieter van Leeuwen Boomkamp, who lives with his family in a historic 16th century farmhouse on the estate. Van Leeuwen Boomkamp grows potatoes, onions, beets, maize, wheat, carrots and chicory on 140 hectares of land. Because he has 96 small fields, most of them surrounded by hedgerows or ditches, he practises precision agriculture. Each plot has a different soil type and humidity level, so the growing conditions vary.

‘Every plot gets its own approach. In the old days, when my father was farming, that was called common sense. Now it’s done digitally and the computer helps work it out,’ says Van Leeuwen Boomkamp.

Since 2018, he has been participating in the National Field Lab for Precision Farming programme that helps farmers and horticulturalists use precision farming to increase yields, reduce costs and the environmental impact, and improve food quality. ‘The essence of it is dealing with varied conditions,’ says Corné Kempenaar, who coordinates the programme for Wageningen University & Research. ‘The technology – sensors, drones and satellites, for instance – is the means.’ In the Field Lab, WUR gives advice on new techniques that have already been tested and proven to work in practice. Wageningen explains the options, the farmer chooses which technique to apply, and the experts help monitor the effects it has on farm operations.

### VARYING DOSES

Van Leeuwen Boomkamp drives a huge tractor into the farmyard after spraying his fields with weedkiller using an electronic soil scanner – one of the many gadgets on his tractor. The scanner measures the amount of organic matter and the acidity of the soil. The farmer uses that measurement to dose the weedkiller. Whereas the sprayer on the tractor used to treat all the plants in a 36-metre band identically, the new sprayer can vary the dosage. This leads to a saving of 10 to 15 per cent on herbicides, he reckons.

For his potato crop, Van Leeuwen Boomkamp has a harvester with a location-specific yield meter, so he knows which parts of the plot produce high and low yields. He links that information with his soil scan so he can see how his soil management affects the yield. His aim is to have soils with plenty of organic matter that sequesters CO<sub>2</sub>. For that reason, he fertilizes the soil mainly with compost and green fertilizers and practises non-inversion tillage rather than ploughing. ‘I hope I will be recompensed for this CO<sub>2</sub> storage once the government has drawn up a climate policy for agriculture.’

Van Leeuwen Boomkamp also makes use of drip irrigation, known as precision irrigation. Weather



PHOTO JAN WILLEM SCHOUTEN

Pieter van Leeuwen Boomkamp, an arable farmer in Gelderland, tests underground drip irrigation in a field of onions.



stations and sensors that measure soil humidity deliver the data for customized watering, thanks to which crops suffer less drought stress in the summer and the farmer can use less water. He is testing drip irrigation on five hectares of carrots this year.

Van Leeuwen Boomkamp continuously weighs up the costs and environmental benefits of his crop-farming methods. 'If chemical and technological methods cost the same, I opt for the technological ones. The nice thing about the Field Lab is that you can exchange knowledge in the network. I'm in a WhatsApp group, for instance, with 15 pioneering farmers. What's more, Wageningen has linked me up directly with the suppliers of products and equipment.' But Van Leeuwen Boomkamp learns the most from his own network. 'I went to technical college and then worked for a farm machinery company for 10 years. I have a network of guys who know a lot about technology and electronics, and who will come over to spend an evening fixing a machine or a program that isn't working. Without that network I would have gone bust.'

### PIONEER IN FRUIT

Martijn Slabbekoorn is another pioneer of precision agriculture. He runs a family farm (he is the sixth generation) that grows apples and pears in Kapelle in Zeeland. The fruit farm now covers 70 hectares, divided over three locations. Slabbekoorn runs the farm with his wife and one permanent farm worker, with the additional help of a regular team of Polish migrant workers and some casual labour. At harvest time, 40 to 50 people work at Slabbekoorn Fruit.

Six years ago, Slabbekoorn asked the supplier to provide him with a sprayer with GPS that could dose each plant separately and would also record where it had sprayed. That was a new development in fruit farming. The machine manufacturer had the machine but no software. A few years later, when Slabbekoorn met a fellow fruit farmer with an IT background, the connection was made and a breakthrough followed. The result is a sprayer with nozzles that can open and shut independently of each other. The data are sent to a registration program. 'Say we see apple scab in certain rows on the farm. We can then see in our registration



Martijn Slabbekoorn, a fruit farmer in Zeeland, with the sprayer that has nozzles that can open and shut independently, and that collects data about the crops.

program what treatments those rows had and whether they were any different. That enables us to assess the effect of treatments. That internal check is the most important thing for me.'

### FEWER PESTICIDES

Using these precision instruments, Slabbekoorn has now discovered that he shouldn't spray his crops with insecticides after 10 o'clock in the morning. In the summer, the humidity is generally too low then and the insecticides don't work well. But the precision machinery also ensures that only the leaves are sprayed, reducing the amount of liquid that gets blown away. As a result, Slabbekoorn uses smaller quantities of pesticides than other fruit farmers. How much the environment is spared varies per fruit type and variety. 'GPS delivers savings of roughly five per cent. The sensor sprayers that only spray the plant produce an average saving of 50 per cent of the product when used on young trees and 10 to 20 per cent for mature trees.'

Slabbekoorn has three diseases and pests to contend with. Firstly, scab, a fungal disease that spreads through the air, so the entire plot has to be sprayed against it. In this case it is the sensor sprayer that makes savings. Secondly, aphids, which he combats with insecticides. He used to spray with broad spectrum insecticides, but these killed off useful insects as well. So he now uses selective agents as part of an Integrated Pest >

Management (IPM) approach. He gets some help with this from WUR, which runs a practical course in IPM on his farm. He does use biological agents too, but says, 'Using biological agents alone wouldn't work.'

### DRONE LOCATES WEEVILS

And that is demonstrated by the third pest Slabbekoorn has to deal with: the pear bud weevil. There are still no biological or selective agents for combatting these weevils, so a strong old-fashioned insecticide is required. He now uses a drone to locate the weevils. The weevil lays eggs in the flower buds and the larvae eat the buds, so no blossom develops. The drone sees the places

in the orchard with less blossom, and that is where the farmer needs to spray. That can only be done after the harvest, but at least the pest will be gone next year. Like Van Leeuwen Boomkamp, Slabbekoorn doesn't see precision agriculture as anything new. 'In the old days, a fruit farmer would walk through his orchard, and he knew exactly what was going on in it. Nowadays, thanks to upscaling, you don't have that overview anymore. And the workers don't have that knowledge or interest. Precision agriculture gives you back that watchful eye and the overview.'

### HERB-RICH GRASSLAND

Precision agriculture can be used when growing grass as well as potatoes and apples. Proof of that is provided by Gerard Uijterlinde and his wife Els Uijterlinde-Mentink, who live on a farm called Erve Mentink, near Oldenzaal. Gerard studied Agrotechnology at Wageningen, and Els did Animal Sciences. Together, they run a farm with 200 cows and 80 hectares of land in the rolling Twente countryside. Besides the usual routines of dairy farming, they conduct several different kinds of research into things like feed additives, housing and working with herb-rich grassland.

When the cows step outside, they find themselves in a large meadow with 13 demarcated strips of grassland. Gerard and Els are experimenting with precision agriculture here. On some of the strips is herb-rich grassland, while uniform English rye grass grows on others. Together with the Louis Bolk Institute, the farmers are testing to see which plot of herb-rich grassland performs the best. They are guessing it will be the strips on the drier land because herbs take deeper root than grass and perform better than grass in dry periods. 'We want to get more out of the soil, which is the starting point for production,' says Gerard. Their irrigation trial might clear up a persistent misconception among livestock farmers: that uniform grass without herbs provides more protein. 'We are now getting a higher yield on the herb-rich strips than on the strips with only English rye grass, but the plots with grass and clover mixes are doing better too. The 20 hectares of herb-rich grassland pays off for our farm. We didn't start growing herb-rich grassland for the



PHOTO: REYER BOXEM

Gerard Uijterlinde and Els Uijterlinde-Mentink, dairy farmers in Twente, test which plot with herb-rich grassland is doing the best.

## ‘We get a higher protein yield on the herb-rich strips than on English rye grass’

sake of nature and biodiversity,’ says Gerard, ‘but to improve the soil.’

The fact that more herb-rich grassland is also good for nature is a nice extra, says Els. ‘We see more deer in the herb-rich strips and the pigeons, herons and storks visit them more often because there is more life in herb-rich grassland. That’s really nice.’

Gerard and Els learned the ropes of doing research as students and now they offer their farm as a research location. The cows in their barn can be divided into four testing groups fed on different diets. Out in the fields, the farmers are doing trials with variable fertilizing regimes based on satellite images. ‘Wageningen converts those images into information that we can use,’ explains Gerard. They have also started an irrigation trial in which they use soil humidity sensors to measure how fast the turf dries out in the summer, and how much they therefore need to irrigate it. Besides that, they measure the effect of irrigation on the yield and on soil life. ‘That is quite new for grassland,’ says Gerard. ‘Sensor suppliers all think their own product is perfect, so it was nice to be able to rely on the experience already

gained by Wageningen Plant Research. Together we also measure the differences in microbial soil activity between herb-rich and herb-poor grassland and in the amount of irrigation. It looks funny, with teabag labels sticking out of the ground all over the place. The teabags are buried and the degree to which they have disintegrated after three months reflects the activity in the soil.’

### GETTING ADVICE

Gerard and Els joined the Precision Farming Field Lab last year. Every participant has a mentor from WUR, and they also got advice on herb-rich grass seed from ecological consultants. ‘When we first started, we were advised to sow the herb-rich grassland in the spring. But that’s not a good idea, because that’s when the weed pressure is highest. And we were advised against fertilizing. But we do fertilize because otherwise even herbs run low on nutrients. We try things out, but we do keep our feet on the ground.’ ■

[www.wur.eu/precision-agriculture](http://www.wur.eu/precision-agriculture)

### FIELD LAB FOR PIONEERS

WUR started the National Field Lab for Precision Farming (NPPL) in 2018, at the request of the ministry of Agriculture, Nature and Food Quality. The ministry hopes to achieve several of its objectives through precision farming, such as reducing pesticide use and nitrogen losses.

In the Field Lab, Wageningen provides advice on new techniques and monitors their effects on farm operations. The Field Lab started in 2018 with six farmers, and now 30 farmers are testing about 20 precision agriculture techniques. The participants are pioneers who want to work with technology: they have sensors, data, a program for converting the data into decision guidelines, and a machine for implementing decisions. All this calls for coordination between farmers and suppliers, and that is done by WUR, explains Corné Kempenaar, WUR’s coordinator for the Field Lab. ‘Sometimes we put suppliers in touch with each other too, so they can link up their systems effectively. For example, we use satellite images that show the variation in crop growth. Doing that involves three sets of calculation from the satellite via electronics to the machine, so they have to line up very well.’

Misset Publishers promotes the sharing of knowledge through sector magazines, and the involvement of Aeres University provides a link with ‘green’ education institutions.



# New names for many thousands of fungi

**Thanks to DNA technology, thousands of new fungi have been discovered over the past 20 years, in water, soil and air. About 2000 fungal species are described for the first time every year. It has also turned out that many known fungi actually represent undescribed genera and families. ‘A tsunami of new names is coming.’**

TEXT MARION DE BOO PHOTOS WESTERDIJK FUNGAL BIODIVERSITY INSTITUTE

Fungi are everywhere. If you reach for your anti-dandruff shampoo during your morning shower, what’s bothering you is a yeast – a single-cell fungus – that causes dandruff. The jeans you then pull on have been stonewashed with the help of enzymes from fungi, and at breakfast there are fungi in the cheese on your bread, which itself was made to rise by fermenting yeast. Fungi produce medicinal drugs such as penicillin and numerous useful substances that are used in the food industry and biotechnology. Worldwide, about 150,000 species of fungus have been described, but it is estimated that there are between 2.2 and 3.8 million different species of fungus on Earth. ‘They become extinct faster than we can name them, and at the same time we are discovering new species at an incredible rate,’ says Pedro Crous, extraordinary professor of Evolutional Pathology at Wageningen, and professor at Utrecht University and the universities of Stellenbosch, Pretoria and Orange Free State in South Africa, where he was born. He is also director of the Westerdijk Fungal Biodiversity

Institute in Utrecht, which houses a collection of about 100,000 strains of fungi, the DNA codes of which are stored in the frequently consulted database, MycoBank. Every year, worldwide about 2000 new species of fungus are discovered and then described. Many of these are also deposited in the collection of the Westerdijk Institute.

## **BABEL-LIKE CONFUSION**

In the interests of effective scientific communication, every fungus should have its own unique name. ‘But modern DNA technology has thrown fungal nomenclature into disarray,’ says Crous. ‘DNA sequencing has revealed to us that well-defined groups of fungi, such as *Candida* yeasts, actually consist of numerous genera and even different families. So they have to be given new names.’ To this end, Crous and his colleagues have developed a method for changing the names of fungi without causing Babel-like confusion among scientists and others who work with fungi. The new system is based on the DNA profile of the fungi. When

their academic article appeared in the prestigious journal *Nature Microbiology*, the authors broke out the champagne. Champagne that is fermented with the help of – yes – a fungus.

For centuries, fungi have been divided into groups in accordance with the system laid down by Linnaeus, the Swedish doctor and botanist who published his standard work *Species plantarum* in 1753. Linnaeus gave every species a genus and a species name. For example, *Penicillium rubens* (which produces penicillin) and *Penicillium roqueforti* (in blue cheese) are two different species of the same genus, *Penicillium*. The standard approach to nomenclature is: collect a fungus, cultivate it and describe it in terms of its visible characteristics. But this approach is being complicated now that new DNA technologies have facilitated the discovery of countless previously unknown species of fungus in water, soil and air. We only know the gene pattern – the DNA codes – of these fungi, and no one has yet got hold of them, let alone cultivated them in a petri dish. Crous: ‘Meanwhile, there is a massive loss of biodiversity going on.’



Four examples of the millions of different fungal species on the planet.

With the deterioration of our forests and moorlands, we lose not only plants and animals but also the fungi that invisibly coexist with the plant roots underground. Every ecosystem houses countless species of fungus.'

### INVISIBLE BIODIVERSITY

Most fungus species are microscopically small and live on or in plants. A thousand different species of fungus can live on or in a tree, but you can't see them. 'Most of our biodiversity on the planet is invisible,' says Crous. 'And very many fungal species become extinct before they have been described and screened, because naming them all is going too slowly. Since 1753, worldwide only 150,000 of the possibly 3.8

million fungus species have been described. That's absolutely scandalous, actually.' In *Nature Microbiology*, Crous and his colleagues propose using DNA sequences as the new method of assigning names to fungi. Nowadays, it need only cost a few euros to create a DNA profile of a fungus, and the results are available in large databases. A DNA profile of this kind does not include the complete genome – a fungus often has a vast number of genes – but just a series of highly characteristic DNA markers that are related to the typical metabolic products produced by precisely this species of fungus. 'Just as you can identify a car by its registration number, without having to describe the entire car,' says Crous.

Crous and his Wageningen colleague Gert Kema used the new system based on DNA sequences to create order in the lineage and genetic variation of many different strains of *Fusarium oxysporum*. This fungus poses a threat to banana plantations all around the world.

Crous: 'The recommendations for the new fungal nomenclature will be on the agenda in 2024 at the International Mycological Congress in Maastricht. The existing system of double Latin names will remain in use, but a tsunami of new names will be added. Fungal nomenclature is never finished.' ■

[www.wur.eu/new-names-fungi](http://www.wur.eu/new-names-fungi)





# More life in streams and ditches

The ditches, streams, lakes and rivers of the Netherlands are returning to a more natural state. And yet the biodiversity in the country's freshwater still comes nowhere near the European norms, partly because of unnatural banks and fertilizers and pesticides from agriculture. 'There is rarely any point in tackling one problem on its own.'

TEXT ASTRID SMIT PHOTO MARCEL VAN DEN BERGH







## ‘If you want to improve the biodiversity in ditches, you must change the way you farm’

‘Oh dear, there’s not much life in this,’ says Ralf Verdonschot as he combs through his catch from the Oliemolen stream near Renkum. You are supposed to be able to find about 40 macrofauna species here, such as beetles, caddisflies, worms or snakes. But the aquatic ecologist from Wageningen Environmental Research can only find five now, and most of those are species that thrive under low-oxygen conditions. ‘This is a rat-tailed maggot from a hoverfly,’ says Verdonschot, laying a wet, grey caterpillar with a huge ‘tail’ on the palm of his hand. ‘That tail is the windpipe, with which it can extract oxygen from the air and survive in water on little oxygen.’

And yet the Renkum valley was restored eight years ago. It looks very beautiful on this summer’s day in July, with its wide vista full of tall grass dotted with greater yellow-rattle. The stream looks as though it is teeming with life, too. Chestnut trees shade the water and large ferns grow on the bank. But the stream hardly flows at all, and the water level is low. ‘The supply of ground water has decreased, partly because drinking water is sourced here. That causes problems in years when there is not much rain, which will happen more often due to climate change,’ says Verdonschot.

### WATER FRAMEWORK DIRECTIVE

The Oliemolen stream is not the only place in the Netherlands where the water plants and animals are not doing very well. In the last survey for the Water Framework Directive, which requires EU countries to bring their biological water quality and biodiversity up to standard, only six per cent of the fresh waters in the Netherlands

passed muster on all points: algae, water plants, macrofauna and fish.

There has been a big improvement in the freshwater quality, though. It had suffered tremendously since the 1950s. A lot of factories used to dump waste into surface water, and both purified and unpurified wastewater in towns and villages contained too many harmful substances such as nitrogen compounds and phosphate.

Agriculture was partly to blame too. After World War II, farmers went over to using artificial fertilizer and pesticides, and channelled or filled in their ditches. Many old farm ditches with a thick layer of mud and rich flora and fauna disappeared. Up until the 1980s, regional water boards also straightened streams and adapted their profile so that water drained as quickly as possible to keep crops and cows dry. The rivers were submitted to this standardization too, for the sake of shipping and fast runoff of river water.

### DUMPING BY INDUSTRY

The tide turned in the 1980s, though. Dumping by industry was firmly tackled, sewage plants were obliged to extract more substances from the wastewater, detergents had to be phosphate-free, and on top of all that, the European Water Framework Directive was established in 2000 and set even stricter standards for water quality. The ‘Room for the River’ project also started in early 2000, prompted by the severe flooding in the Netherlands in the 1990s. The idea was that rivers needed to store more water by means of wider and deeper water meadows, creating inlets, and removing dyke protection on farmland in a process known as depoldering. This benefitted aquatic nature

as well, creating new flood plains and more biotopes. Streams were liberated from their straitjackets too and allowed to meander again, one of the aims of which was to retain more water.

All these measures have improved aquatic biodiversity considerably. ‘On land, what you see at the moment is a massive decline in biodiversity. In fresh water, that decline is actually already behind us,’ says Verdonschot. ‘In fact, aquatic biodiversity has been increasing again since the 1990s.’

### MORE PIKE

Fish biologist Leo Nagelkerke of Wageningen’s Aquaculture and Fisheries chair group confirms this. ‘Since the 1950s, fish such as bream and roach – species that can thrive anywhere – have become dominant. Choosy species such as the Chabot bullhead, the brook lamprey and the weatherfish became rarer.’ But fish biodiversity is on the rise now too, partly thanks to the improved water quality. In many standing inland waters, for example, the pike – a predator that benefits from clear water full of fish – has become more plentiful. ‘That’s a good sign,’ says Nagelkerke.

The rivers have benefitted too. They are no longer as green with algae as they were in the 1990s, and the inlets that were created for Room for the River have worked as was hoped. Between 2017 and 2020, Wageningen PhD researcher Twan Stoffers did a study with Rijkswaterstaat (the executive agency of the Dutch Ministry of Infrastructure and Water Management) of various restoration projects along the Waal, IJssel and Lower Rhine rivers. The extent of changes in fish stocks since the 1990s was assessed, and it was found that, as intended,



## FRESH WATERS HOUSE THE MOST SPECIES

Worldwide, 50 per cent of fish species live in one per cent of all the waters, namely in fresh waters such as rivers, streams, lakes, ponds and ditches. That diversity is mainly found in South America, Central Africa and South-east Asia. In Western Europe, there are naturally fewer freshwater species, which is put down to the fact that during the last ice age the fish there couldn't trek south because most of the rivers run east-west. At present, there are about 50 indigenous and 30 exotic species of fish in the Netherlands. The latter often cause problems by squeezing out indigenous species or transmitting diseases. The diversity of invertebrate water creatures is enormous. There are about 3000 species of these, a large proportion of which are mosquito larvae. Ten per cent of these species have increased in numbers over the last 40 years. These are species that like clean water and species that are invading from further south, as well as common species that are found everywhere.



PHOTOS VAN BOVENNAAR ONDER EN V.L. N.R. BLIK ONDER WATER, ANP (2X), BLIK ONDER WATER (2X)

the new inlets attracted species such as the ide, the common nase and the common barbel, which use these more sheltered, shallow waters as nursery habitats. About 15 years later, however, these species are dwindling in numbers again, while less specialized species such as perch, roach and bream remain. The reason: the inlets silt up in the course of time and the current decreases. Nagelkerke: 'So inlets do need some maintenance.'

### CHOKING

But in intensive agricultural areas, says Verdonshot, there is little or no improvement in the biodiversity in the water. The main reason for that is the still high load of nutrients coming from artificial fertilizer

and the animal manure that farmers spread on the land. 'The monoculture in the fields and meadows is visible in and on the water.' The fertilizer nutrients benefit plants such as reeds and sweetgrass on the banks and algae and duckweed in the water – species that are not good for biodiversity. A massive growth in algae and duckweed can even choke the water, killing off other organisms such as submerged water plants and fish. In the past few years, and in collaboration with the University of Amsterdam, Verdonshot has been studying the biodiversity in a ditch that started in the wet meadows of De Wieden nature reserve and ended in an intensive agricultural area. 'Then you see the number of species dwindle fast.' It is not just fertilizer nutrients from inten-

sive farming that impact biodiversity, but also chemicals that are still ending up in the water. The macro-pollution of the 20th century has given way to micro-pollution with the likes of microplastics, flame retardants, UV filters, pesticides and drug residues. These substances get into surface water in low concentrations but can nevertheless have a considerable impact on the ecosystem, if only because they reinforce each other or are effective even in tiny quantities – an example being the neonicotinoids with which crops were sprayed and seeds were coated until just a few years ago.

### PESTICIDES

The research group led by Paul van den Brink, personal professor of Chemical





The Netherlands has about 300,000 kilometres of ditches, in which the biodiversity is badly affected by the high nutrient load.

Stress Ecology, is working on documenting precisely the effects of micro-pollution such as drug residues and pesticides. They are studying the behaviour of individual organisms – to see, for example, whether psychotropic drugs cause them to speed up or slow down. They also research the persistence of the substances, and determine their effects on experimental ecosystems – ponds used for tests with alga, water plants and macrofauna. It is clear that a neonicotinoid such as imidacloprid can have a big impact. ‘We have seen that a breakdown product from this pesticide sticks to receptors in the common freshwater shrimp and the larvae of the mayfly for a long time,’ says Van den Brink. The overall toxic effect of micro-pollution on the aquatic ecosystems of

Dutch waters has not yet been ascertained. ‘But it is definitely a significant factor,’ says Van den Brink. A German study in 2020, which the Dutch Radboud University helped with, estimated that micro-pollution is responsible for one quarter of the negative effects on freshwater ecosystems. Van den Brink: ‘Which substances are responsible varies from place to place, but in the rural areas it’s usually pesticides.’ The provisional results of a study by Radboud University and STOWA, the Dutch water boards’ research institute, point in the same direction. ‘Aquatic communities are affected by toxic substances on about half of the 8000 locations. And that usually comes about due to interaction between ammonia, metals, polycyclic aromatic hydrocarbons and – above all – plant

protection products,’ says Bas van der Wal, water systems programme coordinator at STOWA.

What can be done to ensure that biodiversity improves in the intensive agricultural areas as well? ‘There is no way around the need to really change the intensive farming system,’ says Verdonshot. ‘If you want to improve the biodiversity in the ditches, 300,000 kilometres of them, and the several thousand kilometres of streams, you must change the way you farm and make sure you cut the quantities of harmful substances getting into the water from the fields and meadows.’

He also thinks it would be a good idea to get rid of abrupt transitions between land and water. For a rich flora and fauna, banks should be gradual, so you get marshy zones or banks that get flooded occasionally. ‘Biodiversity does well when there is a mosaic of biotopes. Species often use different parts of the ecosystem over their life cycle. Water beetles lay their pupae in the film of water between, say, mosses and sedges of the water’s edge. They need such fringe zones around the water.’

### VALLEY-WIDE

A plan has already been worked out for the streams: ‘valley-wide stream restoration’, a concept developed by Verdonshot and his father Piet, head of the Freshwater Ecosystems chair group at Wageningen Environmental Research, and professor of Aquatic Ecology at the University of Amsterdam. The key message is: don’t look only at the stream as such but involve the whole valley and create five zones in it. The stream itself with a gradually sloping bank and flood areas, a woodland zone, a shrubland zone, a buffer zone with

## ‘The monoculture in the fields and meadows is visible in the water’

extensive organic farming, and only then intensive farming or an urban area. The valley of the Grootte Molenbeek, a stream in Limburg, is currently being landscaped along these lines.

Another important factor in the restoration of biodiversity is that waters should be interconnected so that populations can spread and fish such as eel, river lamprey or salmon can migrate back and forth. On this point too, action has been taken in recent decades. Water boards and the Water Works directorate have restored a lot of old links by, for example, creating fish ladders or passes around locks, dams and pumping stations. Nagelkerke: ‘We have now started a national project with Rijkswaterstaat, STOWA and the water boards, in which we are researching how well those fish ladders work. Which ones are functioning well, which ones less so, and why?’

### TREE TRUNKS IN A STREAM

There are lots of factors, then, that play a role in the improvement of biodiversity. There is rarely any point in tackling one problem on its own, according to Ralf Verdonshot. For the water boards and nature organizations, he has studied the effect of small-scale restoration interventions such as placing tree trunks in a stream, which creates variation in the current and provides shelter for animals, or partial mowing of water plants. ‘In itself, that works perfectly, but it only goes well in streams where other measures are taken too, such as improving the flow and reducing the nutrient load.’

STOWA is thinking along the same lines, and has developed what are known as the key ecological factors for the water boards to work with. There are nine factors for standing water and 10 for flowing water:

these include productivity (due to the nutrient load), light climate, connectivity, habitat suitability and toxicity. Only if the water scores well on all these factors can the biodiversity really improve. Van der Wal: ‘The water boards now have useful tools for restoring their waters and achieving the goals of the Water Framework Directive.’

If this is not done, or not done enough, the Netherlands risks being taken to court by the European Commission from 2028. This could eventually lead to a big fine being imposed by the European Court of Justice.

### RECOVERY LOSING STEAM

When it comes to climate change, however, there is not much water managers can do. And yet periods of drought, high temperatures or extreme rainfall are having

a seriously negative impact on biodiversity in regions without much influence of agriculture. ‘So sadly, the upward curve of recent decades has flattened in the past few years, as we see here in the Renkum stream valley,’ says Verdonshot.

The aquatic ecologist continues his search of the Oliemolen stream. He doesn’t want to go home without having spotted a single caddisfly, a species typically found around streams. He carries on searching, inspecting tree trunk after tree trunk. He scores at the fifth. ‘See that little web? That belongs to a net-spinning caddisfly. It uses the web to catch its prey. Look, there it is, behind that little ridge.’ Relieved, he returns the tree trunk to the stream and we can go home. ■

[www.wur.eu/biodiversity-freshwater](http://www.wur.eu/biodiversity-freshwater)

### THE WAGENINGEN BIODIVERSITY INITIATIVE

Wageningen University & Research launched the Wageningen Biodiversity Initiative in June 2021. Researchers from all sorts of disciplines are working on it – ecologists, soil scientists, plant and animal scientists, technologists, economists, behavioural scientists, and other experts – with the aim of better understanding and stemming the worldwide loss of biodiversity. Wageningen expressly invites scientists, students, PhD researchers and societal groups and stakeholders such as policymakers, industries, companies, and NGOs to join the initiative. The initiative addresses three areas: Biodiversity in the Food System, Human-wildlife Interactions, and The Value of Nature.

Professor Liesje Mommer, founder of the initiative: ‘We have 10 to 15 years left to turn the tide, and we are not going to make it at our current rate. There is no quick fix, and a major revolution is needed, with the form it takes varying per region. That is why it is imperative that we join forces now – from sociology to agronomy, ecology and technology.’





CAMPAIGN LEADER NINE DE PATER:

**‘The whole world was looking on’**



**In the space of two years, Nine de Pater rose from doing voluntary work at Milieudefensie to being the campaign leader for the court case against Shell's climate policy. A unique case internationally, which was won in May 2021. 'Companies can no longer just sit back until the government comes up with a climate policy.'**

TEXT ALBERT SIKKEMA PHOTOGRAPHY ALDO ALLESSIE

Shell must reduce its CO<sub>2</sub> emissions by 45 per cent over the next 10 years, compared with the level in 2019. This was ruled by the District Court in The Hague in May this year in a case brought by the Dutch branch of Friends of the Earth and six other environmental organizations. The ruling made an impression internationally because for the first time, a company was held responsible for harmful climate change. Nine de Pater (29) supported the lawyer of Milieudefensie (Friends of the Earth Netherlands) with the preparatory research on the climate and Shell's policy. She had been working on the court case for Friends of the Earth since 2018, first as a researcher and then as the campaign leader. 'I started as a volunteer at Friends of the Earth in 2018, after graduating in Environmental Sciences at Wageningen. Then a vacancy came up for a researcher for the climate case against Shell. A team was already working on the Shell case, and the lawyer had recently written to Shell, saying, bring your policy in line with the Paris Climate Agreement, otherwise we will take you to court. Friends of the Earth had been campaigning and talking to Shell about climate measures for years, but it wasn't working. I was appointed to work on the last option left: a lawsuit. I was very

excited about it: I felt I was going to contribute to something that could really make a difference.'

#### **What did your research entail?**

'One of my colleagues and I worked on gathering the evidence to support the legal summons delivered to Shell. For example, I read the reports of the Intergovernmental Panel on Climate Change, which provided the scientific evidence for climate change and projected how dangerous the problem is going to become. We also had to explain what the climate problem is. We worked on the assumption that the judge was not an expert, so we should explain what CO<sub>2</sub> is and how it gets into the atmosphere.'

#### **Did you do research on Shell's policy as well?**

'I looked into the background to their defence, which meant their investments, the figures, and the company's absolute CO<sub>2</sub> emissions. I read Shell's annual reports, where the investments are explained, and I studied the database with data on fossil fuel companies. We could conclude from that that Shell is not on track to achieve its own climate targets. In the coming 10 years, its investments will lead to growing CO<sub>2</sub> emissions. We think the climate ambitions >





## THE CLIMATE CASE VERDICT

According to the court, Shell's headquarters in The Hague is responsible for the emissions of its 1100 subsidiaries, which are located in 70 countries. The court ruled in May 2021 that Shell has an independent obligation on the basis of human rights to 'do what it can to prevent dangerous climate change', regardless of whether the countries the company operates in are aiming at this. The court makes a distinction between the emissions Shell causes itself and those coming from suppliers and buyers, such as customers filling their vehicles with fuel at petrol stations. With regard to the company's own emissions, the court imposed a compulsory reduction of 45 per cent. And with regard to suppliers and end users, the concern has 'a significant best-efforts obligation'.

they express in press releases are worthless, because those investments will have an effect on the company's CO<sub>2</sub> production for another 30 years. It's quite a technical story, but that's the evidence we presented to the court. Shell's climate policy is full of calculation tricks with which the company gets to carry on polluting the planet. Figuring that out and explaining it wasn't easy, but it was very important in the court case.'

**You calculated not only Shell's own CO<sub>2</sub> emissions, but also those of all the products they supply to other companies.**

'Correct. The Shell factories themselves produce 15 per cent of Shell's CO<sub>2</sub> emissions, and the other 85 per cent come from the products the company supplies to other parties. We think you should count that 85 per cent, and research institutes and the International Energy Agency think so too. Shell thought that was unfair, but the court found for us.'

**How did you go from researcher to being campaign leader?**

'I spent one and a half years reading reports and constructing arguments. We did this as a team. The lawyer, the other researcher and

I assessed all the data and weighed up the facts and figures. But the other researcher left and a bit later, in early 2020, the campaign leader at Friends of the Earth left too. I was appointed to that job shortly afterwards. Suddenly I was the person who knew the most about the climate research and the campaign, so I could get promoted quickly at Friends of the Earth.

'At the end of 2019, I realized we were working on a unique case. I went to the climate summit in Madrid, where I was asked to sit on various panels, because everyone wanted to know how it was going. Normally I sat reading reports; then I suddenly realized the whole world was looking on.

'That was also when Urgenda won the first climate case against the Dutch state in the highest court in the land, the Supreme Court. Then we saw that climate activists really could win a climate case on legal grounds. That gave us a massive energy boost.'

**How did your court case go?**

'In December 2020, we had court hearings for four days at the court in The Hague. Our team from Friends of the Earth stayed in a nearby hotel and we had prepared for all kinds of questions and scenarios.

## ‘I realized we were working on a unique case’

Luckily, we had three extra researchers at our disposal, because we often had to work through the night on additional papers and pleas. But the hearing went very well; we had prepared well for all Shell’s counterarguments, and we had a lot of options and texts ready. As it turned out, we only needed a few of them for the case. But the ruling, the victory, was still a surprise because we didn’t know what to expect and we had no reference points.’

### Was your Wageningen degree useful?

‘I studied Environmental Sciences and took the Environmental Policy track, specializing in Policy and Economics. I learned a lot during my studies about political and economic systems and how to do research on them. Case studies are often central in Wageningen lectures, so you learn to link theories with practice. That was very relevant for my research for Friends of the Earth. ‘In Wageningen I also gained experience of climate protests and campaigning. I was in the student organization Fossil Free Wageningen, in which we did research on the fossil industry and its links with WUR. We discovered, for example, that the banks WUR had its accounts with had investments in the fossil industry. We called on WUR to switch banks to do their bit for the climate. A lot of politically aware students in Wageningen were organizing discussions and consciousness-raising evenings. We also mobilized students for demonstrations.’

### The Shell case has been won. What now?

‘It’s not over yet. Shell is going to appeal. We’re waiting to see which points the company bases its appeal on. But this ruling has already set a precedent. There are a lot

more companies that are contributing to the climate crisis. Now that the court has ruled it illegal for companies to be the cause of harmful climate change, they too will have to establish how big their contribution is.’

### Are you preparing for new court cases?

‘Not yet, but we are going to challenge other companies on their responsibilities. Our director has already been to visit Tata Steel in IJmuiden, a company that is one of the biggest polluters in the Netherlands. But there are also the airlines and the transport sector, that produce a lot of CO<sub>2</sub>. This Shell case has really changed things for companies. They can’t just sit back and wait for the government to come up with a climate policy. They’ve got to do something themselves.’

### Are you going to tackle the food industry too?

‘There are food sectors that contribute to the climate crisis. I’m thinking particularly of the meat and dairy sectors, with their methane emissions and soya imports, for example. The verdict has implications for that industry too. But in the first instance, we think companies should take responsibility themselves, and we are not going to launch new court cases straightaway. What is more: why should we always be the ones to do it? Other organizations can learn from our approach and take companies to court themselves. Perhaps we will start an expertise centre to teach people how to go about bringing a climate case against a company.’

### Where do you get your drive for activism from?

‘My first demonstration was against the war in Iraq, which I went to with my mother and sister. That was my introduction to

mass demonstrations. I have always hated injustice, and I used to sign petitions from Amnesty International and the WWF. As a student I began to realize that if we want change, we’ve got to get organized. We’ve got to turn awareness into action. If you reach enough people with your message, you will be heard. While I was at university, I did courses that taught me how to do that effectively. Wageningen was a good training ground.’ ■



### NINE DE PATER (29)

#### Job:

Milieudefensie campaign leader in the Shell climate case

#### Degrees:

WUR BSc in Biology, 2014  
WUR MSc in Environmental Sciences, 2018



## LIVING LABS BUILD INNOVATION CAPACITY

# Towards sustainable food pr

**In East Africa, local parties are developing new and sustainable food systems in a Wageningen project supported by the IKEA Foundation. 'This could be the start of a long-term transition.'**

TEXT KENNETH VAN ZIJL

In a densely populated village near Nakuru in Kenya, where a lot of live-stock farmers live side by side with other residents, manure and garbage were piling up between the houses. The waste stank and posed a public health threat, and villagers began to complain about it. Then, in 2015, a few women came up with the idea of making compost out of the manure and other organic waste. That idea grew into an innovative startup: Griincom. The waste is still processed manually at present, but Griincom is keen to mechanize and market the compost. Before it can be marketed, however, the compost will have to meet a quality standard, and researchers from Wageningen and from Egerton University in Kenya are going to help Griincom with that. 'At Griincom's request, we are going to run a field experiment to determine the quality of the compost,' explains project leader Jochen Froebrich of Wageningen Environmental Research.

This is one of the hands-on local initiatives within the Refooture project, which aims at stimulating innovation in food systems in East Africa. In the project there is collaboration with local parties in Kenya, Uganda and Ethiopia in 'living labs', explains Ingrid Coninx of Wageningen Environmental Research, who is involved in the Kenyan living lab. 'The living labs include local entrepreneurs, farmers, government bodies, banks, NGOs and scientists. All these parties come together

and develop plans for what a sustainable food system could look like in a particular region. Then experiments are set up to put those plans into action. That is followed by reflection on the outcomes and the work of upscaling the interventions to the regional and perhaps even the national level. The living labs in Kenya, Ethiopia and Uganda also exchange experiences with one another, thus strengthening their innovation capacity,' says Coninx.

### PLANET-POSITIVE

The initiative for this project, 'Refooture – Food Futures Eastern Africa', came from WUR and the IKEA Foundation. This philanthropic foundation, which was set up nearly 40 years ago by IKEA founder Ingvar Kamprad, has allocated nearly 3.5 million euros to the project. One of the foundation's objectives is to 'help people build a better life from planet-positive agriculture in East Africa and India'. 'We look at the potential farming systems of

the future, based on sustainability, circular economies and inclusivity,' says Nico Janssen, who is responsible for part of the foundation's agriculture portfolio. 'We also consider the role of academic research in that. So we and Wageningen University & Research set about brainstorming with a blank sheet of paper to see what the options were for a model that enables East African farmers to generate a higher yield and earn a decent income, while sparing the environment and increasing ecological value.' What makes Wageningen of interest to the IKEA Foundation is that it is a 'melting pot with a vast amount of knowledge, not just from the Netherlands but from all around the world,' says Janssen. Scientists from all the disciplines are involved in the project.

### COLLECTING EVIDENCE

In this project, Wageningen wants to collect evidence for the viability of regenerative and inclusive agriculture in East Africa and map out a path for its implementation together with local partners, explains Coninx. 'But it's questionable whether you will get a lot of people on board in Ethiopia with a term like "regenerative agriculture". It takes a lot of time before a system like that is productive. If half the population is going hungry, you've just got to produce food quickly. If the science says that's possible but there is little popular support, then we have to take that into account in our development ideas. It is a complex subject.'

**'No transition can take place without local innovations'**

# Production in East Africa

PHOTO DIETMAR RAUSCHER / SHUTTERSTOCK.COM



In the Kenyan region of Nakuru, local parties are collaborating in a living lab to improve the regional food systems.

‘Of course you always have short- and long-term objectives. And in the short term, everyone wants to have food on their plate,’ agrees Janssen. So one of the research questions is how to combine the short-term and the long-term objectives. Froebrich believes some evidence can be found for the viability of this specific sustainable food system. ‘And if there turns out to be potential for highly productive, regenerative and inclusive agriculture, that could be the start of a long-term transition through the living labs.’

## TRAINING BUSINESSES

Janssen too believes that the road to sustainable farming systems in East Africa will be a long one. ‘Our agriculture portfolio is currently worth about 40 million euros. That goes to East Africa

and India. We invest in initiatives such as projects that train farmers and businesses, and in research.’

The idea is for the living labs and the visions of the future they generate to mobilize East African innovation capacity. Froebrich: ‘With Refooture we provide a platform for initiating new local, regional and international collaborations on

sustainable food production. No transition can take place without local initiatives.’

The aim is to inspire investors to go on supporting the living labs for many years. ‘Ultimately, to bring about a sustainable future, we need the financial world to get involved,’ says Janssen. ■

[www.wur.eu/refooture](http://www.wur.eu/refooture)

## FACILITATING UNUSUAL RESEARCH

With a view to facilitating out of the ordinary research projects such as Refooture, University Fund Wageningen supports scientists in raising funding and setting up collaborations such as those with philanthropic organizations like the IKEA Foundation.

Info: [www.universityfundwageningen.eu](http://www.universityfundwageningen.eu)



## Alumni give students career advice

**In the very first Career Café in May, alumni spoke to students and recent graduates about their careers and finding jobs. There was a lot of interest. 'I can recommend it to any MSc or PhD student in their final year.'**

All five Career Café evenings were fully booked. At these events, some 200 students and recent graduates got to talk to 24 WUR alumni who work in senior positions at companies, government bodies, universities and other organizations. They were divided into small groups and spoke to two alumni in turn about their careers and job hunting. 'I can recommend it to any MSc or PhD student in their final year,' says Caspar

Geelen, who is doing PhD research at Biometris, the Wageningen group for mathematical and statistical methods. 'It's a good opportunity to find out what working in a particular sector is really like and how you can get started there.' Geelen hopes to get his doctorate soon and wanted to meet people working in the private sector. He spoke to Cazimir ten Brink (Shell) and Arjen van der Woude (Heineken). 'My current chair group

would like to keep me on but I'm not sure I want to stay in academia. I enjoy working actively on change and implementation. The Career Café confirmed that for me and, with that new understanding, I've started talking to people about a job at Wageningen Research.'

Alumnus Marc Verkuyl, senior product manager at the fish farm Yalelo in Uganda, loved talking to the groups of students about his career and advising them. 'I noticed they seemed in quite a hurry to graduate. My tip was that they should to savour their university days and accumulate as much knowledge as possible, although I realize these are hard times for them because of the Covid crisis.'

Verkuyl took part in the Café to get back into contact with the university and students. 'And also out of self-interest to a certain extent. I'm looking for people who are interested in aquaculture and want to work for us. However, I see the teaching currently focuses more on marine conservation and less on fish farming.' The Career Café is an initiative of Young University Fund & Alumni and WUR's Student Career Services. It was held online because of the coronavirus crisis. The intention is to make it an annual event. Info: [alumni@wur.nl](mailto:alumni@wur.nl)



Alumnus Marc Verkuyl:  
*'My tip is to learn  
as much as you can'*

PHOTO KROONRCV/JINELLE DEJUNK

## NETWORKS

### Alumni in Ethiopia and Uganda meet up

**In July, 130 alumni from Ethiopia and Uganda met up at a seminar about food security. This cross-border event was partly online and partly in person.**

The event was organized by the Netherlands Alumni Association of Uganda (NAAU) and the Wageningen Alumni Chapter of Ethiopia (WACE). Most participants were alumni of Van Hall Larenstein or WUR. The full-day programme with 18 short presentations gave them an impression of who is working on food security in Ethiopia and Uganda, where, and what and they are doing exactly. Alumni from Van Hall

Larenstein and Wageningen spoke about projects in agriculture and food production, for example on dairy production in Ethiopia and Uganda, and on enriching food crops with minerals. The Dutch ambassadors to Ethiopia (Henk Jan Bakker) and Uganda (Karin Boven) also spoke at the event. The day concluded with a debate. 'The event was a great success,' says Terefe Taye, co-organizer and the vice-chair of the

Wageningen Alumni Chapter of Ethiopia. He works as a senior dairy production consultant for the Dutch development organization SNV. He is pleased that he accepted the Ugandan invitation to organize a joint meet-up, which was funded by a grant from Nuffic, the Dutch organization for internationalization in education. Aside from networking, the seminar had another purpose for him: raising awareness of Wageningen's alumni network in Ethiopia after a quiet period. 'It was a good opportunity for a relaunch.'

Info: [alumni@wur.nl](mailto:alumni@wur.nl)

## AWARDS

## Entrepreneur prize for promising start-ups

On 26 May, the Wageningen start-ups Scope Biosciences and Pyropower won the AtlasInvest Entrepreneurship Grant 2021 for their commercially promising and sustainable ideas.



PHOTO'S GUY ACKERMANS

Bart Scholten and Niek Savelkoul, Scope BioSciences

Scope Biosciences won the Start-Up Award worth 35,000 euros for its methods for fast, accurate detection of infectious diseases in humans, animals and plants. The detection kits it developed are based on the CRISPR-Cas technique, says co-founder and CEO Niek Savelkoul (WUR Biotechnology 2018). 'In the US, we found out that this technique for modifying DNA can also be used for diagnosing infectious diseases. We investigated that further at the Laboratory of Microbiology at WUR.' He did this together with three other Biotechnology alumni: Bart Scholten, Stijn Prinsen and Jurre Steens. Two years later,

they set up the spin-off Scope Biosciences. They hope to find a venture capitalist soon. 'The 35,000 euros is welcome as bridging capital so we can do more research in the lab.'

Start-up Pyropower won the Impact Award of 15,000 euros for a concept that boosts sustainability. Pyropower, one of whose founders is MSc Nutrition and Health student Anna Everloo, converts waste into the soil conditioner biochar. The method involves heating at high temperatures without oxygen (pyrolysis). Pyropower is focusing initially on the coffee industry. Info: [www.universityfundwageningen.eu/aieg](http://www.universityfundwageningen.eu/aieg)



Anna Everloo, Pyropower

## EMERGENCY FUND

## 120,000 euros in support for students

A second round of crowdfunding for WUR students who got into financial difficulty because of the Covid crisis has raised nearly 120,000 euros from 1324 donors. The initiator, University Fund Wageningen, has used that money to help 35 students so far. Foreign students in particular have ended up in dire need of money due to the crisis. Info: [crowdfunding.wur.nl/project/noodfonds](http://crowdfunding.wur.nl/project/noodfonds)

## AWARDS

## Thesis Awards

Peter La Follette MSc, WUR Earth and Environment 2020, has won this year's UFW Thesis Award for his thesis on errors in measurements and models for predicting extreme precipitation and the associated changes that can be expected due to climate change.

Patrick Barendse MSc, WUR Molecular Life Sciences 2020, Wisse van Engelen BSc, WUR Forest and Nature Conservation 2018, and Lianne Remie MSc, WUR Nutrition and Health 2021, received prizes in the subcategories Life Sciences, Social Sciences, Agrotechnology and Nutritional Sciences. 29 June 2021.

Info: [www.universityfundwageningen.eu/thesisawards](http://www.universityfundwageningen.eu/thesisawards)



PHOTO GUY ACKERMANS

Peter La Follette

## REUNION

## Wageningen Experience Day

Based on the belief 'Once a Wageningen, always a Wageningen', WUR runs an annual Wageningen Experience Day for alumni. This year, the event will take place online on 2 October 2021. It is a day for meeting fellow Wageningers, taking a digital campus

tour, updating your WUR knowledge, learning about study circles and networks, and getting inspiration. A special reunion programme is being organized for people who graduated 25 and 50 years ago.

Info: [alumni@wur.nl](mailto:alumni@wur.nl)



# Wageningen successful at the Olympic Games

Six students and alumni travelled to Japan for the Olympic Games this summer. They returned with five medals: two gold, one silver and two bronze.



PHOTOS ANP

From left to right, top: Femke Bol, Annemiek van Vleuten and Emma Oosterwegel, Nadine Visser. Bottom: Jan-Willem van Schip, Frédérique Matla.

**Annemiek van Vleuten MSc**, WUR Animal Sciences 2007, won gold in the cycling time trial and silver in the road race. ‘I worked very hard for this and had to make a lot of choices,’ she writes on her website. ‘Which I did with pleasure because I really enjoyed the journey.’

**Femke Bol**, BSc student of Communication Sciences, won bronze in the 400 metres hurdles. She ran a new European record of 52.03 seconds. ‘I knew I had to be at my very best and I was,’ said Bol (21) when interviewed afterwards on Dutch television.

**Emma Oosterwegel**, BSc student of Soil, Water and Atmosphere, won bronze in the heptathlon. Oosterwegel (23) set a personal record with 6590 points. Talking about

the concluding 800 metres event, she told the TV interviewer ‘All I could think of was bronze, bronze, bronze’.

Hockey player **Frédérique Matla**, BSc student of Health and Society, was part of the Dutch women’s team who got the predicted gold medal. With nine goals, Matla (24) was also the top scorer in the women’s competition.

**Nadine Visser BSc**, WUR Health and Society 2020, sprinted to fifth in the final of the 100 metres hurdles.

**Jan-Willem van Schip BSc**, WUR Soil, Water, Atmosphere 2018, came sixth in the omnium and fifth in the madison in the track cycling.

**Ruben Dahm MSc**, WUR Soil, Water and Atmosphere 2003, a senior consultant at Deltares, has won the Wrigley Fairchild Award for the best article in Geographical Review in 2020, which he wrote with Ingrid Boas PhD, associate professor in the Environmental Policy chair group, and David Wrathall, associate professor at Oregon State University. ‘Grounding Big Data on Climate-Induced Human Mobility’ is about the risks and benefits of big data for climate-related mobility. 15 April 2021.

**Tichafa Munyikwa PhD**, WUR PhD 1997, has been appointed director of Regulatory Affairs at the American biotechnology company Yieldro Bioscience in Woburn. 29 June 2021.

**Anne-Marie Neeteson MSc**, WUR Zootechnics 1983, international deputy director of Welfare, Sustainability & Compliance at the Aviagen Group (poultry breeding) has received the Special Merit Award from the British Poultry Council for all she has done for animal welfare and sustainability. 1 June 2021.

**Miriam Nienhuis MSc**, WUR Land-Use Planning Sciences 2001, is the new managing director and provincial secretary of the



PHOTOS ROELDIJKSTRA

**Hans Hoogeveen PhD, LL.M.**, WUR PhD 2010, has been appointed an independent chairperson for two years of the FAO Council, the most important executive and advisory body of the UN Food and Agriculture Organization. Hoogeveen has been the Netherlands’ permanent representative at three UN organizations in Rome – FAO, WFP and IFAD – since 2016. 17 June 2021.

## Chair of the Wageningen Ambassadors

**Gerda Feunekes MSc**, WUR Human Nutrition 1989, director of the Netherlands Nutrition Centre, is the chair as of 2021 of Wageningen Ambassadors, a platform for prominent alumni who have a particular affinity with Wageningen. Gerda Feunekes takes over from Peter Reinders PhD, WUR Forestry 1985. Tjapko Poppens, WUR Economics of Agriculture and the Environment 1996, mayor of Amstelveen, is the vice-chair as of this year.



Provincial Authority of Gelderland. She previously worked for the municipality of 's-Hertogenbosch as sector director for Social Development. 17 June 2021.



### **Diana Subardiman PhD**,

WUR Tropical Land Use 1998, research leader at the International Water Management Institute in Laos, will become director of the Royal Netherlands Institute of Southeast Asian and Caribbean Studies (KITLV-KNAW), on 1 January 2022. 17 June 2021.

**Prof. Herbert Prins**, emeritus professor of Resource Ecology, has won the 2021 Langerhuizen Oeuvre Prize, awarded by the Royal Holland Society of Sciences and Humanities, in recognition of the significance of his research on animal ecology and his contribution to the application of that knowledge in nature management. Prins wants to use the prize money of 25,000 euros to finance new fieldwork in the Himalayas. 5 June 2021.

**Prof. Jan van der Stoep**, WUR Biology 1993, has been appointed professor holding an endowed chair in Christian Philosophy and associate professor at Kampen Theological University. He combines his new position with the professorship in Christian Philosophy at WUR. 20 April 2021.

**Paul Vriend MSc**, WUR Environmental Sciences 2021, has won the Folkert Hellinga Thesis Award, given by the Land and Water Network, for his thesis 'Modelling global river export of macro and microplastic pollution'. 20 May 2021.

## Prizes for bioactive nutrition

**Pol Grootswagers PhD**, WUR Nutrition and Health 2016, a postdoc working on nutrition and ageing at WUR, and PhD candidate **Iris Rijnaarts MSc**, WUR Nutrition and Health 2016, have received the 2021 James Lind Prize. Grootswagers received the prize for his research on a new drink containing whey

proteins and amino acids for malnourished elderly people. Rijnaarts received the prize for personalized digital dietary advice aimed at persuading adults to eat more fibre. The award is an initiative of the branch association for nutritional supplements NPN. 22 June 2021.

## IN MEMORIAM

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

**Mr G.J.H. Bieleman PhD**, WUR Landscape Architecture 1976. 9 June 2021.

**Mr T.A. Elmitwalli PhD**, WUR PhD 2000. 21 April 2021.

**Mr A.G. Galema MSc**, WUR Zootechnics 1955. 24 April 2021.

**Mr R. Fransens MSc**, WUR Farming Technology 1965. 2 March 2021.

**Mr H. Hartmans MSc**, WUR Agricultural Plant Breeding 1954. 8 July 2021.

**Mr R. Kho MSc**, WUR Forestry 1988. 4 February 2021.

**Ms N. Köster-Constandse MSc**, WUR Tropical Rural Economics 1957. 26 July 2021.

**Mr J.K. Kouwenhoven PhD**, WUR Farming Technology 1964. 21 June 2021.

**Ms M.J.B.H. Lageschaar MSc**, WUR Forest and Nature Conservation 2015. 9 May 2021.

**Mr F.W.J.L. Maase MSc**, WUR Food Technology 1971. 30 October 2020.

**Mr W.M. Markusse MSc**, WUR Agricultural Plant Breeding 1957. 30 April 2021.

**Prof. A. Prins**, WUR emeritus professor of Food Physics. 27 April 2021.

**Mr R. Reijnders MSc**, WUR Tropical Plant Breeding 1961. 1 July 2021.

**Mr P.M. Rijk MSc**, WUR Farming Technology 1972. 29 May 2021.

**Ms H.J. Scholten MSc**, WUR Phytopathology 1985.

**Mr E. Talstra MSc**, WUR Zootechnics 1963. 23 December 2020.

**Mr G.P. Termohlen PhD**, WUR Horticulture 1951. 20 March 2021.

**Mr J. Volleman MSc**, WUR Agricultural Plant Breeding 1960. 18 May 2021.

**Mr S.I. van der Wal MSc**, WUR Agricultural Plant Breeding 1953. 2 May 2021.

**Mr G. Walstra MSc**, WUR Agrarian Economics 1974. 19 May 2021.

**Mr G.E.J.M. Willems MSc**, WUR Zootechnics 1975. 16 February 2021.

If you would like to inform us of the death of a fellow former student or relative, you can email [alumni@wur.nl](mailto:alumni@wur.nl) or send a death announcement to the Alumni Department, University Fund Wageningen, Droevendaalsesteeg 4, 6708 PB Wageningen, Netherlands



# Cycling 11,000 kilometres and picking up plastic



**Robin Aanstoot MSc**, WUR Forest and Nature Conservation 2021, is cycling down the European coast from Norway to Portugal, having set off on 22 July. Every day, he collects one bag of plastic waste, and he is also visiting companies working on recycling plastic. 'I want to showcase all the good things happening in recycling.' Aanstoot is taking his surfboard on his specially designed bike trailer too so he can catch some waves en route. Aanstoot hopes that he will be cycling back onto Wageningen campus in October with around 11,000 kilometres on the clock. [www.instagram.com/re.cycle.surf](http://www.instagram.com/re.cycle.surf) [www.facebook.com/re.cycle.surf](http://www.facebook.com/re.cycle.surf)

## WAGENINGEN BOOKS

### Garden of Giants



**Ron ten Caat**, MSc student of Animal Sciences, wrote *Tuin der Giganten* (Garden of Giants), a fantasy book for young adults. It is set in 2165, when the dinosaurs are back on Earth and humans have retreated to walled cities. Ten Caat got the idea for the book when cycling home to Ede with his best friend, Lidian Bakkenes. 'She said, "What would it be like if we suddenly saw a huge T-rex walking in the field?" It was an exciting idea that inspired me to write this book. I let her read each new chapter first and she also designed the cover'.

Boekscout, 20.99 euros

### Think like an engineer



**Jan Karel Mak MSc**, WUR Environmental Protection 1983, member of the executive board of the engineering firm Deerns and chair of University Fund Wageningen, wrote the book *Think Like an Engineer, Don't Act Like One*. It is a compilation of 75 anecdotes, tips and observations. 'It is partly written from the inside, from the perspective of engineers like me, and partly from an outsider's perspective, from the point of view of someone seeing engineers at work, which is also what I do,' writes Mak in the preface. The illustrated paperback is available in Dutch and English and is part of a series of books focusing on a specific profession.

Bis Publishers, 14.99 euros

### Living Verges



**Rita van Biesbergen MSc**, WUR Landscape Architecture 1988, photographer and landscape architect, has published the book *Levendebermen* (Living Verges) with **Harry Harsema MSc**, WUR Landscape Architecture 1988, and **Paul Roncken MSc**, WUR Land-Use Planning Sciences 1996. Van Biesbergen spent a year photographing the verges along the Road of the Future, the N329 near Oss, where an innovative approach has been taken to the road and its verges. 'We need to create attractive verges that have been designed with care and have an abundance of flowers. Somewhere welcoming for butterflies and bees that we too can enjoy', says Van Biesbergen. Journalist **Marion de Boo MSc**, WUR Agricultural Sciences 1980, wrote essays for the book. Designer and WUR assistant professor Paul Roncken discusses the design of the N329.

Blauwdruk, 24.50 euros

### Wageningen's landscapes



**Francisca Sival PhD**, WUR Soil Science 1990, soil scientist and ecologist, coordinated the production of the book *De landschappen van Wageningen* (Wageningen's Landscapes), an initiative of the Mooi Wageningen society. The author Wim Huijser writes about the richness of the various landscapes in the vicinity of the town, with peat, sand and clay areas. The biologist and photographer **Sjoerd Schimmel MSc**, WUR Forest and Nature Conservation 2015, also collaborated on the book. *Blauwdruk*, 29.90 euros

**'It's important to me to do something for others'**

## **Edwin Luijks MSc, dentist**

**Biology, 2000**

'I like being able to do all sorts of different things. I extract wisdom teeth, I do root canal treatments, I fit children with braces, I treat cavities and do check-ups. I like that variety. And of course it's nice when people are pleased with the result. Like when a child gives me a drawing they've made, or when someone is happy to be rid of their toothache. I get a lot of satisfaction out of that. It's very important to me to do something meaningful for others.'

'After graduating as a biologist, I first got a job in communications at Plant Sciences at WUR. A reorganization was what prompted me to start a degree in dentistry in 2005. Not because I didn't like biology anymore, but mainly because I wanted more independence and more contact with people. I got a place on the programme straightway, through the lottery system. That degree was very practical: practise, practise, practise. Dentistry is a true craft. I really enjoy that handicraft aspect of it. You need strength sometimes too. It's not easy to pull out a molar.'

'I think it's amazing how extraordinary and complex nature is. As an 18-year-old, I didn't know exactly what I wanted yet, and with biology I could go in various directions. As a dentist, I am happy to have that background knowledge. It gives me a sense of the larger whole, and makes me critical of new drugs. I always try to work in a way that does the least damage. Not even the best filling material can beat the tissues nature makes.'





PHOTO: ANP

## More palm oil per hectare for small farmers in Indonesia

Palm oil is the most widely used plant-based oil in the world. To keep up with the growing demand, vulnerable ecosystems are often sacrificed for palm oil plantations, which poses a threat to biodiversity and the climate. An international research team that includes WUR scientists has been investigating other ways of boosting production in Indonesia, where roughly two thirds of the world's palm oil comes from. The current yield from small-scale plantations – which account for more than

40 per cent of the land used for palm oil production – stands at around 50 per cent of the potential yield, concluded the researchers in *Nature Sustainability*, basing their findings on crop models. If farmers weed around the oil palms more thoroughly, they spot more fallen fruit, which tells them where the fruit is ripe. That helps them avoid picking too much unripe, unsuitable fruit. Farmers should also harvest once every 10 days instead of once every 20 days. That way they limit the amount of overripe

fruit that's picked. And farmers could boost their harvest by using better nutrients. 'At present, farmers often use fertilizers intended for rice plantations, because they are subsidized by the government,' says Maja Slingerland of WUR, who was involved in the study. 'We are trying to get fertilizers intended for palm oil plantations subsidized.' The researchers are also collaborating with local partners on writing a handbook for farmers.

*Info* [maja.slingerland@wur.nl](mailto:maja.slingerland@wur.nl)