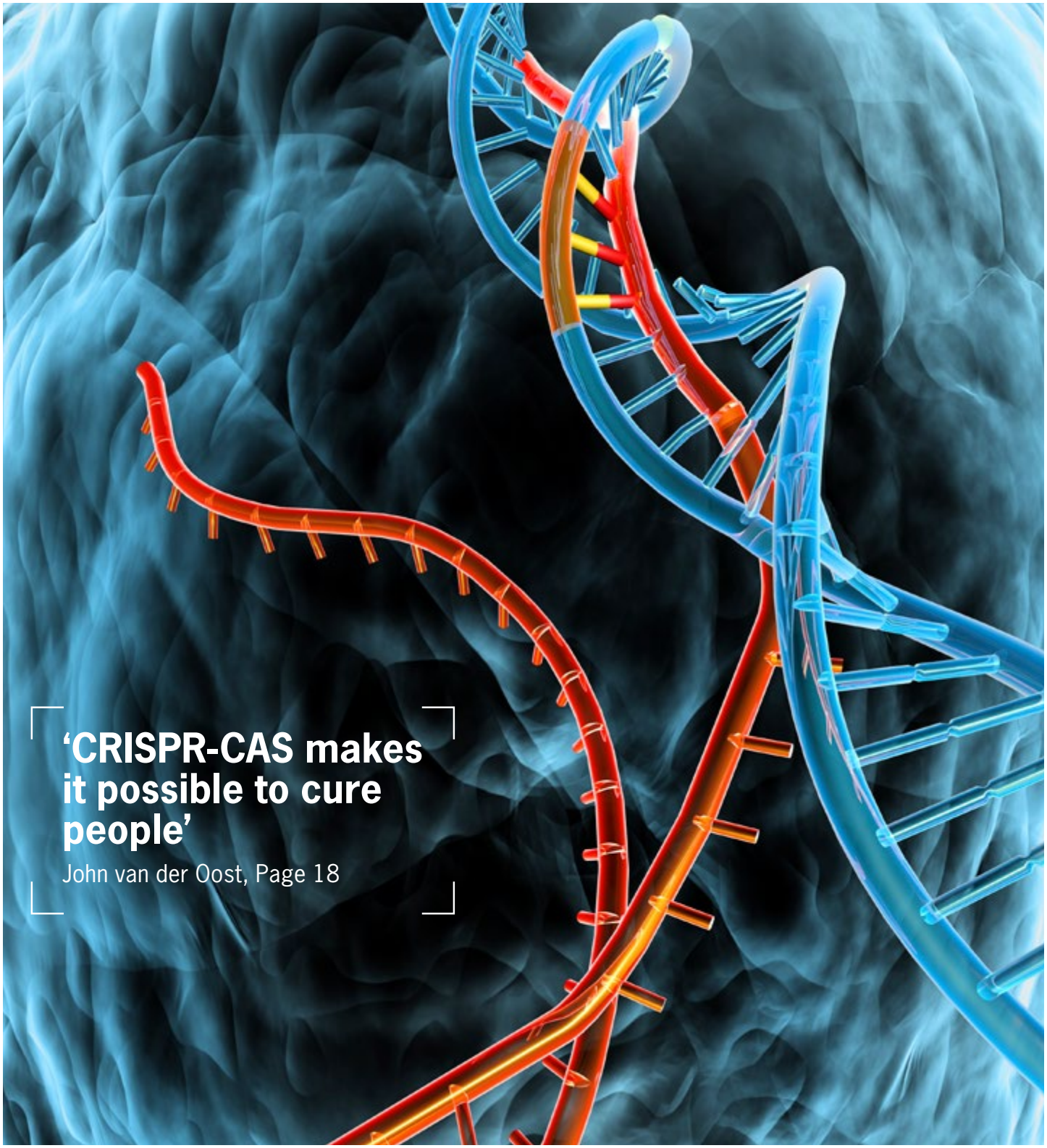
WAGENINGEN WORLD

MAGAZINE OF WAGENINGEN UNIVERSITY & RESEARCH ABOUT CONTRIBUTING TO THE QUALITY OF LIFE no.4 2017



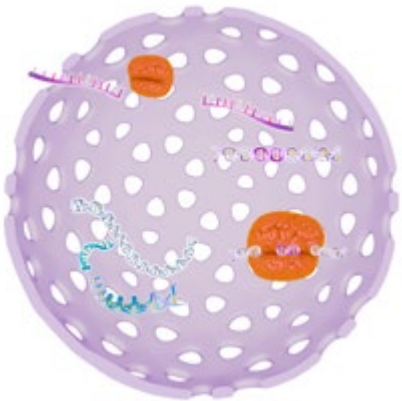
‘CRISPR-CAS makes it possible to cure people’

John van der Oost, Page 18

Phosphate: supplies will run out
Recycling could be a matter of urgent necessity in a few decades

Elephant trouble in Botswana
People and animals are getting in each other’s way

Life around a wind farm
What is the impact of offshore wind farms on birds, fish and bats?



WAGENINGEN UNIVERSITY & RESEARCH

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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, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.

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FEATURES

PHOTO GUY ACKERMANS

A mission

'I still haven't been in this job 100 days, but I can already say I am impressed by the hard work and commitment of Wageningen researchers and students. A commitment that goes beyond the world of academia. In fact, the focus of their efforts is precisely on creating – to use that typical Wageningen word – impact. Wageningen folk have a mission and they are united by that mission. I knew, even before I came for an interview for this job, that scientists and educators at Wageningen are out to make a difference, and that was what attracted and inspired me.

'It is great that I have not been disappointed in that respect. Quite the opposite, in fact. Wageningen University & Research is acclaimed everywhere for our quality and for our contribution to innovation in the food chain, combined with addressing the environment and biodiversity. So I am astonished when politicians and authorities who praise us for these things look the other way when we – and the other technical universities – modestly point out that this innovative and pioneering research cannot be done for nothing.

'The Rutte III coalition agreement offers new opportunities and challenges, I think. The 'new' ministry of Agriculture, Nature and Food Quality, the transfer of green education to the ministry of Education, Culture and Science, combined with more investment in fundamental and applied research, and more attention for development cooperation: all these plans will affect our work. The most positive thing is that the cabinet wants to invest in innovation-oriented research. That is of great importance for the competitiveness of the Netherlands, and for continuing the work of making the agro food sector sustainable and climate-proof.

'We – and I am proud to use this pronoun – are ready to take on the challenge and make our contribution.'

Rens Buchwald has been a member of the Executive Board since 1 September, with responsibility for Finance, Business & Services.

EDUCATION

New Master for liveable cities

In September, the first cohort of students started on the Master's degree in Metropolitan Analysis, Design and Engineering. This is a multidisciplinary degree programme offered by the Delft University of Technology and WUR at the Amsterdam Metropolitan Solutions Institute. The Master focuses on the development of sustainable cities that are pleasant to live in. The 18 students are mostly Dutch and have diverse educational backgrounds. *Info: erik.heijmans@wur.nl*

RANKING

Best university for agriculture and food

Wageningen University & Research is now listed as the best university worldwide for agricultural sciences in the Shanghai Ranking. It already achieved that position in the National Taiwan Ranking and the QS World Universities Ranking. Wageningen also tops the list for food science and technology in the Shanghai Ranking. Overall, WUR is among the top 150 universities in the world (positions 101-150). The Shanghai Ranking is based on the assessment of 52 disciplines, looking for example at the number and impact of publications, international collaboration and winners of academic awards. Until last year, this academic ranking of universities around the world was only compiled for five broad subject areas.
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CROP PROTECTION

App helps combat *Phytophthora*

Wageningen University & Research and Agrifirm have jointly developed and launched an app that helps potato farmers combat the disease *Phytophthora*. It does so primarily by improving the timing of spraying. 'That prevents you from acting too late and having to take much tougher measures,' says WUR researcher Geert Jan Kessel. The system determines the infection risk using such information as the cultivation plan, the potato variety, the measured and forecast weather and previous treatments. The app also incorporates the latest know-how on the effectiveness of pesticides. The app was tested last year in the Netherlands. It is also being tried out in China and Bangladesh.
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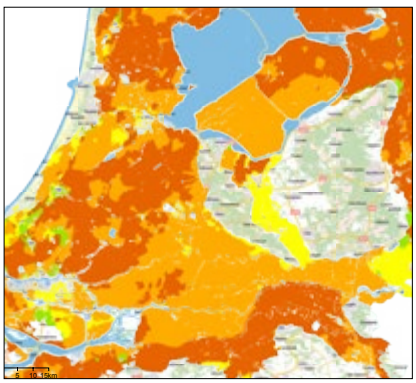
PHOTO SHUTTERSTOCK

SCENARIO STUDIES

Atlas shows climate stress



Climate effect atlas. Effect: flooding
Scenario: current climate

A new climate impact atlas of the Netherlands appeared in September. Not a book but a website, with maps that give a first impression of the possible threat of floods, water damage, droughts and heat. The atlas is based on data from various participating science institutes, including WUR. It contains a lot of new cartographic information and the latest climate scenarios from the Royal Dutch Meteorological Institute. There are also 'map stories' that tell readers what they can see in a map and help them to make use of that information.
In the coming years, municipalities will be carrying out climate stress tests to identify the problems that could arise due to climate change. The climate impact atlas can be an important aid for them. The website is also relevant for educational institutions, students and companies, for example.
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CONSUMERS AND NUTRITION

Sales of more sustainable foods continue to rise

The Dutch now devote 10 percent of their expenditure on food to more sustainable products, mainly organic products and meat with the Better Life label. The figure was only 8 percent in 2015. Sales of sustainable products rose most in supermarkets and outlets for people on the move, says the Sustainable Food Monitor that Wageningen Economic Research produces for the Ministry of Economic Affairs. Products count as more sustainable if they have an independent label that sets tougher requirements than the minimum legal ones for the environment, animal welfare or social aspects.
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BIOBASED MATERIALS

First bicycle tyre from dandelion latex

At the end of August, the company Vredestein presented a tyre for racing bikes made from the roots of Russian dandelions. Wageningen did much of the research behind this innovation.

Natural latex is an indispensable component in countless applications, from tyres to medical equipment. At present, nearly all this latex comes from rubber tree plantations in Asia. Rubber trees also grow in South America, but large-scale production is not possible there because of a fungal disease. There is a possibility of that disease spreading to Asia. What is more, the price of rubber has increased considerably in the past decade. That makes being able to fall back on an alternative an interesting option for Europe. Wageningen therefore joined forces with international companies and research institutes to look for another suitable crop for the production of natural latex.

Among several thousand candidates, the Russian dandelion *(Taraxacum kok-saghyz)* emerged as the best option. This plant is suitable for large-scale production – the crop can be harvested mechanically – and the roots produce high-quality latex. WUR was not only involved in the cultivation of the crop but also in the development and initial industrial-scale production of this special natural rubber. It has now been tested in various mixtures with other substances that give tyres specific properties.

At the end of August, the tyre manufacturer Vredestein presented a prototype bicycle tyre made from this natural rubber at a bicycle trade fair in Germany. It has better grip than traditional mixtures because of the higher concentration of natural resin in the dandelion latex. The prototype uses roots from plants that were grown and harvested in the Netherlands. The bicycle tyre was given a bright green stripe on the side. *Info: ingrid.vandermeer@wur.nl, video: youtu.be/ru_E6doMrlw*

PHOTO ANP/REUTERS

The Russian dandelion root produces natural rubber.

PHOTO CINDY HEIJDRA

A bicycle tyre made of natural latex.

WAGENINGEN ACADEMY

How plant breeding modules can support your career

Over the past few years, a broad audience has followed our distance learning modules on plant breeding. The modules were developed for professionals seeking to gain more theoretical background on basic or more complex breeding and selection methods, and the biological concepts underlying them. Most of our participants come from breeding companies all over the world. But there are also participants who enrol on their own initiative, like Jos Smallegange. He followed five modules in his own time and used them to support him in a career switch from aquaculture to plant breeding. Curious why he did this and how he managed? Read his full story on Wageningen Academy's distance learning page.

www.wur.eu/academy

SOIL

Geomorphological map is now freely accessible to all

Following on from the Soil Map of the Netherlands, the digital Geomorphological Map of the Netherlands also became freely accessible to everyone in September. The geomorphological map gives detailed information about the profile, history and age of the landscape. The map is used for example in education, and in research on climate-proof spatial development and archaeology. Wageningen Environmental Research was able to publish the map thanks to funding from the Ministry of Economic Affairs and the Ministry of Infrastructure and the Environment. The map and explanatory notes can be found by going to *legendageomorfologie.wur.nl* (in Dutch only). *Info: gilbert.maas@wur.nl*

ECOSYSTEMS

PHOTO HOLLANDSE HOOGTE

Woodland area is declining

The Netherlands is experiencing deforestation again. Around 20,000 hectares have been felled since 2013 and only 9000 hectares planted.

These results come from an analysis by Wageningen Environmental Research based on topographical maps combined with aerial photos. The woodland area in the Netherlands grew from about 362,000 hectares to 375,000 hectares between 1990 and 2013. The decline since 2013 is mainly due to the conversion of woodland into other kinds of nature, such as heathland corridors, or farmland. The latter is the case for large plots in Drenthe and Groningen in particular, which were planted with trees in 1986 using grants intended to prevent timber shortages, which were feared at the time. Now that land is once again being farmed. Finally, some woodland has made way for buildings and infrastructure. Information about deforestation is important for climate policy. Sixty percent of carbon sequestration in Dutch ecosystems takes place in woods. Deforestation releases a great deal of CO_2 in one go and young forests absorb much less CO_2. As a whole, Dutch woods are still sequestering CO_2 but if the area felled every year were to increase from the current 3036 to 4000 hectares, the net effect would be reversed.
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ENERGY

Hydropower can play a bigger role

Hydropower is currently the most important sustainable source of energy globally. It supplies about 16 percent of the total demand for electricity. There is potential for this to increase to 50 percent, according to research by Wageningen hydrologists in collaboration with energy researchers at Utrecht University.

The researchers have assessed how much hydropower there potentially is in the world. 'We looked at how much water is available, and used very detailed maps to figure out where dams are possible, what they could generate and at what cost. That had never been done before on such a scale,' says hydrologist Hester Biemans. However, the researchers acknowledge that generating hydropower can also have large negative effects on biodiversity and on humans, in turn limiting its potential. For example, that potential decreases by half if one third of the water has to be able to flow through to let fish survive. The study appeared in September in *Nature Energy*. *Info: hester.biemans@wur.nl*

INFECTIOUS DISEASES

Bacteria protect one another from antibiotics

Bladder inflammation in the elderly is often caused by multiple species of bacteria. Wageningen research has shown that the species protect one another against antibiotics. Applying this knowledge may help improve treatments.

In Wageningen's Laboratory of Genetics, the biologist Marjon de Vos is investigating the role of the environment in the development of bacteria. In a study published in October in *PNAS*, she analysed over 70 bacterium samples taken from elderly people with bladder inflammations caused by several bacteria — what is known as a mixed infection. She monitored the growth of the various bacterial species in the presence of antibiotics.
Working with fellow scientists at the university of Cologne and IST Austria, she developed a computer model that predicts how the composition of bacterial colonies changes under different conditions. De Vos: 'You normally see bacteria competing with one another. But it turned out that these bacteria also collaborated and protected one another against important antibiotics.'
De Vos says her fundamental research could definitely lead to practical applications. The older the patient, the more likely it is that a bladder inflammation is a mixed infection. These are often difficult to treat. This publication contains arguments for identifying all infectious bacteria in urine tests, rather than just the most important species. She says the study also offers openings for a new type of treatment by disrupting the ecosystem in the bladder, for example with a non-pathogenic bacterium.
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PHOTO SHUTTERSTOCK

MULTIMEDIA

Hidde Boersma awarded Press Prize

In September, science journalist Hidde Boersma was awarded the Wageningen Press Priz by the University Fund Wageningen. He received the prize for a multimedia production on genetically modified crops.

'There are lots of anti-GMO films and we wanted to reach the same audience, only with a different side to the story,' says Boersma. 'I find it really sad that the European position on GMO is costing lives in poor countries.' In addition to a report for Dutch newspaper *de Volkskrant*, he and two programme makers made the documentary *Well Fed* and a combination of the two for the Internet. Boersma sees the Press Prize as recognition for his work and the message: better GMOs than toxins and poverty.
Boersma is a journalist specializing in bio-technology, agriculture and bio-ethics. In 2010 he received a PhD in Microbiology in Groningen. The Press Prize jury praised the quality and diversity of his approach. The Press Prize is awarded once every three years to a person or programme that excels at communicating with the general public on a WUR topic. The prize consists of a certificate, 2500 euros and a replica of the artwork *The Wageningen Tree*.
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PHOTO JONNE SELDEL

NUTRITION RESEARCH

TNO research group to move to WUR

TNO's Functional Ingredients research group will become part of Wageningen Food & Biobased Research on 1 January 2018. The move makes this part of WUR one of the largest science institutes in food, nutrition and biobased research in Europe, with over 240 people working there.
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PHOTO MARTE HOFSTEENGE

ECOLOGY

Butterflies as indicators for nitrogen deposition

Among Dutch butterflies, the species that are doing well are the ones that thrive in nitrogen-rich environments. Policies aimed at reducing nitrogen deposition have not yet had enough effect.

These findings come from research by Wageningen professor by special appointment of Insect Ecology & Conservation Michiel Wallis de Vries and a colleague at the Dutch butterfly conservation society *Vlinderstichting*. They developed an indicator for the effects of nitrogen deposition using population trends of species that are attracted to nitrogen and those that avoid it. Butterflies serve as an early warning system in research on biodiversity and nature. Half of the 56 butterfly species in the Netherlands prefer an environment low on nitrogen while 14 percent thrive with more nitrogen. For the rest, it doesn't matter either way. The species that avoid nitrogen include many endangered ones.

Intensive farming produces most of the nitrogen deposited in nature areas in the Netherlands, which affects ecosystems and biodiversity. 'The butterfly world has become increasingly "rich in nitrogen" since 1990,' says Wallis de Vries. 'Policy is based on the assumption that nitrogen emissions are falling. Butterflies now give us an indicator of what is happening in practice. They show that there is still a lot of work to do in reducing nitrogen deposition in nature.'

The research was published in a special issue of the journal *Biological Conservation*, devoted to recent insights on threats to biodiversity. *Info: michiel.wallisdevries@wur.nl*

PHOTO SHUTTERSTOCK

The sooty copper is one of the butterflies that avoid nitrogen.

POLICY

'Globalization can be good for the environment'

PHOTO SHUTTERSTOCK

Globalization is often associated with untrammelled capitalism, social inequality and negative impacts on nature and the environment. But globalization can also encourage the recovery of environments.

This argument was made by Professor Simon Bush in his inaugural lecture on 7 September in Wageningen. Bush, professor of Environmental Policy, investigates how to design effective agreements, legislation and regulations that can help resolve global environmental problems.

He gives the example of more sustainable management of tuna populations, a topic he is currently researching. 'As in many other environmental problems, you start by asking whether consumers can make more sustainable purchases and cook more sustainably. How can you encourage fishermen to make investments and governments to introduce regulations?' says Bush. 'Then you discover that relations between countries and sectors are intertwined throughout the world and that biological resources can only be exploited and safeguarded for future generations if governments, NGOs, companies and consumers join forces globally to achieve this. In the western and central Pacific Ocean, we are seeing that use of the Vessel Day Scheme and the Marine Stewardship Council certification have improved negotiations, agreements and results.' *Info: simon.bush@wur.nl*

AERODYNAMICS

Malaria mosquitoes leave unnoticed

The malaria mosquito has an ingenious technique for flying away safely once it has sucked up its fill, without the victim noticing and splatting it.

Most insects, when they want to fly off again, push off hard with their feet and launch themselves into the air. Scientists at Wageningen and the University of California, Berkeley (US) used high-speed cameras to show that female mosquitoes that have gorged on blood flap their wings exceptionally fast just before setting off (30 milliseconds), at 600 beats a second, three times faster than comparable insects. As a result, the wings provide 60 percent of the power they need to take off. The satiated mosquitoes also use their long legs to slowly increase the pressure during these 30 milliseconds. The study is part of a large project on fighting diseases that are spread by mosquitoes, and it was published in the *Journal of Experiment Biology*.
Info: florian.muijers@wur.nl, video: youtu.be/qe6Grq7jivU

PHOTO SHUTTERSTOCK

CLIMATE

Greenhouse CO_2 emissions continue to fall

CO_2 emissions from Dutch greenhouses continue to fall. Annual emissions fell between 2010 and 2016 from 8.1 megatons to 5.6 megatons, 0.6 megatons below the target that was set for 2020 in an agreement. The reduction is mainly because market gardeners have been generating less electricity for sale as a result of lower electricity prices, energy savings and a decline in the overall greenhouse area. This conclusion can be drawn from the Greenhouse Farming Monitor produced by Wageningen Economic Research. This also means the greenhouse sector is making faster progress than the country as a whole (+9 percent). The target for 2020 has now been changed to a maximum of 4.6 megatons of CO_2 emitted.
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HUMAN HABITAT

Less bullying in healthy school playground

Redesigning a school playground can improve the social climate, according to a Wageningen study of 'healthy' school playgrounds. Such playgrounds do not just have the traditional equipment but also elements that challenge children to play with plants, woods, sand and water. 'After the redesign, the children say there are fewer quarrels and less bullying in the playground than before,' says Sjerp de Vries of Wageningen Environmental Research. Fewer children get left out too. 'That's probably because now every child can find something to do.' The improved social climate in the playground also seems to improve the children's emotional welfare.
Info: sjerp.devries@wur.nl

HUMAN AND ANIMAL DISEASES

Pneumonia caused by sick guinea pig

At least three people in the Netherlands have acquired serious respiratory tract infections from sick guinea pigs in the past four years. This finding comes from research by vets, doctors and microbiologists working at Wageningen Bioveterinary Research and elsewhere. The patients, healthy people in their 30s, were infected with the bacterium *Chlamydia caviae*. It is known that this can cause mild eye infections in guinea pigs, but that the same strain could cause pneumonia in humans had never been proven before. The infection can be treated successfully with antibiotics. To speed up diagnosis it is important for doctors and vets to realize that humans can also be made ill by this bacterium. The study appeared in September in *The New England Journal of Medicine*. *Info: marloes.heijne@wur.nl*

THE PHOSPHATE CYCLE IS NOT CLOSED

Supplies will run

The Netherlands is leading the way in research on reusing phosphate. The main motives for this are to spare the environment and to comply with legislation on manure. But within a few decades, phosphate recycling could be a matter of urgent necessity. 'Europe has hardly any phosphate mines.'

TEXT ARNO VAN 'T HOOG **PHOTO** ALAMY **INFOGRAPHIC** STEFFIE PADMOS

out

‘Europe is dependent on Morocco, China and the United States’

‘The latest estimate is that there is enough easily mined phosphate ore available for making artificial fertilizer for roughly another 300 years. That sounds like a long time but it’s not if you want to take care of future generations,’ says Oscar Schoumans, who works at Wageningen Environmental Research. He has been doing research on the manure problem and phosphate in the soil on farmland since 1984.

In the west nowadays we see phosphate as a problem because of our manure surplus, says Schoumans, but in future it will be a strategic mineral resource. Phosphate is not rare but it is only present in concentrations that make extraction viable in a few places. Morocco is the biggest supplier of phosphate ore, much of which gets shipped to the United States, the main producer of phosphate-based fertilizer.

Schoumans comments: ‘Europe has hardly any phosphate mines and we are dependent on supplies from countries such as Morocco, China and the United States. If phosphate ore or artificial fertilizer became scarce in the ground or on the market, due to geopolitical developments, these countries could opt to protect their own agriculture and food supplies. The moment they turn the export tap off, we’ve got a big problem.’

That problem would be one of falling agricultural productivity. Plants, animals and humans cannot do without phosphate: it is in our bones and DNA in the form of phosphorus, and it is an important source of energy at cell level. Phosphate fertilizer makes crops grow better. Since the 1950s, along with nitrogen fertilizer, phosphate has made a massive contribution to global food production. So it is not for nothing that global consumption of phosphate increased by a factor of five between 1960 and 2013. Arable farming is the biggest customer, but livestock farming uses a lot of phosphate worldwide too: an estimated one third of phosphate fertilizer is used for feed crops and grassland.

The idea behind the use of phosphate fertilizer is actually very simple: you replace the phosphate that the crop has used for its growth, and that the farmer has removed from the land in the form of crops, milk or meat. But in reality, the balance is not so easily restored. Much phosphate from fertilizer becomes fixed in the soil and is only available to plants in limited quantities. In areas with intensive agriculture and livestock farming, a surplus of phosphate builds up over the year. The soil acts a bit like a sponge, absorbing phosphate until it is saturated. If even more phosphate is then added, plants can absorb it more easily, but it can also be washed away faster.

Additionally, millions of tons of phosphate get washed into rivers and the sea all around the world, due to erosion and run-off. Charts which depict worldwide phosphate flows show more being lost than used. Less than one quarter of the phosphate from the mines reaches its intended destination: our plates.

SATURATION

Heavy over-fertilization in the past and phosphate’s tendency to stay in the soil have led to saturation in north-western Europe, says Schoumans: ‘In the top 50 centimetres of Dutch farmland soil, there is an average of 5000 kilos of phosphate per hectare. If you assume that arable land consumes about 50 kilos of phosphate per hectare in one growing season, and grassland 100 kilos, then you can see that the bulk of it stays in the soil. One quarter of that – more than 1000 kilos – is readily available to the plant, but that also means it runs off into ground and surface water. We’re talking about one to two kilos of phosphate per hectare per year. That stimulates the growth of algae in ponds and ditches, and causes problems with swimming water. So efforts are being make to reduce runoff by temporarily applying less phosphate fertilizer than the crop needs on land where there is a higher risk of phosphate runoff.’

A lot of land has become so enriched that the use of phosphate fertilizer in Europe has gone down – in the Netherlands from 75 million kilos in 1990 to 5 million kilos in 2015. Some farmers still give their crops a ‘kick start’ which they can absorb easily at the start of the growing season. But animal manure has largely replaced artificial fertilizer as a source of phosphate. This is because artificial fertilizer imports are not the only route by which phosphate enters the country: it also arrives in imported livestock feed. Soya for livestock feed accounted for 30 million kilos of phosphate in 2010, and much of this ends up in the manure.

The Netherlands produces more manure containing phosphate than may be dumped on Dutch agricultural land according to the fertilizer legislation, says Schoumans. ‘That means we have about 45 million kilos of phosphate left over every year, in the form of animal manure that we cannot dispose of on Dutch farmland.’ This is why it is compulsory to process manure, and why manure from pig and chicken farms is exported to Germany and France, while dairy farmers can largely dispose of their relatively low-phosphate cattle manure on their own land (see inset).

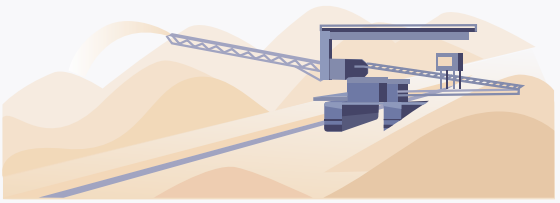
A LOT OF MONEY

Schoumans: ‘By contrast, pig farms do not have much land and produce a lot of phosphate-rich manure. They spend a lot of money on processing and disposing of it. Their manure consists of 90 percent water so exporting it entails high transport costs: about 20 to 25 euros per ton.’

As coordinator of the European project SYSTEMIC and the Dutch top sector project on the added value of manure and minerals, Schoumans is involved in the construction of the new ‘Green Minerals Plant’, where phosphate, potassium and nitrogen will be extracted from pig manure. Schoumans: ‘If you get phosphate out of the manure, you can use the organic matter on farmland, because that is good for the soil life, the soil structure and moisture levels. Since the low-phosphate organic matter no longer >

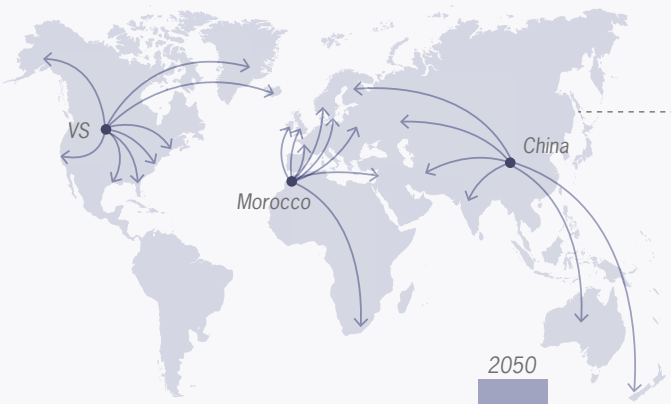
DWINDLING PHOSPHATE SUPPLIES

Worldwide we have created a massive flow of phosphate, mainly for the production of artificial fertilizer. Phosphate from the mines reaches farmland all around the world, and our plates through meat and vegetables. A huge proportion of it is lost, however.

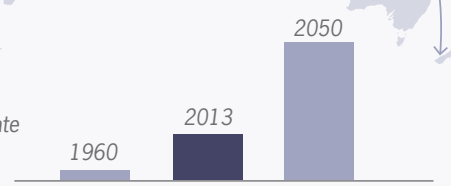


Sources of phosphate

40 million tons of phosphate is mined every year. The total world supply is estimated at **3600-8000** million tons.

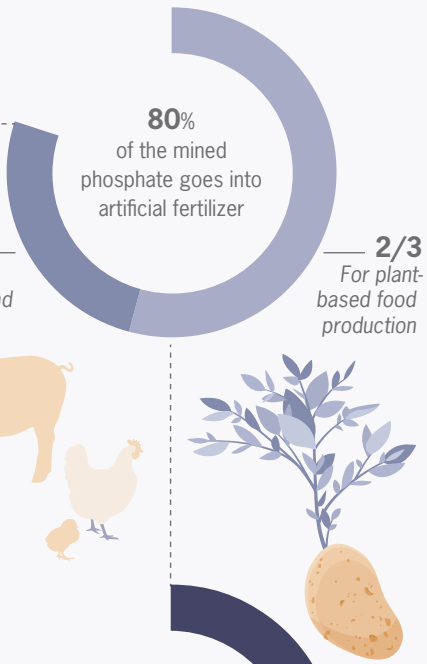


Growth in phosphate consumption worldwide



Main consumer: agriculture

Worldwide, western agriculture is the biggest consumer of phosphate due to the use of artificial fertilizer.



What is phosphate needed for?

Plants, animals and humans cannot do without the mineral phosphorus (P): it is in bones, DNA, enzymes and ATP, a crucial source of energy.

Dutch people consume about **1.2** kilos of phosphorus a year in their bread, vegetables, meat and dairy produce.

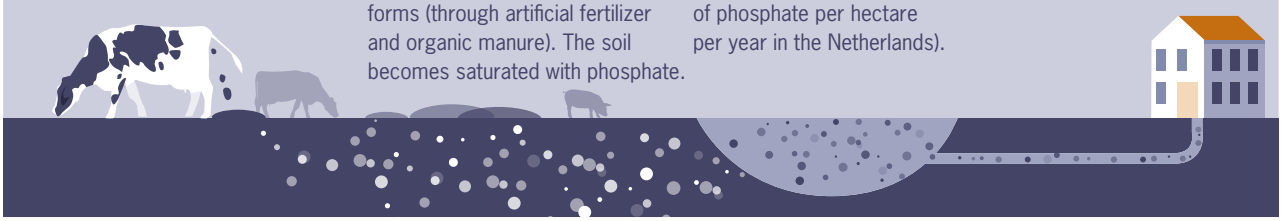
Losses

Manure
A large proportion of the phosphate in livestock feeds and grass ends up in the manure.

Soil
A lot of the phosphate from fertilizer gets fixed in the soil. In areas with intensive crop and livestock farming, a surplus forms (through artificial fertilizer and organic manure). The soil becomes saturated with phosphate.

Water
Some of the phosphate from the soil dissolves in water and washes away into ground and surface water (about **2** kilos of phosphate per hectare per year in the Netherlands).

Sewage
Much of the phosphate eaten by humans goes down the toilet and ends up in surface water via the sewage system.



> ‘The Netherlands has an annual surplus of 45 million kilos’

has to be taken across the border, and you are allowed to dump the decontaminated water, you also reduce transport costs considerably.’
The technology for extracting phosphate, which was developed in Wageningen, is called Re-P-Eat: Recovery of P to Eat. When an acid is added to it, the phosphate separates from the thick manure slurry, after which it is extracted as calcium phosphate, a highly soluble mineral which is also an ingredient of artificial fertilizer.
The Green Minerals Plant should be up and running in November 2018 on the premises of a big manure processing company in the Achterhoek region in the eastern Netherlands, which already produces biogas from about 100,000 tons of pig slurry. With about 25 of these kinds of salvaging plants across the country, 100 million kilos of phosphate from the surplus manure from pig farms could be processed into reusable fertilizer. ‘The task of the Green Minerals Plant is to demonstrate that the technology works on a large scale, and make clear what the quality of the mineral products is. And whether the process is economically viable. It has got to be both doable and affordable.’
This technology helps pig farmers with a manure problem as well as providing a way to further reduce the country’s dependence on artificial fertilizer, says Schoumans. ‘In the Achterhoek region several parties are busy starting up a project with the aim of finding out to what extent we can close the manure cycle in an area of 30 kilometres around the digester plant. We are looking at the kinds of nutrients that are brought to the digester. And identifying the needs of arable farms in the area: which organic and mineral fertilizer types they require. When you know that, you can try to put together a tailor-made product.’

DOWN THE TOILET

Humans in the Netherlands are at the top of the food chain. The Dutch consume about 1.2 kilos of phosphorus per year in their bread, vegetables, meat and dairy products, which is equivalent to 2.7 kilos of phosphate. Most of it disappears down the toilet, so there lies a second opportunity for recycling.
Dutch sewage treatment companies have been working on extracting phosphate for years. Phosphate can crystalize as struvite, or magnesium ammonium phosphate. The main reason for sewerage treatment companies to extract phosphate is to save on maintenance: struvite can form crusty deposits that clog up pipes and pumps. The sewage treatment plant in Apeldoorn already produces tens of thousands of kilos of struvite per year. The installation in Amsterdam West harvests as much as 2500 kilos of struvite per day from the wastewater of hundreds of thousands of residents.
The dried struvite crystals are a rich mineral, containing phosphate and nitrogen, but there is no market for it yet – not in the Netherlands, anyway. ‘Struvite is not popular among farmers here,’ says agronomist Sander de Vries, who does research at Wageningen Plant Research on improving the productivity of agricultural regions around the world. ‘Struvite is not a balanced fertilizer: it contains a high proportion of phosphate, not much nitrogen and no potassium. And it also dissolves quite slowly over the years, whereas farmers want to see fast results. Dutch farmers also usually have a glut of phosphate. So it is difficult to find a market here for a substance which is also less handy to use than conventional phosphate fertilizer.’

TO AFRICA

Other regions often do have land lacking in all sorts of nutrients, such as phosphate, nitrogen and potassium. ‘In some regions of Africa there is plenty of scope for increasing agricultural yields considerably, much more than in Europe. One of the things you could do in Africa is to improve local phosphate fertilization, and for that you could use struvite from Dutch sewage plants,’ says De

THE PHOSPHATE CEILING AND MANURE PROCESSING

Pig farmers have very little land to spread their muck on. And there is very little demand for it in the Netherlands, so these farmers incur high costs to get their manure processed and transported to other countries. Poultry farmers do not have much land, either, but the market for chicken manure is a bit more favourable. Chicken manure contains little water and high levels of phosphate. It can be dried and exported to other European countries. The BMC Moerdijk power station processes chicken manure by burning it as fuel for generating power. This way one third of Dutch poultry manure is processed into 60,000 tons of phosphate-rich ash.
Cattle manure contains relatively low levels of phosphate and dairy farmers have their own grasslands and fields for fodder crops, on which they can use their manure. After the European milk quotas were abolished in 2015, Dutch dairy cattle numbers shot up. Countrywide phosphate production therefore exceeded the European ceiling of 172.9 million kilos and as a consequence, dairy herd sizes were cut back again. In the first half of 2017, phosphate production in the dairy industry fell by 8.3 million kilos, so the Netherlands has ended the year just below the European phosphate ceiling.

PHOTO GETTY

A worker walks through a PhosAgro warehouse full of artificial fertilizer granules in Cheropovets, Russia.

Vries, who has calculated the feasibility of exporting Dutch struvite.
On paper it looks viable compared with the production and transport of traditional artificial fertilizer, both in terms of costs and in terms of greenhouse gas emissions. 'But that is not the end of the story,' says De Vries. 'In practice there are obstacles posed by the export process, customs regulations, and local processing and distribution. To get struvite from the harbour to small farmers, you need transport, and the cost price goes up with every kilometre. And then the farmers don't know yet how to apply this kind of fertilizer efficiently in combination with potassium and extra nitrogen. In other words, if you want to do something with struvite you've got to set up a whole new system. Local recycling of struvite in Africa and Asia is of interest, too, except for the lack of well-functioning sewerage and water purification in many big cities.'

MORE PHOSPHATE IS NEEDED

Recycling and more efficient use is increasingly important in view of the projected growth in the world population and increasing wealth. A western diet with more meat, dairy and eggs will become more common, increasing the demand for phosphate for animal feeds and grassland. The expectation is that worldwide grass production for meat and milk will have to increase by 80 percent by 2015 to cater for the increased demand. If the prognoses are correct, global agriculture will be consuming twice as much phosphate fertilizer in 2050.
Besides extracting phosphate from manure and sewage, another promising strategy in the face of growing scarcity is to make smarter use of phosphate in agriculture. 'If the supply of phosphate goes down, a dairy farm will have to become more efficient to keep up the same output,' says PhD candidate Mart Ros. 'Better use needs to be made of phosphate that is already present in the fertilizer and the soil.' Ros did his research on phosphate cycles in the dairy industry, supervised by Oene Oenema of the Department of Soil Quality at Wageningen University. The 'No food without phosphates' project is supported financially by the University Fund Wageningen through a donation from livestock feed company De Heus and several individuals.
On a dairy farm the phosphate cycle goes from raw feed and grass to the cow, to manure, and then via the soil back to grass and maize fodder crops. But that cycle does not function optimally because phosphate is bound to the soil. Ros: 'In most soils the concentrations of free phosphate in the soil are less than one percent of what a plant needs over the growing season. So the rest has to come from the solid phase of the soil. That could happen when phosphate is gradually released by soil particles, or from the breakdown of organic matter. How available this phosphate is depends on processes in the soil which convert that fixed phosphate into a form those plants are able to absorb.'

WORM FAECES

Ros noticed that the root structure of grass plays a role in the absorption of phosphate. It became clear from greenhouse trials that grass species with a lot of root biomass and long roots grow better and produce bigger yields. Secondly, earthworms play a useful role in the release of phosphate: the availability of phosphate in their faeces goes up by a factor of between 30 and 1000. So grasses grow better in worm-rich soils. 'Under low-phosphate conditions we see a rise of 10 percent in the grass yield due to the impact of earthworms. Field trials are needed to see whether the results we get in the greenhouse are achieved out of doors. But I am convinced that this is a first step towards measures that can help to optimize phosphate application in agriculture.'

TACKLING WASTE

'By using artificial fertilizer we are actually redistributing and diluting phosphate,' says agronomist De Vries. 'You extract it from mines where it is present in high concentrations and spread it over farmland all around the world in the form of artificial fertilizer. You can reclaim phosphate, but recycling gets more and more difficult at lower concentrations of phosphate.'
And yet phosphate recycling is badly needed for the sake of reducing waste. De Vries; 'Many articles have been written about scarcity and rising fertilizer prices. It might become a pressing problem in about 50 years' time, but it is hard to predict precisely. New sources of phosphate get discovered, but we are also starting to use more phosphate. And yet we are still not doing certain obvious things on a large scale. Extracting struvite from sewage water is a start, and the Netherlands is in the lead on that. We are also working on manure processing, and phosphate recycling and export. None of it is particularly complicated but it does take time and money to develop the technology and the market.' ■

www.wur.eu/phosphate

First a joy and then a nuisance

The beaver is thriving in the Netherlands, especially in Limburg. But now the province is considering culling nuisance animals. Such a step could be avoided with better beaver management or by moving some Limburg beavers to a national park – which would benefit the otter too.

TEXT RENÉ DIDDE **PHOTO** SHUTTERSTOCK

Castor fiber is doing very well in the Netherlands. The estimated 1700 beavers in areas such as the Biesbosch, the Gelderse Poort, the Oostvaarderssplassen and the province of Limburg add up to a sustainable, viable population. The likeliest explanations for its success are the improved quality of the water, the more nature-friendly banks with willows and poplars, and above all the protected status of the beaver.
'Support for the beaver among the locals in Limburg is under pressure, however, because of the problems the beavers are causing there,' observes population ecologist Hugh Jansman of Wageningen Environmental Research in a report published this autumn on the status of the beaver in the Netherlands.
Almost 30 years after the reintroduction of 42 German beavers in the Biesbosch, the biggest rodent in the Netherlands has become a 'keystone species', reveals the study. 'That means that typical beaver activities such as digging lodges, gnawing at tree trunks and, of course, building dams create niches which benefit other species too,' explains Jansman.
Poplars stripped by beavers form perfect perches for white-tailed eagles, and dams create shallow little lakes which provide spawning grounds and nurseries for fish, and thus also well-stocked snack bars for kingfishers who sit on the dam looking out for a good catch. Unusual species such as the black stork and the crane benefit too, as do bats and amphibians, says Jansman.

GENETIC IMPOVERISHMENT

There are regional variations in the success of the beaver, however. 'Beavers released in the Biesbosch and the Gelderse Poort have reproduced more slowly than the population in Limburg,' says Jansman. The Biesbosch beavers came from the Elbe region of Germany, while the Limburg population is of mixed origins. The first arrivals were originally Polish and Russian beavers that had been released in Belgium, and they have since been joined by German beavers. That population is genetically diverse, whereas the German Elbe beavers may suffer from in-breeding and genetic impoverishment.
It is also possible that the Biesbosch beavers suffered from heavily polluted river sludge from the Maas and Merwede rivers in the 1980s. 'The beavers' kidneys were certainly full of cadmium at that time, and that is a notoriously toxic heavy metal, so that got them off to a bad start. But to be honest, we don't know what is behind the difference in reproduction rate.'
What is certain is that the reproductive success of the beavers in Limburg is leading them to expand their habitat and they are now found in areas where they are

‘The beaver’s arrival could benefit the otter tremendously’

damaging trees and agricultural crops. Their dams are also causing undesirable flooding on farmland. And they sometimes pose a danger: by digging in dykes and gnawing on nearby willows, they can damage the layer of clay, causing the core of sand in the dyke to be washed away when water levels rise.

A committee from Limburg Provincial Council agreed this autumn to a plan to cull beavers that are causing a nuisance. A controversial decision among nature conservationists and animal lovers. The beaver owes its protected status in part to the fact that the animal died out in the Netherlands just 150 years ago, as a result of hunting for its pelt and its perfume-rich musk glands. ‘You could see the fact that you want to start culling a previously locally extinct species as proof of successful nature conservation,’ says Jansman. ‘After all, the species is thriving again. The controversy about culling them is understandable because city folk only experience the joys of seeing these animals in the countryside, while for the rural population they are also a nuisance.’ The ecologist hopes the beavers will be spared. ‘With targeted beaver management, such as grates protecting dykes or crucial waterways, you can prevent a lot of damage. Cutting down vegetation on and around dykes can help too.’ But Jansman has another idea as well. ‘By capturing Limburg beavers and releasing them, starting in Weerribben-Wieden National Park, where there aren’t any beavers yet, a stepping stone can be created so they can spread into the north of the Netherlands, to places such as the Hunze valley in Drenthe.’ Later, more Limburg beavers could be released elsewhere. ‘And if they are still causing a nuisance after that, you can always resort to culling,’ says Jansman.

HELP WITH MAINTENANCE

In the Weerribben-Wieden, a lot of labour and money goes into cutting down vegetation to maintain the wetland character of the park, says Jansman. The beaver could help with that maintenance. ‘And the otter, the icon of vital wetlands, will benefit too. Otters were released there in 2002 but in icy conditions they have great difficulty getting underwater to catch fish. We know that otters use beaver lodges, with their underwater entrances, to dive underwater. So the beaver’s arrival could benefit the otter tremendously.’ ■

RISE OF THE CRISPR-CAS DNA EDITING TECHNIQUE

Quick and simple gene repairs

It is a dream solution for molecular biological research. The CRISPR-Cas9 technique allows changes to be made in DNA quickly and cheaply. 'Hopefully, it will very soon be possible to cure people. Wouldn't that be fantastic?'

TEXT RIK NIJLAND **ILLUSTRATIONS** MAARTJE KUNEN

A rolled-up piece of paper is pinned to the noticeboard in Professor John van der Oost's room. It is evidence of a bet. Will the scientists who developed the gene technique CRISPR-Cas9 be awarded a Nobel Prize in the years to come (something no one really doubts) and which researchers will be given the honour? Van der Oost and a postdoc have bet a bottle of wine on the outcome.

No, says Van der Oost, he didn't bet on himself. In the Dutch newspaper NRC, cancer researcher and former columnist Piet Borst wrote that Van der Oost deserves a Nobel Prize for his role in the development of CRISPR-Cas9. 'That was nice to read, good to see someone giving us the credit for all the fundamental work that we carried out. But as Borst himself said, the prize for medicine won't go to a microbiologist.'

In scientific journals, Van der Oost is indeed seen as the pioneer paving the way for the three researchers judged likely to get the prize: the French scientist Emmanuelle Charpentier and the Americans Jennifer Doudna (Berkeley) and Feng Zhang (MIT).

The triumphant march of this new technique, which lets precise changes be made in DNA at low cost, started in the late 1990s quite by accident in Wageningen.

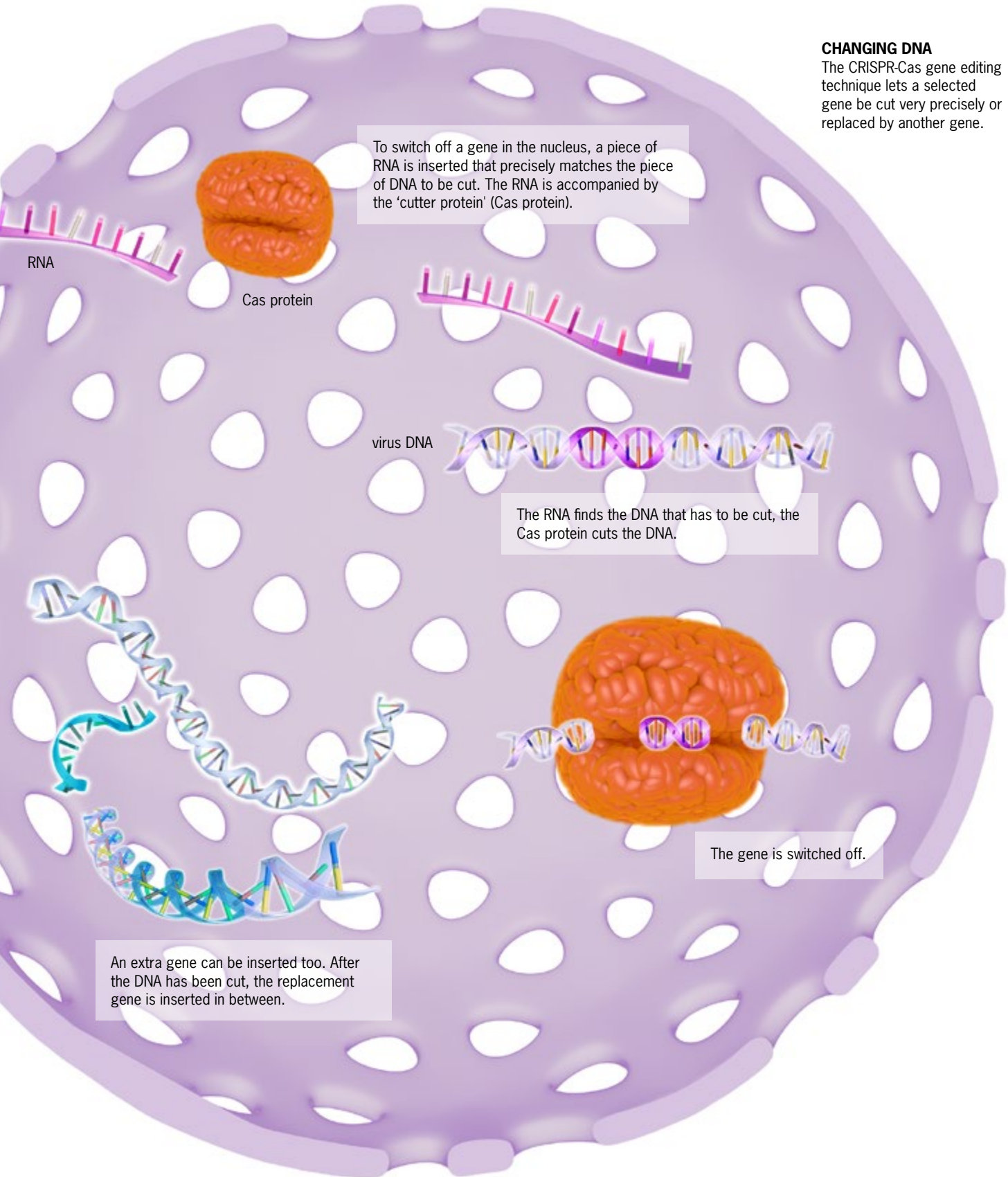
'We were involved in deciphering a genome from a bacterium from a geyser in Yellowstone,' says Van der Oost. 'We found that it contained repeating pieces of DNA. We published this result in 2001 and then forgot about it. We had no idea what it was for. In 2005 French and Spanish researchers suggested that this could be an immune system to protect bacteria from viruses. I had just received a Vici grant from the Netherlands Organization for Scientific Research and that's what made the difference. It let us immediately put a postdoc and a PhD candidate to work on the topic.'

INVADING VIRUSES

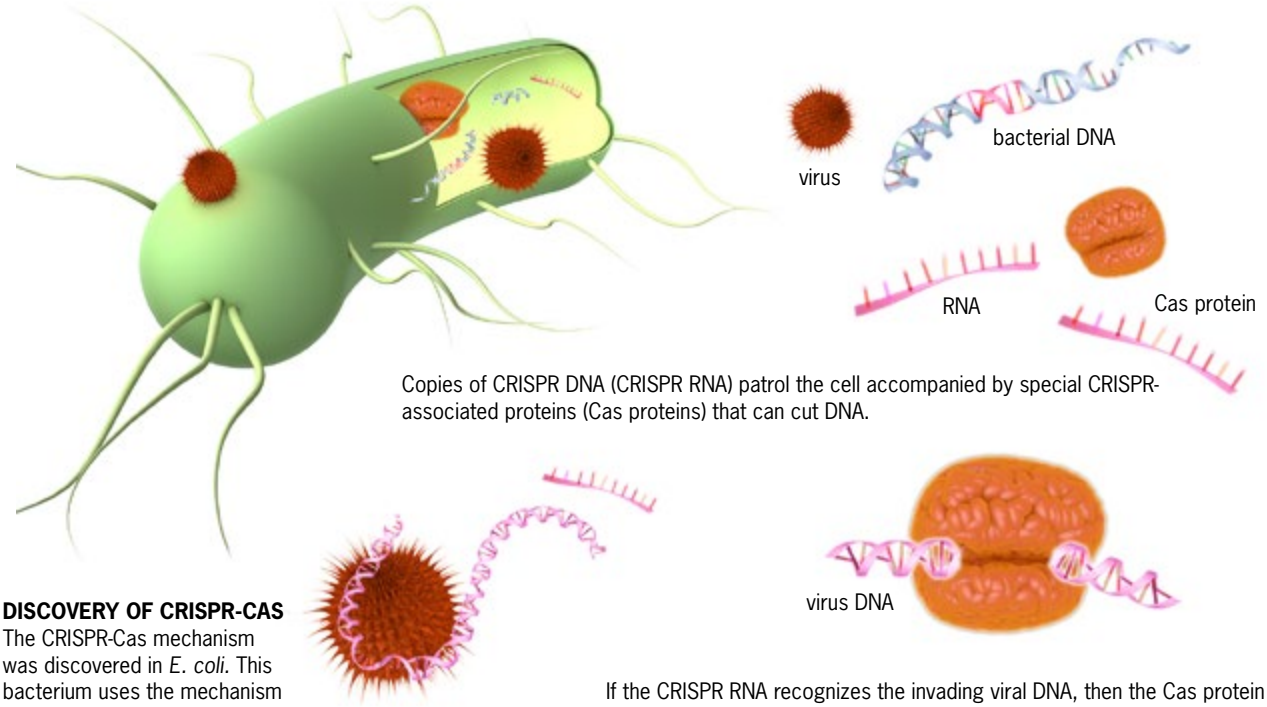
That led to an article in *Science* in 2008 in which the Wageningen group explains how the immune system works to protect the bacterium *E. coli* from invading viruses. To do this, the bacterium has incorporated fragments of DNA from the attackers. Copies of this (CRISPR-RNA) patrol the cell. If this CRISPR-RNA recognizes a virus that has got in, it squeezes between the two DNA strands of the virus and pushes them apart. Then special proteins known as Cas inflict the mortal blow: they cut the viral DNA to shreds. That is the end of the invader. The Wageningen study also showed that the CRISPR-RNA can be adapted so that the protein scissors cut where you want them to in the DNA.

The publication led to a deluge of research on variants of this immune system. The now-celebrated CRISPR-Cas9, which was discovered in lactic acid bacteria, is a simpler variant than the system Van der Oost discovered in *E. coli*. It has turned out to be just the thing for a wide range of applications in medical and biotechnological labs. >

CHANGING DNA
The CRISPR-Cas gene editing technique lets a selected gene be cut very precisely or replaced by another gene.



As a defence mechanism against viruses, the bacterium has pieces of the attacker's DNA built into its own genetic material, so-called CRISPRs (Clustered Regularly Interspaced Short Palindromic Repeats).



Copies of CRISPR DNA (CRISPR RNA) patrol the cell accompanied by special CRISPR-associated proteins (Cas proteins) that can cut DNA.

If the CRISPR RNA recognizes the invading viral DNA, then the Cas protein cuts the DNA and eliminates the invader.

DISCOVERY OF CRISPR-CAS
The CRISPR-Cas mechanism was discovered in *E. coli*. This bacterium uses the mechanism as a defence against viruses.

That is because the cutting mechanism, the protein scissors that bacteria use to protect themselves against viruses, also works in plant, animal and human cells. It can be used in these cells for gene editing, rewriting DNA both very precisely and quickly. But you also need something to tell the protein scissors where to cut. American researchers managed to give the scissors a different guide every time that took them to just the right spot in the genetic material.
That made gene editing virtually a piece of cake. The researcher decides where they want to make a change in the DNA of the organism they are studying. Then they order a CRISPR-Cas9 set online from a supplier that will contain the piece of RNA that corresponds to the location in question on the DNA. Once the postal service has delivered the set, it's child's play for an experienced laboratory technician to insert it in the cell nucleus. Then the RNA – the guide – will take the scissors along in search of the spot in the genetic material where the cutting is required.

> **'We should definitely have a debate on how far we want to go'**

DEACTIVATING GENES

Cutting sounds destructive but sometimes that is all that is needed to deactivate a bad gene. But making repairs is not always that simple. Sometimes the CRISPR-Cas9 set has to include the good gene as well. The cell uses that repair set to rectify the original error. Last summer, a team of American, Chinese and Korean researchers published an article on how they were able to use this technology to remove the hereditary heart condition hypertrophic cardiomyopathy from human embryos. A tiny but destructive genetic abnormality was replaced very accurately with a healthy piece of DNA. It should be noted that this was an experiment in the laboratory; the use of genetically modified embryos is currently forbidden. Were such an embryo to be placed in the uterus, it would very probably result in a healthy child. Researchers can go one step further still by having repair sets with an extra gene to introduce new properties. British scientists used this approach to treat a baby suffering from an incurable form of leukaemia. They used CRISPR-Cas9 to programme the immune cells to attack the cancerous cells.
But the possible applications are much broader than just medicine. The precision

PATENTS

The successor to the gene technique CRISPR-Cas9 is already in the making. Last year, the Wageningen microbiologist John van der Oost and Feng Zhang of the Broad Institute at MIT described and patented an alternative mechanism for cutting DNA: CRISPR-Cpf1, also known as CRISPR-Cas12. 'Waiting to see how successful it becomes is exciting,' says Van der Oost. 'Income is already beginning to trickle in. It has been agreed that the money that Wageningen University receives will be used to encourage innovative research in biotechnology.'

Feng Zhang has been involved in a fierce legal battle ever since 2013 about the main patent for CRISPR-Cas9. It was assigned to Zhang but that decision has been challenged by Emmanuelle Charpentier and Jennifer Doudna. So far the decision has been upheld by the courts. Experts speculate that the patent could be worth hundreds of millions of dollars.

instrument CRISPR-Cas9 is a dream solution for all kinds of molecular biological research. Older techniques for modifying DNA are not nearly as accurate and require far more effort. What now takes a couple of weeks used to cost two to six months and the result was less predictable.

GENE THERAPY IN HUMANS

Despite this precision, even CRISPR-Cas9 makes the occasional blunder, for example by snipping in the wrong place. 'If that happens to be in a different gene, you might even end up further from your goal', says Van der Oost. 'If we want to use this for gene therapy in humans, we need to develop it further to make it error-free. Although a huge amount of progress has already been made on this front in the past few years.'

For example, when repairing the hereditary heart disease hypertrophic cardiomyopathy, the scissors did their job in the right place every time. Even so, the scientists said in their article that more research is needed before this form of gene editing can be used in hospitals. They also noted that the ethical aspects need to be discussed in a broad public debate.

How far do we want to go in modifying human genes? That question is all the more urgent because the technique is so easy to apply. Should we decide on the limits first and only then proceed to further research? Van der Oost thinks that this can be done in parallel. 'We should definitely have a debate on how far we want to go, but in practice there are already strict safeguards such as the rules on the use of embryos. People always go on about whether you should be able to turn brown eyes blue. If people with loads of money ever want to do such stupid things, we won't be able to stop them anyway. We should focus on the positive side. Just think of the opportunity we will have to eradicate a hereditary disease that has been passed down in a family! What began 10 years ago with us deciphering a defence mechanism in bacteria will hopefully very soon make it possible to cure people. Wouldn't that be fantastic?'

VERIFYING MUTATIONS

CRISPR-Cas is now a familiar technique among other chair groups in Wageningen too. 'It's an important tool in our research,' says Martien Groenen, professor of Animal Breeding and Genetics, 'for example to determine what a certain gene does. You can use gene editing to switch it off and then see what happens. We are currently using the technique to verify the effects of a mutation in a gene in chickens by testing it out in zebrafish. It has the same gene but it is a much easier lab animal.'

Groenen thinks CRISPR-Cas could eventually be used in animal breeding but he does see a downside. 'In animal breeding, it's all about finding the right balance between different properties such as the milk yield, growth and resistance to disease. Focusing on one change often means you lose out in other areas. If you want to introduce a new property within a reasonable period without causing inbreeding, you have to modify thousands of animals so as not to lose any other properties.'

RIPENING TOMATOES

Researcher Ruud de Maagd at Wageningen Plant Research studies which genes are important for the ripening and shelf life of tomatoes and how they are regulated. Not only does he switch genes off with CRISPR-Cas, he sometimes also makes two cuts in a single DNA strand. The plant cell often glues the two ends together so that the piece between the two cuts has been removed. That provides information about how the genes are controlled by the surrounding DNA. The researcher thinks this information could eventually lead to a tomato that does not become soft so quickly and also tastes good, with a bit of genetic help from CRISPR-Cas. The big question for plant breeding companies is whether such a tomato would be allowed under the strict rules for the admission of genetically modified crops in the EU.

The EU had promised to take a decision about CRISPR-Cas in its GMO rules by the end of 2016, but the European Commission has twice delayed making that decision. French scientists have now instituted proceedings with the European Court of Justice. 'I can understand that people are worried about playing around with DNA,' says De Maagd. 'But the question is whether CRISPR-Cas is always covered by the restrictions in the GMO regulations. If you just switch a gene off or remove some DNA, that change is no different from the mutations that occur in nature as well.' ■

www.wur.eu/crispr-cas

WAGENINGEN ACADEMY

Wageningen Academy will be running the Masterclass on new breeding techniques for ornamental plants again in 2018.
www.wur.eu/academy

‘Let’s take the lead in sustainable agriculture’

Europe, with the Netherlands in the vanguard, should play a leading role in making farming and the food sector much more sustainable, says the Wageningen innovation expert Frans Kampers. In the Mansholt lecture in September in Brussels, he explained to European policymakers how this could work. ‘They should be using our greenhouses in Spain, Kenya and China as well.’

TEXT RENÉ DIDDE **PHOTO** HARMEN DE JONG

Farming has not got a good reputation when it comes to the environment, says Frans Kampers, innovation expert at Wageningen University & Research. 'In the past, we have been wasteful in our use of fossil fuels, not just for tractors and machinery but also for heating and lighting in greenhouses. They devour energy. Stocks of phosphates for fertilizers are also being depleted at a rapid rate,' says Kampers. And let's not forget the felling of rainforest for soya fields and palm oil plantations. This is still going on despite agreements to curb it. The possibility can also not be excluded that agricultural pesticides are a factor in the dramatic decline in the number of insects, as turned out to be the case this autumn. Kampers could list plenty more examples. 'We are still doing all of this even though we know that we have the planet on loan from our children.'

Things have to change, he says, especially given that we will have 10 billion mouths to feed by 2050 compared with 7.5 billion now. And because incomes are rising in China, India and African countries, those mouths will probably be on a diet with more animal protein. 'This means that Europe, with the Netherlands in the vanguard, urgently needs to introduce the world to a new food system in the period up to 2030,' argues Kampers. 'A food system that provides sustainable, healthy food based on energy-friendly and climate-neutral cultivation. That system must deal more efficiently with raw materials, reuse them more, be innovative, and stop the exodus of people from rural areas,' concluded Kampers in the Mansholt lecture this autumn in Brussels.

Together with the President of the Executive Board Louise Fresco, Kampers developed a diagram in which these European Union objectives are combined with various solution areas, such as an increase in marine cultivation and aquaculture, smart animal and plant farming systems, and the transition from animal protein to protein from plants or insects.

Why do you see a leading role for Europe, and the Netherlands in particular?

'Agriculture here has been perfected. We are setting an example for the rest of the world. Take greenhouse tomatoes. Everything is regulated and fine-tuned: the temperature, air humidity, nutrients, recycling the water, organic pest control, pollination. The most modern greenhouses no longer even consume energy, they produce energy. Spain should have those greenhouses, but so should Kenya and China. The Netherlands can help the world modernize farming systems. It is unbelievable what we achieve here in our tiny country with 17 million people and 8 million cars. We export more agricultural products in terms of value than any other country apart from the United States.'

That performance is however the result of a huge footprint elsewhere in the world. Soya plantations in former rainforests for Dutch pig feed and ministers who go all out in Brussels to get an exemption for their manure surplus.

'The Netherlands has a long way to go too. But our agriculture *is* the state of the art. There is nothing better. You could say we have done 10 percent of what is needed to achieve all the sustainability targets. Spain has done five percent and Eastern Europe barely one percent. To get a big increase in that percentage, we need precision farming where drones map out which plants in which sections of the plot need which pesticides and how much of them, and robots that carry out the work and pull up diseased plants and weeds while they're at it. Improved technology will also improve working conditions for the farmers and make the sector more attractive to young people. That will give the local community a role and livelihood again, which will help prevent the exodus from rural areas.'

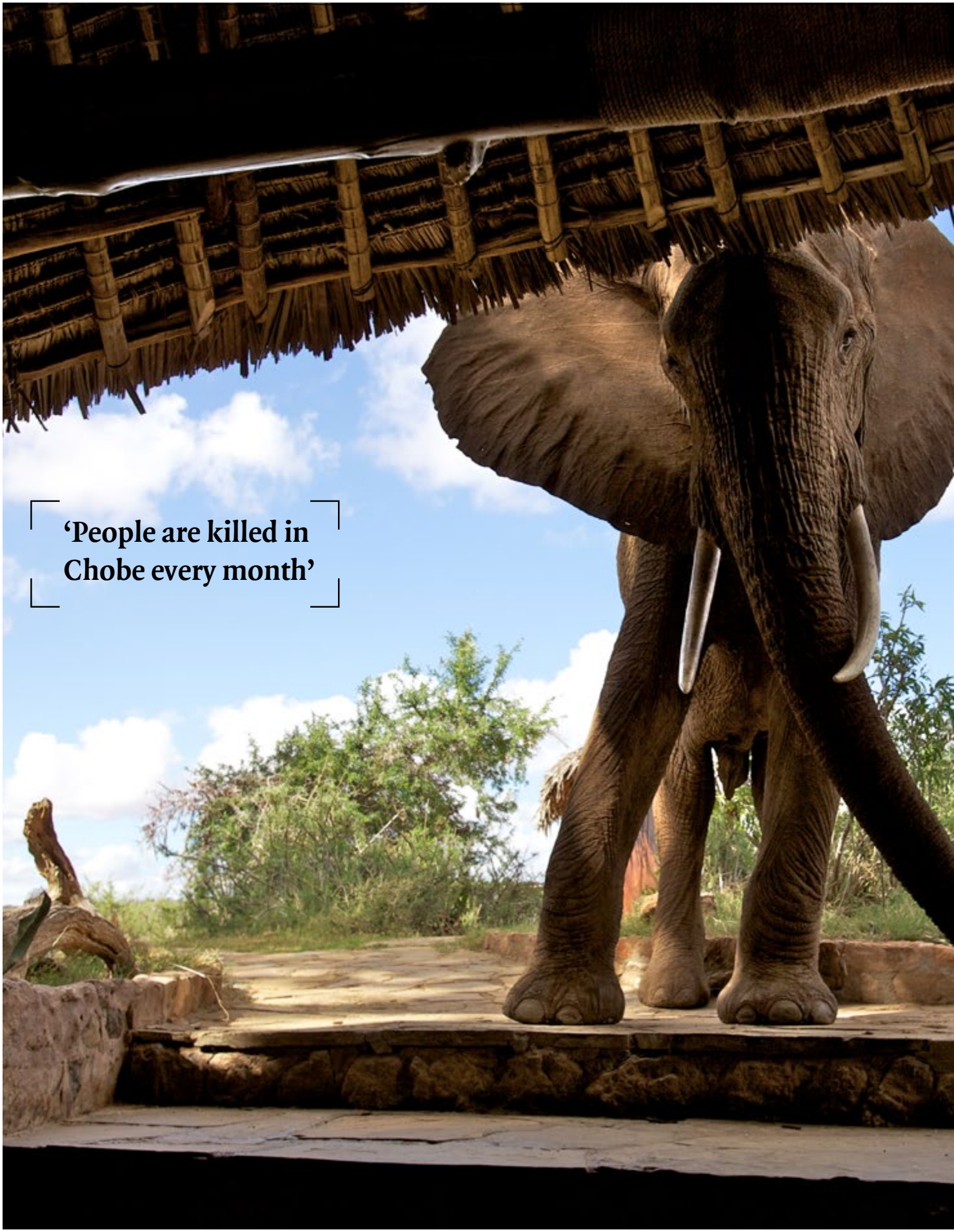
Can technology solve everything? Shouldn't we rather be cutting back?

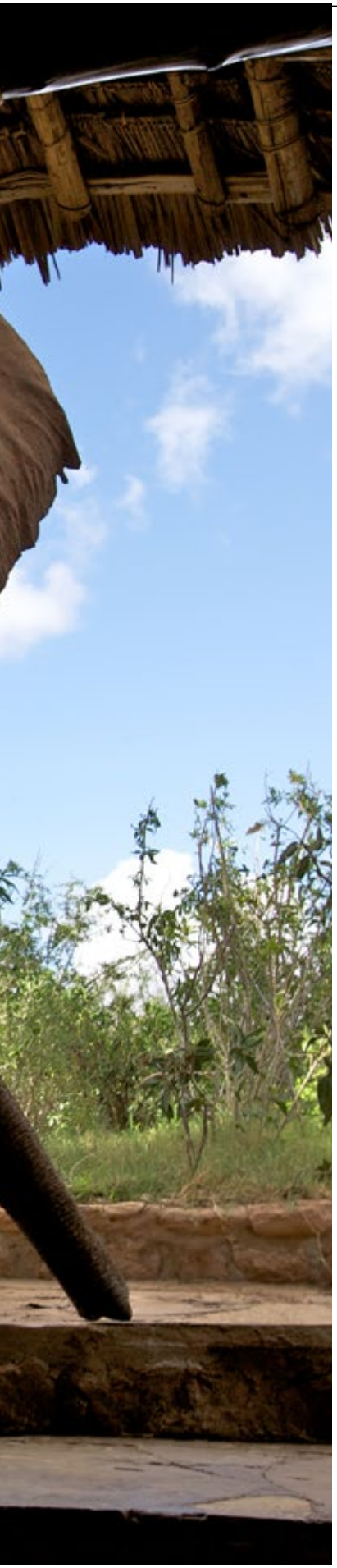
'Sure. As Western consumers, we need to cut meat consumption, become "flexitarians" more, whereby I hope we will see tastier meat substitutes on the market that are better at imitating the structure of meat. Farmers will also have to feed their livestock waste products and grass from unviable land. The pampas in Argentinian could easily be used for grass. Both people and livestock need to eat more insects.' ■

www.wur.eu/mansholt

FRANS KAMPERS

Frans Kampers (Helmond, 1957) graduated in Technical Physics at the Eindhoven University of Technology (1984) and also obtained his doctorate there (1988). He then joined the Technical and Physical Agriculture Department. Kampers currently works for Corporate Value Creation in Wageningen University & Research, on programmes aimed at innovation in areas where high-tech, agriculture and the food industry meet.


‘People are killed in Chobe every month’



PLAN TO REDUCE CONFLICT

Benefits and burdens

Wildlife in the north of Botswana is doing so well that, increasingly, local people and animals are getting in each other's way. A Wageningen plan aims at harmonious cohabitation – and at ensuring that locals benefit from game tourism.

TEXT RIK NIJLAND **PHOTO** GETTY/DAVID CAYLESS

If children in Parakarungu or Satau villages in northern Botswana walk home from school in the afternoon, their parents are nervous. From four o'clock onwards, one herd of elephants after another walks through the villages en route to a watering place on the river. A confrontation with these short-fused giants can be fatal, so the only safe mode of transport is by car.

Botswana is proud of its wealth of game. Across most of the continent, elephants are not faring well, but in this southern African country the population is booming. Twenty-five years ago there were 30,000 elephants in Botswana; now there are around 130,000. One of the elephant hotspots is Chobe National Park and the surrounding nature areas, in the far north of the country. Besides about 50,000 elephants, the park is home to lions, leopards, zebras and the biggest population of wild dogs in Africa. Tourists come from all over the world to stay in lodges and enjoy this wealth of game. Tourism has become one of the country's main sources of income.

But the success of nature conservation here has its downside, says Theo van der Sluis of Wageningen Environmental Research. Together with Elmar Veenendaal of Wageningen's Plant Ecology and Nature Management chair group, he drew up a land use plan for Chobe District. 'In and around game parks, there are more and more conflicts between the growing human population, economic activities such as tourism and farming, and the large numbers of wild animals. People are killed in Chobe every month. Of the 368 "problem animals" registered in 2014, 142 were elephants which had trampled crops, and 119 were lions which had killed livestock.' >

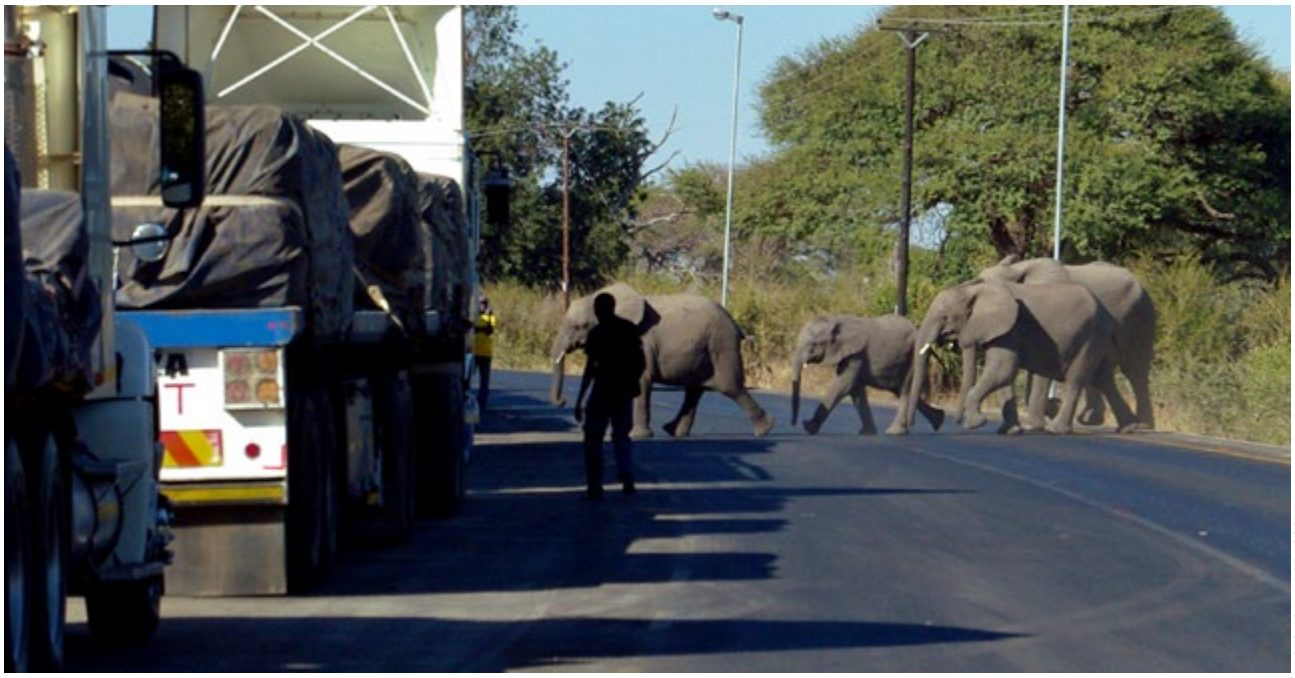


PHOTO HOLLANDSE HOOGTE / AP

Elephants cross the main highway in Northern Botswana, leading to Zambia.

Protecting wildlife is a major priority for Botswana. The army deals with poachers severely, and President Ian Khama has banned big game hunting by tourists, partly in response to international opinion. 'But that hunting did make millions every year, and some of the profits went to local people,' says Van der Sluis. 'Thanks to the ban, the residents of Chobe District – several tens of thousands of people – have seen their incomes fall. Whereas on the other hand, the number of incidents is increasing, with herds of elephants or buffalo trampling the maize, millet and beans, for instance, or grazing livestock falling prey to lions and hyenas. Often, people are utterly distraught.'

These rising tensions are a headache for the Chobe Land Board. The United Nations Development Programme UNDP, which supports the game parks in northern Botswana, therefore issued an invitation to tender for the formulation of a land use plan that would regulate the cohabitation of humans and animals in the district, as well as steering the development of tourism and agriculture in the right direction.

Landscape ecologist Van der Sluis and vegetation ecologist Elmar Veenendaal – both of whom lived in the country for years – won the tender for writing this plan at the end of 2016. They formed a multidisciplinary team of 11 people: experts from Wageningen, from the University of Botswana, and from the district itself.

'Land use planning is often based on reasoning from the perspective of one sector alone – forestry or tourism, for instance,' says Van der Sluis. 'In Wageningen we opt for a broad approach in order to integrate knowledge about the landscape and the people, to draw stakeholders into the process, and to take various different interests into perspective. The key question was: how can tourism grow sustainably, with more people benefitting from it, and nature continuing to be protected?'

Although the diamond mines are still Botswana's main income source, tourism comes a close second. Chobe District – 23,000 square kilometres, two thirds of it national park and forest reserves – is especially dependent on visitors from abroad. There is no mining in this region.

> 'There is increasing conflict between humans and wildlife around parks'

ZONING

The land use plan that Van der Sluis and Veenendaal drew up with their colleagues provides for spatial zoning: there are zones where tourism can grow, zones that need to remain accessible for the wildlife, and zones where there is more scope for farming. This plan gives the Chobe Land Board criteria for assessing land use planning permission applications.

To give an example: the plan proposes setting limits to the development of Pandamatenga, a large farming area some-

times described as the bread basket of Botswana. Expanding this crop farming area is a national priority. And that is perfectly feasible, say the researchers, but only to the west, not to the north. In that direction, space is needed to maintain a nature corridor for wildlife migrating between Botswana and Zimbabwe. Crop farming there would also irrevocably disturb the hydrology in a crucial valley, the research team concluded.
This land use plan is more than a district plan indicating what is and is not allowed in each section of the map. The authors also outline the opportunities for the local population to play a bigger role in the tourism sector. Tourism could be spread out more, for instance. Most of the lodges are located in the north around the district town of Kasane; there is scope for some new hotels or camps further into the interior.
The plan also argues in favour of small-scale irrigation for market gardening. The cooks at the lodges are eager to get hold of fresh produce: vegetables would therefore be much more lucrative than the traditional maize crop. To prevent the elephants from playing havoc with these fields as well, the farmers must be allowed to erect fences. There is also a need for more flexible provision for compensation for damage by wildlife.

SMALL-SCALE TOURISM

But the biggest change in the land use plan is the proposal to branch out into a new market segment. The plan identifies areas with small villages for small-scale tourism from which local people will benefit more. 'The focus at present is on high-end tourism,' says Van der Sluis. 'Luxury accommodation with prices of up to 2000 dollars a night. To run a hotel like that, you need investors and trained staff from outside the district. But you could also consider simpler accommodation, run by a local community. At the moment people tend to assume that accommodation for westerners has to be super deluxe. But there is a market for smaller scale, cheaper tourism too, as tourism organizations and safari companies confirm. One idea might be to rent out a couple of little houses with views over the river, for 50 dollars a night, or to set up campsites for touring South Africans in the smaller villages a few dozen kilometres away from Kasane. There is only a tiny bit of that going on at present, and it could be stimulated more. That would enable the locals to get some of the benefits of tourism, and therefore indirectly of the many elephants. And it would spread the tourism better.'

HUNTING

Isn't it also time to allow hunting again? 'You can see that the tall trees along the river have disappeared and the riverbanks look more and more trampled, but there is still no serious erosion in Chobe,' responds Van der Sluis. 'Hunting is a highly sensitive topic in Botswana; we mention it as an option, but that is primarily a political decision.'
The writers of the land use plan have no fear that their report will end up in a bottom drawer. 'I presented our plan this spring to 25 people from a wide range of government organizations and NGOs,' says Van der Sluis. 'They were enthusiastic. The Chobe Land Board and the provincial government are in no doubt at all that something must be done. And that the local population should not just be left to shoulder the burdens resulting from tourism but should also enjoy a share of the benefits. Of course, I don't know what goes on behind the scenes, but Botswana is a well-organized country with an excellent reputation: it is not for nothing that it gets called the Switzerland of Africa. Besides, I expect the UNDP will be prepared to support new developments.' ■

www.wur.eu/land-use-botswana

PHOTO GETTY

Experience wanted

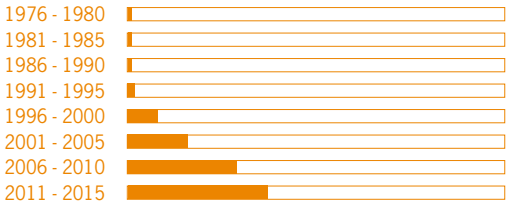
With the economy picking up, a lot of businesses are looking for new employees again. Experts are especially in demand. 'It is very hard to get hold of people with more than 10 years' relevant experience.'

TEXT ALEXANDRA BRANDERHORST **PHOTO** HOLLANDSE HOOGTE

MORE OVERSEAS ALUMNI

In response to increasing globalization and the tight Dutch labour market, companies in the Netherlands are employing more and more graduates from overseas.

The number of overseas graduates at Wageningen University & Research has risen substantially, going from less than 1% in the 1970s to 43% between 2011 and 2015.



PHD GRADUATES

The number of PhD graduates among Wageningen alumni is rising fast.

Almost one in five graduates have a PhD, from Wageningen or elsewhere. In 1970 only 8% went on to gain a PhD.

22% of the non-Dutch graduates have a PhD, the figure for Dutch graduates is 16%.

SOURCE: CAREER MONITOR 2016

'The market has really turned around in the last six months,' says Timo de Smet, director of the recruitment bureau KLV Professional Match, which is affiliated with links to Wageningen University & Research. 'When I started here two years ago, we had to go looking for vacancies for candidates. This year it's the other way around.'

Recruitment bureaus and temporary employment agencies are the first to notice which way the economic wind is blowing. After the crisis of 2008 and the years of simmering recession that followed it, there are now jobs for the asking in more and more sectors. Companies want to expand again. And the jobs of the baby boomers who are starting to retire are being freed up. This means good prospects for many of the graduates who will be job-hunting in the next few years.

Graduates in the Wageningen sectors of agriculture and nature management stand to benefit too. Sectors such as food, animal feeds and plant breeding are crying out for staff, says De Smet. 'There is great demand for people for research, sales and quality control departments. Quality control is especially important in the food industry because of EU legislation and exports.

A scandal like the Fipronil eggs last summer hits the industry very hard. But students are not familiar with the job opportunities jobs in quality control, which is why the biggest staff shortage is there.'

Reinforcements are needed across the wider 'green' sector, in fact, including at consultancy firms and nature management organizations. There is an acute shortage of soil and water specialists, for instance.

OFFERING INTERNSHIPS

With the economic sea change, it is not only for new graduates that companies have vacancies. In fact, it is people with 10 or more years of experience, Smits sees, who are highly sought after for middle-ranking and senior posts. Previously, KLV Professional Match did a lot of job-hunting for new graduates and organized things like job application training. Nowadays, companies know how to get hold of starters themselves, namely by offering them internships and traineeships, says De Smet. A study of Wageningen alumni, the KLV Career Monitor 2016, shows that 10 percent of new graduates from Wageningen find jobs through their thesis research or an internship. That is double the number in 2006.

Animal feeds producer De Heus can indeed find starters for itself, confirms Isolde Eleveld-Terwel, global director of Human Resources. The company regularly seeks researchers, buyers, nutrition experts and product managers. Graduates with a Master's degree often follow a two-year traineeship. And PhD candidates who do research at De Heus receive a part-time contract, followed by a permanent job. 'But it is hard to find people with more than 10 years of relevant experience. In the group of people who are around 40 years old there are relatively few animal scientists,' says Eleveld-Terwel. She expects it to get even harder in future. 'The influx from Wageningen is too meagre, actually. All the livestock feed producers are fishing in the same pond.' The internationally operating company does recruit from other countries too, says Eleveld-Terwel. 'But the level of education and expertise is not always as high as that of Wageningen graduates.'

CONTINUOUS RECRUITMENT

There are just as many jobs going in the food industry. Danone Nutricia Research is recruiting continuously at the moment, according to Ingrid Cusiel, recruitment manager at Research & Innovation. 'For starter positions and final internships and research projects, we get a reasonable number of applicants, including from people of other nationalities who are here on ex-

> ‘Industry is becoming ever more knowledge-intensive and complex’

change programmes,’ says Cusiel. But as in the animal feed sector, experienced people are hard to find. Cusiel: ‘Then it’s a case of experts with specific product knowledge in the life sciences, Big Data or systems biology, and with management experience, preferably in an international environment. And specialists in biostatistics, processing and innovation are thin on the ground too.’

In the future it is only going to get harder for food technology companies to find talented workers, predicts Cusiel. ‘The sector is becoming more and more international and flexible, and that calls for different skills. And on top of that, the current generation switches jobs more often. The challenge is going to be to remain interesting for them as an employer.’

The quest for experienced people is less of an issue in the plant breeding sector. ‘Breeders take a long-term view; the breeding process takes 10 years. That means these people tend to stay put for longer,’ explains Nanja Stams of Plantum, the branch association for the 260 companies that breed, grow and trade in seeds and plants in the Netherlands. The breeding companies are looking for starters. The sector is still growing by an average of five percent annually, says Stams. ‘This professional field is evolving extremely fast and is getting more technical and more interdisciplinary. We have vacancies for molecular biologists, biotechnologists, nanotechnologists, IT specialists, analysts and lab staff. But the essential thing remains knowledge of plants.’

INTERNATIONAL ALUMNI

Thanks to increasing globalization and the tight Dutch labour market, companies – including animal feed producer De Heus, active in 50 countries – increasingly recruit graduates from abroad. KLV Professional Match gets a lot of enquiries from international alumni who would like to work in the Netherlands, says Timo de Smet. ‘There are opportunities for them too.’

So it is good news for internationally oriented employers that the number of international graduates at Wageningen University has gone up considerably, from less than one percent in the 1970s to 43 percent between 2011 and 2015.

The interesting thing is that more people in this group are choosing to do a PhD. Of the non-Dutch graduates since 2001, 22 percent have a doctorate; of the Dutch graduates in that period, 16 percent have one.

This rapid rise in the number of PhD holders among Wageningen alumni is a striking development. Almost one in five graduates have a PHD, whether from Wageningen or elsewhere. And of the people who graduated between 2011 and 2015, almost one in four are doing PhDs. By way of comparison, in 1970 only eight percent did so. ‘With the formation of graduate schools in the 1990s, the popularity of PhD programmes picked up speed all over Europe,’ explains Gab van Winkel, a researcher and advisor on PhD programmes at Wageningen University & Research. ‘The graduate schools offer PhD candidates a variety of workshops to prepare them for the job market. That has led to a professionalization of the PhD trajectory.’ An additional factor is that external financing of PhD places has increased enormously since the 1980s, explains Van Winkel. Funding sources include the Netherlands Organization for Scientific Research NWO, natural gas revenues, the EU and overseas funds.

Three quarters of PhD graduates go straight on to do further research at a university, a research institute or in industry, shows the KLV Career Monitor 2016. In the years that follow, this proportion falls as the researchers move into management jobs. Danone Nutricia Research prefers to appoint PhD holders to many posts, says Ingrid Cusiel: ‘For senior roles such as those of department managers or senior scientists, for instance, we ask for a PhD, because they often manage employees with PhDs or work in teams where practically everyone has a PhD.’

THINKING COMMERCIALLY

PhD graduates often prefer to concentrate on research, however, and sometimes lack the skills and experience for management roles, suggests De Smet of KLV Professional Match. What is more, not every PhD graduate is cut out for a commercial, results-driven environment. ‘At the university you can develop a drought-resistant and nutritious apple, but the plant-breeding sector looks for a product that stays fresh for longer in the supermarket, and can therefore be on sale for longer. Not everyone can get into that commercial way of thinking,’ says De Smet. Nevertheless, employees with PhDs are very much in demand, says Van Winkel. ‘Industry is becoming ever more knowledge-intensive and complex. These people have been through the Navy Seals training of the sciences, and they know how to deal with complex questions and large amounts of data. Of course there are nerds among them who are totally consumed by their research. But many PhD holders are so smart that they pick up those management skills within a few years ’. ■

www.klv.nl/arbeidsmarktonderzoek

MOBILE RESEARCH FACILITY FOR FRUIT, VEGETABLES AND FLOWERS

Assessment on location

The condition of vegetables, fruit and flowers can be assessed anywhere in the world in *Cool – Research on the Move*, a mobile research facility full of high-tech apparatus. That helps producers and transporters to store and transport their produce under optimal conditions.

TEXT AND PHOTO HANS WOLKERS

The quality of vegetables, fruit and flowers sometimes suffers badly from a sea voyage: avocados go brown, while mangos or melons fail to ripen properly and remain hard and tasteless. Even in the producer country itself, fresh products do not always reach the consumer in good condition, sometimes for lack of knowledge about appropriate methods of transport and storage.
The *Cool – Research on the Move* concept helps producers and transporters to store and transport the harvest under optimal conditions. This mobile research unit, developed by Wageningen Food & Biobased Research and technology company Fotein, consists of a shipping container equipped with lots of built-in high-tech equipment. This includes 10 climate compartments in which researchers can separately regulate temperature, humidity and concentrations of oxygen and carbon dioxide. This enables them to test the influence of these factors on product quality during storage and transportation. That knowledge can help reduce food losses and boost export potential.

SIMULATING TRANSPORT

Production of vegetables, fruit and flowers has risen sharply in emerging economies in Asia, Africa and the Americas. This has led in turn to rising demand for the expertise and technology required to guarantee the quality and shelf life of these perishable goods. To meet this demand, Wageningen and Fotein put their heads together one and a half years ago to develop the Cool – Research on the Move concept. The research container can be shipped to anywhere in the world. 'All the steps in the supply chain, from harvest to storage and then transport to the buyer, influence the quality of fresh products in the shop,' says Peter Ravensbergen, Business Developer at Wageningen Food & Biobased Research. 'With the *Cool - Research on the Move* unit, you can optimize product quality at every point.' It takes four days, for instance, to transport tomatoes from Mexico to the US by truck. By selecting the fruit to be harvested for colour, and thus for ripeness, and then simulating the transport in the container under a variety of environmental conditions, the exporter sees what state the harvest is in when it eventually reaches the customer. The transport conditions can then be adjusted. 'For example, the exporter could decide whether the truck should be cooled,' explains Ravensbergen. 'That way, local researchers learn to manipulate the transport conditions so that the product arrives at exactly the right stage of ripeness.'

TRAINING RESEARCHERS

'Wageningen Food & Biobased Research has more than 80 years' experience in research on storage conditions for fruit and vegetables,' says Ravensbergen. 'We share that knowledge by training and supervising local researchers who are going to work in a *Cool - Research on*

All sorts of high-tech equipment is built in to the research container.

the Move unit that has been bought or leased, so that they can carry out research and apply their findings.' Those researchers can then explain the effects of cooling to local entrepreneurs, or determine the optimal conditions for stimulating ripening during transportation – or for slowing it down. That kind of simulation on location gives an insight into the optimal degree of ripeness in avocados at harvest, so they can withstand the long sea voyage from South America. The producer can bear this in mind when timing the harvest. That has a positive impact on the quality of the product when it reaches a foreign buyer. It does require some investment, but Ravensbergen says that can be recouped within a couple of years by charging higher prices for a better quality product.

EN ROUTE TO THE CUSTOMER

For the time being, the first demo model of the research container is on display next to Phenomea, the Wageningen Food & Biobased Research building that was opened on the campus in October. But eventually, the idea is that the container will go to a client in a country such as China, India or Mexico. In Phenomea, researchers develop new techniques for quality control of fresh products. The technology they develop can then be built in to the *Cool - Research on the Move* unit. 'Because we are continuously working on the development of new sensors and robots, there are more and more, and increasingly sophisticated methods of quality control available,' says Ravensbergen. 'We have developed non-destructive sugar measurements for fruit, for example, in which the reflection of infrared light reveals something about the sugar content of the product. So we don't have to cut open the fruit.' Additionally, combinations of sensors and 3D cameras can be used to assess a product for hardness, colour, shape and weight. Ravensbergen and his colleagues also look for biomarkers for quality: biological components of the product which correlate strongly with quality. Researchers might for example measure particular aroma components in order to estimate the ripeness of a product. ■

www.coolresearchonthemove.com

Life at a wind farm

Wind farms are changing the ecosystem of the North Sea. What sort of impact will that have on seabirds, coral polyps, seals, porpoises and bats? 'We are on the brink of very rapid large-scale change. There is cause for concern there.'

TEXT MARION DE BOO **ILLUSTRATION** JEROEN MURRÉ

'Two Nathusius's pipistrelle bats!' Full of curiosity, Sander Lagerveld takes samples from the contents of a bat nesting box in a deciduous wood along the coast near Petten. 'Both young females,' he says. 'Look, their joints are not fully grown yet. The faces are still very dark and there is not much sign of wear and tear on the teeth.' The captured bats are weighed and measured, and then a miniscule transmitter is stuck on to the middle of their backs. This is done with surgical skin glue which comes off by itself after about three weeks. 'We have now tagged 13 bats with a transmitter, and the aim is to tag 500 of them over the next four years,' says Lagerveld, who has been working at Wageningen Marine Research in Den Helder since 2012. In ten years' time there will be 100 wind farms in the North Sea. 'Our client, the Ministry of Infrastructure and the Environment (Rijkswaterstaat) wants more of an insight into bat migration routes over the sea. Because wind energy off the Dutch coast can be dangerous for migrating bats,' says Lagerveld. 'They can be killed by a stroke of the blades, or by the rapidly changing air pressure near the rotor, which can be fatal for their lungs or other organs,' he explains. 'And they are inquisitive animals that don't avoid the wind turbines but come towards them to hunt for insects.' The usual estimate on land is that 10 bats die per wind turbine per year. Higher numbers have been reported in the US, sometimes up to 100 bats per turbine per year. Little research has been done yet on the number of victims at offshore wind farms.

> 'A totally new North Sea landscape is emerging'

Every five kilometres along much of the North Holland coast antennae have been set up, which receive a kind of Morse code from the transmitters on the bats. The memory cards are read every few months to see where and when the bats fly, how many of them fly together, along which routes, and in which weather conditions.

BAT MIGRATION

The main species the study focusses on are the Nathusius's pipistrelle and the common noctule. These are migrating bats, which cover distances of up to 2000 kilometres in the spring and autumn on the journey between their breeding colonies and their overwintering habitats, with a cruising speed of 40 kilometres per hour or more.' In the autumn, between the end of August and mid-October, they migrate with their young, mainly from north-east to south-west when there is an east wind and temperatures are high.

Lagerveld: 'Flying by day is too dangerous because of birds of prey and gulls. Bats don't fly non-stop but take breaks along the way to look for food and to rest. They forage on the open sea, too, and use drilling platforms in the middle of the sea as resting places during the day.'

Once the bat migration route has been established, the next question is how many bats fall victim to wind farms and what could be done about it. 'Maybe you can scare them away with unpleasant noises,' suggests Lagerveld. 'And if we can predict exactly when the bats migrate, you could stop the wind turbines for a while at those times. The permit for the new wind farm near Borssele makes provision for that.'

CUMULATIVE EFFECTS

Wageningen Marine Research is analysing the environmental impact of offshore wind farms. Not just on bats, but also on seabirds, seals, porpoises and fish.

According to theoretical ecologist Tobias van Kooten, the coordinator of the wind turbine study, a lot of studies have already been done on the impact of individual farms. 'How many fish congregate around these turbines? From how far away can a porpoise hear the pile driver? But what policymakers need now is insight into the cumulative effects of all those wind farms together,' says Van Kooten. 'Because wind energy is being developed on a massive scale by all the countries around the North Sea. The entire North Sea ecosystem is being manipulated. A totally new landscape is emerging. What is that going to mean for fish stocks, and where are the fisheries supposed to go in future? What steps should we take in order to protect international bird populations? These are the kinds of questions we and our international colleagues will be seeking answers to. We shall also be studying the multifunctional use of wind farms, in which they are combined with fish farming or mussel and seaweed cultivation. And we are going to research the usefulness and necessity of all kinds of measures for mitigating negative impacts, and the development of new nature under water.'

PHOTO UDO VAN DONGEN

Mussels, hydropolyps, soft corals and sea anemones have been found on the bases of wind turbines and drilling platforms.

That nature development occurs spontaneously. 'On the bases of the turbines, a complete ecosystem forms with 100 to 200 species per location,' says marine ecologist Joop Coolen of Wageningen Marine Research, who got his PhD in Wageningen in March.
For years Coolen has been diving down alongside the pillars of platforms and wind turbines to get a picture of the biodiversity down there. 'On wind turbines, and also on the bases of oil and gas platforms and on shipwrecks, we found gigantic mussels alongside brightly coloured hydropolyps, soft corals and sea anemones. We found crustaceans and small shrimps, and they attract unusual fish such as the goldsinny wrasse, which finds a food supply on this artificial reef.'
One fifth of the North Sea bed used to be covered in oyster and other shellfish banks, but these have all but disappeared thanks to fishing, diseases and pollution. The underwater platforms make up a little for that loss of hard substrate. Coolen discovered that animals which would not stand a chance on the sandy North Sea bed move on from one platform to the next, thereby conquering more and more of the North Sea.

TEMPORARY HEARING LOSS

For marine mammals, however, offshore wind energy is harmful. Noise pollution from the pile-driving for the foundations of the wind turbines can disturb porpoises and both grey and common seals. 'Pile-driving can lead to temporary hearing loss, changes in distribution patterns and loss of habitat,' explains marine ecologist Geert Aarts of Wageningen Marine Research.
'Piles metres in diameter are thumped into the seabed with hard blows from large pile-driving ships. It takes about two hours to drive one pile into the ground, but creating a complete wind farm can take six months.'
Sound carries much better than light under water. Many animals use sound under water to locate their food. The 30,000 to 80,000 porpoises in Dutch coastal waters – numbers change seasonally – emit short 'clicks' and listen to the reverberation of echoes in order to navigate and find food, as well as to communicate among themselves, between mother and baby for instance. Unnatural underwater sounds can disrupt this echolocation.
Aarts: 'It has been found that porpoises avoid an area of up to 20 kilometres around a location where piles are being driven, resulting in a significant loss of habitat.' The pile-driving at sea could lead to a big reduction in the porpoise population, a model calculation suggests. 'For the Dutch government that was sufficient reason to sharpen up the criteria for issuing permits for new wind farms. This includes setting a limit to the noise that pile-driving machinery is allowed to make. One way of cutting down the noise is to put down a curtain of air >

PHOTO SANDER LAGERVELD.

A red bat with a transmitter.

bubbles around the pile-driving location, which seems to work particularly well for the high frequencies which porpoises make use of. Quieter pile-driving machines are also being developed, and the industry is looking for alternative methods of anchoring the turbines without piles.'

EXTREMELY SENSITIVE

Seals, too, react to the sound of pile-driving from up to tens of kilometres away. Unlike porpoises, seals do not use sonar to hunt, but they are extremely sensitive to the low-frequency sounds released by pile-driving.
Aarts and his colleague Sophie Brasseur are tracking individual seals by sticking small transmitters onto their skins, which fall off after a few months. More than 100 seals have already been tagged with transmitters. 'This enables us to trace exactly where they are, where they dive and how deep,' says Aarts. 'When the pile-driving starts, foraging stops abruptly and they swim away. A lot of our tagged seals seem to avoid the wind farms, too. They can hear the turbines turning underwater and they can also see the rotating blades, and apparently that scares them off. We and some Scottish researchers did notice some seals visiting a wind farm, probably because there were a lot of fish there. But that farm was not yet operational.'

Seals themselves actually make a lot of noise underwater, especially the males. They attract females in the mating season by making roaring underwater sounds. 'We don't know if that courting is disturbed by unnatural underwater sounds,' says Aarts. 'But wind farms have been built close to the German Wadden islands and that noise penetrates right into our Dutch Wadden Sea.'
Ultimately, policymakers are primarily interested in conclusions at the population level. They want more insight into the extent to which the vitality of marine mammal populations goes down when wind farms are built. In a new project funded by the Netherlands Organization for Scientific Research (NWO), the researchers are going to make further calculations of the effects of noise at the population level.

SEABIRDS WILL DIE

As part of this project, Mardik Leopold, a researcher at Wageningen Marine Research, is studying the impact of offshore wind farms on seabirds. 'If an individual entrepreneur wants to set up an offshore wind farm, the environmental impact assessment always trots out the conclusion that just that one farm won't have a significant effect on seabird populations. But there are already 100 of them planned between now and 2030. You can be sure all those wind farms together *will* have an impact on bird populations. Model calculations suggest that many tens of thousands of seabirds will die.'
According to Leopold, wind farms are harmful to birds in two ways. 'They can die from a blow from a blade, especially at night when they can't see the turbines. And they also lose habitat because they are scared to come near the wind farms.'
'Collision models' have been worked out for all the bird species over the North Sea, partly based on visual and radar observations. The axis of a turbine is about 90 metres high and the blades are 60 metres long. So the risk of collision is mainly in the flight zone from 30 to 150 metres high. The chances of crashing into a blade depend on the size and flight behaviour of the birds. Most species will reroute, while some fast birds fly in between the turbines or swerve away from the blade at the last minute. Birds which mainly swim or swoop low over the water are rarely hit by the blades.
Another factor to take into account in establishing the effects at population level is how fertile a species is. The scoter, which starts to brood at the age of two and has

eight ducklings per year, is much less vulnerable as a species than the northern fulmar, which only lays one egg per year, and only from the age of 10 or 15. It takes a very long time to 'replace' a northern fulmar. Also, timid birds probably lose out more than bold birds.
In explanation, Leopold says, 'Altogether, it seems that the black-throated loon, for instance, which has a small population, lays few eggs and cannot manoeuvre easily in the air, is more vulnerable as a species that the small, fast-moving and fertile black-legged kittiwake. Some species of gull fly freely in and out of the wind farm, and the great cormorant loves it there. It sits on the turbines to dry its wings, and they add quite a big area to its habitat. Northern gannets, on the other hand, always fly around the wind farms, running little risk of collision, but losing quite a bit of their habitat.'
Loss of habitat can affect the fitness of a population. In order to calculate that effect, the international rule of thumb is that one in ten exiled birds will die. The Wageningen researchers are now trying to get more precision about that rule of thumb. In general, the model calculations suggest that the main species that are approaching the danger zone at population level are the black-throated loon, the red-throated loon, the velvet scoter and the common eider.

MANY TOURISTS

Meanwhile, the Wageningen bird researchers have drawn up a map of the North Sea. In the red zones, wind turbines pose a serious threat to bird populations. In green zones there is less risk for birds. Leopold: 'The bird-rich Dutch coast, with its many overwintering scoters and its foraging seagulls and terns, is mainly coloured red. But because a lot of tourists come here too, the wind turbines are not too close to the coast. That is a happy coincidence. The idea of stopping the turbines at the height of the bird migration season is being considered. New wind farms will probably be equipped with bird and bat radars.'
Leopold is also interested to see how birds will evolve when the sea is full of wind farms. 'We are on the brink of very rapid large-scale change. There is cause for concern there. The fisheries will have to give up fishing grounds because wind farms will soon fill the North Sea. Some bird species will avoid the farms, while others might learn to live there. The stupid birds will be pushed out, the smart and the bold ones will survive.' ■

www.wur.eu/wind-farm-sea

'The goldsinny wrasse finds its food on these artificial reefs'

WIND TURBINES TAKE OVER THE NORTH SEA

Offshore wind energy is indispensable to achieving the targets of the Paris Climate Conference of 2015, aiming at limiting global warming to a maximum of 2 and preferably 1.5 degrees Celsius. According to the Energy Agreement of 2013, the wind energy capacity in the Dutch section of the North Sea has to grow to 4.3 gigawatts (GW) by 2023. One gigawatt is 1000 megawatts, or 1000 million watts. By 2015 production of offshore wind energy had only reached 357 megawatts. In the period up to 2050, the Netherlands has plans for at least 50 GW of wind capacity offshore, on top of 15 GW on land. In contrast to land-based wind farms, which are subject to restrictive noise norms, both the turbines and the wind farms offshore are getting steadily bigger.
Several North Sea countries have big plans for expansion. A consortium of Dutch, German and Danish grid operators, led by European electricity transmission system operator TenneT, is working with the gas infrastructure company Gasunie on plans for an artificial island on Dogger Bank, 300 kilometres from the Dutch coast, where 7000 wind turbines, each 200 metres high, will be located.
Placing the wind farms outside the 12-mile zone spares key bird migration routes, and does not spoil the view from the beach, thanks to the earth's curvature. New wind farms will be equipped with a radar system for monitoring bird and bat migration. If necessary the turbines can be stopped for a while.

MELANIE PETERS, DIRECTOR OF THE RATHENAU INSTITUTE

‘In reality there is great confidence in science’

People can only change their behaviour if the solutions proposed by scientists match their needs – something Melanie Peters learned as a student in Wageningen. She is still guided by this insight, says the director of the Rathenau Institute, which facilitates dialogue and debate on innovations in science and technology.

TEXT ALEXANDRA BRANDERHORST **PHOTOGRAPHY** BRAM BELLONI

It feels almost as though you were sitting at her kitchen table. There’s a bunch of flowers on the table in her office in The Hague, and Melanie Peters has a friendly outlook on the world. She is cordial, chatty, and has a fund of anecdotes.
A graduate of Food Technology, Peters has headed the Rathenau Institute since 2015. The big issue facing this institute now is the unstoppable march of digitalization, says Peters. ‘Microchips are getting smaller and cheaper all the time, and they are being used everywhere. There are sensors now in cars, clothes and packaging, and there are better and better cameras in telephones. What is more, we can link everything up thanks to the internet. Those developments really go very fast.’

RAISE AWARENESS

The Rathenau Institute raises awareness among the general public, politicians and journalists of many more developments in the fields of technology and science, and does research on their implications for society. A brief browse through recent publications shows reports and ‘briefing notes’ to parliament on the digital threat, investments in science and innovation, the fragmentation of knowledge in the health sector, the international competition for talented scientists, and the safeguarding of public interests in the sharing economy.
The organization was named after the physicist and professor Gerhart Rathenau, who coined the term ‘information society’ in 1979 and advised the government on automation in society. Rathenau was involved in the first incentive projects to get the Dutch using personal computers in the 1980s, which led to PCs becoming part of the furniture in many households. The idea of retraining unemployed people to work in ICT was another brainchild of his.
‘Automation changed many aspects of people’s lives and work. It meant, for instance, that they no longer bought train tickets from a man at the station, but at a >

‘We should have the right not to be followed online’

> ‘People are afraid that genetic modification will lead to one company deciding which crops are grown’

ticket machine,’ says Peters. ‘Technological development can have a big social impact. Rathenau foresaw this and made sure people around him learned to handle automation.’

At the behest of the Council of Europe, the Rathenau Institute published a study in May on human rights in the digital era. A study about human rights?
‘Our ethical and legal systems are still not fully prepared for digitalization. An example is the way Airbnb threw the hotel market and all our agreements about it into disarray. We need to look at how we can steer developments, without stopping them altogether. How do we see the respective responsibilities of the government, the business world and the general public in this regard? And what is our take on digitalization and people’s autonomy? We should have the right not to be followed, analysed and influenced online. Or the right to opt for meaningful human interaction in healthcare rather than contact with a robot.’

Are you succeeding in getting a political and public debate going on digitalization and human rights?
‘That debate is still in its infancy. I have noticed that there is a kind of taboo on ethics in the Netherlands. People see human rights, animal rights and all their societal ramifications – how you treat each other, basically – as a matter of personal opinion. In the Netherlands we have the ‘polder model’, in which the various parties come up with a compromise after some horse-trading. Because of our history of compartmentalizing ideological groups, we find it hard to talk about shared values. Our society now faces serious challenges such as the transition to sustainable energy and a circular economy. In the coalition agreement, the cabinet has included a few measures such as reducing reliance on natural gas and making more use of renewable energy, but not the rationale that underpins them. That is a pity. People are quite prepared to give up, say, natural gas, but only if you enter into dialogue about how that is in the public interest. If you only mention the measures, the debate focuses on those. Societal debate is often about measures or technologies, and not about the underlying values and common ground between the different parties.’

Can you give an example of that?
‘Take genetically modified crops. If you really start a dialogue with the public, what comes out is that people have no objections to the technology itself. We have learned that from 30 years of Rathenau research. The technology itself raises no issues around shared values. Those issues are raised by the institutions and the companies: whether people feel safe in their hands. In the case of genetic modification, for instance, people are scared that soon one company will be deciding which crops are grown and what we eat. Companies ought to have to shoulder their responsibilities and respond to citizens’ concerns by showing that the fear of economic monopolies and a landscape dominated by a single crop is unfounded. They can help think through the issues around biodiversity and how to ensure that pesticides are used safely.’

Isn’t another problem that confidence in science is going down?
‘That is a misconception. And it is very silly of scientists to say that, because they thereby plant the idea in people’s minds. What we see in reality is that there is a lot of confidence in science – except when scientists start prescribing things. There is no need for researchers to engage with the public in order to explain once again what they know. If they want to connect, they’ve got to be genuinely interested in the questions and concerns citizens have.’

The Rathenau Institute will soon publish a report on collaboration between scientists and businesses, and financing from the business world. Can you say something about that?
‘Companies represent private interests for whom they create value. Universities are financed with public funding and create public value, such as making their knowledge available to society. The collaboration agreement should make arrangements on this. At present staff at universities often make their own individual arrangements, when they acquire funding. It is better if that is shared within the department and the university, so that individual staff members can’t be put under pressure by a client – whether it is a company or the government – not to publish, for example. Universities can define their responsibilities in this together, establishing some kind of professional code of conduct. That makes accountability to the public an integral part of the work approach and culture, and not a matter for the individual researcher.’

You studied in Wageningen yourself. Why Food Technology?
‘At secondary school I wanted to do something about the hunger in the world and the overproduction of food in the EU, such as the milk lake and the butter mountain. So I decided to work on food production.’

How did you like the degree programme?
'Wageningen was a very nice, international community. I really liked the freedom in the degree programme; you got the chance to sample all sorts of things. I took courses in art history, for instance, and philosophy. I specialized in toxicology. That is a nice kind of puzzle. You take a toxic substance, add a chlorine group and the substance becomes either more toxic or less so. You can study the effects of substances that affect body functions. In those days we had the idealistic idea that we could rid the world of cancer.'

After graduating in 1990, Melanie Peters went to Imperial College in London, where she did her PhD on the carcinogenic effects of cinnamon. Then she did research on cancer of the kidney at the University of Texas in Austin. In 1995, she returned to the Netherlands to work as a toxicologist for Shell Research & Development. Three years later, she was appointed to the Ministry of Agriculture.

Why did you change directions, from research to policy?
'There was a growing insight among toxicologists that we would never be able to prove the safety of many substances with enough certainty. Yet we badly need some of those substances, so legislation has focused increasingly on risk management. For example, by ruling that people in the workplace can only handle certain substances when wearing gloves. This shift turned the entire discipline on its head. It also meant the government had to answer more questions from the public. I wanted to help with that.'

Is that the common thread running through your career?
'I always start with the question: what do people need? They can only change their behaviour if the solutions proposed match their day-to-day behaviour and needs. That was drummed into us in Wageningen, and that insight is still important in my work.'

MELANIE PETERS (b. 1966, GELEEN)

1984 – 1990	Food Technology, Wageningen University
1990 – 1993	PhD in Biochemistry, Pharmacology and Toxicology, Imperial College London
1993 – 1995	Postdoc in Toxicology, University of Texas, Austin
1995 – 1998	Researcher and toxicologist, Shell, Amsterdam
1998 – 2000	Account manager for Veterinary medicines and hormones, Ministry of Agriculture
2000 – 2006	Campaigner on Public Health and Corporate Social Responsibility, Consumers' Association
2006 – 2015	Director of Studium Generale and lecturer in Liberal Arts and Sciences, Utrecht University
2015 – present	Director of the Rathenau Institute

Are universities still too far from the reality on the ground?
'No, they're not. But we must stop thinking researchers must all do exactly the same: conduct original research, write excellent articles, and sell themselves. Let different people do what they are good at. More value should be assigned to collaboration with people who do applied and policy support research. Dutch universities and research institutes do a lot of research to keep us safe – things like food safety research or collision trials with cars. This is not material for articles in Nature and Science, but it does meet the needs of society.

'The knowledge infrastructure has taken a few knocks in recent years. There have been budget cuts at all the government science organizations such as TNO, KNMI and DLO, and the product boards have been abolished. The government must once again aim at multi-year, far-reaching collaboration between science institutes, universities, users and ministries. For innovation related to public objectives such as a sustainable living environment or a legal system which satisfactorily addresses the debt problem, cybercrime and fake news, you have to build a knowledge base and give it attention over the long term.' ■

FUND FOR STUDENTS FROM INDONESIA

Gijsbert will not be forgotten

Pieter Oomen and Françoise Oomen-Kalsbeek have established a named fund that will support students from Indonesia. The fund is named after their son Gijsbert, who died in 2000. 'What is important to me is to see that life goes on, and that we can help someone.'

TEXT YVONNE DE HILSTER **PHOTOGRAPHY** HARMEN DE JONG

Pieter Oomen and Françoise Oomen-Kalsbeek are not Wageningen alumni; they both studied Biology at Utrecht University. Nevertheless, they have established a named fund under the University Fund Wageningen which, every two years, will help one student from Indonesia to obtain a Master's degree from Wageningen. 'There are more degree programmes here that focus on developing countries, the underprivileged, and rural development: things we find important. Besides, in the 35 years plus that we have been living in Wageningen, we have become very involved in Wageningen life,' explains Pieter. 'Our two daughters studied here, too,' adds Françoise. 'But they did leave home when they were 18.'

The couple gained a lot of experience of living abroad themselves. As students they both had working abroad in mind, partly due to the example of relatives who worked in tropical countries. Their first country was Mexico, where Pieter got a job with the FAO in 1971. Their oldest daughter was born there. They moved straight on to Burkina Faso and then Indonesia, after which, in 1980, they moved back to the Netherlands with their three children.

Pieter continued to travel a lot for his job with the National Plant Protection Organization (NPPO) – now part of the Netherlands Food and Consumer Product Safety Authority (NVWA) – and he kept up with international contacts. 'We also regularly hosted students from the IAC who were looking for the warmth of a family during the months they spent in Wageningen,' says Françoise, whose work has included teaching Spanish. As a member of a reception committee, she also organized social activities for expatriate women in Wageningen.

AN IDEA RIPENED

They set up the bursary fund in memory of their youngest child, Gijsbert. The idea ripened slowly over the years. Gijsbert Oomen died of sudden, unexpected heart failure at the age of 23, when he was in his room getting ready to go to bed. 'For years we wondered about what we could do so that he wouldn't be forgotten,' says Pieter. He is silent for a moment. 'At some point we thought of using the share of our inheritance that would have gone to Gijsbert for another purpose. Our daughters supported the idea straightaway.'

Gijsbert had just completed an Applied Sciences degree in Den Bosch, explains Françoise, and had gone on to further studies at Tilburg University. 'We funded his studies, just as we had done for our daughters. And suddenly that stopped. With that in mind, the idea grew of investing in someone else's higher education. We were keen to give someone of Gijsbert's age the opportunity to develop further.'

But how do you go about this, what exactly do you

spend the money on, and how can you arrange it? The idea of a fund came from a Wageningen acquaintance, says Pieter. 'The nice thing about a named fund is that you can specify the purpose of it.' They chose to support students from Indonesia. Gijsbert was born there, and lived there until he was three. When he was 11, Françoise took him back for a visit. Pieter: 'An added benefit is that we can have contact with the students we support, if the students themselves want that.' They both still speak Indonesian. But if the students don't want any contact, that is fine, says Françoise. 'What is important for me is to see that life goes on and that we can help someone.'
Gijsbert would have been 40 this year. Pieter: 'The wish to give your children a good upbringing and education has had to take a different turn for us. Yet this is a way for us to let something positive come out of by far the saddest disappointment of our lives.'

THE SAME PREFERENCE

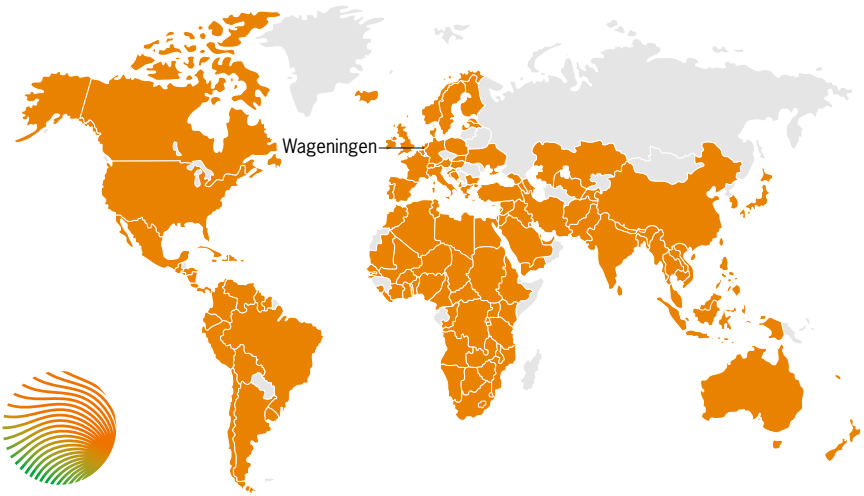
The Gijsbert Oomen Fund has an annual budget to cover the living costs of one Master's student. The Anne van den Ban Fund makes a preliminary selection of candidates. Françoise: 'A few months ago we got anonymized CVs from two students. We both read them and independently of each other, we had the same preference. We took into consideration how badly the student needed a grant, what kind of job they could get in the future, and how the country could benefit from it.' Pieter: 'It is nice that we don't have to arrange these kinds of things ourselves.'
And this is how Muhammad Ulil Ashan comes to be studying Development and Rural Innovation in Wageningen now. The couple have met Ashan twice. The second time, he came for dinner at their house. 'He had asked us which Indonesian dish we really liked,' says Françoise. 'We said, something with tempeh. And he brought it with him. It turned out he had first phoned his mother in Indonesia to get instructions, and he had even tested it on his flatmates. It was delicious and it was a very pleasant evening.'
Pieter: 'You don't know in advance how you will get on. But we are very glad it's going well, and that we now know a bit more about his background.' ■

www.universityfundwageningen.eu/oomenfund

CENTENARY

100 years in 100 places

The worldwide alumni day to celebrate WUR's centenary next year is beginning to take more concrete shape. In addition to a central event in Wageningen, there are plans for activities in various other countries. Alumni are busy organizing activities in Mali, Ethiopia, Honduras, Guatemala, Ecuador, Argentina, Iceland, India, Australia, Indonesia and China, at least.



100years
1918 — 2018

In 2018, Wageningen University & Research will be celebrating its centenary as an academic institution. As part of this, a World Wide Wageningen Day (WWWD) will take place on Saturday 23 June for all alumni, centred on the topic of sustainable food. There will be a festival on Wageningen Campus that will combine 'substance, celebration and solidarity'. For example, there will be short lectures. guided tours, demonstrations, documentaries, talks by alumni and a symposium, as well as music and opportunities to catch up and eat together.
Simon Middelkamp (Land Development 1976), an active member of the South Netherlands alumni group, is one of the alumni who helped decide on the content of the WWWD. 'I think it will be interesting for alumni to come and see what has changed in Wageningen and meet up again with their fellow students from back then. I'm looking forward to sharing memories with old friends and I'm curious to see what Wageningen has to offer now.'
Given that 10,000 of the more than 47,000 alumni live abroad, spread across 160 countries, the organization also hopes that there will be at least 100 places outside the Netherlands where alumni get together on that day. People from around a dozen countries have announced they want to organize something.
In both China and Ethiopia, which have relatively large numbers of alumni, former students are considering several gatherings across the country. In Ecuador, Carla Sandoval Guano (Biotechnology 2017) and Victoria Coello Ortiz (Food Technology 2016) are making plans. 'Compatriots in Wageningen develop a bond and we want to show everyone where we come from and what unites us,' explains Victoria. They are finding it really interesting getting to know older Ecuadorian alumni.
WUR and the University Fund Wageningen have started a crowdfunding exercise for the travel expenses of international alumni who want to make a substantive contribution to a local event or the central WWWD.
Info: wur.eu/worldwidewageningen, *www.100x100.wur.nl*, *alumni@wur.nl*

ARCHITECTURE

Land Surveying building on a stamp

The Land Surveying building familiar to all Wageningen alumni has been immortalized on a stamp as one of a series of ten featuring architecture from the post-war reconstruction period (1945-1958). The former Faculty for Geodesy on the slopes of Wageningse Berg was designed by F.E. Röntgen. The building was completed in 1953, a period in which the then Agricultural College was growing fast. WUR sold the premises in 2000. It became a listed building in 2007 and is now used as residential accommodation and office space.

NETWORKS

Alumni at 4TU gathering

In May 2016, WUR joined the federation of technical universities (Delft, Eindhoven and Twente) with the aim of improving cooperation between the domains of hi-tech, agriculture and food. This 4TU federation has its own alumni network: the Dutch Engineers Alumni Network. This network organized a network meeting during the Dutch Design Week in October in Eindhoven. Wageningen alumni attended for the first time – making up about 10 of the 300 visitors. There are Dutch Engineers Alumni Network groups in various other countries too, including the United States, Spain and Norway. No WUR alumni were spotted at the meetings in early September in Barcelona and Trondheim.
Info: alumni@wur.nl

PHOTO 4TU

FUNDS

'Being able to study here is an amazing opportunity'

As of last September, the Anne van den Ban Fund has been supporting eight new Master's students, four men and four women from Africa and Asia. They include Felix Arum from Uganda, an International Development student. Arum obtained his BSc in development studies in Uganda in 2009. He is now on unpaid leave from his job as a programme worker for The Apac Anti-Corruption Coalition (TAACC), an NGO that upholds the rights of people living in rural areas. 'We analyse policies and projects, investigate whether money is being spent sensibly and then make our findings public. A Master's will help me further in my career.' He has had to leave his family with three young children behind. 'But studying here is such an amazing opportunity. I would never have been able to pay for this myself.' He has been pleasantly surprised by the room for questions and discussions in lectures. 'You learn that there are different sides to every issue and you become skilled in applying knowledge.'


PHOTO WUR

WUR CONNECT

WUR Connect app

WUR Connect is now also available as an app, making it even easier to contact former university friends, KLV members and students, and to extend your network. You can log in via Facebook or LinkedIn, or after registering. The app is available for Apple and Android.

Wanted

The United Community of African Students (UCAS) in Wageningen is looking for African alumni for the centennial celebrations who are willing to talk about how they work on the quality of life. Share your story and show everyone the impact studying at Wageningen has had on you. *Info: Vera Sham*

Event

6 February 2018: Career Day, Wageningen Campus. Aimed at bringing together employers, students and PhD candidates in the life sciences. Your company is invited to take part and reach 1000 students on the verge of graduating in the life sciences. It will also be an ideal occasion to network. Go to *wur.eu/careerday* for more information and to register.


FOTO BART DE GOUW

Community

Over 7000 people from Wageningen based all over the world have already joined WUR Connect.
Find dozens of vacancies in Wageningen's domains.
More applicants and vacancies at *wurconnect.nl*.

Prof. Johan Bouma, WU Soil and Fertilization Sciences 1966, emeritus professor of Soil Science, received the 2018 Dokuchaev Award from the International Union of Soil Sciences (IUSS). 28 September 2017.

PHOTO NANCY BEIJERSBERGEN / SHUTTERSTOCK.COM

Jeroen Dijsselbloem MSc, WUR Economics of Agriculture and the Environment 1991, will continue to chair the Eurogroup until January. On 26 October, his tenure as Minister of Finance ended and he will not be returning to the Dutch Parliament. 11 October 2017.

Theo van Haeften PhD, WUR Biology 1988, has been appointed director of the Undergraduate School of Veterinary Medicine at Utrecht University. 1 June 2017.

Frank Jorna MSc, WUR Zootechnics 2000, animal feed expert and formerly employed by SecureFeed, has been appointed operations manager at the WUR Dairy Campus. 1 November 2017.

Karel Keesman PhD, WUR Land Development 1984, has been appointed professor of Biobased Chemistry and Technology at Wageningen. 1 October 2017.

Johan Kroes MSc, WUR Environmental Protection 2004, won the 2017 'Prince's Speech Award', the speechwriting competition in the festival marking the opening of parliament. 15 September 2017.

Miranda Meuwissen PhD, WUR Economics of Agriculture and the Environment 1995, has been appointed professor holding a personal chair in the Business Economics group. 1 October 2017.

Arthur C. Ouwehand PhD, WUR Biology 1992, has received one of the three 2017 Pedersen Awards given by the DowDuPont Specialty Products Division. 17 October 2017.

Prof. Eric Smaling, WUR Soil and Fertilization Sciences 1982, former professor of Soil Surveying and Land Evaluation and an MP for the Socialist Party until 26 October, will be working at WUR on international research projects in the field of food security and soil fertility. 1 October 2017.

Laan van Staalduinen MSc, WU Economics of Agriculture and the Environment 1992, has been appointed director of Institutional Affairs on the executive board of VU University Amsterdam. 1 August 2017.

Harry Paul PhD, MPA, WUR Phytopathology 1985, Wageningen Ambassador, former inspector-general of the Netherlands Food and Consumer Product Safety Authority and deputy project secretary-general at the Ministry of Finance, has been given the task of preparing the way for the new secretary-general of the new Ministry of Agriculture, Nature and Food Quality. In the previous two governments, agriculture was covered by the Ministry of Economic Affairs.

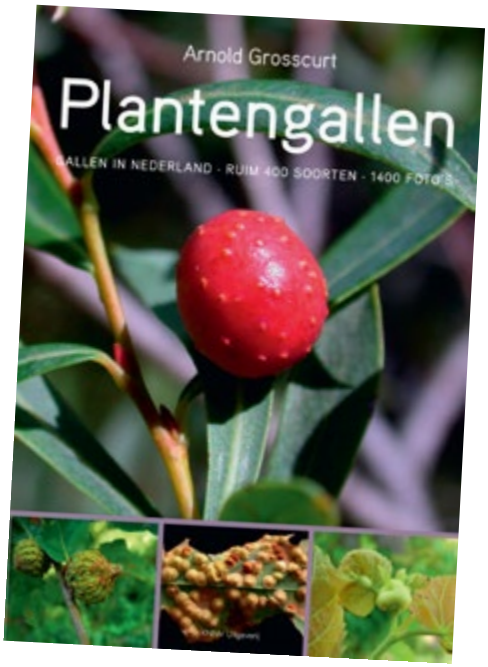
PHOTO DLR-PT / HANS-CHRISTIAN PLAMBECK

Aretha Aprilia receives the Green Talent Award from Matthias Graf von Kielmansegg.

Green Talent Award for small-scale power generation

Aretha Aprilia (Urban Environmental Management 2005) won one of the 25 Green Talent Awards 2017 at the end of October that were awarded by the International Forum for High Potentials in Sustainable Development, part of the German Ministry of Education and Research. Aprilia, who obtained a doctorate from Kyoto University after her Master's, works for CDM Smith in Jakarta via the US Green Prosperity Project. She works on small-scale systems for generating electricity in rural areas and is studying the incentive policy for generating green energy in Indonesia. More than 2500 villages in Indonesia do not have access to electricity. The jury was particularly impressed by Aprilia's commitment to giving every household in Indonesia access to energy, however remote they might be.

A book about plant galls



Arnold Grosscurt (WUR Horticultural Botany 1972, PhD Entomology 1980) has written a reference work on more than 400 plant galls that can be found in the Netherlands and often also in neighbouring countries. It includes 1400 photos he took himself. Plant galls are growths that occur in response to the presence or activity of a gall inducer, a parasite such as a bacterium, aphid, gall midge or caterpillar. The gall protects the parasite from enemies and adverse climate conditions and can help improve food uptake. Parasites usually specialize in one or just a few plant species, and choose their spot carefully. Grosscurt has mapped the entire lifecycle of many of the galls, with numerous details such as cross-sections. 'Some galls have the most wonderful shapes but little is known at present about how exactly they develop.'

Grosscurt spent his entire career working in R&D on crop protection agents. He retired eight years ago. 'I had always taken photos of insects and plants and that was how I got to know about the fascinating world of plant galls. Not many people work in this field.'

In addition to information about the sorts of galls that have been photographed, the book also includes chapters on gall formation, the choice of host plant, environmental factors, host plant resistance, galls as food for other species and their use in the past in tanning and the preparation of ink. *Publisher KNVV, ISBN 9789050116039.*

The year's most talented engineers

Wageningen alumni **Arend van Woerden** (WUR International Land and Water Management 2014), **Pieke Molenaar** (WUR Aquaculture and Marine Resource Management 2012) and **Birgit Dekkers** (WUR Food Technology 2014) were among the 13 most talented engineers in the Netherlands this year according to the technology magazine *De Ingenieur.* 'They do exceptional things to make the world that little bit better,' says *De Ingenieur.* Molenaar and Dekkers work at WUR, while Van Woerden works for the engineering consultancy firm Sweco on spatial questions and climate adaptation. In a competition, he thought up 'The state of your street', a system comparable to the energy label for buildings, only measuring how climate-proof individual streets are. 'Seventy percent of urban space is privately owned so you will never achieve the changes that are required to adapt without the help of residents.' Van Woerden finds it 'incredibly cool' to get this mark of appreciation, and it has resulted in attention for the issue he most enjoys working on: spatial adaptation. 'My boss says I'm good at combining commercial drive with an ability to develop innovative products. I also think my boldness and enthusiasm are important.'

IN MEMORIAM

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

Ms N.O. van Aalst-van Maren MSc, WUR Food Technology 1973. 17 October 2017.
Mr H.F. Bannink MSc, WUR Horticulture 1948. 6 October 2017.
Mr R. Dorfmeyer MSc, WUR Water Purification (Environmental Protection) 1966. 10 September 2017.
Mr W.F.S. Duffhues MSc, WUR Horticulture 1967. 1 November 2017.
Mr M.J. Eybergen MSc, WUR Tropical Land Development 1963. 22 July 2017.
Prof. A. de Groot, former professor of Bio-organic Chemistry. 11 September 2017.
Mr E.W. van Heurn MSc, WUR Tropical Rural Economics 1954. 27 August 2017.
Prof. H.J. de Jongh, former professor of Animal Science. 19 July 2017.
Mr J.S. Kadijk MSc, WUR Farming Technology 2003. 7 August 2017.
Mr S.R. Kuipers MSc, WUR Farming Technology 1964. 6 July 2017.
Mr J.W. Menger MSc, WUR Dairy Production 1955. 22 September 2017.
Mr H.J. Noteboom MSc, WUR Tropical Land Development 1958. 28 April 2017.
Mr T. Ooms MSc, WUR Agricultural Plant Breeding 1987. 20 May 2017.
Mr H.A. Overmars MSc, WUR Agricultural Plant Breeding 1949. 25 July 2017.
Mr J. Patyi MSc, WUR Forestry 1966. 16 October 2017.
Mr J.W.G. Pfeiffer MSc, WUR Land Development 1954. 10 July 2017.
Mr J.W. Righolt MSc, WUR Agricultural Plant Breeding 1952. 30 August 2017.
Ms O.S.M. Vazquez MSc, WUR Food Safety 2005. 26 April 2017.
Mr A.J. Vijverberg PhD, WUR Phytopathology 1962. 18 July 2017.
Mr A. Willemsen MSc, WUR Agricultural Plant Breeding 1954. 8 September 2017.

If you wish to inform us of the death of a fellow former student or relative, you can email alumni@wur.nl or call +31 (0)317-485191.

The little termite

Niels Kerstes (WUR Biology 2008) has written and digitally illustrated a children's book called *Ietje Termietje*. It is about the lifecycle of a termite colony and is suitable for children aged up to seven. As a student, Kerstes studied termites that cultivate fungi in South Africa and his story is inspired by that field work. Termites are social insects and the role they will play in the colony is not fixed at birth. In the book, Kerstes follows the career of Ietje, a little termite who eventually becomes queen. Since obtaining a doctorate in evolutionary ecology in Zurich, Switzerland, Kerstes has been combining biology with creativity in an effort to introduce new audiences to biological phenomena. The book, which is in Dutch, can be ordered via his website: *nielskerstes.nl*.

Startup Challenge

In the FoodNexus Startup Challenge, the companies Seamore and Cereson were chosen as the two best Dutch startups in the food and agriculture sector in 2017. Cereson has developed an automatic asparagus harvesting machine while Seamore develops and sells seaweed products. One alumnus is involved in Seamore: **Carel Callenbach** (WUR Economics of Agriculture and the Environment 1993) is director of R&D and Quality Affairs. 400 companies from all over Europe took part in this competition for startups in the food industry and in agriculture. In addition to the two Dutch companies, 13 other companies from eight different countries were nominated for the European final in December. The two Dutch companies have received support from StartLife in Wageningen. StartLife wants to encourage entrepreneurship in the food and agriculture sector and is in turn part supported by WUR. The Startup Challenge jury assessed the teams, how scalable the innovation is and its impact on our food system.
www.fnsc.eu

KLV

KLV | WAGENINGEN ALUMNI NETWORK

KLV announcement
We've given the KLV pages a new look, with an emphasis on our members. Who are those active and committed alumni who make up the KLV network? After all, these are the people who make the network what it is, and keep it lively. We also draw your attention to a few events. You can always find more extensive information on our website. And of course, as a member you also receive the KLV update and newsletter. Would you like to feature in Wageningen World as a KLV member with a passion in life? Send an email to secretariaat.klv@wur.nl

For your diary:
VWI
27 januari 2018: VWI New Year drinks party. Join us for a chat about our network. vwi-netwerk.nl
Workshop
23 maart 2018: YOUNG KLV workshop on Scientific English. klv.nl/youngklv
100 years
23 juni 2018: World Wide Wageningen Day, including KLV activities. www.wur.eu/worldwidewageningen
NVTL
AgEng 2018 Wageningen: conference run by the Dutch Society of Agricultural Engineers (NVTL) and WUR. ageng2018.com

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Ton den Nijs

KLV member since 1973

A PASSION FOR

Belmonte Arboretum

Since he retired, ex-manager Ton den Nijs has time for his interests: badminton, tennis, grandchildren, choir, beekeeping, book club, sculpting. Not to mention working in his vegetable garden or what is practically his back garden: Belmonte Arboretum. As a plant breeder he used to work on vegetables, potatoes and grasses. Now he tends plants and trees from all the corners of the earth. He is passionate about that biodiversity too. 'Lecturers still bring students here to have a look, you know,' he says. The planning is done by the gardeners from the company that manages the Arboretum. All Den Nijs and the other volunteers have to do is carry it out: weeding, clearing, pruning, and maintaining paths. He gives the occasional guided tour. 'Here you have the French rose, the basis for all hybrid tea roses.' Mmm, smells lovely.

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PHOTO GIJY ACKERMANS

PHOTO JEROEN SCHOORL

Reconstructing the formation of Badlands in Turkey

'A spectacular ghost landscape with sparse vegetation on narrow little ridges, and gullies 10 to 20 metres deep.' This is how Jeroen Schoorl of the Soil Geography and Landscape chair group describes his research area in the Badlands near Kula in Turkey. Any fertile soil has been completely eroded away, but 3000-year-old pottery shards have been found on the ridges. Apparently, humans did once live here. 'There are many of these kinds of degraded landscapes around the world, but there are very divergent theories about how they were formed,' says Schoorl. 'Ranging from natural causes such as climate change, volcanic activity and rivers cutting into the landscape, to over-exploitation and deforestation by humans.' In the framework of an NWO-ALW project, Schoorl and a team of international researchers are studying the age of soil and sediment deposits, with a view to reconstructing the history of the Badlands formation. 'Only when we understand that will we stand a chance of preventing badlands from forming or spreading elsewhere.'

The study is meaningful to the local community too. The research area is part of a UNESCO Global Geopark, a designation for world heritage of exceptional geological and geomorphological value. 'We translate our knowledge about the landscape and the early inhabitants into relevant information for local authorities. They make use of it to develop tourism, by setting up a museum, for instance, or signposting viewing points.'

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