WAGENINGEN WORLD
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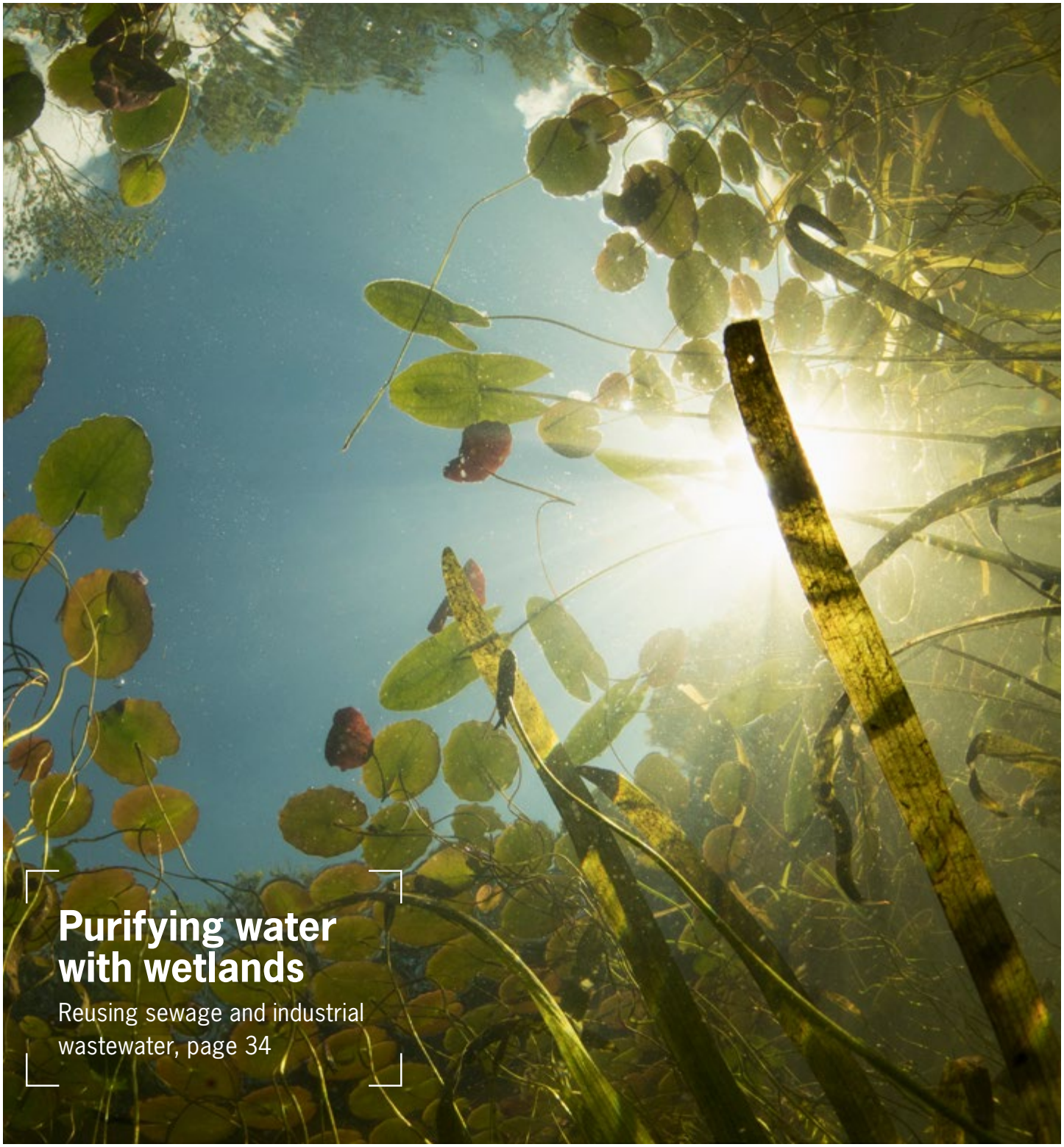

Purifying water with wetlands

Reusing sewage and industrial wastewater, page 34

Lovely Netherlands in 2120
A more natural future ahead with nature-based solutions

Protein from beet foliage
Sugar industry to extract protein from beet leaves

Better seed for Myanmar
Farmers benefit from less bureaucracy and an app

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 12,000 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 UNIVERSITY OF ILLINOIS

Improving photosynthesis

'The world's crop productivity is stagnating, whereas population growth, rising affluence, and mandates for biofuels are making increasing demands on agriculture. Meanwhile, rising demand for cropland is competing with equally crucial global sustainability and environmental protection needs. Addressing this looming agricultural crisis will be one of our greatest scientific challenges in the coming decades. We assert that increasing the efficiency and productivity of photosynthesis in crop plants will be essential if this great challenge is to be met. This is precisely what we have been researching at our university for the past decade, and we have found numerous opportunities for re-engineering photosynthesis. These and any other opportunities discovered are dependent on fundamental photosynthesis research, including that of WUR scientists. During our study in Illinois, we switched off a gene that is responsible for the normal elimination of the toxin in the tobacco plant, and we added alternative genes for breaking down toxins, taken from an alga and pumpkin. As a result, the genetically modified tobacco plant can now produce 25 per cent more biomass. Of course, we don't have much use for a larger tobacco plant, but we want to apply the method to plants that are important to people. So we are now testing our technique on potato and soya plants.
The current engineering prospects range from simple alterations, which have already shown signs of being feasible, to substantial redesigns that haven't left the drawing board yet, but that may be enabled by new developments in synthetic biology and new understandings of photosynthesis. Although some proposed redesigns are certain to face obstacles that force us to find alternative routes, all the efforts should lead to new discoveries and technical advances with important impacts on the global problem of crop productivity and bioenergy production. We shall have to test the modified crops stringently, but two things are clear: to cope with the challenges of the future we are going to need to improve the efficiency of photosynthesis, and a boundless curiosity driving fundamental research is invaluable.'

Donald Ort, professor of Biology at the University of Illinois, was the main speaker at the Dies Natalis at Wageningen University this year.

EDUCATION

Two Wageningen MOOCs in top 10

Two free online courses (MOOCs) provided by Wageningen University & Research have been ranked among the 10 best MOOCs in the world. They are 'The Science of Beer' and 'Sustainable Tourism: Rethinking the Future'. The top 10 were chosen from 2600 MOOCs offered on the edX platform.
Info: wur.nl/moocs

PLANT BREEDING

Urine for beans on Mars

An experiment by space farmer Wieger Wamelink shows that green beans can be grown on the Moon or on Mars using fertilizer from human urine.
The Wageningen researcher is attracting attention around the world with his experiments with crops in a closed agricultural system that could work on Mars, the Moon or the desert.
Human urine could play a role here. Wamelink fertilized the green beans with struvite, a salt containing nitrogen and phosphorous that can be extracted from urine. The beans were sown in replica Mars soil, replica Moon soil or standard potting soil. Half the pots also contained struvite. The plants with struvite grew much better, particularly those in potting soil and replica Moon soil.
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PHOTO HOLLANDSE HOOGTE

ENTOMOLOGY

Farming flies for peace

Wageningen entomologists are helping former FARC fighters in Colombia to retrain as soldier fly farmers. Soldier flies are rich in protein and can be used in animal feed.

These flies are easy and cheap to rear on organic waste. That results in animal feed plus higher incomes. Karol Barragán from Colombia received a doctorate in Wageningen for her research on black soldier flies. Now she is using her knowledge in the Insects for Peace project to help former guerrilla fighters start a new life. Wageningen entomologists are cooperating with the Universidad Nacional in Colombia. 'We want to foster a sustainable local economy,' says professor of Entomology Marcel Dicke. After the peace agreement in 2016, many former FARC fighters turned to small-scale farming but they found it hard to make ends meet.
The researchers aim to identify the optimum mix of manure and plant-matter waste for the fly larvae. Karol Barragán: 'If we can make the process more efficient, the farmers will be able not just to produce good animal feed for their own livestock but also to earn money from selling the surplus.'
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ORGANIC CHEMISTRY

Detecting cancer with biosensors

Two researchers, one from Wageningen and one from Twente, are developing biosensors that can detect cancer in the blood at an early stage. The method is fast and effective.

Pepijn Beekman in Wageningen is studying biomarkers for his PhD research. He also works at the University of Twente, where a former fellow student Dilu Mathew is investigating sensor technology. Together, they have developed a detection method for diagnosing cancer and enabling more targeted treatment. In November last year, Beekman and Mathew won the Dutch 4TU Impact Challenge for their start-up ECsens. The prize consisted of tickets to the 2020 World Expo in Dubai where they will be able to present their idea to potential investors. Beekman: 'If all goes well, the technology could be on the market in six years.'
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ENVIRONMENTAL ECONOMICS

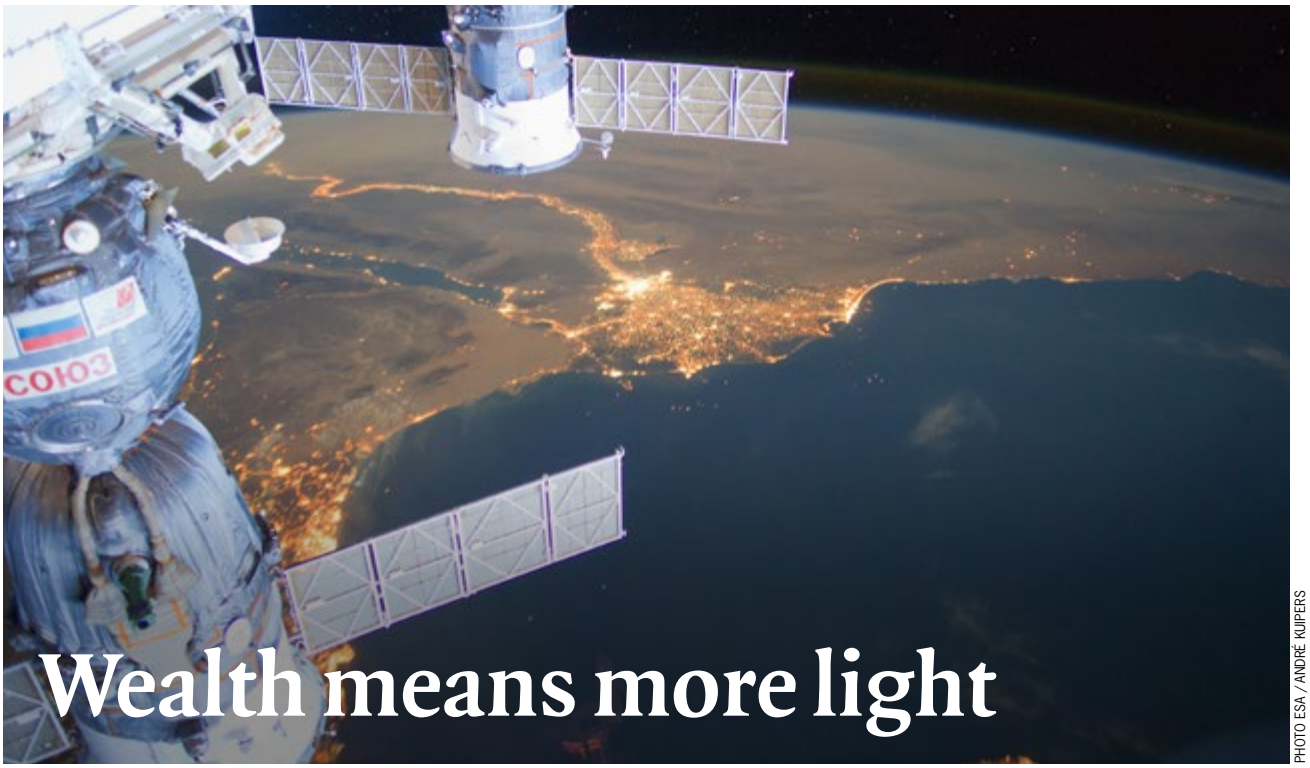

PHOTO ESA / ANDRÉ KUIPERS

Wealth means more light

Income inequality can be deduced from the amount of light in satellite images, especially in less developed countries. These are often countries that have little in the way of data on incomes.

PhD candidate Usman Mirza was looking for a new way to determine the degree of inequality in income distributions for his research on inequality. Economists usually use the Gini coefficient but reliable income data is needed to calculate this coefficient. A study that mapped poverty in different neighbourhoods using Google Streetview images gave Mirza the idea of examining satellite images and data.
The PhD candidate calculated the 'light Gini' by dividing the quantity of light per square kilometre, as measured by satellites at night, by the number of people living there. This let Mirza exclude uninhabited or unlit areas such as industrial estates, forests and deserts. 'Night light' turned out to be a good indicator of inequality, especially in places where the rich and the poor are segregated. 'These are often also less developed countries for which there is little or no data on incomes,' explains Mirza. 'Rich people live near to other rich people in well-lit neighbourhoods in relatively large houses while the poor live in slums or even in tents with less lighting. In general, your light footprint increases in line with your income.'
The advantage of this method is that the data from different countries can be compared and also linked to other spatial data, such as land use or the availability of water. Mirza is an environmental economist. His supervisor is professor of Aquatic Ecology Marten Scheffer.
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WAGENINGEN ACADEMY

Advances in Feed Evaluation Science

Insects as animal feed. Climate-friendly cattle feed. These are just two of the many outcomes of research on animal feed, which leads to innovations, useful new insights and optimized diets. There are a great many technical innovations, trends and advances that are worth considering when we seek to optimize the nutritional value of feed and feed ingredients. People interested in formulating precise mixed diets and/or in learning about the latest advances in feed research and the feed industry are welcome on the course 'Advances in Feed Evaluation Science', which will be offered at the WUR campus. The course will cover pig, poultry, ruminant and pet feed and will include lectures given by experts from WUR and abroad.
www.wur.eu/academy

NUTRITION AND HEALTH

Traditional Zambian drink to combat malnourishment

In Zambia, 40 per cent of children under the age of five suffer from retarded growth due to malnourishment. Two traditional drinks that have declined in popularity in the cities could help children get more vitamins and minerals. Sijmen Schoustra of the Laboratory of Genetics supervised three PhD candidates in their research on the nutritional value, microbiology and production of the drinks. Mabisi, a fermented boiled maize porridge, and munkoyo, fermented milk, are both good for gut flora and they contain vitamin B12.
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CONSUMER BEHAVIOUR

PHOTO SHUTTERSTOCK

More veg and less meat

Restaurant guests seem happy to have somewhat less meat and more vegetables on their plate. However, they do then need more varied, colourful and 'exciting' vegetables to be included, such as capers. These findings come from experiments in various different kinds of restaurants that were conducted by Wageningen Economic Research in partnership with Greendish, Unilever Nutrition Research and the Louis Bolk Institute.
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PHYSIOLOGY

Old muscles take longer to recover after excercise

The muscles of the elderly take longer to recover after exercise than those of young people. That is because they are not as good at converting energy, discovered PhD candidate Bart Lagerwaard.

There has already been a lot of research on muscle mass in the elderly, but Lagerwaard was looking for an explanation of why older muscles are not able to recover so quickly. He focused on the mitochondria, which use oxygen to convert sugars and fats into energy. Lagerwaard used a new method to test the muscles of 20 young men and 20 men aged 65 plus. All his subjects were equally physically active.
Using a device on the leg muscles, he measured the use of oxygen by the mitochondria in the muscle cells. He discovered that the older mitochondria took longer to recover. At least, those in the thighs and calves did. But Lagerwaard found that was not the case for the tibial muscles. 'Not all muscles age in the same way, which is interesting,' says Lagerwaard. He now wants to investigate why that is. It also turns out that physically active seniors are not only more muscular than less active men of the same age but also that their mitochondria function better and their muscles are able to absorb more oxygen.
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PHOTO SHUTTERSTOCK

SOIL GEOGRAPHY

Light traces betray origins of sand grains

Grains of sand can emit a light signal that reveals where they come from. This 'memory' lets Jakob Wallinga find out what happens to the sand that is deposited in the Wadden Sea.

Coastal erosion is causing the Wadden islands to shift slowly towards the mainland. To stop this, five million cubic metres of sand were dumped in the sea off the coast of Terschelling in 2018. The idea is that the wind and sea will spread the sand in such a way as to strengthen the island coasts.
However, it is difficult to predict what effect sand replenishment will have, says Wallinga, who is a professor of Soil Geography and Landscape. To track how the sand is spreading, he uses a luminescence signal from the sand grains that were added. That signal developed in the sand's place of origin deep in the North Sea as a result of natural radioactivity in the seabed. Wallinga normally uses the signal to determine the age of different soil layers but it can also be used to differentiate between the replenishment sand and the local sand. This method is new and will be developed further in the Wadden Sea over the next few years.
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PHOTO RIJKSWATERSTAAT

PLANT BREEDING

PHOTO SHUTTERSTOCK

Plant performs better after chlorophyll transplant

Plant scientists have managed to replace the chloroplasts in one thale cress plant with ones from another thale cress plant. The technique could be used to make plants grow better and faster.

Plants get their energy from sunlight. In their chloroplasts, they use that energy to convert water and carbon dioxide into oxygen and glucose. Glucose feeds the plant and lets it grow. Wageningen scientists are studying thale cress in an effort to improve this photosynthesis process. Now they have managed to replace the chloroplasts in one plant with chloroplasts from another. They were also able to transplant mitochondria, the cell's energy factories. This did not change the genetic material of the plant's chromosomes.

This new technique will let the scientists compare plants with similar ones with 'new' chlorophyll. They can then determine which combinations of chloroplasts and chromosomes maximize the efficiency of the conversion process. 'Modern plant breeding methods allow us to create new combinations of chloroplasts and chromosomes,' explains PhD candidate Tom Theeuwen. 'Now we have demonstrated that this could result in plants that perform better, a number of companies are interested in finding out whether this could apply to their crops too.'

The study was published in January in the scientific journal *Nature Plants*.

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GREENHOUSE HORTICULTURE

Tripling Saudi tomato harvests with less water

Greenhouse horticulturists in Saudi Arabia have managed to achieve an annual production of 80 kilograms of tomatoes per square metre. That is three times as much as the usual yield.

Improved climate and irrigation control in which water was applied in a targeted manner using a computer program led to yields that were a factor three higher, while water usage was significantly lower. At present, Saudi commercial greenhouses require 400 litres of water to produce one kilogram of tomatoes. Greenhouse horticulture specialists at the research centre in Riyadh were able to reduce this to 80 litres of water. Hi-tech greenhouses require only three litres of water. Wageningen experts have been working for 13 years now on reducing the use of water and pesticides in the Arabian Peninsula, where the hot, dry conditions make agriculture difficult.

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BIOCHEMISTRY

Mould in aster inhibits tumours

PHOTO SHUTTERSTOCK

In traditional Chinese medicine, the Tatarian aster is considered to be a medicinal plant. A team of international scientists including researchers from Wageningen has discovered that an internal mould in the flower produces active substances that combat cancer and immune diseases. They have also figured out how the mould does this. This knowledge can be used to produce the tumour-inhibiting and anti-allergenic substances artificially.

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BIOFUEL

PHOTO WUR

Fuelled by seaweed

In Denmark, a car has driven 80 kilometres on a mix of petrol and biofuel based on seaweed. That is a first. Wageningen Food & Biobased Research produced the biofuel in question — butanol — from sugars in seaweed. The experiment is part of the European research project MacroFuels, in which the Wageningen researchers work closely with TNO and the Danish Technological Institute. The car tests show that the mix performs just as well as ordinary petrol.
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EDUCATION

Training for Iraqi researchers

Wageningen scientists will be training fellow scientists at six Iraqi universities in collaboration with the Institute for Water Education in Delft and ICRA Global. The researchers will modernize the universities' teaching methods by introducing group work and practical assignments. The six universities will also send one researcher each to Wageningen, where they will write a joint article on climate-proof agriculture and water management. The universities want to work with farmers to find solutions for the shortage of water and soil salinization. Karrar Mahdi, a researcher in the Soil Physics and Land Management chair group in Wageningen, is coordinating the project, which is financed by the ministry of Foreign Affairs.
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CONSUMER BEHAVIOUR

Emphasizing animal welfare is not effective

Consumers are concerned about animal welfare but often still end up buying cheaper products that are less animal friendly. 'Marketing strategies geared purely to emphasizing animal welfare are not effective with most consumers,' says Lenka van Riemsdijk. She obtained her PhD in Marketing and Consumer Behaviour at the end of 2019. Her research shows that consumers mainly appreciate product marketing that plays to their curiosity or emotions, for example a picture of a happy animal on the packaging. Another option is putting 'Did you know...?' on the packaging followed by facts about animal welfare. Alternatively, the product's improved flavour thanks to more animal-friendly farming methods could be promoted.
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BIOINFORMATICS

PHOTO SHUTTERSTOCK

Bacteria help sugar beet

If there is a risk of a fungal infection, bacteria in the roots can help protect the plant. An international research team discovered which bacteria provide assistance.

New software developed by Wageningen bioinformatics experts make it possible to rapidly analyse the DNA of thousands of species of microorganisms in one go. As a result, scientists from the Netherlands, Brazil, Colombia and the US were able to map the genetic diversity of communities of microorganisms. They discovered which of the bacterial families living in the roots help the plant to protect itself. If there is a risk of a fungal infection, these bacteria produce protective substances such as enzymes that break down the cell walls of the attacking fungi.

The researchers used this knowledge to select two bacteria with a protective function from thousands of bacteria in the soil, based on DNA analysis. Tests with sugar beet showed that the selected bacteria are indeed effective against fungal infections. They also discovered the bacterial gene responsible.
The researchers, who include Wageningen plant scientists, believe this study marks an advance in the development of more sustainable crop production methods with less pesticide.
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BIODIVERSITY

Masterplan to save insects

Over 70 scientists from 21 countries have come up with a plan of action to restore insect populations around the world. They advocate more varied farming landscapes and the gradual abolition of pesticides.

All over the world, insect species are becoming extinct and numbers of insects are declining alarmingly. The reasons include the loss and fragmentation of their habitats, pollution, the use of pesticides and climate change.

To kick-start the restoration and protection of insects, an international group of 70 scientists published a roadmap in Nature Ecology & Evolution in January. 'Insects are incredibly important in a wide range of nature services, some of which are indispensable in food production and safety, for example disease and pest control,' they write. To start with, steps could be taken already to increase the natural variation in farming landscapes and conserve protected species. Pesticides could be replaced by ecological alternatives. Water, light and noise pollution could be reduced. Furthermore, more research is needed on the impact of human activities on insect populations. Collaboration is also needed to protect and restore insects' habitats.

David Kleijn, professor of Plant Ecology and Nature Conservation, is one of the authors. 'Two years ago, an alarming study was published showing a fall of 76 per cent in the number of insects in German nature areas over a period of 27 years. We have signs that the decline is continuing apace, for example based on research by the Dutch butterfly society. So something urgently needs to be done. There are local initiatives but key factors such as the loss of habitats and excessive use of insecticides must be combated across the board,' says Kleijn.

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PHTO SHUTTERSTOCK

ROBOTICS

Robot trims hedge

Wageningen researchers, manufacturer Bosch and five other European universities have developed a robot that trims hedges and prunes roses. TrimBot2020 is fitted with 3D cameras and has a 360-degree field of vision. With its independently operating arm with pruning shears, it is able to cut a bush into the shape of a sphere or cube, or to prune roses. The process is slow and laborious but the research has increased understanding of autonomous navigation, image analysis, deep learning and movement control. That was the aim of this European Horizon 2020 research project.

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PHOTO GUY ACKERMANS

ECONOMY

Agricultural exports reach record high

Dutch exports of agricultural products totalled 94.5 billion euros in 2019, up 4.6 per cent on 2018 and the highest figure for exports ever. This finding comes from Wageningen Economic Research and Statistics Netherlands. The Netherlands imported an estimated 64.1 billion euros worth of agricultural products in 2019. That means the agricultural trade surplus exceeded 30 billion euros for the first time ever; it accounted for almost 55 per cent of the overall trade surplus for goods.

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Mapping a bright future

In 100 years' time, the Netherlands could be an attractive mix of green cities, sustainable agriculture and climate-proof nature, claim Wageningen researchers in a vision paper. That's if we tackle the spatial planning challenges with nature-based solutions.

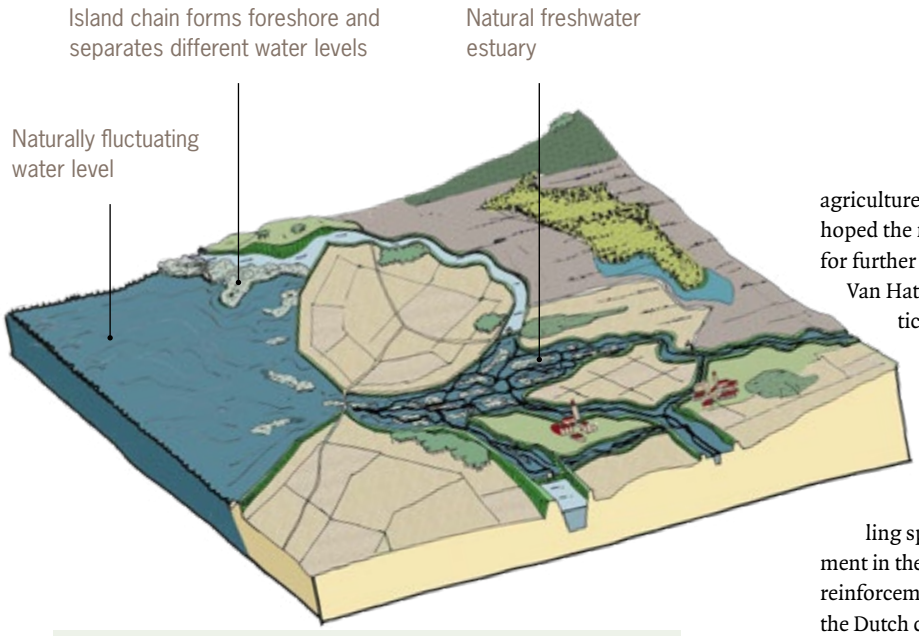
TEXT NIENKE BEINTEMA **ILLUSTRATIONS** WUR

The first thing that strikes you is the amount of green and blue. Dense forests on the Veluwe and on the sandy soils of Twente, Drenthe and Brabant. Green foreshores around the IJsselmeer bay, restored wetlands in the peaty soil areas, wide rivers meandering through the countryside. That is what the Netherlands could look like in 2120, according to a diverse team of Wageningen scientists. Last December, they presented a detailed map in the vision paper *A natural future for the Netherlands in 2120*.

The report caused a stir in the Dutch media, and got coverage on TV, radio, social media, and in full-page articles in national newspapers. 'We were quite surprised by all that attention,' says Tim van Hattum, Green Climate Solutions programme leader in Wageningen and one of the instigators of the report. He can guess at the reasons for all the attention, though. 'We are facing a number of huge, complex challenges such as climate adaptation, rising sea levels, the energy transition and housing construction,' he says. 'All you hear in the media is doom scenarios. It seems like people badly need a more hopeful outlook. A graphic can give them that: see how beautiful it could be. It really won't be all gloom and doom. As long as we prepare for all those changes in time.' As far as Van Hattum is concerned, this is the core message of the vision paper and the pretty blue-green map: the Netherlands could be a very attractive country in 2120, and one that is climate-proof and offers scope for >

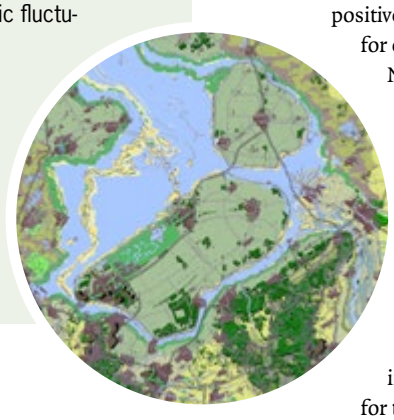
THE NETHERLANDS IN 2120

At the behest of the Dutch ministry of Agriculture, Nature and Food Quality, 17 Wageningen scientists have come up with a vision on how to make the landscape of the Netherlands future-proof. This can help the country tackle the major social transitions ahead, such as climate change adaptation, the energy transition, agricultural reform, and urbanization. The main principle is to make optimal use of natural processes in spatial planning.



IJSSELMEER WITH WATER LEVEL FLUCTUATION

The water level of the IJsselmeer is kept stable around the edges for shipping, with natural dynamic fluctuation in the middle of the lake. The Houtrib dyke between Lelystad and Enkhuizen has been divided into sections, creating little islands with bridges between them. A new freshwater delta has been created at the mouth of the IJssel river. Maintaining two separate water level regimes is a new idea, which the researchers want to develop further.



‘It seems people badly need a more hopeful outlook’

agriculture, home-building, industry and nature. It is hoped the report will provide inspiration and pointers for further thinking. ‘It is a very appealing picture,’ says Van Hattum. ‘But it is also well researched and realistic. It is not a utopian fiction.’

SAND REPLENISHMENT

The vision’s starting point is the concept of nature-based solutions. The idea here is to take the natural processes at work in the soil, water and coast as the basis for tackling spatial planning challenges. Sand replenishment in the right places can automatically lead to a reinforcement of the dunes along the entire length of the Dutch coast. Dunes help with water purification, and green roofs are useful for tempering rainfall peaks and keeping buildings cool effectively. Besides their primary function, natural solutions often have additional positive effects – on biodiversity and the quality of life, for example.

Nature-based solutions produce dynamic systems that regulate themselves, adapting to changes such as rising sea levels. This makes them cheaper in the long run that static systems made of steel and concrete. Van Hattum: ‘We consciously chose to present just one perspective, and not to offer other scenarios that involve using concrete or doing nothing.’ The reason for this is that the Wageningen researchers feel there has been too little interest in nature-based solutions. ‘We are quick to reach for technological solutions,’ says Van Hattum, ‘whereas worldwide forests and wetlands capture a lot of carbon and therefore have the potential to contribute 30 per cent of the necessary global CO_2 reduction. And in the process they also increase climate resilience, biodiversity, health, quality of life and a whole lot more. That’s why we say: take a good look at this scenario. Just let this sink in.’

It is hard to say exactly what the cost-effectiveness of the scenario is, says Van Hattum. ‘The costs and benefits are much harder to calculate than they are with civil engineering solutions, because we have far more experience with those.’ Also, the advantages of nature-based solutions lie precisely in areas that are not easy to express in money terms. What is the monetary value of biodiversity, health, quality of life, or recreation? ‘Precisely on those points, this scenario outstrips other solutions,’ claims Van Hattum. ‘We are convinced that

this is more cost-effective. The next step is to calculate that properly.'

FANTASTICALLY BEAUTIFUL

Many of the elements on this map are not new, emphasizes co-author Michael van Buuren, Landscape Architecture researcher at Wageningen Environmental Research. 'What is new is that all those aspects are now interlinked,' he says. 'That synthesis. The fact that something so fantastically beautiful has been created, which is actually feasible as well.'

Van Buuren's role in this project has mainly been focused on freshwater. 'Just look at the lovely lake zone with the Randmeren, the IJsselmeer and the Markermeer,' he says. 'Our proposal is to start managing them in a very different way. You allow more water-level fluctuation in the core zone, to create more natural dynamics. On the edges you keep water levels more stable, partly by creating foreshores and chains of islands. That is better for agriculture and for shipping.' Following two different water-level management regimes is a very new idea, Van Buuren stresses. 'We want to work that out in more detail.'

Another striking feature is the wide rivers. 'A lot of the water meadows along the Waal have already been designated for temporary water storage and nature development,' explains Van Buuren. 'We must carry on with establishing these zones. Instead of reinforcing the dykes, Wageningen researchers propose a more natural solution. On the inside of the existing winter dyke you can build small dykes with water and swamps in between them, to hold back the groundwater that wells up at high water and wants to seep under the winter dyke and flow on. In the area in between, there can be space for wetland agriculture or nature.' Wetland agriculture could give us reeds, wetland nature reserves, sphagnum moss and cranberries. You could even graze water buffalo there, says the report. Columnist Bert Wagendorp in the Dutch daily *De Volkskrant* is looking forward to 'delicious Dutch mozzarella'.

DALMATIAN PELICAN

In this plan, the IJssel river will become twice as wide as it is now. 'A wider IJssel can help dispose of the additional peaks in the runoff from Germany.' A wider IJssel would also provide more space for new nature areas. 'Thanks to nature development, we already have breeding pairs of fish eagles in the country,' notes Van Buuren, 'and there could be a lot more of them. In the long run, you can expect other interesting species too, such as black storks and Dalmatian pelicans.'

> 'Something fantastic has been created, and it is feasible too'

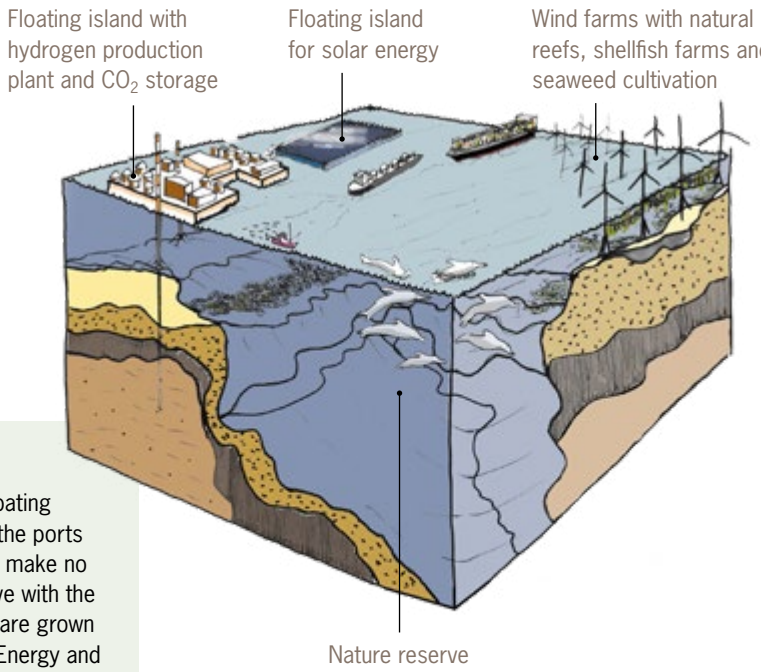
More woodland, more cities, and more wetlands too: that raises the question of how all this will fit in this overful country. Tim van Hattum's answer is: 'We shall have to explore where multifunctional use – combining functions – is possible.' Examples include solar farms and marine protein production, nature-inclusive cities and nature-inclusive agriculture. 'Through the transition to more plant-based food, the right crop in the right place, and production at sea, we can further optimize our agriculture and that will make room for new functions.'

WIND FARMS

Another noticeable feature of the map is how much of the Netherlands consists of sea. 'The part of the North Sea that is Dutch is larger than our land surface,' says Martin Baptist, a researcher at Wageningen >

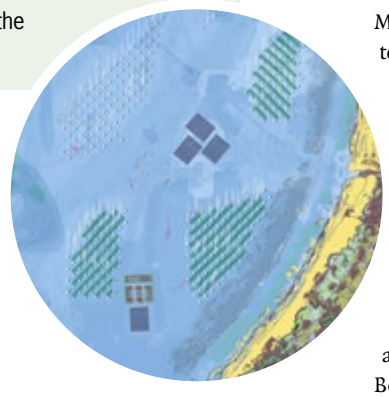
WIDE RIVERS

The rivers will have to be able to carry more and more water. River beds are doubled in area. Instead of reinforcing dykes, you can build small new dykes inside the current main dykes, with water or swamps between them that help push back water seeping under the main dyke at high water. This area between the dykes lends itself to wetland crops such as cranberries. The river zone could also serve as a location for floating homes.



THE NETHERLANDS AT SEA

The map shows large offshore wind farms and floating islands covered in solar panels. Transhipment in the ports can become floating too. Solar panels out at sea make no demands on scarce space on land, and they move with the rising sea levels. Mussels, oysters and seaweed are grown in the North Sea, mainly around the wind farms. Energy and food harvesting in the North Sea is combined with nature development, with nature reserves being established to create space and peace for species such as anchovies and porpoises. Natural reefs with flat oysters and sand mason worms can grow around the bases of the wind turbines.



Marine Research and another of the project's instigators. 'That part of the Netherlands is often forgotten. I am pleased that it is now on the map.' There are large marine wind farms drawn on the map. 'The cabinet has already decided to go for wind power,' notes Baptist. 'But those wind turbines don't last 100 years. You can remove the old turbines, but you can also use the infrastructure, the piles for instance, for other purposes such as seaweed farms or oyster farms.' The map also features floating islands full of solar panels. Placing solar panels out at sea makes no demands on scarce space on land. Because they float, they adapt to rising sea levels. 'You can even make transshipment in ports floating,' adds Baptist. The biodiversity of the coastal zone will be richer in 2120 than in the previous century, the report says. Species such as anchovies, porpoises, bottlenose dolphins and humpbacked whales will be common again. Nature reserves will be established to give these species space and peace.

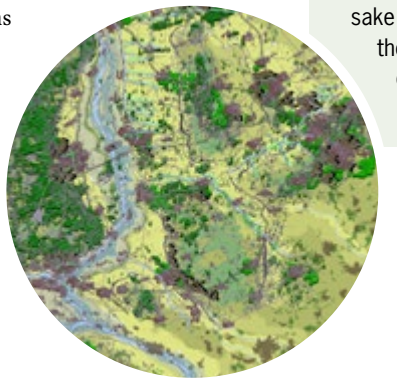
'We don't say: this is the way it's got to be. We want to feed the discussion'

MUDFLATS UNDERWATER

The western part of the Wadden Sea is not going to survive the rise in sea levels, the researchers predict, and the mudflats here will disappear underwater for good. The eastern section will continue to be exposed at low tide. 'To achieve that we shall need more sand replenishment on the seaward side of Ameland and Schiermonnikoog islands,' says Baptist. Another of the Wadden islands, Griend, is a lot bigger on the map than its current

dimensions. That too will have to be achieved with sand replenishment. 'We are not going to let such an important bird island disappear.' So the Wadden Sea will change, but will be no less diverse. Rising seawater temperatures will also attract new species such as flamingos, bottlenose dolphins and whiptail stingrays.

Sand replenishment will continue to be necessary not just in the Wadden Sea but all along the Dutch coast, especially given that the dunes will be twice as broad as they are now. That will take millions of tons of North Sea sand every year. 'People often think that costs too much,' says Baptist. 'But the alternative, a technological solution, is far more expensive. And doing nothing is the most expensive of all. The Dutch cities of the Randstad will be protected by the dunes. And we really can maintain those dunes with nature-based solutions for next to nothing.'



POLITICAL CHOICES

So all this is possible, but it does mean going into action – something all three researchers stress. 'It is important to make political choices that look further ahead than the four-year term in government,' says initiator Tim van Hattum. 'But that is tricky. And at present problems are often tackled seperately. Nature, agriculture, biodiversity, climate, water safety, urban development, and so on... But of course, all these things are interconnected. Our solution contributes something positive in all these areas.'

So what is needed, according to Van Hattum, are not separate major programmes for water safety and biodiversity, as we have at present, but an integrated Delta Plan that brings it all together.

The media hype about the project has already drawn reactions from ministries and businesses. 'Big construction companies want to contribute to making the Netherlands a healthy and pleasant place to live, by helping to figure out how to create green and climate-proof neighbourhoods, for instance,' says Van Hattum. 'It really isn't the case that all they want to do is build houses, but they often run up against rigid legislation and old-fashioned contracting systems. So that is another plea we are making to the government: do something about this. Facilitate those companies.'

GREEN-BLUE CITIES

New economic hubs are no longer developed in the urban west of the country, but on higher sandy soils further inland. Cities are full of trees and surrounded by woodland, for the sake of biodiversity and to temper the heat island effect in the city. There is a lot of open water to improve the city climate and provide a buffer for weather extremes. The dominant building material is wood.

'A technological solution is much more expensive'

The Wageningen researchers have also presented their vision to the ministries of Agriculture, Economic Affairs, Home Affairs and Infrastructure and Water Management. 'It seems like we have struck the right chord,' notes Van Hattum. 'I think we've sparked off something all the way up to the top.'

Of course there are still plenty of questions to be answered: both technical scientific questions and socio-economic ones. But Van Hattum stresses that the Wageningen vision is realistic, even with our current knowledge and possibilities. 'Whether it is also a desirable scenario is not within our brief. That is for the politicians to decide.'

In other words, this is not a blueprint. This is a possible line of reasoning, which takes us in the direction of an integral future-oriented vision for the Netherlands. 'So we don't say: this is the way it's got to be. We want to feed the discussion. And if you ask me, that is already working rather well.' ■

www.wur.eu/netherlands2120

TEN YEARS OF N2AFRICA

The rise of legumes in Africa

Ken Giller has worked on improving the cultivation of legumes by small-scale African farmers for 10 years. His approach has brought significantly bigger yields and incomes to over half a million farmers. Now the project is coming to an end. 'If a method is good, it spreads amongst farmers.'

TEXT ALBERT SIKKEMA **PHOTO** GEORGINA SMITH / CIAT

'We had a formula,' says Ken Giller, professor of Plant Production Systems. 'Leguminous crops plus *Rhizobium* bacteria fix nitrogen from the air, giving you a natural fertilizer. That is a big advantage. Together with fertilizers such as phosphate and potassium, it ensures a good yield. We had successfully tested this for the project in small-scale experiments, and then we rolled it out through N2Africa.' For 10 years, Giller promoted the cultivation of these legumes – beans such as the common bean, soyabean, peanut and chickpea – among small-scale African farmers, with the aim of improving their food production. The main funding came from the Bill and Melinda Gates Foundation, which contributed 52 million US dollars.

The project worked to ensure that farmers in 11 African countries gained access to seed of new varieties of grain legume crops. As well as seed, the project helped to organize the supply chain so as to ensure access to the necessary fertilizers and the appropriate *Rhizobium* bacteria for fixing nitrogen. Preliminary studies were done in every country to see which crops would be the best choice to match local needs and habits, the climate and the soil composition. Studies were also done to find out which *Rhizobium* strains would be most effective.

IMPROVING SALES

Poor agricultural infrastructure was a bottleneck for the project. The seeds, inoculants and artificial fertilizer that the project supplied and tested were not widely available in rural Africa, and sales outlets for the legumes were poorly developed. The project teams in the 11 African countries therefore sought the cooperation of dozens of local partners to help improve the marketing and distribution system.

Most of the farmers the project reached, about 600,000 in all, benefitted from the N2Africa formula. Many of them had never worked with bacterial inoculants and talked of a 'magic black powder'. In combination with good management – early sowing, and weeding – the formula produced significantly higher yields and incomes in 80 per cent of cases, says Giller.

And so N2Africa achieved good results with half a million African farmers. Yet Giller is reluctant to call it an unqualified success, 'because it didn't work everywhere.' Not all farmers managed to get better harvests with the N2Africa treatment, and it was not clear why that was.

YIELD GAP

Giller's group set up trial plots everywhere with four sections: one for the crops alone, one with the crops and bacterial inoculants, one with the crops and artificial fertilizer, and one with all the relevant inputs. Broadly speaking, the trial plots with all the inputs produced the highest yields. But something odd happened too. 'In theory, you get the biggest increase in yield on the plots with low soil fertility, where the yield gap – the difference between the actual and the potential yield – is biggest. But that is not what came out of our tests.'

After extensive analysis, the researchers found two more causes of the variation. Firstly, the cocktail of good seeds, inoculants and phosphorus didn't work at all on about 10 per cent of the plots. 'Some soils were so exhausted that nothing would grow on them,' says Giller. Secondly, the variation in yield turned out to be related to the way the plot had been treated in the past. This meant some fields had more micronutrients, potassium and magnesium available than others, and that had an effect on the yield too.

80 per cent of the farmers benefited from the method

The funding from the Gates Foundation has stopped now, so N2Africa is over. But in a way, it is not, says Giller. 'If a crop or a practice is good, it goes on spreading among the farmers.' He points to research by the Knowledge, Technology and Innovation chair group on the distribution of new seed in Africa. If a farmer gets hold of better seed, he passes it on to an average of 4.5 more farmers. 'Based on the 600,000 farmers we reached directly, the N2Africa method probably reached up to 2.5 million African farmers.'

And on top of that, says Giller, N2Africa worked with 30 to 40 local partners in every country, including national research centres, radio stations, and seed and artificial fertilizer producers. Those partners may continue to spread N2Africa's methods. 'If we want to measure the impact, we should take another look in five years' time.' ■

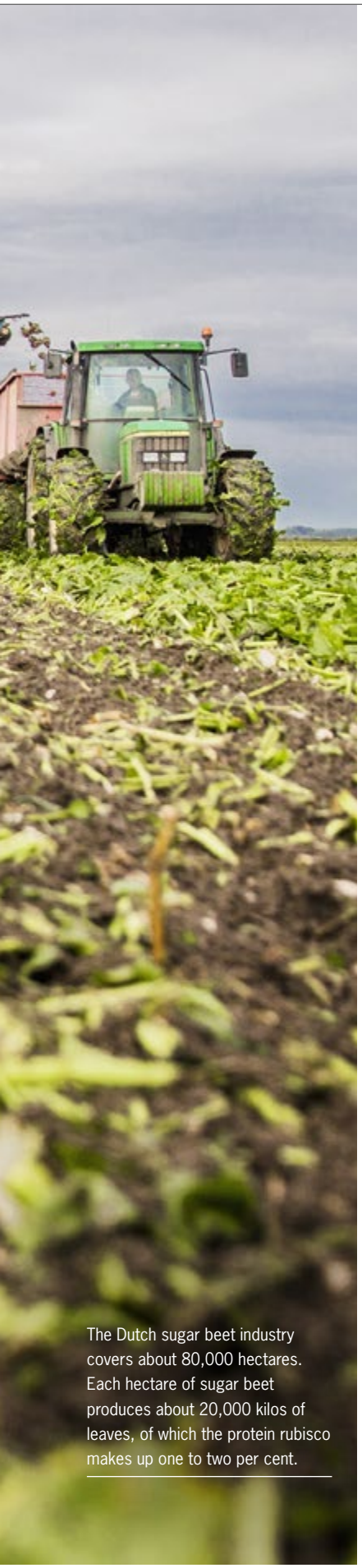
www.wur.nl/n2africa

'RELEVANT CONTRIBUTION'

The Institute of Development Studies (IDS) in the UK evaluated the claims made by the N2Africa project, on the basis of interviews with small-scale African farmers in Ethiopia and Ghana. The IDS reported that N2Africa made a relevant contribution to expanding soya cultivation in northern Ghana. In Ethiopia, N2Africa made a key contribution to the production and supply of inoculants and to making farmers more aware of these nitrogen-fixing bacteria.

SUGAR UNION EXTRACTS PROTEIN FROM WASTE STREAM

From worthless leaves to valuable powder



The Dutch sugar beet industry covers about 80,000 hectares. Each hectare of sugar beet produces about 20,000 kilos of leaves, of which the protein rubisco makes up one to two per cent.

After the sugar beet harvest, the leaves are usually left in the fields. That is set to change. In a demo factory, the sugar industry is processing the beet leaves into the protein rubisco, which can replace animal protein in foods.

TEXT ARNO VAN 'T HOOG **PHOTO** HOLLANDSE HOOGTE

At first sight, it looks like flour or milk powder, but the substance the Cosun factory in Dinteloord makes out of sugar beet leaves is practically pure rubisco, the enzyme that transports carbon dioxide in plants towards the photosynthesis process. Rubisco is not a household name, and yet it is the commonest protein in the world in terms of mass. Whenever you eat lettuce or spinach, half the protein on your plate is rubisco. In its pure form, it can be an interesting ingredient for use in protein foam, sauces and other food applications.

But first you need to get hold of a pure and economically viable form of rubisco. Besides protein, leaves consist largely of water, fibre and chlorophyll. It takes a lot of steps to turn the one to two per cent of rubisco they contain into a powder. On the factory floor in Dinteloord, in an area the size of two volleyball pitches, stands a shredder the height of a man, a press, centrifuges, membranes, columns and drying apparatus. This collection of stainless steel machinery was able to process 1500 kilos of sugar beet leaves per hour during the harvest period from September to December.

The process revolves around stripping the leaves step by step, removing the solid components, colour, smell and taste, says Paul Bussmann, senior researcher at Wageningen Food & Biobased Research. Bussmann started the research on developing rubisco purification 10 years ago, and has registered a patent for the refinery technology.

'You start by grinding up and pressing the sugar beet leaves, which gives you a juice that still contains tiny fibres and sand. The juice goes into a centrifuge and comes out as a clear, dark green liquid.' The green colour comes from the proteins with which the plant captures light. They react to heating by coagulating and then get left behind in a second centrifuge. The liquid that comes out, which contains the rubisco, is a light greenish-brown colour. 'That colour comes mainly from polyphenols, which make fruits and vegetables change colour when damaged. We remove them with membrane filters. After that the juice looks pure enough but the aftertaste is still green and extremely bitter.' The juice then flows through a porous column with a resin that the odour and flavour components stick to. And the last stage is drying it to form a protein powder.

FLAVOURLESS POWDER

Making rubisco powder odourless and flavourless is essential for using it in foods such as sweet foams, as an emulsifier in sauces or a binding agent in a veggie burger, says Bussmann. 'The steps in the refining process are not straightforward. We have detailed knowledge of the flavour components involved here and how you can remove them with resin columns. And for these kinds of technological developments you need to be able to bring together experts from different disciplines, such as protein and process technologists, project leaders and commercial types. Two PhD >


Sugar beet leaves are ground up and juiced.

research projects in Wageningen have also played an important role in developing the refining processes.''

EGG SUBSTITUTE

Rubisco can be a substitute for protein from hen's eggs in many foods. Because no animal is involved, the powder has potential in the market for plant-based and vegan foods. Bussmann: 'We know that rubisco performs very well in comparison with egg protein, whey protein and soya protein. That means you don't need as much of it. So we don't look so much at the powder's nutritional value, because that is not what the industry pays for. Companies want to know: does it foam, does it gel, does it emulsify? If it does, the price shoots up by a factor of 10 or more.'

The demo factory in Dinteloord is the finishing line for now of years of development. It all began 10 years ago when Bussmann and his colleagues at TNO started extracting rubisco from algae and sugar beet leaves. The group transferred to Wageningen Food and Biobased Research two years ago. By then the researchers could already manually make a few kilos of pure rubisco out of hundreds of kilos of leaves.

The Dutch start-up Green Protein was interested in the patented process and with funding from a large French cooperative, a small pilot factory was built in Normandy to process waste streams from large vegetable-processing companies. Bussmann: 'You can isolate rubisco from the outer leaves of lettuces too. That factory processed 150 kilos of vegetable waste per hour. So we could do experiments to see whether it was worth scaling up. Sadly, the cooperative decided against continuing with a larger factory.'

EXCLUSIVE PATENT

Meanwhile, Green Protein had obtained exclusive patenting rights to the rubisco refining process, and at the end of 2018 the company was itself taken over by *Suiker Unie*, the Netherlands' largest sugar beet processor. This company, part of the Royal Cosun cooperative, already processes other waste streams such as sugar beet pulp, and wants to develop alternative sources of protein too. The demo factory, which went into operation at the end of 2019, was built with the aid of a large European project grant of 4.2 million euros.

'That EU grant is very important for research on the technical and economic feasibility, too,' says Paulus Kosters, co-founder of Green Protein and nowadays senior protein programme manager at Cosun. 'Half of the amount is being used to set up the factory and the other half for research. Such a big investment is often a stumbling block, whereas you really do need a demo factory on this scale to help you decide whether to build a large commercial factory. You discover all sorts of things and you design things beforehand that then turn out differently to what you had in mind. In this phase you can make those mistakes and make improvements, because most of the apparatus is hired.'

BEET HARVEST

Another important purpose of the demo factory is to find out what the return on investment is. 'You can lose some of your protein at every stage. That can only be studied on the factory floor, which is why we wanted to gather as much information as possible during the beet harvest over the four months up to just before Christmas,' says Kosters. Although work in the demo factory went on around the clock in a three-shift system, and 1500 kilos of leaves were pressed per hour, this was still only a fraction of the total harvest of sugar beet leaves. Even a large-scale commercial rubisco factory could only process 5 to 10 per cent of the Dutch sugar beet leaves, reckons Kosters. About 20,000 kilos of leaves are produced from every hectare of sugar beet, and Dutch beet production covers about 80,000 hectares. Kosters: 'The availability of sugar beet leaves is not a limiting factor for now.'

During the first practical test, the entire process was examined and developed. 'We could only proceed to the next step of the refining process once the previous step was

PHOTOS SUIKER UNIE

The juice is purified, rid of colour, smell and flavour, and dried into protein powder.

> ‘Companies want to know: does it foam, does it gel, does it emulsify?

stable. The goal for the first year was a stable process on this scale, and then the production of protein. Only in the final weeks of the sugar beet harvest did we run through the refining process from start to finish, and produce protein.’

REGISTRATION WITH THE EFSA

Those batches of rubisco are now being subjected to further research, explains Kosters. Their chemical composition and characteristics are being studied, as well as ways of processing them in demonstration products for food companies. The rubisco powder is also being used to put together a food safety dossier so it can be registered with the European Food Safety Authority (EFSA). This involved checking whether the powder can provoke allergic reactions and whether it contains any harmful substances. Rubisco is a natural protein isolate, says Kosters, but the EFSA looks at other issues as well. ‘You are refining a protein, and in doing so you could end up concentrating other, undesirable substances. So you can’t say: rubisco powder is no different to leaf vegetables. The turnaround time for an EFSA dossier is a year or two. That is all part of the investment. The chances of it not being approved are very small, but the submission does affect when you can launch the product on the market.’

ENDIVE AND LETTUCE

The demo factory will not stand still for the eight months until the next sugar beet harvest begins. In that time, a number of summer crops are being experimentally processed into rubisco powder, says Kosters. ‘A commercial factory will not be able to operate at a profit if it is only open for four months a year. You need to be able to process crops and leaf waste almost all year round. We are going to run trials with vegetable crops such as endive and lettuce, and also with field crops such as certain grasses, green fertilizers or alfalfa, a crop that is mainly used as livestock feed at present. We have screened a number of crops in the laboratory. Now that the factory is up and running anyway, we can test them on a bigger scale. It won’t be as extensive as the research on sugar beet leaves, but we can learn a lot from it as well.’

Given that rubisco only makes up a tiny percentage of the leaf mass, the process creates a lot of leaf waste at the factory. Currently, sugar beet leaves only stay behind in the fields, but the pressed leaf fibres could be used for livestock feed, says Kosters. And the liquid waste streams might contain other usable substances. ‘We will research that too. But for the first few years, we are focussing on the protein. That product has to be profitable to produce.’

At this point, Kosters cannot predict when the demo factory will have delivered enough information to make it feasible to upscale to a large-scale installation that can refine 15,000 kilos of leaves per hour. ‘That is affected by all sorts of commercial decisions about investments and estimates of the market for rubisco powder. Our ambition is to market a commercial rubisco product for food producers in 2022. Whether we’ll be talking about tons of powder straightaway should become clear in the course of next year.’ ■

http://greenproteinproject.eu

Particle physics helps combat securities fraud

Markets expert Joost Pennings hopes to be able to identify fraudulent transactions on futures markets using technology from the particle physics laboratory CERN in Geneva. This might make it possible to prevent stock market crashes and fraud.

TEXT KENNETH VAN ZIJL **PHOTO** BLOOMBERG / GETTY IMAGES

'They did wonder what on earth an economist from Wageningen was doing among all those physicists and Nobel Prize winners at CERN,' says Joost Pennings, professor of Marketing at Wageningen. CERN is the centre in Europe for fundamental research on elementary particles. During a guided tour with an acquaintance who works at the site of the particle accelerator in Geneva, Pennings had a brainwave: he saw a similarity between the billions of collisions between elementary particles over ultrashort timespans and the millions of transactions that take place on the stock exchange in hundredths of a second.

'The people at CERN told me that most collisions go perfectly. Only if a collision is imperfect, or if a particle moves abnormally, does it throw up new insights. On the stock exchange, if the bid price and the offer price are the same, you have a transaction – in CERN terms, a perfect collision. If that is not the case, something is up. I suddenly saw an analogy with the data we had just received.'

Pennings won a data set with transaction data from the Chicago Mercantile Exchange Group (CMG), the largest stock market in the world for futures trading. CMG had run a competition for the data. Universities could submit plans outlining what they wanted to study using the data from the 'Limited Order Book'. 'I think our reputation was the decisive factor. Not many people know this, but Wageningen is a world leader in research on commodities future markets.'

USING TRANSACTION DATA

Pennings and his Wageningen colleagues want to study whether it is possible to use data from the Limited Order Book to find out whether transactions have taken place that broke the rules. Agri-business traders buy and sell grain or potatoes, for instance, on the futures market in order to cover themselves for the consequences of price fluctuations. 'Sometimes the price goes up and down in nanoseconds. Nowadays many transactions are generated by algorithms,' says Pennings.

One of the problems in analysing the Limited Order Book is that economists do not have the tools to analyse this big data, which can amount to thousands of terabytes. So Pennings wants to make use of ROOT, a CERN program which is capable of storing and analysing the gigantic quantities of data generated by the millions of elementary particle collisions in fractions of milli-

> 'We are going to store and analyse the transaction data'

A trader on the Chicago Board Options Exchange, November 2017

seconds. It then converts them into graphics which reveal any deviations in the collisions or movements. 'Together with the people from CERN, we are going to store and analyse the big data on transactions in ROOT. The question is whether we shall find deviations that way.'

SPOOF INTEREST IN BUYING

One of the anticipated anomalies appears when a trader uses algorithms to put a series of buying orders on the market at just below than the market price. This creates the impression that there is a lot of interest in buying. Other traders notice that and buy the forward contract, thus pushing up the price. This 'spoofing algorithm', as it is called, then cancels the buying orders and sells the trader's own contracts at a profit. All this happens in nanoseconds. In 2010, spoofing led to a flash crash in which one trillion dollars' worth of stock exchange value evaporated on the Chicago Mercantile Exchange in a matter of seconds.

'The buying and selling of commodities on the futures market should always be based on correct information. That is a fixed rule of the game. In spoofing, the information is false because the buyer has no intention of actually buying. That is not allowed.'

Pennings wants to use ROOT not only to track down spoofing, but also in the end to be able to say how much risk there is that spoofing is about to occur, based on monitored market transactions. A forecast based on analysis of big data can be wrong too, of course. 'That is why it is ultimately up to the law courts or the financial market authority to determine whether there is any question of spoofing.'

Pennings has just embarked on a three-year research project, and cannot yet say what the data will reveal. He now has stock exchange data from 2015 at his disposal. Maybe that was a very virtuous year in which no one behaved badly. Pennings laughs: 'There is never a dull year on the stock exchange, never. You see, we are going to go ahead with CERN and we don't know exactly where we'll end up. There is a chance that it leads to something relevant to society. The only thing we know for sure is that it's going to be very interesting.' ■

www.wur.eu/wur-cern-joinforces

Lisa Becking researches the coral reefs around the Raja Ampat islands in Indonesia.

‘Coral reefs are social-ecological systems’

Marine biologist Lisa Becking has just come back from an expedition to the coral reefs around the Raja Ampat islands in Indonesia. Her view of nature as a social-ecological system is reflected in the diverse crew she took along with her. At the university too, she is strongly in favour of diversity.

TEXT ROELOF KLEIS **PHOTO** ERIK MEESTERS

The coral reefs of the Raja Ampat islands to the west of the Bird’s Head Peninsula, West Papua, are a paradise on earth and home to nearly 600 species of coral and 1500 species of fish. But how long will these reefs withstand the consequences of warming seawater and a growing tourism industry, wonders marine biologist Lisa Becking. She is just back from an expedition to the region, where the team studied the state of the coral. For once, not because it is degraded. Actually, the coral here is thriving.

Many reefs around the world have been affected by ‘global bleaching’: increased seawater temperatures causing the world’s reefs to become bleached and die off. ‘But not in this area,’ says Becking. ‘Here the ecosystem appears to be resilient. Why is that? Is it the biology, the enormous diversity here, or could it be thanks to the management of the six marine nature reserves in the area? And what can we learn from that for nature reserves in other parts of the world?’
Raja Ampat gets promoted for tourism purposes precisely because the reefs are still so beautiful. ‘That tourism context was important for this expedition’, says Becking. ‘Tourism has increased by more than a factor of 30 since I first went there 10 years ago, from 900 visitors per year back then to 30,000 now.’
The expedition went to two marine protected areas, which are exploited for tourism to differing extents. Almost pristine reefs were compared with spots visited by large numbers of tourists. The programme included the usual ecological measurements to gauge the quality of the reef. What was different about the expedition vessel the *Temukira*, though, was the make-up of her crew. Besides ecologists and biologists, there >

PHOTO BARBARA KIEBOOM

LISA BECKING

Lisa Becking (1978) is a tropical marine biologist and an assistant professor in Wageningen. She graduated in Biology at the University of Amsterdam (2004) and got her PhD at Naturalis Biodiversity Centre and the University of Leiden (2012). Becking has received various grants and last December won the L’Oréal UNESCO Award for Women in Science. Becking writes a monthly column in the Dutch newspaper *de Volkskrant*.

were also sociologists, modellers and engineers on board. Ecological and hydrodynamic research at sea went hand-in-hand with sociological and economic research onshore. The firm conviction behind this is that nature conservation and the resilience of nature are inextricably bound up with human activity. 'Humans have a big impact on coral reefs,' explains Becking. 'We're taking a social-ecological approach to ensuring the resilience of the Marine Protected Areas in the face of growing tourism and development. This approach explicitly links the resilience of ecosystems to governance structures, economies and society.'

Is that a new insight?

'Not really. The human factor has always been an aspect of my work. The fieldwork always starts with a cup of tea with the *kepala kampung*, the village chief, to explain what we want to do and to ask permission to work in the area. Local people always join us on the boat, and I always learn loads from them about the area, their interaction with nature, their work and village life. Only it has never been part of my research before. At some point, I realized that half of what I observed never got into my papers. Nature conservation of coral reef systems depends on both ecological processes underwater and socioeconomic processes at work above the water line.

'It is important for the university to become more diverse'

I want to integrate those processes into my work more.'

So you need knowledge about humans in order to understand and protect nature better?

'Humans influence nature and nature influences humans. Nature reserves visited by lots of tourists are social-ecological systems. Tourism is a given, and trying to keep them away is no longer realistic. I think there is a better way of protecting nature by assuming that humans are an integral part of the system and thinking about how you can change behaviour and adapt policy. No, I haven't suddenly turned into a sociologist. My aim is still to understand the natural system, but that system has become larger for me, and now I work together with social scientists.'

The effects of the tourism are clearly visible, especially on land, says Becking. 'You start seeing social change, in terms of the activities taking place in the village. Access to the area has increased substantially. Two years ago, there was a slow boat every two weeks; now there are three high-speed ferries a week. There is an airport. The number of B&Bs, most of them huts on poles, has shot up. Villagers who used to live from fishing alone now combine it with tourism-related activities.'

Last December, Becking received the L'Oréal-UNESCO Award for Women in Science for her research in Raja Ampat. The aim of the award is to support women scientists in their academic career, thus contributing to getting more women into top academic jobs in the Netherlands. 'I am on a tenure track. Most scientists embark on that with the idea of working towards a professorship.'

Does a scientist have to be ambitious?

'I think all scientists are ambitious, only their ambitions take many different forms. At the moment the definition of a successful academic is extremely narrow: someone who is competitive, writes a lot of papers and brings in a lot of funding.'

EXPEDITION

The Resilience of the Richest Reefs expedition to the Raja Ampat islands (West Papua, Indonesia) in January studied the resilience of coral reefs in relation to diving tourism in the area. It was financed by the KNAW from the SPIN programme, and by the Dutch Young Academy. The team consisted of scientists from the Netherlands and Indonesia as well as local teachers, nature conservation organizations and policymakers. Besides Becking, WUR was represented by the coral ecologist Erik Meesters, the economist Eva van den Broek, the modeller Ingrid van de Leemput, the sociologist Machiel Lamers, and the PhD students Ludi Aji and Ery Atmodjo.


PHOTO JOOST BOITEMA

Lisa Becking studies the sponges of the coral reef.

What's wrong with that?

'In itself, it produces perfectly good scientists who do great research. The disadvantage is that such a narrow definition creates a very specific image of what makes an excellent scientist. It is important to broaden that image so that it reflects a range of different people. And by doing so, to make the university more diverse. It's not about lowering the bar, but about appreciating a more diverse range of qualities. Just as an ecosystem benefits from high diversity, I think the university is stronger – and, frankly, nicer – if it has people with diverse talents and qualities. Also, the complex scientific and societal challenges facing us today call for a range of different solutions and therefore for a range of different approaches and talents. Nationally, Wageningen scores poorly on the percentage of female professors. That could be partly due to that narrow definition.'

So we should make more room for diversity?

'Yes. Diversity includes gender and cultural background, and goes beyond them. It's about being able to be a successful scientist in different roles and with different talents. That would include being an inspiring leader, for instance – people who know how to get the best out of their colleagues. Or people who are excellent teachers or who engage in dialogue with the general public. By changing the evaluation system, you create a different academic culture and make room for a wider range of people. The way the evaluation criteria at WUR currently work, to become a personal professor you have to be a "sheep with five legs", as we say in Dutch. I see extremely good scientists doubting if they should stay in academia because they don't recognise themselves in the evaluation criteria for full professor. But luckily, change is in sight. The Universities Association, the Dutch Research Council (NWO) and the Royal Academy of Arts and Sciences (KNAW) have written a position paper called *Room for Everyone's Talent*. In it, they argue for recognition and rewards not just of research and publications but also for valorization, science communication, and education. I think we should aim for teams of people with different talents. Team science, rather than expecting individuals, unrealistically, to excel at everything.'

Becking's ideas about diversity and her views on nature as a social-ecological system are reflected in the varied, international crew of the expedition she led. They did the research together as far as possible. So the ecologist went along on visits to villages, and the sociologist helped take measurements at sea. As far as is practical, of course. 'We talk a lot about multidisciplinary work, but it is quite difficult to put into practice,' says Becking. 'You don't speak the same language. By being in the field together in close proximity to the problem, and seeing how other people go about their work, you gain a better understanding of the kind of data people collect and how that relates to what you do.'

How did that work out?

'The cooperation was spectacular. Everyone had a very open attitude to it. I learned a lot from other people's methodologies and approaches. For example, natural scientists are used to following protocols and instructions for their work, and taking measurements. Sociologists do that too of course, but they deliberately leave some room in their conversations with people for serendipity, the unexpected and coincidental. That creates the possibility of obtaining unexpected but highly relevant information. That interests me. I want to see whether I can build it into my research design as well.' The aim is for this pooling of perspectives to lead to a more complete knowledge of the system. The L'Oréal-UNESCO grant gives Becking five months to flesh out the idea, which she is doing at the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS) in Amsterdam. 'I get the space there to think, write and work on new ideas for proposals. It's funny really, that you need a grant to get a chance to think. The peace you need to be able to think associatively and come up with new ideas is really something we should build into our daily lives as scientists.' ■

www.wur.eu/richestreefs

Longer shelf life with smarter film

A new packaging film that adapts to changing temperatures has been developed in Wageningen. Fruit and vegetables packed in it stay fresh for longer.

TEXT PAUL DE JAGER **PHOTO** SHUTTERSTOCK

It was a stroke of luck. Eelke Westra's colleagues at Wageningen Food & Biobased Research were working on a film with high barrier properties, but when tested, the material they had developed proved as leaky as a sieve. 'We were extremely happy about that. We saw application potential as packaging film and we carried on developing the idea,' says Westra, Post-Harvest Quality programme manager. 'Step by step, we arrived at a new dynamic packaging material that is highly suitable for the packaging of fruit and vegetables in a modified atmosphere.'

Fruit and vegetables are made up of living cells which absorb oxygen and emit CO_2, explains Westra. 'If the products are packed in airtight material, the oxygen runs out and the CO_2 level goes up. Then the cells can't absorb any more oxygen to generate energy with, and they die off.'

However, respiration in fruit and vegetables depends on the ambient temperature. The rate increases at higher temperatures, and goes down at colder ones. And the new film reacts to this, adjusting its permeability to gases depending how long the product has been in the fridge or at room temperature. As a result, the packaged product stays fresh for longer.

OPTIMAL CONCENTRATIONS

'We aim at an optimal gas concentration in the packet for keeping the product fresh,' explains Westra. Under cold conditions, the film remains closed and the product is kept at the right gas concentrations. In warmer conditions, the permeability to gases increases so that the oxygen that is needed can go in and the CO_2 that is produced can go out.

The new material is a thermoplastic polymer made up of a polymer that keeps the material flexible and strong and a polymer that regulates the gas permeability. 'As far as we know, that is unique,' says Westra. 'There is no existing material with these properties. So we think we stand a good chance of obtaining a patent and of developing future applications.'

> 'There is no existing material with these properties'

SLOWING DOWN DECAY

In the food supply chain, much effort goes into keeping temperatures consistently low, to slow down decay. This is not entirely successful. Fruit and vegetables can be exposed to higher temperatures in transit, and even in the shop. As an example, strawberries might be displayed somewhere prominent but outside the chilled section to stimulate impulse buying.

Fresh products are exposed to temperature fluctuations after purchase too. A shopping

bag can get very hot on a summer's day. And at home, consumers do not always store food in the best place. The new packaging material adapts to this, extending the shelf life of fruit and vegetables and thus preventing food waste.

The new packaging material has the biggest effect on products with high respiration rates such as strawberries and mushrooms. 'Those products benefit from a regulated composition of the atmosphere, but currently they cannot be packed in film because that will make the gas conditions deteriorate quickly. Packed in our new film, though, the products keep the right gas concentrations, which lengthens their shelf life.'

This packaging has already been tested on pears and mushrooms. The pears remained firm, which is considered a quality yardstick. At this stage, the research on mushrooms mainly focused on the permeability properties of the film. The research results were promising enough to start exploring commercial applications. 'We are now talking to producers of packaging material. They see a market for this. The cost price will not be a limiting factor,' thinks Westra. 'The raw materials are no more expensive and the manufacturing process is well-known.'

REPLACING THE FOSSIL COMPONENT

Westra does have some reservations about this innovation. The new packaging material has a fossil component and a component made out of starch, which is biodegradable. 'We don't have to just accept the amount of fossil material used,' believes Westra, 'We can carry on working towards replacing that component with biobased material as much as possible. That's what we're here for as a research institute.'

But no matter how biobased it becomes, it will still be packaging, notes Westra. 'After use, it is waste, and we want as little waste as possible. And yet we do need to use it, as it has a protective function, which extends the shelf life of products. The packaging can be used for communication too. You can put a sticker on it with product information and a barcode. And the ecological footprint of the plastics used is considerably smaller than that of food that is needlessly thrown out.' ■

www.wur.eu/sustainablepackaging

Better seed brings progress to Myanmar

Farmers in Myanmar find it hard to get hold of quality seed. Wageningen scientists are working on this with the government, farmers, businesses and NGOs. This has already led to less bureaucracy, new investments and a handy app. 'Now I can buy a small rice thresher and send my children to school.'

TEXT ALEXANDRA BRANDERHORST

'More and more farmers in Myanmar have access to smartphones,' says Abishkar Subedi of the Wageningen Centre for Development Innovation. 'That is why we developed the free app Quality Seeds, which they can use to buy baskets of seeds. A basket is a standard measure in Myanmar.' Subedi leads Integrated Seed Sector Development (ISSD) Myanmar, a project in which Wageningen scientists work with the Myanmar government, agricultural research and development organizations, farmers, national and international seed companies, and NGOs on strengthening the seed sector.
On his smartphone, Subedi opens the English-language demo version of the app,

PHOTO YE AUNG THU / AFP / ANP

Farmers sowing their fields in Magway, July 2019

which won a certificate of merit in Hong Kong last year at the Asia Smart App Awards. The app is speech-controlled in Burmese, so that illiterate farmers can use it. The home screen shows pictures of rice, sesame, peanuts and legumes such as chickpeas, pigeon peas, black grams and green grams. Users can choose a crop variety and growing season, whereupon the app shows the nearest seed producers and how many baskets they have in stock. The farmers can then phone the producer to reserve seed.

'Over the whole of Myanmar there are about 15,000 small-scale seed producers who are also farmers, as well as a few national seed companies,' says Subedi. Sometimes farmers have to travel great distances to buy quality seed, running the risk that it has sold out by the time they get to the producer. The app solves that problem.

The story of farmer U Aung Myo Thant from Central Myanmar illustrates the importance of good seed. He grows rice, chickpeas and green grams, but finds himself forced to grow local varieties from seed from previous harvests. 'That seed germinates poorly, and produces seedlings that are not uniform, and gives low yields. So our product doesn't fetch a good price and we get into financial difficulties as a family,' he says.

The app has given him better access to quality seed. It solved a problem for seed producers too. Subedi: 'Seed producers need registered seed as propagation >

'Local seed germinates poorly and gives low yields'

PHOTOS ABISHKAR SUBEDI

ISSD MYANMAR WORKS ON FOOD SECURITY

Since 2017, Wageningen has been leading the ISSD Myanmar project, which works on improving the seed sector in Myanmar. The programme is funded by the Dutch government's Directorate-General for International Cooperation (DGIS). 'We are working on the availability of quality seed of a wide range of improved varieties of nutritious crops. That leads to bigger and more reliable harvests, and as a result, food security increases, people eat a more varied and nutritious diet, and farmers earn more,' says project leader Abishkar Subedi of the Wageningen Centre for Development Innovation (WCDI).
Ever since 2010, WCDI has also led ISSD Africa, in which seed experts work with local farmers, companies, NGOs, government bodies and research institutes to improve the seed sector in 12 sub-Saharan countries, including Nigeria.

material, in order to produce certified seed themselves. It used to take six months for the government to tell seed producers whether the ordered registered seed was available. Now the producer knows that within a month via the app.'
Thanks to its military regime, Myanmar was closed to the outside world for over 30 years before it became a democracy in 2011. That history has had an impact on the agricultural sector. There is not much knowledge about artificial fertilizers, for example, or about simple techniques for increasing yields. 'There are still a few older people who studied abroad, but after that the country shut itself off. It is very important now to train young people at all levels,' explains Subedi. ISSD Myanmar runs training courses on business management for small-scale seed producers, and demonstrations to introduce them to new varieties and quality seed. The sector also needs agricultural extension workers and advisors on product quality and marketing. An education project is contributing to that (see inset).

DISEASES AND PESTS

Besides a lack of knowledge, the farmers and seed producers also face more and more problems related to climate change. 'Central Myanmar is experiencing more frequent and longer periods of drought. By contrast, the delta in the west, where a lot of rice is grown, floods more often due to heavier rainfall. In one particular area, the entire harvest of green grams was washed away recently. Salinization is advancing in the lower-lying coastal regions. The changes in temperature and weather conditions are also causing diseases and pests,' says Subedi. So the farmers need seeds of resilient varieties of crops such as sesame, legumes and rice, which are more adapted to drought, too much moisture, brackish water or tolerant of diseases. To achieve this, the whole supply chain for seed is being professionalized, from the plant-breeding end to seed production and trade. The project works closely with the Myanmar Ministry of Agriculture, with consultations every six months with government bodies, businesses and NGOs to see what can be improved. As a result of these discussions, rules and regulations have been changed and time-consuming

bureaucratic procedures such as licensing procedures for seed producers have been simplified and speeded up.
Foreign seed companies can do business in Myanmar more easily now too. The Dutch ministry of Foreign Affairs and the Dutch embassy in Yangon are helping to stimulate trade, partly through financial support for ISSD Myanmar.
'It used to be a terrible job to get hold of information about all the licences you needed. Companies had to submit applications to three different departments,' explains Subedi. Nowadays an English-language website launched in 2018 provides clear information about licences for the import, production and sale of seeds. Through this website, the Myanmar Seed Portal, companies can also apply through a single channel. The applications are dealt with behind the scenes by specially trained staff.

SEED VALLEY

International companies such as Rijk-Zwaan and East -West Seed sell seeds of crop varieties from other South-East Asian countries in Myanmar, says Subedi. 'Myanmar also wants to produce its own local seed for rice, legumes, oil seeds, maize and vegetables, thereby creating more jobs. To this end, the country is allocating 800 hectares of land in Central Myanmar to both local and international companies.' This 'Myanmar Seed Valley' will also offer facilities for storage, processing, packaging and training.
The government hopes to attract foreign investors and companies with tax exemptions. The government also has plans for the small-scale seed producers, who are required to start working in seed cooperatives. 'It is easier to organize training courses and to obtain loans if we work together,' explains Subedi. ISSD Myanmar has carried out pilots for the establishment of local seed producer cooperatives. The small companies that participated had more seed to trade and saw their turnover go up. To assess the effects of this on the farmers, the ISSD team interviewed 1300 farmers. 'In total, about 62,000 farmers benefitted directly from quality seed,' says Subedi. Among them was farmer Ma Thein Nu from Chaung Oo, who grows rice, chickpeas and green grams. The seed she received germinates well and produces high yields, she says. 'Our incomes have gone up. I can now buy a small rice thresher, send my children to school, and renovate our house.'
'We are moving in the right direction,' Subedi remarks. The project leader expects that the seed sector in Myanmar will be competitive in South-East Asia in five to ten years. 'The culture in Myanmar is hierarchical. The advantage of that is that if the boss decides something, it happens.' Myanmar is the poorest country in South-East Asia and the government is determined to change that. 'When they see how good the agricultural sector is in Vietnam and the Philippines, they think: we want to achieve that too.' ■

www.wur.eu/issd-myanmar

BETTER AGRICULTURAL EDUCATION

One of the challenges for strengthening the seed sector in Myanmar is the lack of knowledge and well-trained people. Wageningen is therefore engaged in improving agricultural education in Myanmar. At present, after their three-year programme, graduates of the 15 regional agricultural colleges do not have the knowledge the agricultural sector needs, says project leader Herman Snel of the Wageningen Centre for Development Innovation. 'We identify the needs on the labour market and help organize regional councils for consultations between educational institutions, agricultural organizations, companies and government bodies. We also advise the government and encourage cooperation between ministries and the public and private sectors, to secure more support for agricultural education.' The education project is led by Aeres Group from Wageningen, and the programme is financed by Nuffic, the Dutch organization for internationalization in education.

> **'The country is allocating 800 hectares of land to companies'**

WCDI

WCDI's course 'Integrated Seed Sector Development' will be offered again in Wageningen in May.
www.wur.eu/academy

Purifying water with

wetlands

Salinization and drought are increasingly causing shortages of freshwater in coastal regions. In the Zeeuws-Vlaanderen district on the southern Dutch coast, a Wageningen solution is being tested: the purification of sewage and wastewater from industrial processes in wetlands. This could provide a buffer supply that the entire district can draw on in the summer months.

TEXT RENÉ DIDDE **ILLUSTRATION** JEROEN MURRÉ **INFOGRAPHIC** STEFFIE PADMOS

> ‘Plants contain enzymes that break down substances such as ibuprofen’

That salinization of freshwater in the coastal provinces of the Netherlands would become an ever more serious problem was something Huub Rijnaarts already knew 10 years ago. ‘In the deltas of China, Vietnam and Bangladesh, we could already see problems, with an insufficient influx of freshwater from the hinterland combined with the increasing infiltration of salty seawater due to rising sea levels,’ says the professor of Environmental Technology. In recent years, the message has got through in the Netherlands too that an adequate supply of freshwater to households, farms and industry can no longer be taken for granted. The dry summer of 2018 caused particularly serious problems, with lower agricultural yields, shortages of irrigation, cooling and drinking water, and shipping brought to a standstill.

The Rhine and the Maas rivers supply water to almost all of the Netherlands through a smart system of channels and pipelines. The province of Zeeland is the exception. It is not directly connected with this ingenious main water system and depends for its freshwater on a 120-kilometre-long pipeline from the storage basins in the Biesbosch wetlands nature reserve. ‘Particularly in dry summer periods, people and industry in Zeeuws-Vlaanderen are very dependent on the scant supply of freshwater from this pipeline. And during a long and severe drought, an adequate supply is not guaranteed,’ says Rijnaarts.

WETLAND

Since 2015, he has been doing research in the WaterNexus project on the potential to collect used freshwater and brackish water and to purify and reuse it, starting in Zeeland. He is doing this with 24 partners: universities, research institutes, consultancy firms, technology suppliers, water boards and water companies. A total of 15 PhD students and two postdocs are doing research on different aspects of the topic. At the heart of the project is something called a helophyte filter, now on a small scale, but potentially several hectares in size. The filter is a natural basin – which Rijnaarts calls a ‘constructed wetland’ – that provides natural purification. ‘The wetland removes organic matter and micro-pollutants that pose problems for the reuse of the water in agriculture and nature, or for the desalinization of the water.’

The first applied tests by WaterNexus are taking place at Dow Benelux, which has the biggest chemical plant in Western Europe in Terneuzen. The plant needs 20 million cubic metres of cooling and processing water a year. ‘This company’s main production resource is under pressure. In times of scarcity, industry is the first to be cut off from the pipeline. That hasn’t happened yet in the Netherlands, but in an emergency, drinking water and water for sensitive nature get priority,’ says Rijnaarts. The farmers, who increasingly need water to irrigate both their arable fields and their greenhouse crops in the summer months, are not at the top of the priority list of water consumers either. And given the salinization of surface water, they cannot just pump water out of the ditches to water their fields.

CONDENSING STEAM

Dow Benelux, which is encountering a freshwater scarcity not just in Zeeland but at many delta locations around the world, can reuse about half the water used in its plants. ‘By condensing the steam from the production process into water, for instance,’ explains water specialist Niels Groot, professor and water technologist at Zeeland University of Applied Sciences. Dow obtains the other half of the water it needs from Evides water company. ‘Some of that water comes from the pipeline from the Biesbosch, but in order to be less dependent on river water, especially in the summer, we get some of it from purified domestic wastewater from the municipal wastewater treatment installation run by the water board in Terneuzen,’ says Groot. The cooling processes, which take six million cubic metres, are the biggest water guzzlers for Dow. ‘We try to go on reusing that cooling water as long as possible. To protect our pipes we have to add anti-corrosive materials, as well as chemicals to control legionella bacteria. Because a lot of this processed cooling water evaporates during cooling after hot processes, the residue that remains gets more and more concentrated and salty,’ explains Groot. Dow discharges this water in the Westerschelde estuary, to the tune of about 1.5 million cubic metres a year.

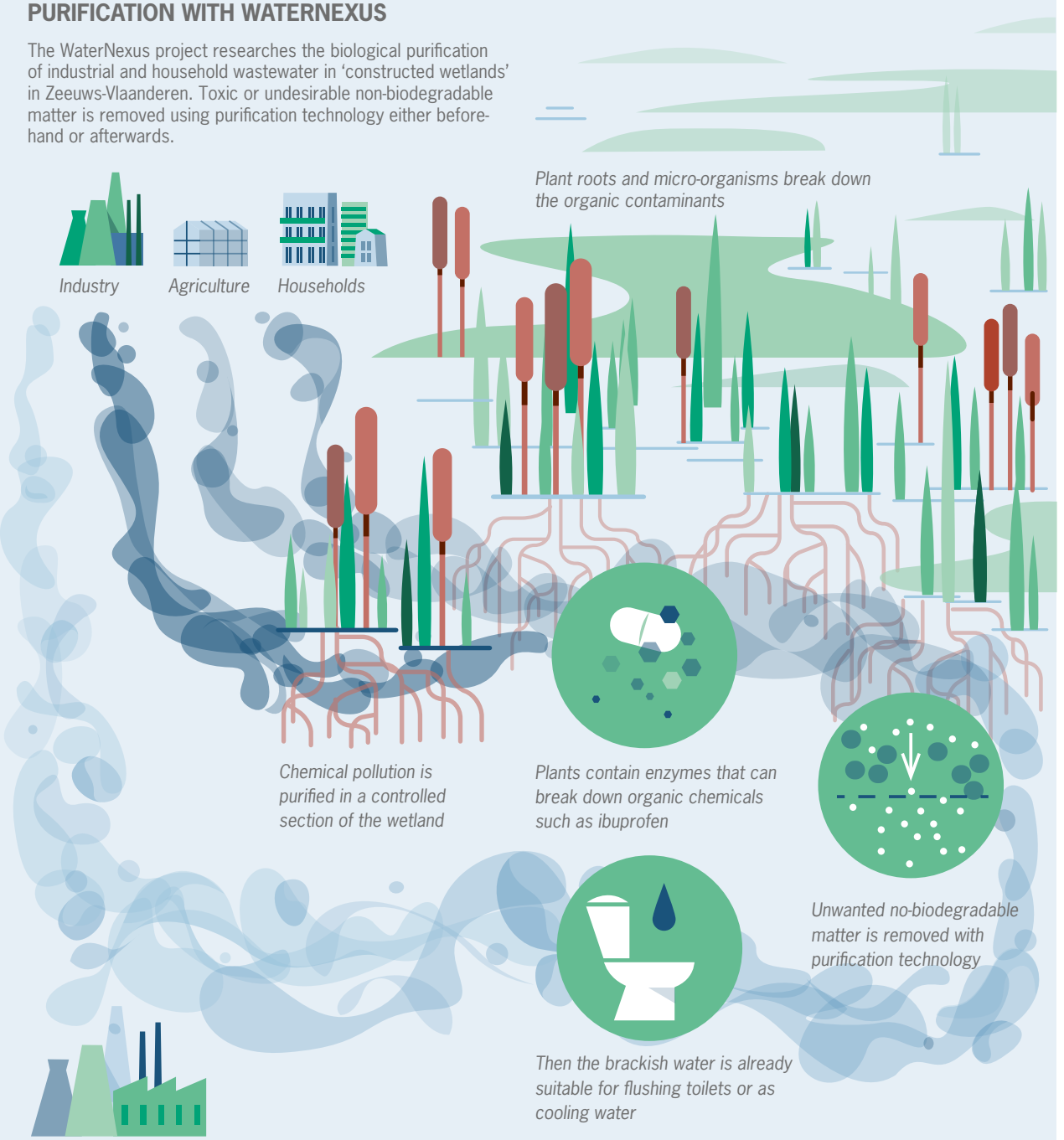
This wastewater can be treated in WaterNexus’s helophyte filter to make it fit for reuse, say Groot and Rijnaarts. The wetlands are not in contact with ground- and surface water. And the biological purification in such wetlands can break down much more chemical pollution than a lot of people imagine, says Rijnaarts. Industrial process chemicals that Dow adds to the cooling towers could be broken down in the scaled-up wetlands of the future. That is WaterNexus’s ambition. ‘The chemicals could be broken down in a small, controlled area of the wetland, after which the water flows through to the main area for storage,’ says Rijnaarts. There humus hydrocarbons are also removed that are naturally present in water and become concentrated due to the evaporation of water in cooling towers. ‘The whole process creates a supply of good quality water for getting through the dry season.’

EIGHT BASINS OF REEDS

On a small trial plot in Wageningen, PhD student Thomas Wagner demonstrates what this gentle, biological purification process in a wetland looks like. Eight basins containing algae and reeds are irrigated with ‘cooling water’. ‘It is not the real saline cooling water from Dow; I replicated that water in the cellar of our lab,’ says Wagner. ‘The basins contain sand to which humus particles stick, and the plant roots absorb disinfection and anti-corrosion substances, which the micro-organisms on the roots then break down further.’ A number of the basins contain >

PURIFICATION WITH WATERNEXUS

The WaterNexus project researches the biological purification of industrial and household wastewater in 'constructed wetlands' in Zeeuws-Vlaanderen. Toxic or undesirable non-biodegradable matter is removed using purification technology either beforehand or afterwards.

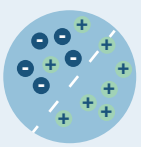


Desalinization

The surface water in Zeeuws-Vlaaderen, like many other parts of the world, is plagued by salinization. For some forms of reuse, the water is desalinized afterwards. New energy-saving techniques are used for this, which were developed in Wageningen.

Capacitative deionization
Porous electrodes attract and absorb salt ions

Electrodialysis
Ion-selective membranes selectively let positive or negative ions through



> ‘We can design an alternative water network for the whole of Zeeuws-Vlaanderen’

strikingly few plants. ‘In those we have looked at the breakdown of the same substances by sunlight,’ says Wagner, who received his PhD for this study at the end of February.
One of the things he studied was how to achieve optimal aeration of the roots and the micro-organisms by letting the water flow through the basins both horizontally and vertically, and varying the speed of the flow. He also studied the optimal order for the basins. ‘The main lesson is that we shouldn’t aim to break down as many pollutants as possible in a single basin,’ says Wagner. ‘Every time, you should leave just enough pollution for the reeds in the next basin to have something to do as well, so they can grow and break down the contaminants.’ He adds: ‘We want to work with these kinds of compartments in the real-life situation too, in what we call engineered or constructed wetlands.’ At first he succeeded in breaking down 40 per cent of the anti-corrosion materials, and now he has reached an elimination rate of 100 per cent. ‘The micro-organisms need to be given time to evolve and to adapt to the pollution.’

UPSCALING QUICKLY

Meanwhile, similar basins have been installed on the site of Evides water company next-door to the Dow plant in Terneuzen, where the optimal configuration figured out in Wageningen will be tested on real cooling water. Wagner does not expect problems. ‘I hope that after this test, Dow can quickly upscale to the demonstration scale of several hundred square metres with larger quantities of cooling water than the 150 litres a day I test here. Eventually we’ll need a few hectares.’
And that is not all, says Rijnaarts. ‘Plants have enzymes at their disposal that work in the same way the human liver works to break down waste products. The cytochrome P450 enzyme system, for example, can break down organic chemicals such as the medicine ibuprofen in wastewater.’ Making use of these plants would mean that domestic wastewater in Zeeland towns doesn’t have to be discharged into the sea but can be purified in a wetland and saved for reuse. That is a good method for all domestic wastewater in the Netherlands, which is full of pharmaceutical residues. It might also be feasible to purify water left over from the cultivation of bell peppers and aubergines in the greenhouses of Terneuzen in the basin. ‘And farmers from the surrounding area could store their surplus water from the fields in the winter in this kind of wetland,’ adds Johan Elshof of the farmers’ branch organization ZLTO. ‘In times of drought in the summer, they could pump it back to water their outdoor crops.’

TOXIC CHEMICALS

WaterNexus does not focus exclusively on gentle, biological techniques, though. ‘For a few substances, such as non-biodegradable chemicals, we use hard chemical decontamination technology to extract them from the water,’ says Rijnaarts. ‘Before the wetland treatment for toxic substances for the plants or organisms in the wetland, or afterwards if they are problematic for reusing the water.’
For some applications it is necessary to desalinate the water too. With desalinization techniques, the researchers want to be able to reduce the salinity of the wetland water to any level required. ‘Some crops or nature areas can cope with a bit of salt water, and toilets in houses and business premises can be flushed with brackish water too,’ says the technologist. If the water for industrial or agricultural purposes needs to be less salty, then WaterNexus wants to use the most energy-saving desalinization techniques. So not only using reverse osmosis, a widely used technique, pushing saltwater through

WATERNEXUS

WaterNexus is a project in which partners collaborate on new solutions for the water supply in coastal zones facing shortages of freshwater. It is financed by the Dutch Research Council (NWO) through the ministry of Infrastructure and Water Management and supported by 24 partners. Besides Wageningen University & Research, they include six other universities (the University of Amsterdam, VU University Amsterdam, Utrecht University, and the Technical Universities of Delft, Eindhoven and Twente), research institutes such as Deltares, KWR, TNO, and STOWA, consultancy firms (Witteveen+Bos, RH-DHV and Fugo), technology suppliers, water boards and the water companies Evides, Oasen and WLN. WaterNexus is coordinated by Professor Huub Rijnaarts of the Wageningen Environmental Technology group.

a membrane so that the salt stays behind on the membrane filter. That uses a lot of energy for pumping and for cleaning the membrane. WaterNexus is considering two energy-saving techniques developed in Wageningen: electrodialysis and capacitive deionization (see illustration).
If the purification process in the trial basins is upscaled to the level of large natural reed filters used in combination with these more heavyweight techniques, Rijnaarts thinks it can produce a sizeable buffer of water that the whole district can draw on in the summer months. WaterNexus therefore wants to create models that calculate the supply of and demand for water of different qualities, with a view to honing the management of the 'second-hand water'. Rijnaarts: 'We can soon develop an alternative network of this kind for the whole of Zeeuws-Vlaanderen, reducing its dependence on the Biesbosch pipeline. This design could be in place in 10 years.'

FISH IN THE DESERT

Shell is involved in WaterNexus too. Environment manager Albert Janssen: 'The project is interesting because it researches integral solutions for the real world.' Shell needs cooling and processing water too, but also ends up with water that is discharged when fossil fuels are extracted from deep layers of rock at all its oil and gas extraction locations around the world. 'This production water can contain a wide variety of salts. So we are very interested in how the wetlands can improve the quality of this water and which plants can grow in it,' says Janssen, who studied in Wageningen and has been a part-time professor in the Environmental Technology group for several years. In the Gulf state of Oman, Shell's partner Petroleum Development Oman has created a wetland on the edge of the desert. 'We are exchanging experiences with WaterNexus on that. There are now all sorts of birds and fish in a place where there used to be nothing but desert.'

The valuable flora and fauna that the wetlands foster is an important aspect for the Netherlands too, says Rijnaarts. It means cycling and walking routes can be part of the landscape. So WaterNexus has invited the nature conservation organization Natuurmonumenten, the nature management agency Staatsbosbeheer and some environmental organizations to collaborate on a follow-up project aiming to strengthen the green dimension of the concept. 'You see,' says Huub Rijnaarts, 'whether there is a WaterNexus project or not, nature is going to be faced with salinization due to rising sea levels. Salt can have negative effects, but we can also create unusual nature areas out of freshwater-saltwater transition zones. And don't forget that these wetlands don't just purify water; they also absorb the greenhouse gas CO_2, thus contributing to climate mitigation.'

WATER IN AMSTERDAM

What can be done in Zeeland can also be done in other coastal provinces, reckons Rijnaarts. In Amsterdam, for instance, the supply of freshwater in dry summers is dwindling due to the diminishing influx from the Rhine and the IJsselmeer. At the same time, more and more saltwater is seeping into the soil from the polders and through the big new locks in the North Sea Canal at IJmuiden. Reusing water purified in wetlands could be part of the solution to this. 'Just like all big cities, Amsterdam needs to create more green infrastructure to cope with overheating in the city and make it more liveable,' says Rijnaarts. 'What is more, cities can combine green water purification with rainwater harvesting from extreme rainfall, helping to prevent flooding of the sewerage system.'
Together with the Institute for Advanced Metropolitan Solutions and the water board Waternet, Rijnaarts is studying various options for improving the Amsterdam water system. There is also potential for exporting this way of thinking about freshwater and salinization to other deltas. Several twinning projects are already part of the WaterNexus project. In the city of Khulna in Bangladesh, a proposal is being drawn up to purify urban wastewater instead of discharging it into the river. Rijnaarts: 'Once treated, that urban water supplies clean fresh water that can be used for agricultural purposes.' In Ho Chi Minh City in Vietnam, the Saigon and the Mekong rivers converge in the Mekong delta. 'There are enormous industrial estates there with hundreds of companies that cannot get any more processing water from the rivers because seawater has infiltrated beyond the factories' intake points,' explains Rijnaarts. Three PhD students, two of them Vietnamese, are researching the possibility of using a wetland in combination with hard technologies for the reuse and storage of water, and for purifying industrial wastewater. But in other countries such as China, Qatar, Oman and Saudi Arabia too, a combination of wetlands and desalinization technology could contribute to an extensive reuse of water, says Rijnaarts. 'There too, WaterNexus wetlands have a lot to offer.' ■

http://waternexus.nl/

HUUB RIJNAARTS
professor of Environmental Technology:

'Cities can combine green water purification with harvesting rainwater from extreme rainfall'

ALUMNUS GIE LIEM TAKES HIS AUSTRALIAN STUDENTS TO THE NETHERLANDS

‘I have praised Wageni

After his PhD in Wageningen, nutrition researcher Gie Liem left for Melbourne. Regardless of the enormous distance, he comes back regularly, and this year he brought a group of enthusiastic Australian students with him. ‘The links between nutrition research, government and industry are strong in the Netherlands.’

TEXT MARION DE BOO **PHOTOGRAPHY** GUY ACKERMANS

Wrapped up warm in woollen scarves and hats, a group of Australian students walks across Wageningen Campus with a biting east wind against them. At home last week it was over 30 degrees. ‘I’m practically freezing to death,’ says a girl in a thick down jacket. ‘I had hoped it would get even colder,’ says a fellow student. ‘I’ve never seen snow!’ Nutrition expert Gie Liem (45), who took the initiative for the study tour, can’t help laughing. ‘Some of these students have never been outside Australia,’ says Liem. ‘That is why we organize our International Food and Nutrition Study Tour every other year. It’s a two-week tour of top-ranking international research institutes, and I’ve taken my students to various countries, including the US, Thailand, Singapore and Malaysia. This year it’s time to visit the Netherlands.’

Liem embarked on a degree in Human Nutrition in Wageningen in 1994. He is now associate professor of Sensory & Consumer Science at Deakin University in Melbourne, Australia. His motive? ‘I want our students to get an international perspective.’

GENERATING KNOWLEDGE

‘The Netherlands is the second biggest food producer in the world. In this country, the knowledge generated in Wageningen gets applied in agricultural practice. Australia is 183 times bigger, but is only in 15th place as a food producer. And the Australian food industry is a lot less innovative than the Dutch one. A nice thing about this kind of study tour is that you have so much more contact with your students. I chat a lot with them about their career prospects and I encourage them to seize the opportunities they get, for example by finding out about the options for further studies in the Netherlands. I have praised Wageningen to the skies to my >

Alumnus Gie Liem, associate professor at Deakin University in Melbourne, with his students of Nutrition and Dietetics on campus in Wageningen.

ngen to the skies’

> ‘I want our students to get an international perspective’

students.’The group is made up of 27 BSc and MSc students of nutrition and dietetics, most of them women. Some of the participants are already working in the food industry and are doing a Master’s at the same time. There is also a paediatrician who is doing a Master’s in nutrition to deepen her knowledge of the field. The students have to apply to join this study tour, and pay a contribution to the costs of about 4000 Australian dollars.
From their base at the StayOkay hostel in Soest, the group is visiting not only the Nutrition and Food Technology department in Wageningen but also the Nutrition Centre, the Netherlands National Institute for Public Health and the Environment (RIVM), the ministry of Ministry of Health, Welfare and Sport (VWS), the Netherlands Organization for Applied Scientific Research (TNO), the Nutrition Alliance at the Gelderse Vallei hospital, FrieslandCampina and The Hague University of Applied Sciences. Liem has connections everywhere – university friends and other Wageningen contacts. ‘Just like me, they have climbed slowly up the ranks over the past 20 years. When I got in touch, all the doors flew open for us.’’

AFTER GRADUATING

‘An intensive study tour like this helps students to look beyond national borders and explore what they want to do after or maybe even during their degree course. Spend a term studying in the Netherlands, perhaps? The links between nutrition research, government and industry are strong in the Netherlands. And thanks to the Nutrition Centre, communication about nutrition research to the general public is done well here. There are lots of ex-Wageningen students at the Nutrition Centre.’
Conversely, two groups of Wageningen PhD students have travelled to Australia, where Liem was in charge of hosting them at Deakin University, and put them in touch with other Australian institutes. Liem: ‘We set up an exchange programme, too. Students from Wageningen can come to Deakin for a short period, and vice versa, without having to pay extra tuition fees.’
The group’s hostess on this bitter Wednesday morning is Monica Mars, who started her degree in Human Nutrition in 1994, like Liem, and is now an associate professor in the Sensory Science and Eating Behaviour chair group. Mars and Liem did research together on children’s flavour preferences as part of their graduation thesis work. And that is still a relevant theme in this chair group. ‘You cannot make children unlearn their inborn preference for sweet things, but you can teach them to enjoy new flavours,’ says Professor Kees de Graaf, who taught both Mars and Liem 25 years ago. He is now leading a large-scale research project focussing on the potential for influencing the preference for sweetness, with a view to weight loss. Test subjects follow a sweet or a non-sweet diet for six months, to find out to what extent that alters their preferences.

GIE LIEM (45)

Works: As associate professor, Deakin University, Melbourne, Australia
Studied: Human Nutrition, 1999
PhD: Monell Chemical Senses Center, Philadelphia, USA and Wageningen University, 2004

LOWLANDS POP FESTIVAL

After the introduction there is a demanding substantive programme in which the results are presented of a multi-sensory study at Lowlands pop festival in the Netherlands. Test subjects were invited to smell, taste and evaluate all kinds of foods at an improvised food market, and then had a memory test sprung on them. Where did you see this product? People have a kind of spatial memory for where you can find which food. And it transpired that they recall the locations of high-calorie foods significantly better than those of other foods. No doubt this characteristic was helpful for survival in prehistoric times. Nowadays it just helps you get fat.
The students are surprised to hear that the degree programme is taught in English and that almost all Wageningen Bachelor’s students go on to do a Master’s. ‘Higher education works differently in Australia. There is no distinction between applied and academic degree courses,’ says Liem. A student adds, ‘A Bachelor’s degree is considered a good starter’s qualification for the job market.’ The opportunities for distance learning, such as Massive Open Online Courses (MOOCs), appeal to them too. Liem: ‘Deakin University is itself very active in the field of distance learning. That is quite usual

Australian students have lunch in The Spot student café on Wageningen Campus.

in Australia, as you could see in the TV series *The Flying Doctors*. Long before the internet existed, children in the outback of this vast country received distance education through transistor radios.'

The students are fascinated by the new technologies they get the chance to look at today. 'Food out of the 3D printer, and gastroenterology research *in vitro*, what astonishing ideas,' says Jasmine Wright. 'I'd never seen anything like it. Up to now we have mainly sat in the classroom. On a study tour like this you suddenly discover a ton of possibilities for using technology for food research. I've picked up loads of ideas for topics I would like to do research on later, such as links between nutrition and health, or personalized dietary advice.' Her fellow student Kobe Ferteis would like to go on to work on campaigns to promote healthy diets and public health. 'Very interesting to hear how all that is funded in the Netherlands and which strategies have been adopted. I would love to set up a similar system in Australia.'

Matthew Silipo was fascinated to hear first-hand about the relations Wageningen nutrition researchers maintain with the private sector. 'Nice to see that applications of scientific research in daily life are so much in evidence. That keeps both students and professors motivated.'

ENVIRONMENTAL PROTECTION

In passing, Gie Liem tells us a bit about his career. 'I originally came to Wageningen to study Environmental Protection, but I soon found out it was too technical for me, and that I would prefer to work with people. My family are all in the medical world. The cutting edge where nutrition meets health and psychology fascinates me. Why do people eat what they eat? And why do they sometimes eat so much they get far too fat?

Liem was involved in numerous extracurricular activities alongside his degree in Human Nutrition. Like driving the veterinary ambulance in Rhenen. 'But that mainly came down to scraping dead cats off the asphalt and answering phone calls from people who had seen a lost dog but couldn't catch it.' He was also a reporter for the local radio station Rijnstad FM. 'Local news about all sorts of things, first on Friday evenings and later from seven to nine in the morning before I went to lectures.'

That was how he came to interview Marije Weits during the introduction days for new students. She was a biology student on his corridor in the Rijnsteeg student residence, whom he was eager to impress. 'She was not best pleased.' But they have now been married for 19 years and have three children. Monica Mars still uses a video in her lectures of Liem's firstborn baby Stijn pulling a face the first time he was offered tastes of sweet, sour, salty and bitter foods.

ADVENTURE

In 2004, Liem got his PhD for comparative research on the taste preferences of American and Dutch children, done in Philadelphia and Wageningen. 'After that we wanted to go to Australia because it was an adventure. So when a job came up at Deakin University, I went for it and we have stayed there ever since.'

Liem comes to Europe regularly for conferences, and always pops in on friends and colleagues in Wageningen. Two years ago he had a five-month sabbatical at WUR and FrieslandCampina. Wageningen's nutrition research is among the best in the world, according to Liem. It is more structured here than in Melbourne. 'The presence of all those big companies on the campus adds value. And there is a lot of money here for nutrition research, as well as good facilities.' He stayed in a static caravan with his nine-year-old daughter Loren. 'It was a special experience to cycle through Wageningen with her. She went to the Jozefschool, where I did a study on children and sour drinks in 2003, as part of my PhD research. So Wageningen felt very familiar. The same supermarkets, cyclists everywhere, the directness of the people. And Loren loved the drinking chocolate in the Leeuwenborch.' ■

AN ARTIST AMONG THE SCIENTISTS

Desire to downsize

Artist Arne Hendriks is spending a year and a half among the researchers on the Wageningen campus. As artist in residence, he wants to help scientists by looking at the protein transition through a different lens.

TEXT ANJA JANSSEN **PHOTO** PETER LIPTON

Arne Hendriks enjoys a big challenge. Like the transformation that human beings must go through as a species to restore balance in their relationship with the planet. 'How we are going to produce our food is possibly the most important chapter in the book on that transformation. And within that, the transition to different sources of protein is hugely important,' says Hendriks.

The artist is in his element in Wageningen. 'Here, one big narrative is being written: everyone who works here has connected in one way or another with stories about us as a species, and about how we relate to food. Every day, thousands of incredibly dedicated people contribute to those stories. To me, that is really inspiring. And it could be really inspiring for everyone. Actually I would love everyone to be able to spend a period in residence at WUR.'

Since September 2019, Hendriks has spent two days a week on the campus, helping scientists to take a look at the transition to a more plant-based diet through a different lens. At Hendriks' request, we meet in an indoor garden on the campus. 'The surroundings affect how you feel, how you talk and how you think,' he says. That is why he is thinking about creating a Diego Rivera-like mural somewhere on the campus, to portray the past, the present and the future of the protein transition. 'Murals are much more than pictures. They represent a space for thinking that can go on providing inspiration for a long time.'

But Hendriks's main artistic expression on the campus takes the form of stories, ideas, presentations, encounters and, hopefully, inspiration. 'Sometimes all I do is to create space for other people to shine or to meet each other.'

> 'I create space for investigation'

Hendriks is fascinated by the human craving for abundance. By way of illustration, he brings out a pile of postcards. They are 'exaggeration cards', showing giant bunches of grapes, apples, melons or fish. 'I can look at them for hours. To me, these cards are a splendid visualization of our deep-rooted longing for abundance, and the promise that everything is going to be all right. That promise of abundance is very much alive in Wageningen. But we have come to realize that the promise is not for ever. I find it very interesting to see how on the one hand, we as a species go off the rails – because of that longing – and how, on the other hand, we have the capacity to gain new insights and to act on them.'

As a counterbalance to the craving for growth, Hendriks studies all things small, and the desire to downsize. In this context,

The Incredible Shrinking Man is a key figure in Arne Hendriks' work.

ARTIST IN RESIDENCE

Arne Hendriks (1971) has an 18-month posting as artist in residence at Wageningen University & Research for two days a week. WUR contributes to the costs of this project, which also receives funding from the DOEN Foundation of the Dutch Charity Lotteries. University Fund Wageningen brokered that contribution. The Fund sees the project as important because Hendriks can offer scientists a whole new perspective on the theme of the protein transition, says public relations officer Fusien Verloop. 'And he can bring people together in a playful fashion.'

he launched The Incredible Shrinking Man project 10 years ago. 'This is the crux of my work, in a way. The Shrinking Man is based on the naïve idea that we human beings need to become smaller, because then we won't need to consume as much and we'll be more capable of living in balance with the planet. We can shrink that so passionately desired abundance.'

Hendriks brought The Shrinking Man along to Wageningen. 'It is the lens I use to look for the small, for less, for downsizing. That might be a very practical example of smaller cows instead of large cows, or of algae instead of lettuce, but it is also about our obsession with growth and how we can aspire to less rather than more.''

CHICKETARIAN

Hendriks also introduced eight characters with their own visions about our trajectory as a species. He aims to use these characters to collate and examine the narratives about the protein transition. There is the 'oceanic farmer', for instance, who farms seaweed and algae at sea, while the 'chicketarian' believes a visit to Kentucky Fried Chicken can save the world.

For a while now, he's been walking around the campus with pictures of these characters, and asking people to comment on them. He calls this a job application procedure, to see whether the characters are capable of doing their jobs. 'I thought it would be thought-provoking to invite these kinds of speculative figures into a research context.'

In all the discussions and encounters of his first six months, Hendriks felt 'incredibly welcome'. 'When you are doing scientific research these days, there is not much room for stepping outside your own straight lines, whereas scientists are generally very creative people. I try to provide a creative space they can step into, and where we can collaborate. The main aim is of course the transformation. But a transformation starts with having the space to take steps.' ■

LECTURE

‘We must switch to fossil-free clothing’

The use of polyester in clothing is still on the up. That situation is not tenable, said biobased materials researcher Paulien Harmsen in a World Lecture in Wageningen. ‘We need to switch to fossil-free clothing in the future.’

The World Lecture on sustainable fashion got the audience thinking.

Of the raw material used in clothing, 92 per cent is new rather than from waste streams or old clothes, and 73 per cent of the material ends up on rubbish dumps or in incinerators after use. ‘Clothing waste is growing because the industry produces an enormous amount of clothing, fashion is only briefly in the shops and the quality is often poor, which makes recycling as second-hand clothes difficult,’ says researcher Paulien Harmsen. She was one of three speakers at the World Lecture on the transition to sustainable fashion at Wageningen campus in November. World Lectures are an initiative of Wageningen Ambassadors and are organized with the aim of updating WUR alumni and business relations on societal and technological developments.
It is often difficult to recycle clothing because of its complex composition. ‘At present, almost everything contains some elastane and that clogs up the recycling machines. Clothing that is 100 per cent cotton or 100 per cent polyester *can* be recycled.’
But polyester is made from fossil raw materials. ‘In recent years, it has supplanted cotton and wool in the textile fibre market, and its use in clothing is still on the up. That situation is not tenable. We need to switch to fossil-free clothing in the future,’ says Harmsen. That means more renewable raw materials are needed such as hemp, flax or bamboo – materials that contain cellulose, as cotton does.

The lecture attracted around 70 mainly young alumni to Wageningen campus. An audience of the clothing-aware, it turned out. ‘I asked them whether they ever looked at the clothing label and knew what their clothes were made of, and most did know that,’ says Harmsen. ‘They’re probably not representative of the rest of the population. There were also quite a few people who sometimes wear second-hand clothes.’
The World Lectures are organized by Wageningen Academy and KLV.

NETWORKS

Gatherings of Latin American alumni


Alumni in Bogota, Colombia

Last autumn, there were meet-ups of alumni in Ecuador, Peru, Colombia and Mexico, says WUR’s representative in Latin America Francisco Martinez (WUR Organic Agriculture 2010).
Every autumn, Martinez travels to these countries to represent Wageningen at major education fairs. ‘I was looking for some additional activities as a way of promoting a study in Wageningen. And alumni are the best ambassadors,’ says the Mexican Martinez, who lives in the Netherlands. Martinez was able to bring people together using Facebook groups of alumni in the countries in question and with the support of the alumni office. The Dutch embassy and the Dutch organization for the internationalization of education Nuffic were involved too in some countries. Martinez describes these gatherings as sociable, small-scale reunions in an informal atmosphere. For example, in the Colombian capital Bogota, about

‘Alumni are the best ambassadors’

20 alumni including 5 Dutch people had dinner together. ‘It was really nice meeting them, swapping information and looking back at the great times in Wageningen.’
Info: alumni@wur.nl

GRANT

‘I hope to be able to set up my own research group’

On 26 November 2019, entomologist Chantal Vogels received the Marina van Damme grant of 9000 euros. ‘This will let me attend training courses on an innovative technique for large-scale testing of viruses.’

The aim of the Marina van Damme grant is to broaden and deepen the careers of female scientists. Vogels (WUR Biology 2012) will use the grant to learn a new technique. ‘The big advantage of this technique is that I will be able to test all variants of a virus in one go rather than having to study individual variants separately.’ Vogels is working as a postdoc at the Yale School of Public Health in New Haven (USA). She wants to use the technique in her research on the Zika virus. She hopes to be able to predict the extent to which the virus variants can adapt to new environments. ‘For example, whether Zika can be transmitted more easily by mosquitoes after a genetic adaptation.’

PHOTO VERA WILDERS

Chantal Vogels (left) and Judith Houtman

Only a few laboratories can use the new test method, says Vogels. ‘Without the grant, I would never have had the funds to learn the method and I would have been dependent on experts who have mastered this technique. Learning such techniques will help me find my own unique niche and set up my own research group.’ Vogels would like to return to the Netherlands for that. ‘But that depends on the opportunities that come my way.’

In addition to Vogels, Judith Houtman (WUR Nutrition and Health 2012) also received a grant of 9000 euros. Nienke van Staaveren (WUR Animal Sciences 2012) was given an encouragement grant of 2500 euros.

Info: www.universityfundwageningen.eu/marinavandamme

GATHERING

Alumni visit circular-agriculture farm

On Thursday 14 November 2019, over 50 Wageningen alumni visited the Eytemaheert nature farm in the Drenthe village of Leutingewolde. They were shown how nature-inclusive circular agriculture works.

Alumni at Eytemaheert nature farm

Eytemaheert became one of WUR’s research farms at the end of 2019. Maurits and Jessica Tepper’s farm borders Leekstermeer lake and the Onlanden Natura 2000 nature area. They have 150 blaarkop cows that are fed purely on grass, as the Teppers told the alumni in their barn. They do not use any fertilizer or animal feed brought in from elsewhere. However, the farm takes clippings from the adjacent nature area and turns them into the fertilizer bokashi, a mix of clippings, clay and microorganisms that break down the cell structure of the hay. The Teppers are also trying out other things such as growing oats and malting them for use as an ingredient in beer. They also plan to milk their blaarkop cows so that they are used as both beef and dairy cattle.

Alumni gatherings in the regions of the Netherlands are organized by University Fund Wageningen and KLV in partnership with the region committees.

REUNION

PHOTO GUY ACKERMANS

Alumni give to charity

On Saturday 26 October 2019, alumni who started their degree 25 years earlier returned to Wageningen while the freshers of 50 years ago had their reunion on Saturday 16 November. Both groups collected money for charity. The 1994 cohort donated 1000 euros to the Anne van den Ban Fund. This fund lets high-potential students from developing countries study at Wageningen. The donations by the 1969 cohort, also around 1000 euros, will go to the Belmonte Arboretum Foundation, which manages the university’s former botanical garden.

Next autumn it will be the turn of the freshers from 1970 and 1995.

Info: www.wur.eu/25yearreunion
www.wur.eu/50yearreunion

Prof. Duur Aanen, WUR PhD 1999, has been appointed professor holding a personal chair in Evolution Biology in the Genetics chair group at WUR. 30 October 2019.

Prof. Bram Bregman, WUR Environmental Protection 1991, has been appointed professor of Climate Change Interactions between Science and Policy at Radboud University. Bregman also heads the Department of Nature and Rural Areas at the Netherlands Environmental Assessment Agency. 2 December 2019.

Tijs Breukink PhD, a member of the WUR Executive Board from 2005 to 2017, has been appointed interim member of the executive board of Fontys until a successor is found for the former board member Nienke Meijer. 1 January 2020.

Prof. Adri van den Brink, WUR Land Development 1978, emeritus professor of Landscape Architecture at WUR, has been appointed visiting professor in the Landscape Research Group of the Czech University of Life Sciences in Prague. 10 December 2019.

Jan-Willem van den Beukel MSc, WUR Forestry 2006, has been appointed alderman for the municipality of Lansingerland, responsible for sustainability, greenhouse horticulture, greenport, finance and land matters. Van den Beukel, a member of the CDA political party, has worked as a manager at the accountancy firm PriceWaterhouseCoopers and as a policy officer for the CDA parliamentary party. 20 February 2020.

Prof. Erwin Bulte, WUR Forestry 1992, professor of Development Economics at WUR and member of the Royal Netherlands Academy of Arts and Sciences, has been appointed a member of the Social Sciences Council (SWR). 1 January 2020.

Aalt Dijkhuizen PhD, WUR Agrarian Economics 1977, President of the WUR Executive Board from 2002 to 2014, has become chair of the Landbouwcollectief, the association that combines all the farming lobby groups on the nitrogen issue. 5 November 2020.

Corné Kempenaar PhD, WUR Phytopathology 1988, project manager of the National Experimental Centre for Precision Agriculture, has joined the Board for the Authorization of Plant Protection Products and Biocides (CTGB). 14 January 2020.

Bernard Koeckhoven MSc, WUR Agrarian Economics 1983, chair of the Horticultural Academic Board, is the new chair of the supervisory board of RHP, the European centre of expertise for substrates. 1 January 2020.

Eisse Luitjens MSc, WUR Agricultural Plant Breeding 1978, has joined the board of the Foundation for Applied Water Research (STOWA). Luitjens is a business developer with the Investment and Development Agency for the Northern Netherlands (NOM) and a director of the Noorderzijlvest water board. 1 December 2019.

Prof. Hans Komen, WUR Biology 1985, has been appointed director of the graduate school Wageningen Institute of Animal Sciences (WIAS). Komen is a professor holding a personal chair in the department of Animal Sciences at WUR. 1 January 2020.

Prof. Dirk-Jan de Koning, WUR Zootechnics 1996, has been appointed international fellow of the Royal Swedish Academy of Agriculture & Forestry. De Koning is a professor of Animal Breeding at the Swedish University of Agricultural Sciences in Uppsala. 12 December 2019.

Prof. Frank van Langevelde, WUR Land Development 1993, has been appointed professor and chair holder in the Wildlife Ecology and Conservation group at WUR. He succeeds Prof. Herbert Prins, who retired at the end of October 2019. 1 October 2019.

Nicole Olland MSc, WUR Environmental Protection 1998, has become director of the Unie van Bosgroepen, an association of independent cooperatives of forestry and nature area owners. She was previously an

Valuable lessons from the mountains

Katja Staartjes MSc, WUR Food Technology 1988, who became the first Dutch woman to climb Mount Everest in 1999, wrote *Topteams – Samen bergen verzetten* ('Top teams – moving mountains together').
The book is intended for everyone who works in a team, says Staartjes, who gave up her job as a manager in the dairy industry to climb the world's highest mountain.
When she is not on a mountaineering expedition, Staartjes gives talks on collaboration and leadership. She also worked for several years as an interim manager and these days she is a coach. 'Over the years, I've formed an increasingly clear picture of the issues in leadership and collaboration. I incorporated these insights in this book. 'I hope to inspire people to get more out of themselves and their teams.'
Staartjes describes the issues using the phases of an expedition. 'Mountains are a powerful metaphor. Everyone comes up against their limits when they're at high altitudes, where the air is thin and conditions extreme. You really get to know yourself and one another then. Collaboration becomes particularly difficult. The mountains teach us many valuable lessons for life.'
Publisher: Management Impact, 32.50 euros.

PHOTO CAREL SCHUTTE

'I hope to inspire people to get more out of their teams'

PHOTO TEB

Lucas Noldus PhD, WUR PhD 1989, professor holding an endowed chair in Behaviour, Information Technology and Innovation at Radboud University in Nijmegen, has received the Food Valley ICT Award for his company Noldus Information Technology. Noldus IT also won the Parel award given by the Economic Board, a collaboration between public authorities, knowledge institutions and the private sector in the Arnhem-Nijmegen-Wageningen region. Noldus develops measurement and analysis systems for behavioural research. November 2019.

alderman in Rheden municipality and worked as a process coordinator for the regional energy strategy of Arnhem-Nijmegen region. 1 February 2020.

Marleen Riemens PhD, WUR Plant Breeding and Crop Protection 2002, has joined the Board for the Authorization of Plant Protection Products and Biocides. Riemens is the Crop Protection team leader at WUR. 14 January 2020.

Anneke de Rouw PhD, WUR Tropical Plant Breeding 1982, has been promoted to *Chargé de recherche classe exceptionnelle* for her research on the ecology of farming systems in the Sahel and in the mountainous regions of South-East Asia at the French National Research Institute for Development (IRD), which specializes in scientific research in the tropics. 4 December 2019.

Kees Slingerland MSc, WUR Zootechnics 1985, has been appointed deputy chair of the Netherlands Commission for Environmental Assessment. Slingerland, former director of the Environmental Sciences Group at WUR, is director of the Automotive Centre of Expertise. 1 January 2020.

Prof. Karin Schroën, WUR Food Technology 1990, has been appointed director of the graduate school VLAG. She succeeds Prof. Renger Witkamp. Schroën is a professor holding a personal chair in the department of Agrotechnology and Food Sciences at WUR. 1 January 2020.

Prof. Paul Struik, WUR Agricultural Plant Breeding 1978, professor of Crop Physiology at WUR, has received the International Crop Science Award 2019. The prize is awarded annually by the Crop Science Society of America for exceptional contributions to agricultural science. 15 November 2019.

Prof. Louise Vet, professor holding an endowed chair in Evolutionary Ecology at WUR, has been appointed Knight of the Order of the Netherlands Lion. She received the royal honour from the minister Carola Schouten when she stepped down from her position as director of the Netherlands Institute of Ecology (NIOO-KNAW). 31 October 2019.

Lucie Wigboldus MSc, WUR Zootechnics 2004, has been appointed director of Nederlandse Brouwers, an umbrella organization representing the interests of 10 Dutch brewers. Wigboldus spent the last six years as director of the headquarters of the VVD political party. 20 November 2019.

IN MEMORIAM

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

Mr B.M. Arnolli MSc. WUR Tropical Forestry 1973. 21 November 2019.
Mr J.P. Augustijn MSc. WUR Forestry 1977. 6 December 2019.
Mr L. van den Berg MSc. WUR Dairy Production 1953. 18 May 2019.
Mr H.M. van Binsbergen MSc. WUR Tropical Rural Economics 1964. 22 December 2019.
Mr S. de Boer MSc. WUR Rural Economics 1962. 21 November 2019.
Mr C.J.A.M. de Bont MSc. WUR Rural Economics 1974. 23 December 2019.
Mr J.P. van den Briel MSc. WUR Forestry 1986. 14 December 2019.
Mr L.C. Davidse PhD. WUR Phytopathology 1972. 5 November 2019.
Mr E. van Es MSc. WUR Forestry 1964. 2 April 2019.
Mr B.A. van der Haven MSc. WUR Zootechnics 1971. 30 September 2019.
Ms J.P. Heemskerck Veeckens-Baretta MSc. WUR Tropical Rural Economics 1953. 16 December 2019.
Mr J. Jepma MSc. WUR Zootechnics 1948. 16 January 2020.
Ms C. de Jong-Goedhart MSc. WUR Tropical Plant Breeding 1969. 12 December 2019.
Mr M. Joordens MSc. WUR Plant Breeding 1963. 5 November 2019.
Mr T.A.M. van Keulen MSc. WUR Landscape Architecture 1956. 20 November 2019.
Mr F. Kindt PhD. WUR PhD 2004. 20 October 2019.
Mr M.E. Loman MSc. WUR Agrarian Economics 1993. 20 June 2019.
Mr N.J.B. Mentink MSc. WUR Tropical Plant Breeding 1988. 23 January 2020.

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IN MEMORIAM

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Mr H.R. Pijlman MSc. WUR Rural Sociology of the Western Regions 1963. 10 November 2019.
Mr E. Stapelveld MSc. WUR Tropical Forestry 1953. 16 December 2019.
Mr E. Steinbuch MSc. WUR Dairy Production 1960. 14 December 2019.
Mr K.J. Stol MSc. WUR Farming Technology 1996. 17 October 2019.
Prof. J. Wieringa. Former professor of Meteorology. 1 November 2019.
Mr H.J.H. Zegger MSc. WUR Dairy Production 1954. 15 November 2019.

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

Wageningen alumnus at world youth forum

David Fisher MSc, WUR Plant Sciences 2019, currently working as an agricultural advisor, represented the Netherlands at the Youth Ag Summit in the Brazilian capital Brasilia in November 2019. The biennial gathering is intended to support and connect up the new generation of decision-makers in agriculture so that they are better equipped to tackle the challenge of feeding the world. One hundred young people aged between 18 and 25 came to Brasilia to network, get skills training and set up projects.

Climate change knowledge

Bart Verheggen PhD, WUR Environmental Protection 1996, climate scientist and lecturer at Amsterdam University College, has published the book *Wat iedereen zou moeten weten over klimaatverandering* ('What everyone should know about climate change'). 'The book is intended for non-specialists who want to know more,' says Verheggen, 'and for people interested in scientific knowledge on this subject so that they're better able to assess the different views in the public debate on their merits.'
Publisher: Prometheus, 15.00 euros.

KLV

KLV | WAGENINGEN ALUMNI NETWORK

KLV winding up
KLV, the alumni association for Wageningen University & Research, is in the process of closing down operations. Until that is official, in September 2020, KLV will continue to organize activities such as study circle network meetings – and these will still be held after the closure. A complete overview of activities can be found at www.klv.nl.

Young KV – Writing your first academic article.
31 March 2020. klv.nl/events

Plant breeding study circle – Thematic discussion: CRISPR-Cas
3 April 2020. klv.nl/pv

Young KLV – Everyone can network. Workshop ending with networking reception
21 April 2020. klv.nl/events

KLV – Closure AGM 1
The first member's meeting with voting on the disbanding of KLV.
30 June 2020. klv.nl/events

KLV – Closure AGM 2
Second members' meeting with voting on the disbanding of KLV.
22 September 2020. klv.nl/events

KLV Farewell event
Saying goodbye to KLV in a programme preceding the Alumni Open Day.
3 October 2020 klv.nl/events

KLV Wageningen Alumni Network is the alumni association for Wageningen University & Research. The network has about 7000 members.

More information
www.klv.nl

KLV

Jozef van de Wouw

KLV member since 2003

Horticultural Plant Breeding 1986

A PASSION FOR painting

Jozef van de Wouw discovered his love of painting by accident. When he had to organize the annual family activity in 2008, it was a painting workshop, says the vegetable seed quality manager. 'A lot of material was left over and it seemed a shame to throw it away. So I sat down and started painting. I became so absorbed that I lost track of the time.' It turned out that others appreciate the work of the self-taught artist too: Van de Wouw now regularly sells his paintings and exhibits them occasionally too. 'I often paint rugged animals such as Zeeland draught horses. Those beasts look so powerful.' Van de Wouw also likes to paint wild rock stars such as Queen's Freddie Mercury and Pearl Jam's Eddie Vedder. 'My portrait of Eddie Vedder was inspired by the number *Black*. That's why I made the background in this painting so dark.'

If you are a KLV member with a passion, or know someone who is, send an email to secretariaat.klv@wur.nl.

Visit our website www.klv.nl

PHOTO: SJOERD AARDEN

PHOTO MARDIK LEOPOLD

Ageing red-billed tropicbirds on Saba island

To use up his accumulated leave days, seabird expert Mardik Leopold spent a month on the island of Saba in the Caribbean Netherlands to study red-billed tropicbirds. About 12,000 pairs of these birds brood on the steep slopes of the island. Leopold is worried about how the population is ageing. There is a plentiful supply of food – especially flying fish, as Leopold and his co-researcher Michiel Boeken have observed. And yet this population of red-billed tropicbirds – the biggest in the world – is slowly dwindling: a lot of eggs and chicks fall prey to rats and stray cats.

'These birds reach a great age,' says Leopold. 'They come back here to brood year in year out, even when they don't manage to raise any chicks here. The number of brooding pairs can stay the same for a long time without any increase in numbers of young birds.' Nor are there any 'immigrants' to this bird colony. Red-billed tropicbirds brood on the nearby St Eustatius island too, but research has shown that there is no interaction between the birds on the two islands.

DNA research is needed to confirm that isolation, but Leopold thinks the red-billed tropicbird is extremely vulnerable to local extinction. 'Just as happened to the white-billed tropicbird. At a meeting for nature conservationists and politicians, we suggested that stray cats should be rounded up again. That's something Saba has done successfully in the past.'

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