

WAGENINGEN WORLD

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

no.4 2016



**'When there is drought
in the Amazon, global
CO₂ levels rise faster'**

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Appeal for **food policy** | Search for **new antibiotics** | Combining wind and **seaweed farms**



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WHAT WILL THE AMAZON DO?

The weather in the Amazon is becoming drier, causing the world's biggest rainforest to produce vast quantities of CO₂, with serious consequences for the climate.

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OF POULTRY AND PARTICLES

People living near poultry farms suffer from respiratory problems caused by dust and endotoxins in barn ventilation air. It could help to let chickens take their dust baths in a separate 'bathroom'.



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APPEAL FOR FOOD POLICY

European agricultural policy must stop focusing exclusively on the needs of farmers and pay far more attention to consumer demands, say Wageningen president Louise Fresco and economist Krijn Poppe.



COLOPHON Wageningen World is the quarterly magazine for associates and alumni of Wageningen UR (University & Research) and members of KLV, the Wageningen Alumni Network. A PDF version of the magazine can be found at www.wur.eu/wageningen-world **Publisher** Wageningen University & Research, Marc Lamers **Editorial Board** Yvonne Fernhout, Ben Geerlings, Bert Jansen, Jac Niessen, Irene Salverda, Erik Toussaint, Delia de Vreeze **Editor-in-chief** Pauline Greuell (Corporate Communications Wageningen University & Research) and Edwin van Laar (Editor-in-chief Resource, Wageningen University & Research) **Magazine editor** Miranda Bettonville **Copy editor** Rik Nijland **Alumni news** Yvonne de Hilster **Translators** Clare McGregor, Clare Wilkinson **Art direction and design** Petra Siebelink (Communication Services, Wageningen University & Research) **Cover picture** CIAT / Neil Palmer **Overall design** Hemels Publishers **Printer** Tuijtel Hardinxveld-Giessendam **ISSN** 2212-9928 **Address** Wageningen Campus, Droevendaalsesteeg 4, 6708 PB Wageningen, PO Box 409, 6700 HB, Wageningen, telephone +31 317 48 40 20, wageningen.world@wur.nl **Change of address alumni** alumni@wur.nl **Change of address associates** wageningen.world@wur.nl, mentioning code on address label **Change of career details** alumni@wur.nl

The mission of Wageningen University and Research is 'To explore the potential of nature to improve the quality of life'. Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.



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The world urgently needs new antibiotics. Wageningen researchers are looking for inspiration and substances in deep-sea sponges, soil bacteria and plant sprouts.

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Food waste has proven difficult to stamp out. 'Industry, consumers and the government need to come up with a joint strategy.'

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PHOTO GUY ACKERMANS

Gaps in climate data

'Transparency is essential to monitoring the effectiveness and progress of the agreements in the Paris climate treaty. That is why we argued at the follow-up conference in Marrakesh that data on greenhouse gas emissions and measures to curb them should be available to anyone. That is the only way to make independent verification possible. Openness is important, too, for estimating how much progress has been made towards the UN's Global Goals, including those for the climate and for food security.

We focused our contribution to the conference on the need to improve access to weather and climate data in Africa, where there are hardly any long meteorological time series to date. That is a serious limitation: you can predict the future better when you know more about the climatic history. The current global climate models are largely based on western data, so they are useful for describing the climate in Europe, for example. The inhabitants of Africa are not responsible for climate change but they are certainly affected by it, even though they already have to cope with a difficult climate. And what is hanging over them is not clear to anyone, not even aid organizations, because there are big gaps in the models. That is painful: the people who are the most vulnerable to climate change and the least well-informed. One of the ways being used to improve on that is to dig up meteorological data from colonial archives. We also urge governments to make their meteorological data generally available. And it is equally important that weather data is recorded in various different places in Africa and made public so that farmers get some idea of what lies ahead for them.'

Ben Schaap, Climate and Agriculture researcher at Wageningen University & Research, and research leader at GODAN, an organization promoting global openness on data on agriculture and nutrition.

TNO nutrition research comes to Wageningen

TNO's nutrition research is moving to Wageningen, the ministry of Economic Affairs (EZ) has decided. The ministry wants to concentrate applied nutrition research in Wageningen. This means the Functional Ingredients research group in Zeist will be integrated into Wageningen Research (the former DLO) from 1 January 2018. The group has been working with Wageningen Food & Biobased Research since 2015 on innovations in the field of nutrition and biobased products made from waste flows in the food industry. Like the Wageningen research institutes, TNO has been forced to cut back over recent years by declining government funding.

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EDUCATION

Most satisfied students



Students at Wageningen University & Research are the most satisfied of all Dutch university students. None of the 19 Wageningen Bachelor's programmes scores below the national average and 12 of the programmes score above average, writes Dutch magazine Elsevier, based on the results of the National Student Survey.

The Keuzegids, the guide to Dutch universities, concurs in finding that Wageningen offers the best programmes in the country – for the twelfth year running. The Keuzegids is based on the views of education experts and students, and rates almost all the Wageningen BSc programmes as 'top programmes.'

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PHOTO: SPORTPOINT / MAI GROVES / SHUTTERSTOCK.COM

Many top sportspeople have vitamin D deficiency

Seventy percent of the top Dutch sportspeople have vitamin D deficiencies. This can affect their performance and cause injuries.

Vitamin D is important for bone building and for maintaining muscle tone and coordination. So a deficiency is bad news for sportspeople. It affects their performance and slows recovery after training. At the behest of sporting umbrella organization NOC*NSF, Evelien Backx, a PhD candidate at Wageningen University & Research, did a preliminary study of vitamin D levels in top Dutch sportspeople.

For her study, Evelien analysed the blood of 128 top Dutch sportspeople, most of them hockey players, athletes and footballers. Athletes with a deficiency or suboptimal level of vitamin D were given supplements: 10, 27.5 or 55 micrograms a day for a year. For comparison: the average Dutch person ab-

sorbs three to four micrograms a day from food and the body manufactures an average of seven micrograms a day from sunlight. Backx took a concentration of 75 nanomols per litre of blood as the norm in her study of top sportspeople. Internationally, 50 is the current norm for bone health, but earlier research has shown that top sportspeople can cope with more training and perform better on 75 nanomols. Of the sportspeople studied, 70 percent came in under the lower limit of 75. The deficiency can be made up: with a daily dose of 55 micrograms of vitamin D, 80 percent of the athletes with a shortfall were back on track within three months.

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Source: resource.wur.nl

PLANT-ANIMAL INTERACTIONS

DISTANCE LEARNING

Bees track down cannabis

Bees can learn to sniff out dope. A group of Wageningen students has opened up new options to help the police locate cannabis plantations.

For the Academic Consultancy Training course (ACT), the students were asked to come up with innovative projects for combatting cannabis cultivation, based on Wageningen knowledge.

The students wondered about using bees as detectives. It was discovered in the 1980s that bees can learn to recognize new odours. This can be done in an hour using classic conditioning, with sugar water as a reward. After that, when the bee smells the

odour it automatically sticks out its proboscis. A detector for 36 bees has already been designed. In this instrument, sensors register when the bees respond to air currents carrying odours. A test in Wageningen showed that bees can learn to respond to the smell of cannabis. Further research is needed to ascertain how sensitive the method is.

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Biobased micro-master's online

Wageningen University & Research has developed its first micromaster's: Biobased Science for Sustainability. The programme offers Master's level modules but online and going at your own pace. The micromaster's consists of five separate MOOCs (Massive Open Online Courses), a final project and an exam. Students who want to gain a certificate and 24 ECTS credits (one fifth of a complete Master's programme) pay 1200 US dollars. You can take the course free of charge if you don't want a certificate or credits. The biobased micromaster's starts in January. Registration is open on edx.org/micromasters.

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COLLABORATION

Unilever on campus

Unilever wants to concentrate its nutrition-related R&D activities on Wageningen Campus. The company announced this early in October. Unilever's research centres in Vlaardingen in the Netherlands, Heilbronn in Germany and Poznan in Poland are to be closed down. The multinational chose Wageningen because it wants to collaborate more with universities, institutes and startups. The R&D activities provide roughly 550 jobs. If all goes to plan, Unilever's Food Innovation Centre will open in summer 2019.

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PHOTO TASKFORCE BRABANT-ZEELAND

Bee in a detection device. If it smells cannabis it sticks out its tongue, upon which an infrared ray is interrupted and a square on a screen turns red.

WAGENINGEN ACADEMY

New distance learning modules on plant breeding

Wageningen Academy is now offering two additional distance learning modules on plant breeding. The new modules are: F1 Hybrids, and Mutation breeding. In total there are now five modules on plant breeding, all taught in English. The distance learning course started in 2013 and covers basic and more complex breeding and selection methods, new technological developments and underlying biological concepts.

The distance learning modules Plant breeding and Plant pathology & entomology are designed for professionals. They can compose their own tailor-made course from the mix of modules offered. Wageningen University also offers an online MSc programme in Plant Breeding, aimed at international MSc students.

www.wur.eu/academy

Fungus curbs reproduction of fruit fly

An insecticidal fungus has proven effective in curbing the reproduction of the destructive fruit fly *Drosophila suzukii*, suggests research at Wageningen Plant Research.

The *D. suzukii* fruit fly, originally from Asia, has been causing increasing damage in Europe and the United States to fruit such as cherries, blueberries, blackberries and raspberries. The fly lays its eggs in healthy ripening fruit. Wageningen collaborates with related institutes on integrated crop protection for fruit through research on prevention and response to pests and diseases. The effect of *Metarhizium robertsii* was discovered during testing of various insecticidal fungi. Fruit flies in a cage were lured towards a bowl containing fungus and blueberries. The offspring were counted four weeks later. When the fungus used was *M. robertsii*, hardly any offspring came out of the berries. The fungus killed off most of the insects before they could lay any eggs. If the odour trap with fungus is used before the fruit is ripe, the researchers think there is a strong chance of successful pest control. They are going to test this in 2017.

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PHOTO ANP



PHOTO HOLLANDESE HOOGTE

Burning stubble pollutes air in China

The air pollution on the northern China plateau caused by burning stubble is more serious than believed.

A team of researchers, among them Folkert Boersma of the Wageningen Meteorology and Air Quality chair group, has managed to quantify the pollution using satellite measurements. After the harvest in June, mainly of wheat and maize, the stubble in the fields is burned to clear the fields and provide a form of fertilizer. This burning causes a great deal of air pollution in a region with more than 300 million

inhabitants, and it is bad for their health. The fires send the ozone concentration in the troposphere up by 7 percent, and cause an 18 percent increase in fine particles in the air. The measurements are twice as high as previous measurements taken from the ground. The research results were published at the end of August in Scientific Reports.

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RESEARCH

Best agricultural university

The National Taiwan University Ranking 2016 has ranked Wageningen University & Research as the world's best agricultural university for the fourth year running. For the subcategories Plant and Animal Sciences and for Environmental Sciences and

Ecology, Wageningen is ranked in second place. The NTU Ranking rates universities on the basis of publications and their impact. Overall Wageningen UR rose to 146th place in the rankings.

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AGRICULTURE AND CO₂

Trees on farmland have more impact on climate than believed

Trees on farmland make a bigger contribution to CO₂ sequestration than was believed till now. So agroforestry deserves more attention in climate plans.

Agriculture is responsible for one quarter of global greenhouse gas emissions. One source is livestock and another is the felling of forests to create space for farming. Climate models for this process tend to assume that farmland hardly stores any carbon.

An international group of researchers, including Meine van Noordwijk, special professor of Agroforestry at Wageningen University, collected data about trees on land categorized as farmland. From sources including satellite images, it can be seen that in 2010 there was at least 10 percent tree cover on half the agricultural land. What is more, the surface covered with trees was 2 percent larger than in 2000. The agroforestry this figure represents raises CO₂ sequestration in farmland from 5 to 20 tons of carbon per hectare. Trees on

land where livestock are kept or crops tilled have stored nearly 0.75 gigatons of carbon per year for the past ten years. For comparison: 0.85 gigatons of carbon is released annually through the transformation of rain-forest into farmland.

The most trees were planted on farmland in China, India, Brazil and Indonesia. According to the researchers, this is a reflection of increased attention in these countries to climate-smart agriculture. Trees on farms contribute to milder temperatures, soil retention and nitrogen fixing, which in turn helps soil fertility. Trees also help combat erosion. The most forest disappeared in Argentina, Myanmar and Sierra Leone. The study was published online in July in Scientific Reports.

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Source: resource.wur.nl

ENVIRONMENT



Rating of landscape drops below 6

The Dutch are giving the landscape in their immediate surroundings a lower and lower rating. In 2015 they rated it at just below 6 out of 10, shows a study by Martin Goossen of Wageningen Environmental Research (formerly Alterra). Since 2006, Goossen has been collecting data on the tastes in landscape of visitors to the website daarmoetikzijn.nl. 'In 2009, the average rating of the more than 47,000 visitors to our website was over 7,' says Goossen. 'But then the rating dropped steadily.' An explanation for the downward trend has yet to be found.

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CONSUMPTION

FoodProfiler tracks your eating habits

Wageningen Economic Research is using an app to collect data about patterns of consumption. The FoodProfiler asks users once or twice a day what they have eaten in the last two hours. If enough answers are submitted, users get an analysis of their eating habits. 'We didn't have any data about exactly what people eat and when. The trends in these data provide particularly interesting insights, for example into changes in the timing of eating and differences between cities,' says Jos van de Puttelaar. In the two months since the launch, nearly 2000 people have answered the questions using the Dutch app. There are English and German versions of the app in the App Store and Google Play too.

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PHOTO SHUTTERSTOCK

A variety of plants is good for the soil

Plant diversity plays a big role in maintaining and restoring soil fertility. The roots of various plant species complement each other in contributing to the structure and stability of the soil. This was demonstrated by soil biologist and personal professor Gerlinde de Deyn of Wageningen University & Research, together with colleagues from the UK and Germany, in a series of field experiments with monoculture and mixed cropping. Their results came out online in July's *Ecology Letters*. Deep-rooted legumes such as bird's foot trefoil can speed up the rate at which rain-water soaks into the ground, make the soil stronger and fix nitrogen. Grasses, with their fairly delicate roots, form a network that keeps soil particles together. This knowledge can be useful for making crop production more sustainable and protecting dykes against erosion.

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PHOTO SHUTTERSTOCK



PHOTO LINEAR

Drought kills elephants too

A lot of elephants die during persistent droughts in the African savannah. This is because food becomes scarce in areas where there is still water.

This finding came out of research by PhD candidate Yussuf Wato and colleagues at the Resource Ecology chair group in Wageningen, and a colleague in Kenya. Wato works for the Kenya Wildlife Service. He studied the influence of periods of drought over nine years in the Tsavo Conservation Area, a cluster of national parks in Kenya. He used satellite images of the vegetation and data about the location of carcasses. He only included elephants whose deaths were not caused by poachers or disease in his research.

Elephant deaths occur mainly after about four months of drought, and then usually in the vicinity of rivers, shows a study that appeared in *Biological Conservation*. Elephants need to drink every two days so if they stray too far from water they die of thirst. But during dry periods the lack

of vegetation is the main cause of death. Wato also makes clear that drought is a natural mechanism regulating elephant numbers. In national parks where the animals can also make use of artificial water sources, near lodges for instance, populations often get out of control.

The decline of the African elephant is usually put down to poaching and shrinking habitats. At the end of September, nature conservationists sounded the alarm about the growth in the illegal ivory trade. 'The new data show that drought is at least as important a factor in the decline of the elephant,' says Wato's co-supervisor Ignas Heitkönig. If periods of drought become more frequent as a result of climate change, it will be more and more difficult for elephant populations to recover.

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PLANT SCIENCES

Student discovers old Japanese crops

A surprising variety of cereals grew in Japan around 1800. Besides rice, these included barley, millet and buckwheat. Wageningen Master's student Shantonu Abe Chatterjee discovered this by studying a rare botanical agricultural catalogue from Japan, which dated back to around 1800.

Peppers grew in the fields at that time, too, which must have been imported by the Portuguese. There were also orange carrots, and lilies were grown for their edible bulbs. The book, printed on rice paper, is part of the Siebold Collection at Leiden University Library. The document had not been studied before; the text is in Japanese.

The variety of cereals suggest that Japan was not completely isolated before the arrival

of Von Siebold in 1823, as has often been assumed. Half of the crops described are no longer grown in Japan, but perhaps they are still present in the wild. Abe sees opportunities here for plant breeders wanting to develop new crop varieties. The catalogue contains many drought-tolerant cereals, for instance.

Source: resource.wur.nl

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A Japanese lily

HEALTH

Book about nutrition and dementia

Eating and drinking often become problematic for people with dementia. Loneliness can play a role in this, as well as changes in perceptions of taste. Yet it is possible to get dementia patients enjoying their food, says researcher Ondine van de Rest at the department of Human Nutrition at Wageningen University & Research. She and journalist Jeroen Wapenaar wrote a book for people

with dementia, their carers and health professionals, called Voeding en dementie: gezond en genieten in 1 recept (Nutrition and dementia: health and enjoyment in one recipe). The book provides background information on the problems that can present themselves and practical stories which show what is still possible.

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PHOTO SHUTTERSTOCK

INFECTIOUS DISEASES

Adaptability of fungus is doctor's dilemma

Aspergillus is highly sensitive to change. Any disturbance, whether natural or caused by human activity, can stimulate the fungus to adapt.

The finding comes out of research on the development of resistance at the Laboratory for Genetics at Wageningen University & Research, and Radboud University Medical Centre. *Aspergillus* fungi are common and are found for instance in compost heaps, where they contribute to the breakdown process. But they can cause lung damage. Infection with these fungi is particularly problematic for lung patients or people whose immune systems are weakened. The new knowledge poses a dilemma for doctors: treatment with drugs can soon provoke resistance, but not treating an infection can give the fungus a chance to get even better established in the lungs. The study came out in November in *The Lancet Infectious Diseases*.

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**LASERS, SATELLITES AND TAPE MEASURES TELL US
HOW THE RAINFORESTS COPE WITH CLIMATE CHANGE**

What will the Amazon

The weather in the Amazon is more often dry nowadays and when it is, the world's biggest rainforest produces vast quantities of CO₂. This may be the forest's death warrant, with serious consequences for the climate. Wageningen researchers see both signs of stress and a surprising degree of resilience.

TEXT ARNO VAN 'T HOOG PHOTO ANP INFOGRAPHIC STEFFIE PADMOS

A photograph of a lush tropical rainforest. In the foreground, a thick, gnarled tree branch extends diagonally from the bottom left towards the top right. The background is a dense canopy of green trees and foliage, with some mist or fog visible in the upper parts of the forest. The overall scene is vibrant and detailed, showcasing the biodiversity of the Amazon.

amazon do?

‘We can already pinpoint the vulnerable areas of the forest’

In Manaus, the capital of the federal state of Amazonas, the weather is always humid and oppressively hot. This metropolis in the heart of the Brazilian rainforest sees little variation in daylight hours or seasons: maximum temperatures in the hottest and coldest months, October and February, are not far apart, at 32 and 30 degrees respectively. The difference between day and night temperatures is bigger, at seven degrees, but it never gets colder than 23 degrees.

The only thing that does vary is the rainfall. Every year there is an extremely wet period and a somewhat less wet period, which falls between June and October. The total rainfall is high: an average of 2100 millimetres per year in Manaus (compared with 880 in the Netherlands). In the far west of the Amazon there are districts which get as much as 3000 to 6000 millimetres of rain per year.

DRY YEARS

A lot of water combined with heat and sunlight provide ideal conditions for luxuriant plant growth. This becomes apparent when rain suddenly becomes scarce, as it did in 2005, 2010 and 2015. The vegetation grew at a slower pace and there were more forest fires. Ingrid van der Laan-Luijkx, a postdoc at the Meteorology and Air Quality chair group, can even see such effects from Wageningen by studying the air quality above the Amazon. ‘We compared air quality data from 2010 and 2011. There was a serious drought in the Amazon in 2010. That is directly reflected in less CO_2 absorption by the trees and in the release of more CO_2 due to the breakdown of biomass and forest fires. So in that dry year the Amazon was a net producer of CO_2 , whereas in the more normal year 2011, the Amazon absorbed more CO_2 than it released. Worldwide atmospheric concentrations of CO_2 are rising every year, but they rise faster when there is a big drought in the Amazon. This happened again in 2015 under the influence of the global drought caused by El Niño.’

Van der Laan’s lab is working with Brazilian researchers who take regular air samples from a small plane at different altitudes above the Amazon. Hundreds of bottles of air are posted to the Netherlands where infrared measurements reveal the CO_2 concentrations. The measurements provide the data for the Carbon Tracker computer model, developed by Van der Laan’s colleague Wouter Peters, professor of Carbon Cycle and Atmospheric Composition. Carbon Tracker creates an overview of the carbon balance of the Amazon.

Fluctuations in the carbon balance entail significant quantities, says Van der Laan. The global combustion of oil, gas and coal produces about 35 gigatons of CO_2 . During a dry period, the Amazon produces around 0.9 to 1.8 gigatons of CO_2 . ‘So it really is significant in relation to fossil fuel emissions. It is equivalent to between five and ten times the Netherlands’ annual CO_2 emissions.’

THINNER CROWN

Drought causes problems for trees and other plants which are used to a humid environment. The crowns of trees thin out and some trees die off completely. But not all forests are affected to the same extent. Jan Verbeest, associate professor at the Wageningen laboratory for Geo-information Science and Remote Sensing, wants to gain a better understanding of these differences by taking a good look at the recovery of tropical forests after a drought. A forest’s resilience tells you something about how much it will be able to cope with.

Verbeest works with satellite images. Some modern satellites detect microwaves emitted by vegetation, or they use radar to see through the clouds from an altitude of 700 kilometres. The European Sentinel 1 satellite, for example, films the Amazon several times a week with a resolution of 20 by 20 metres.

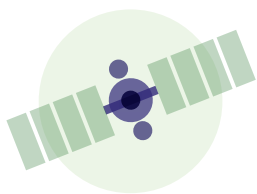
When Verbeest compares and analyses these images, changes in the rainforest gradually emerge over the weeks and months. ‘We look at the quantity of leaves

and the photosynthesis. These vary over time because in dry periods the photosynthesis and number of leaves go down. In rainy periods the forest recovers again.’ If the post-drought recovery goes slowly, that is a sign of stress in the forest, says Verbeest. ‘We can now pinpoint which areas of the Amazon would be vulnerable to even more major droughts, or to fires or felling. We want to use our method to develop a warning signal, so that people can be more careful with vulnerable forests.’

Verbeest published an article in *Nature Climate Change* in the autumn of 2016, together with Marten Scheffer, professor of Aquatic Ecology and Water Quality Management in Wageningen. The article is based on satellite research on the recovery of rainforest and approaching tipping points: the points at which forests reach a level of stress that will cause widespread death of trees if drought hits again. The big question is whether such devastation is lasting: will the rainforest then change into a drier forest, or even into an open savannah landscape? There are several model studies which suggest that this kind of reversal is possible: tropical forest can indeed change into a savannah landscape after repeated droughts.

FAST RECOVERY

This same issue is the focus of field research in tropical forests for Lourens Poorter, personal professor of Forest Ecology and Forest Management in Wageningen. One thing strikes Poorter repeatedly: tropical vegetation has a great capacity for recovery. If people leave felled or burned tracts of forest, abandoned fields or farmland undisturbed, the land becomes overgrown with weeds, shrubs and trees in no time. Ten years later there is a young forest, and 60 years later a mature one. In the longer term, it is hard to detect signs of earlier deforestation. Poorter: ‘Even I can’t, and I’ve been knocking around the tropics for years. When I was in Guatemala I saw a gorgeous forest with a strange topography. There were steep climbs and descents. Apparently, the ruins ➤



Satellites measure the foliage and the photosynthesis using microwaves.



Aeroplanes take air samples to determine the concentration of CO₂.

CARBON BALANCE IN THE AMAZON

The Amazon region plays a major role in the global CO₂ balance. Drought has big implications for carbon sequestration by the tropical rainforest, and that is the key to more precise forecasting of the global climate.

Amazon forest

The Amazon forest is the largest rainforest on earth (5.5m km²), spread over 9 countries.



Annual rainfall in the Amazon

2000 mm



Annual rainfall in the Netherlands

880 mm



Secondary forest

Vast amounts of CO₂ are absorbed by the vegetation that regrows on open tracts of land after felling, fire or farming. In this secondary forest the biomass is restored to its original level.

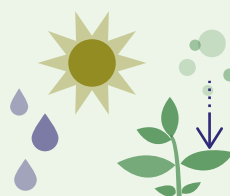
All the secondary forest in Latin America (most of it in the Amazon) can sequester 31 gigatons of CO₂ in the next 40 years.

That is just as much as was produced in the countries of Latin America between 1993 and 2014.

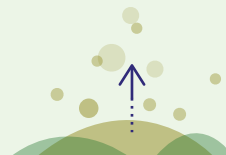
31 Gton

CO₂ absorption and emissions

Under stable conditions in the Amazon, when numbers of new seedlings and tree deaths are equal, absorption and emissions of CO₂ are more or less balanced:



The large amounts of water, heat and sunlight make for abundant plant growth, leading to CO₂ storage.



When plants are broken down, for example due to microbes which digest dead wood, CO₂ is released.

CO₂ production during drought

The weather is becoming drier in the Amazon. This slows the growth of plants and causes die-off, so that less CO₂ is stored while more is released.

0.9-1.8 Gton



CO₂ emissions by the Amazon in dry conditions (5 - 10 x the annual emissions of the Netherlands)

35 Gton



Annual global emissions of CO₂ from the burning of oil, gas and coal

Ecological research shows in detail which species are present.

The capacity of secondary forest to absorb CO₂ is 11 times bigger than that of virgin rainforest.

11X



PHOTO WUR/JEFFREY VAN LENT

Researcher Jeffrey van Lent (left) measures CO₂ emissions from the soil in the Amazon forest.

of an old Maya city were buried in the hills. The vegetation looks like virgin forest but it is actually an overgrown ruin. You have to look very carefully to spot any signs of that old civilization. Ecologists who know the local vegetation well showed me that there are a lot of fruit trees, species which were once planted by the Mayas.'

For Poorter, such observations are evidence of the resilience of the rainforest, which may also tell us something about its likely response to climate change. 'We are all doing research, but we do not understand the real mechanism yet. That makes it so important to pursue a combination of different approaches. With the remote sensing that Jan Verbesselt and Marten Scheffer use, you can see things on a far bigger scale than I can see as an ecologist. Except that from a great height everything just looks green: you don't know whether it is shrubs or trees you are looking at. So it is important to validate your findings on the ground with ecological studies of tracts of forest. Looking for example at which species grow there, and tying a tape measure around

every tree to measure its girth. The numbers tell the tale.'

Poorter uses ecological data in new calculation models to predict the effects of climate change. In a publication which came out in August 2016, he and his German colleagues model how forests respond to more frequent droughts. The result came as a surprise to most people: the forest may change in the composition of species present but it remains tropical rainforest, with more or less the same amount of biomass and of sequestered CO₂.

THE FOREST REGROUPS

The key to this resilience lies in biodiversity, says Poorter: 'Older model studies predicted that things would go badly wrong as a result of climate change: you would end up with dry forest or savannah. But those models work on the basis of plants with only two characteristics: evergreen and deciduous. That is not a realistic reflection of the vegetation of the Amazon. In the new model, we calculate with plants with a wide variety of characteristics. Then you see trees first

dying out as conditions get drier. But after that you get succession. The plant community starts regrouping and the trees and plants which are successful are those which are a bit more drought-resistant. The whole system bounces back and the biomass recovers to its original level. So biodiversity is crucial for a healthy and resilient ecosystem.' He sees similar resilience in the growth of what is known as secondary forest: the vegetation which returns after felling, fire or farming. This almost exponential capacity for recovery after deforestation is no surprise, says Poorter. 'On open patches you get a lot of light, water and nutrients. At first, pioneer plants and young trees can grow unhampered and the growth rate of biomass and the absorption of CO₂ are tremendous. That capacity is 11 times bigger than that of an undisturbed rainforest, because in a stable rainforest trees die off at the same rate as new ones grow, so the absorption and emissions of CO₂ are roughly balanced.' Two articles Poorter published in the spring of 2016 together with Latin American colleagues systematically describe the capacity

of secondary forest to absorb carbon using studies of 1500 tracts of forest. The researchers calculate that the secondary forest all over Latin America can sequester 31 gigatons of CO₂ over the next 40 years. That is the amount the countries of Latin America produced between them between 1993 and 2014. Most of that secondary forest is in the Amazon.

Poorter hopes his research will generate interest among politicians and policymakers in the natural recovery of secondary forest as a cheap way of protecting biodiversity and storing CO₂. 'It is important to protect virgin tropical forest but we really need to rethink our ideas about the value of secondary forest. The term "secondary" may make it sound second-rate, but it is the way nature goes about restoring forest. If there are still any bits of forest left, we don't have to do much at all for recovery to take place.' Carbon sequestration is just one of the functions which is saved this way. Tropical forests also have a water cycle: they create their own climate and precipitation, says Poorter. 'Forests pump water around. Trees and plants transpire vast amounts of fluid, which get transported away by air currents, sometimes referred to as "flying rivers". This means that if forests disappear in the Amazon, there are consequences elsewhere in South America, for agriculture in Paraguay or for drinking water in Sao Paulo, for instance.'

THE ROLE OF WATER

Lourens Poorter's ecological research delivers a range of data for improving the Carbon Tracker and the underlying biosphere model SiBCASA, says Professor Peters. 'What are the dominant tree species and how much do they grow every year? What does the root system look like? How do they react to dry and wet conditions?' Water determines the progress of many processes in the Amazon, says Peters. 'You get loads of rain and massive evaporative. And rivers carry water away as well. This balance determines how much water is

available for the vegetation and that varies enormously per region of the Amazon. In some districts the root systems of trees go down to a depth of seven metres, so they are less affected by drought. What I want now is to gain a far better understanding of the role of water in the carbon cycle of the Amazon.'

The next stage for Peters is to fine-tune the Carbon Tracker for use in the Amazon, as although the computer model shows us that the Amazon produces CO₂ in dry years, exactly what happens is not clear. Peters: 'There are always two opposing processes at work: the absorption of CO₂ due to plant growth and CO₂ emissions through breakdown by microbes, for example, which digest dead leaves and wood. These two major flows largely balance each other out. What remains is the amount of CO₂ which the Amazon releases in a dry year.' But those gigatons of CO₂ do not tell us which of the two flows changes the most, says Peters: do the trees absorb much less CO₂ or is much more released due to the breakdown of biomass? 'That question is crucial too for being able to predict what will happen if it gets hotter and drier more often in future.'

MONEY FOR ISOTOPES

New research on isotopes can provide insight into this. Peters had an innovative idea which won him a prestigious ERC grant from the EU in 2015. There are different variants of CO₂ because of the different carbon and oxygen isotopes in existence. Isotopes are chemically identical but vary subtly in mass. There are three oxygen isotopes: the common oxygen-16 and the rarer

oxygen-17 and oxygen-18.

'The relative proportions of the three oxygen isotopes tell us something about the processes the CO₂ has gone through,' says Peters. 'Contact between CO₂ and water has a clear impact on the relative proportions of the isotopes because of the exchange between CO₂ and water. Most of this contact takes place in plants. They continuously absorb vast quantities of CO₂ which comes in contact with water molecules. Above the Amazon, you can clearly see the isotope proportions in CO₂ change due to contact with water in plants and trees.'

The isotope research will make it possible soon to isolate the absorption of CO₂ by plants and the emissions from decomposition. Until recently, research on oxygen isotopes was fairly complex, but Peters has now used some of his grant to buy a new piece of equipment which can measure isotopes directly with laser technology. In the years to come this will provide the PhD researchers in Peters' group with a lot of data that will help them improve on the Carbon Tracker. This also means that the air samples from the Amazon won't have to be flown to the Netherlands. Peters: 'This apparatus will be installed in the lab in Brazil early next year. Then we will measure the isotopes right there in the air above the Amazon. We expect to obtain important new insights that way. In particular, the impact of drought on carbon sequestration is the key to more precise forecasting of the global climate in the 21st century.' ■

www.wur.eu/amazon

'Biodiversity is crucial for a resilient ecosystem'

RESEARCH INTO REDUCING ENDOTOXIN EMISSIONS

Of particles and poultry

People living near poultry farms often suffer from respiratory problems. Dust and endotoxins in the barn ventilation air are to blame for this. The ideal solution has yet to be found, but letting chickens take their dust baths in a separate ‘bathroom’ could help.

TEXT RENÉ DIDDE PHOTO MARCEL BEKKEN INFOGRAPHIC WUR/PETRA SIEBELINK



People living near livestock farms have an above-average risk of pulmonary conditions. If they have prior respiratory problems then they get more symptoms and need more medication. This is particularly the case for residents living near poultry farms. There is also a link between reduced lung function and the number of livestock farms in the area, and between the level of ammonia in the air and impaired lung function. These findings come from a three-year study of the health of residents living close to intensive livestock farms in the Peel region, on the border of Brabant and Limburg. The research report, which was published last

summer, had good news too. Local residents suffered less than average from allergic asthma and no evidence was found for an increased incidence of zoonoses (infectious diseases that are transmitted from animals to humans).

The research was commissioned by the ministries of Health and Economic Affairs and was carried out by Utrecht University, Wageningen University & Research, the National Institute for Public Health and the Environment (RIVM) and the Netherlands Institute for Health Services Research (NIVEL). The study was one of the largest of its kind in the world. The scientists examined patient records of 110,000 patients, surveyed

14,000 people and conducted medical examinations of 2500 people.

Endotoxins played a role in all the conditions where an effect was found. Endotoxins are fragments of the cell walls of dead bacteria, and are found for instance in manure and animal skin flakes. ‘Endotoxins cause shortness of breath, and chronic exposure leads to a decline in lung function,’ says Nico Ogink, a researcher in livestock and the environment at Wageningen Livestock Research (see box).

BRIEF FEVER

Endotoxins stick to larger dust particles in particular. As a result they spread and can



‘We need innovative ideas’

Barn full of free-range chickens.

reach people living up to about one kilometre from the barn. In high concentrations, they trigger a brief reaction with fever. In lower concentrations, they are a factor in respiratory conditions such as chronic bronchitis and non-allergic asthma. The lungs of the livestock farmers themselves are also affected by the dust and endotoxins. ‘We already know this from research on working conditions from the 1990s. Livestock farmers are still taking huge risks with their own health given the poor quality of the air in the barns. Poultry farmers would be well advised to wear protective equipment such as dust masks in the barn,’ thinks Ogink. The chickens themselves may also

have reduced lung function. ‘We’ve never actually investigated that properly. The birds have a short turnaround time and there is a lot of noise in the data with health problems from other sources such as pathogenic viruses in the barn air and bacteria in the manure.’

Pigs, goats and cows also produce dust with endotoxins, but not nearly to the same extent as poultry. That is because chickens are more active than other farm animals.

TAKING A DUST BATH

The endotoxins end up around and in the homes of local residents because they are blown out of the barn along with the dust in

the ventilation air. The quantities involved are considerable in modern-day large-scale housing systems. Chickens produce a great deal of heat, and each hen needs three cubic metres of fresh air per hour. A standard modern barn can easily contain 40,000 laying hens, so that means 120,000 cubic metres of ventilation air is being blasted out of the barn every hour, taking dust and endotoxins with it.

On top of that, the individual space for laying hens has increased to almost A3 paper size rather than A4 since 2012. ‘That makes it easier for a chicken to take a dust bath and forage in the litter with its feet,’ says Ogink. He was the co-supervisor for a ➤

PhD project completed this autumn by Albert Winkel on dust emissions from different kinds of barn. To the surprise of the Wageningen PhD candidate, he found that the modern aviary housing system, where the chickens range freely during the day and can roost at night, produced dust concentrations including endotoxins that were up to 15 times higher than for the old battery cages.

This puts the poultry sector in a dilemma: improving animal welfare leads to increased dust emissions. Winkel describes some new ideas for barn designs that could combat the dust problem at the source. Farmers are already making the layer of litter thinner in order to reduce the dust problem, but a more fundamental approach would be to move the litter. Laying hens would then eat, drink, sleep and lay eggs in a large aviary barn without any litter and take the dust baths they love so much in a separate ‘dust bathroom’. The advantage of this is that the ventilation air in the large hall would then be virtually free of dust while customized measures can be taken in the dust bathrooms.

Another option is one that is already being used for broiler chickens, in which the air is ionized with electrons. This makes the dust to stick to the ceiling. ‘The disadvantage is that it only traps the fine particles, and only half of them. It’s less effective for the larger particles that carry the endotoxins,’ says Ogink. Another, more expensive technique is to spray rapeseed oil on the litter. ‘The oil causes the dust to stick together and form larger particles, so that it is less likely to swirl up. But that approach requires a lot of cleaning as the oil also gets into the pipework.’

Up to 70 percent of the dust can be extracted from the air using what are known as ‘end-of-pipe’ measures, just before the ventilation air leaves the barn. But that

does nothing to improve the air inside the barn: the farmer and chickens are no better off.

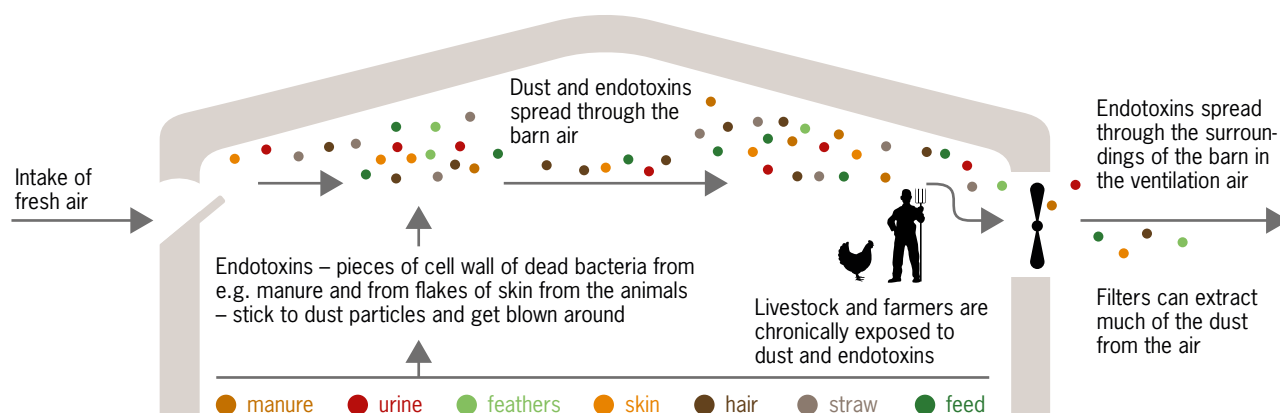
Free range systems do not offer the perfect solution either. As Ogink explains, ‘The point is that even when chickens can go outside, they prefer to spend a lot of time indoors and take their dust baths there.’

COMPETITION IN THE EGG MARKET

Farmers also think something needs to be done. ‘The Dutch Federation of Agriculture and Horticulture (LTO) believes it is important to improve the climate in the barn. Concentrations of dust in the air, including endotoxins, are far too high. Better air quality would be good for poultry farmers themselves, their chickens and the surrounding area, but the measures do need to be affordable,’ says Hugo Bens. He is on the LTO board with the environment for poultry farming in his portfolio and is himself a poultry farmer in Haps (Brabant). The egg sector is an international market where competitiveness depends on tenths of a cent per egg. Bens points out that about half the poultry

‘Measures to improve air quality must be affordable’

ENDOTOXINS IN A BARN



'The solutions have to be accepted by society'

farms have taken measures. Farmers are increasingly being required to take action as a condition for permit renewals. 'Poultry farmers are making sure the layer of litter is thinner, which helps reduce dust emissions,' he says. They are also taking end-of-pipe measures, for example in the heat exchangers that warm up incoming fresh air using the heat from the outgoing ventilation air. 'The dust gets deposited on special strips, reducing emissions into the environment.' Ammonia is also deposited onto the strips.

The Wageningen research has shown Bens that all of this is still not enough to reduce dust emissions to acceptable levels. What is more, only half of the farmers are taking steps so far. 'We are talking to Wageningen and other parties about the barn of the future. We need innovative ideas.'

SAFE LIMIT

Various studies are already being conducted to achieve this. For example, Wageningen Livestock Research is currently testing different housing systems to figure out what delivers the best performance. There is also

research planned on the safe limit for endotoxins as set by the Health Council of the Netherlands.

Furthermore, Wageningen University & Research and Utrecht University have been commissioned by the Ministry of Infrastructure and the Environment to follow up on the large-scale health study by investigating exactly which poultry farms are responsible for the respiratory problems. 'We are trying to find out for example whether the presence of pig farms in the vicinity of poultry farms has a cumulative effect on public health,' says Ogink. 'We are also trying to develop an assessment framework for endotoxins so that we can see whether the endotoxin levels in the locality of these farms remain below the safe limit. Such an assessment instrument could help when evaluating permit applications.'

ONE HEALTH

The research into the reduction of fine particles and endotoxins at the source falls within Wageningen's strategic research theme 'A Global One Health'. 'In it, we

study the complex interactions between health, genetics and animal physiology, housing systems and management by farmers,' explains Annemarie Rebel, head of Animal Health and Welfare at Wageningen Livestock Research. 'These are all cogs that are interconnected. We can no longer work on single-issue solutions without considering whether they lead to problems elsewhere.'

As an example, research is also being carried out on the feed given to chickens and the effect that has on gut flora and the production of manure. 'Making a group of chickens more robust by improving their feed means they need fewer antibiotics and may well produce fewer endotoxins,' says Rebel.

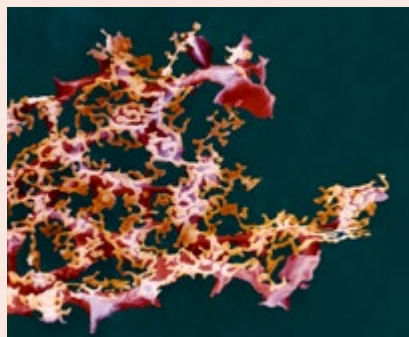
The studies involve not just agricultural scientists but also researchers in the medical sciences, economists and social scientists, who investigate the interpretation and perception of the research among farmers and local residents. 'After all, the solutions do have to be accepted by society.' ■

www.wur.eu/particulate-matter-stables

A DRY COUGH

Endotoxins are fragments of the cell walls of dead bacteria, found in the feed, manure or skin of farm animals. They adhere to dust particles in the barn, particularly the larger particles, although they sometimes stick to fine particles too (defined as particles smaller than a hundredth of a millimetre). If a livestock farmer or local resident inhales endotoxins, this can cause symptoms such as shortness of breath or a dry cough. This is followed several hours later by flu-like symptoms: tightness in the chest, headaches and painful joints.

The symptoms disappear when exposure ends, for example during a holiday, but the cycle is repeated when the person is exposed to endotoxins again. Chronic exposure leads to a clear decline in the lung function. This can make the lungs susceptible to infections, which in turn can lead to pulmonary conditions.



Electron microscope record of E. Coli endotoxins.

PHOTO: AMP

A scanning electron micrograph (SEM) showing a dense network of intertwined, rod-shaped bacteria. The bacteria are illuminated with a blue and green light, giving them a textured, almost crystalline appearance. They are arranged in various orientations, some straight and others curved, creating a complex, web-like structure.

STUDY ON NEW ANTIBIOTICS

The arms race against bacteria

The world urgently needs new antibiotics. Wageningen researchers are looking for inspiration and for promising substances in deep-sea sponges, soil bacteria and plant sprouts.

TEXT RIK NIJLAND PHOTO ANP



In the brand-new Laboratory for Microbiology on Wageningen campus, Anak Indraningrat holds up two glass test tubes containing bright orange and muted red pieces of sponge. Indra was on board when the submersible from the Curaçao Sea Aquarium plucked these specimens from the Caribbean seabed at a depth of over 200 metres. 'In Wageningen I am going to study the extracts from these sponges for their antimicrobial effects,' explains the Indonesian PhD candidate. 'Against *E.coli* for example.'

All around the world, researchers are searching for new compounds with which to keep bacteria in check. Overuse of antibiotics is making more and more pathogenic bacteria resistant to these drugs. As a consequence diseases which are still treatable at the moment, such as pneumonia and bladder infections, could become life-threatening. So new antibiotics are more than welcome.

CHEMICAL WARFARE

For several decades now, scientists have been studying sponges as potential sources of medical drugs. Sponges make certain unusual bioactive compounds with which to defend themselves against attackers. Sponges are primitive multicellular organisms without an immune system and they cannot get away if they are attacked. So they depend on chemical warfare to defend themselves. A handful of the compounds which these sea creatures use have already been registered as drugs for treating cancer. But scientists suspect there are many more interesting candidates for use in human medicine. Indra and his supervisor Detmer Sipkema published an article in *Marine Drugs* in May with an overview of the antibacterial and antiviral compounds discovered in sponges over the past few decades. They hope to be able to add a few new candidates themselves.

Sipkema did his PhD in Wageningen on the cultivation of sponges, but during a postdoc period at Berkeley he turned his attention to bacteria. It has now become clear that most of the bioactive compounds are made not by the sponge itself but by bacteria it harbours.

Since then Sipkema has studied the interaction between bacteria and sponges, still uncharted territory. 'In the submersible we go deeper than 30 metres, the usual depth limit for submersibles. Below that we are in a whole new world with new sponges, as well as familiar species which are just different in colour in

deeper waters. That means there are probably different bacteria in them and other substances too. That has never been studied.'

KILOMETRES DEEP

He is currently working with sponges from Curacao, from as deep as about 250 metres below sea level, but he will soon be tackling specimens from even greater depths than that. Sipkema participates in the Norwegian project SponGES, EU-funded to the tune of 10 million euros, which researches sponge fields at depths of between one and seven kilometres on the Mid-Atlantic Ridge. 'They occur in places where scarce minerals may be mined in future. We want to try to get a better understanding of those ecosystems,' says Sipkema. 'It is my role to find out what kinds of micro-organisms live in those biotopes, and what interesting substances they produce.'

'Some of the compounds from plant sprouts are just as powerful as conventional antibiotics'

Among the subjects Sipkema's team studies are the antimicrobial effects of the substances, and which genes are involved in their production. If a suitable potential antibiotic is identified, he will hand over the substance to a research group in Sweden which specializes in clarifying chemical structures.

But even then, pharmaceutical companies will not be raring to get involved. The quantities of bioactive substances made by sponges are negligible, and to get enough to carry out tests, pharmaceutical companies would practically have to exhaust the ocean's supply. Yet chemical synthesis of these usually complex bioactive compounds is extremely expensive or even impossible, says Sipkema. 'As long as we don't have a method of cultivating enough material to at least do clinical tests, no pharmaceutical company is going to be keen.'

So elsewhere in Wageningen, work has been going on



The search is on for new antibiotics in soya sprouts (above), which manufacture bioactive substances when they encounter a fungus, and in fungal filaments (below), which make these substances when competing with other fungus species.



PHOTO'S SHUTTERSTOCK

for years on cultivating sponges or sponge cells in tissue culture. It remains a tricky process. Sipkema focuses primarily on breeding the bacteria involved. If only you have enough of them, you can manufacture enough of an antibiotic. But how do you do that? How do you find out the preferences of these prima donnas that are accustomed to the depths of the oceans and to high pressure? Trial and error produced an occasional success but the bacteria from the sponges are not usually amenable to being isolated and cultured. This also made it impossible to study their DNA for hints about the conditions they require.

PUZZLES

Sipkema has recently started using a new trick to get around this chicken-and-egg problem: reverse engineering. 'For this we sequence all the DNA, both of the sponge and of the bacteria living in it. Out of that mixed bag of DNA fragments we try to reconstruct the genome of an individual bacterium. That is like having a lot of puzzle pieces but not knowing how many different puzzles they are part of. But it works pretty well. Once you have the genome of a bacterium you can say something about the breeding conditions it requires.'

Using this approach Sipkema has found out in the case of one sponge bacterium that it grows extremely slowly and with the help of carbon dioxide. 'No wonder we didn't find that one in our breeding experiments. It needs more time and uses only CO₂ as a source of carbon. This new technique makes me optimistic. Maybe we will eventually be able to manufacture enough bioactive material in the lab.'

The researcher sees the ocean as by far the most promising potential source of new bacteria. 'Marine organisms have not been studied nearly as much as those on land. Last year it was found that at least 90 percent of the genes of DNA fragments fished out of the sea at 500 metres down were unknown. There's a much bigger chance of finding really new antibacterial mechanisms in the sea than on land.'

THOROUGH SCREENING

But Wietse de Boer, a researcher at the Dutch Institute for Ecology (NIOO-KNAW) in Wageningen, has by no means lost interest in the possibilities on land. Although micro-organisms and fungi have been thor-



PHOTO'S WUR, SHUTTERSTOCK

Sponges photographed from the Curaçao Sea Aquarium's mini-submarine Curasub. Pictured above right is the submarine itself with PhD candidate Indra (left).

oughly screened for bioactive compounds in recent decades, De Boer does not think their potential has been exhausted. 'That screening is often done one test at a time. You have an organism, a fungus perhaps, and you test it against a pathogen. If nothing happens, that species is ruled out.' To demonstrate that this is a premature conclusion, De Boer shows a sawn-off birch trunk in his office. Two kinds of fungus, a tinder and a birch polypore, have moved into the tree. Where the fungal filaments touch each other, chemical warfare breaks out between the competing fungi. The frontlines can easily be made out because they are marked by extra melanin – a dark pigment which protects them against chemical attack – produced by the fungi.

In the mushroom which grows as the fungus's fruiting body on the bark of the tree, however, nothing happens. No special compounds are manufactured there. The arsenal is only activated if danger threatens. 'I want to use that knowledge to find out whether we can find new antibiotics like this, on the basis of the ecological reality that species compete,' says De Boer. He hopes to get research funding to do this. At the end of September the Dutch minister of Public Health Edith Schippers announced that her ministry would be investing an extra 6 million euros in research on new antibiotics.

De Boer, who is also special professor of Microbial Soil Ecology at Wageningen University & Research, has experience with a comparable approach to bacteria. 'We discovered six years ago that a *Pseudomonas* soil bacterium which does not manufacture any antibiotics on its own does so when combined with other bacteria,' explains De Boer. 'They only produce antibiotics when necessary. They only shoot when they have an enemy in their sights.'

LITTLE INTEREST

Olaf Tyc got his PhD in Wageningen last month for a screening method for antibiotics in which bacteria are tested together. A number of those combinations of bacteria have delivered new components which have been tested successfully on pathogenic bacteria such as *E. coli* and *Staphylococcus*.

The chemical characteristics of these compounds are currently being investigated in Germany. At this stage De Boer is extremely cautious about the chances of success. 'In the past we've had a promising substance that was so unstable that it changed in appearance after every stage of refinement. Because of that uncertainty, the pharmaceutical industry is showing little interest at the moment. And then there is the fact that a new antibiotic

‘There’s a much bigger chance of finding really new antibacterial mechanisms in the sea than on land’

would probably only be prescribed in emergency cases and therefore only rarely, in order to prevent resistance developing. So it is not an interesting prospect financially.’

PRODUCING ANTIBIOTICS

Researcher Jean-Paul Vincken and his colleagues at the Wageningen Laboratory for Food Chemistry, headed by professor Harry Gruppen, have already taken the first step towards producing antibiotics. Working with scientists from Singapore, they are developing a method of producing new antibiotics that could be attractive to the industry.

The candidates for this were discovered in Wageningen, says Vincken. ‘We’ve been doing research on isoflavonoids in soya for ten years. At first we focused mainly on the estrogenic effects of these molecules. These seemed promising for use in nutritional supplements that are anticarcinogenic or prevent hot flushes, for example. Four years ago we started looking into what else these substances do,’ says Vincken.

‘We had already noticed that soya bean sprouts which are affected by a fungus during germination manufacture ten times more isoflavonoids. And these compounds have a slightly different structure. It didn’t take long to join the dots: they must have antimicrobial properties. It seems there is a defence mechanism in the sprouts which we can switch on through stress, in this case by introducing the fungus. Although plants have been extensively studied, these kinds of stress responses have hardly been looked at yet.’

In order to grow sprouts in the laboratory, Food Chemistry bought a malting machine: a stainless steel appliance the size of a large washing machine. Breweries use XXXL versions of this machine to germinate barley for beer production. The machine at Food Chemistry does the same with a maximum of five kilos of soya beans, and seeds of other plant species too. A spoonful of fungal spores is added as an ingredient. ‘The conditions have to be precisely right,’ says Vincken. ‘The temperature and humidity must be such that the seeds germinate and the fungus thrives too.’

Potential antimicrobial substances are extracted from the sprouts and tested against bacteria. Next spring, Carla Araya-Cloutier will present her PhD thesis on the initial results. She scrutinized the isoflavonoids in soya

bean sprouts as well as those from related plant species such as other beans, lupin and liquorice. Together with her colleague Milou van de Schans, she refined and described about 30 substances, and tested their effectiveness against *E. coli*, *Listeria* and MRSA, a resistant *Staphylococcus*.

‘Some of our compounds are just as powerful as conventional antibiotics such as vancomycin or ampicillin,’ says Vincken. The new components turn out to be effective against what are known as gram-positive bacteria. Most of these isoflavonoids probably bore holes in the cell membrane of the bacterium.

Gram-negative bacteria have a protective mechanism against being punctured. However, if the researchers simultaneously added a substance which switches off that protection, those bacteria bite the dust too. Two more PhD candidates are now studying sprouts of various brassicas and grains, looking at their effectiveness against bacteria.

The sprouts that come out of the small malting machine on the campus produce at the most a few tens of milligrams of potential antibiotic. That is not enough to be of interest to the pharmaceutical industry. With a view to being able to produce the newly discovered antibiotics on a large scale, Food Chemistry is working with a research group at Nanyang Technical University in Singapore on a yeast which can manufacture the isoflavonoids. In the pharmaceutical industry, biotechnological production in yeast is a tried and tested strategy for producing medical drugs.

To achieve this, all the plant genes required for the entire production process need to be built into yeast. ‘We have now managed to take the first steps,’ says Vincken.

If it really works, and the yeast turns out to be capable of making a new antibiotic on a large scale, Vincken expects some interest from the pharmaceutical industry. But that is some way off yet, he warns. ‘The crucial question is of course: won’t the yeast – itself a micro-organism – die too if it produces an antimicrobial substance?’ ■

Jean Paul Vincken is looking for additional funding for the research on new antibiotics. If you want to know more about this project or contribute to finding new antibiotics, visit the website: www.wur.eu/new-antibiotics

**‘We want to increase
plant yields by a factor
of two to four’**



RESEARCH ON PHOTOSYNTHESIS WILL BEAR FRUIT

Simulating plants

Plants are champions at putting sunlight to good use. It lets them convert water and carbon dioxide into sugars and oxygen. Wageningen researchers are able to simulate and improve this process. They want to use that to produce biofuels and crops that grow better.

TEXT MARIANNE HESELMANS ILLUSTRATION IEN VAN LAANEN INFOGRAPHIC JORRIS VERBOON

Your cheese sandwich, your milk, tea, the sheets on your bed, the plastic bag you take to the supermarket, all of these products exist ultimately thanks to plants, and photosynthesis in particular, the process that lets plants convert water and carbon dioxide into sugar and oxygen with the help of sunlight.

Biophysicists have been studying this process for years. Now the knowledge they have built up is being used to improve plants, and to simulate the process in order to produce biofuels.

‘Look, we have here an artificial leaf that we use to simulate the process of photosynthesis,’ says René Klein Lankhorst in his room at Wageningen Plant Research. He shows a photo of a prototype, built by Leiden University. We see a black solar cell in an aluminium frame measuring about 20 by 20 centimetres. This ‘leaf’, which contains two catalysts as well as the solar cell, is able to use sunlight to split water into oxygen and hydrogen gas. Roughly like a proper leaf does in photosynthesis. Klein Lankhorst: ‘We want to convert the hydrogen gas plus carbon dioxide into a liquid fuel such as methanol or formic acid.’

Creating clean fuels from sunlight and water — it seems too good to be true. Yet this first artificial leaf, however primitive it may be, proves that this is possible. Hydrogen gas can serve as a clean source of energy, for

example to run cars on. This is one of the results of Bio-Solar Cells, where Klein Lankhorst was the managing director. This programme, with funding to the tune of 42 million euros, had ten science institutes and about 40 companies working for five years on ideas for putting the photosynthesis process to good use.

DIFFICULT TO STORE

Of course solar energy as a source is nothing new. We produce electricity from solar panels and install solar thermal collectors for hot water. The unique thing about the artificial leaves is that they use sunlight as a source of energy to produce hydrogen gas. ‘But gases are difficult to store,’ explains Klein Lankhorst, ‘so here in Wageningen we looked at how to convert hydrogen and carbon dioxide into a liquid biofuel such as methanol or formic acid.’ Biofuels like that can be used to run cars. Or industrial companies can use the liquid fuel as the basis for plastics or other synthetic materials. The researchers are now seeking additional funding for follow-up research on the conversion of hydrogen and carbon dioxide to liquid fuels.

The Bioscience department at Wageningen Plant Research has found two enzymes that can bring about the conversion of hydrogen and carbon dioxide into methanol in the laboratory. The Wageningen scientists have ➤

‘Perhaps we need the pigments from the red Ferrari paint’

now joined forces with an industrial partner to link that laboratory setup to the first artificial leaf. Klein Lankhorst: ‘In doing so, we have run into new problems. For example, how to separate out the methanol from the rest of the mixture.’

The BioSolar Cells partners think that in about 30 years’ time, thousands of hectares in the Netherlands will be covered with artificial leaves, that may or may not be connected up to systems for conversion to a liquid bio-fuel. But artificial leaves will need to become much more efficient first. The current prototype converts about 1 to 2 percent of the solar energy into energy in the form of hydrogen gas, whereas the theoretical maximum is 40 to 50 percent.

REPLACING SILICON

Pigments are crucial to improving the efficiency. The prototype for the artificial leaf contains a conventional solar cell made of silicon that converts solar energy into a charge. But solar cells are not particularly efficient and will eventually have to be replaced by pigments, which can be more efficient. In plants, pigments capture the solar energy and pass the energy along to each other until it reaches a reaction centre. The energy is then converted into a positive charge and a negative charge, which are used to split water into oxygen and hydrogen gas.

But it is no simple matter to replace silicon with pigments as most pigments are sensitive to overexposure to light; they are easily destroyed. In plants, they only last for 20 minutes. That is not a problem as the pigments are soon replaced by new ones. But an artificial leaf should preferably have a useful life of five to ten years. ‘Perhaps we need pigments that are based on the red paint of a Ferrari,’ suggests Klein Lankhorst. ‘They are among the most stable colours we know.’ The technical universities of Delft and Twente are currently trying out those Ferrari molecules.

PREVENTING COMBUSTION

In addition to the solar cell, the artificial leaf also has two types of catalysts: one is needed to split the water into oxygen and positively charged hydrogen ions while the other is for converting the hydrogen ions into hydrogen gas. Those catalyst molecules are placed in such a way that hydrogen gas and oxygen gas do not end up in the same compartment, which would produce a dangerously explosive mixture. Researchers are therefore look-

ing at how the catalysts and pigments are arranged in plant cells.

The artificial leaf also needs to become even cheaper. The catalysts in the prototype contain precious metals such as platinum and iridium. They will need to use cheaper metals like iron, manganese, calcium and magnesium, as plants do. But these metals are soon affected by acidic environments, or indeed alkaline ones. Nature could offer some solutions here too. The metals in plants are embedded in such a way in the pigments that they are protected against excessively acidic or alkaline conditions.

According to Klein Lankhorst, the artificial leaf currently costs a couple of thousand euros per square metre. ‘The price needs to come down by a factor of 1000 to 10,000, roughly speaking, for commercial applications. That is fairly standard for these kinds of developments. We are currently already tentatively exploring the possibility of 3D-printing, for instance, to reduce costs.’

In a follow-up project that is currently being negotiated, the universities and companies involved in Biosolar Cell want to build a second prototype of the artificial leaf that would cover 100 square metres. The groups involved would then be able to try out their ideas for pigments, catalysts or enzymes on two different scales. In this way the teams are gradually working closer to the ideal of cheap, efficient artificial leaves.

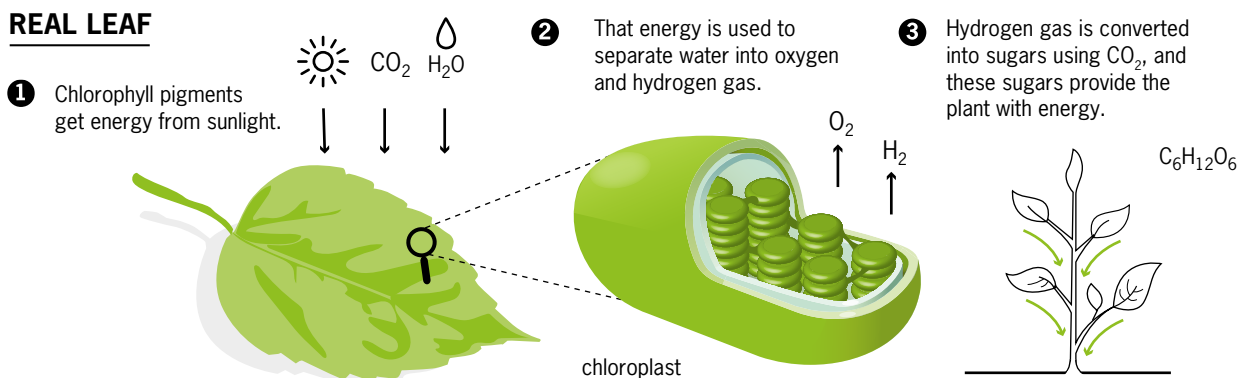
KNOWING THE GENES

The BioSolar Cells programme has delivered other results too. Wageningen geneticists have discovered several dozen places in the genome of the thale cress (*Arabidopsis*), a well-known experimental plant, that have genes involved in photosynthesis. Ten genes have even been localized precisely. ‘If we know the genes, plant breeders can select deliberately for more efficient photosynthesis,’ explains Wageningen geneticist Mark Aarts from Wageningen Plant Research. ‘Seed companies can then cultivate plants that quickly restart photosynthesis after a cold snap, for example.’

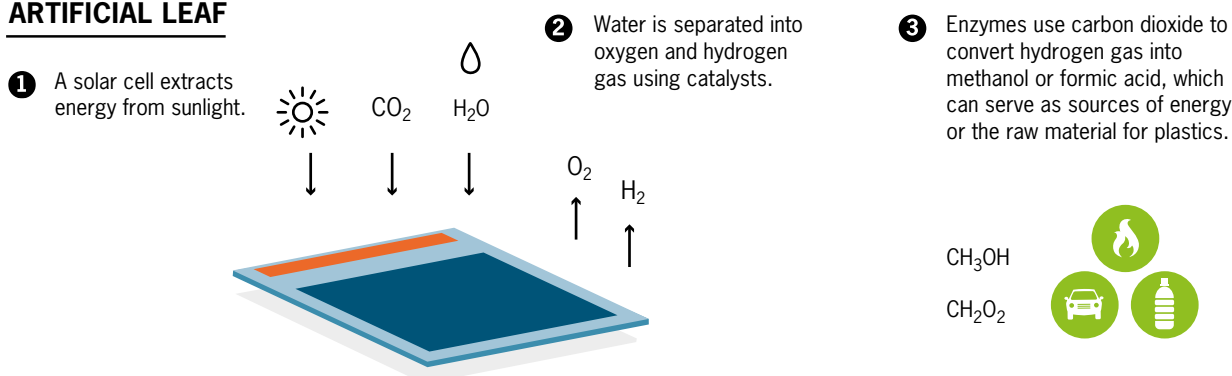
Aarts used the ‘Phenovator’ for his research, an instrument he developed with his colleague, horticultural expert Jeremy Harbinson. This image analysis robot has made it possible for the first time to find out what genes are involved in photosynthesis efficiency.

Aarts demonstrates the Phenovator through a hatch in a climate room with *Arabidopsis* plants. A camera moves rapidly from plant to plant, stopping each time for

REAL LEAF



ARTIFICIAL LEAF



15 seconds during which it emits a series of quick pulses of ultrared light. Then the fluorescence is measured. This is the light reflected by plants that has a slightly different, somewhat redder, wavelength to the light that fell on them. The more efficient the photosynthesis, the less fluorescence.

The researchers found the photosynthesis genes by letting the plants grow with a certain stress factor, for example a sudden increase in light or reduction in nitrogen. Some plants deteriorate more rapidly then or take longer to recover, which can all be measured by the Phenovator. By comparing the DNA in all the plants against their adaptability, the researchers were able to find the genes that influence photosynthesis efficiency.' Klein Lankhorst and some colleagues have written a proposal for a European project — with 48 science institutes in 17 countries — aimed at developing plants that photosynthesize more efficiently. This could help boost crop yields considerably. 'At present, the photosynthesis efficiency of crops is about half a percent,' says René Klein Lankhorst. 'We want to increase that to one to two percent.' ■

www.biosolarcells.nl

If you'd like to know more about this research on sustainable energy sources, or to contribute to it yourself, visit our website: www.wur.eu/ufw/liquidsunlight

ORDERLY PIGMENTS

Wageningen biophysicists discovered that pigments in nature often operate in a more orderly way than was thought. For instance, the clusters of pigments in photosynthetic bacteria that absorb light turn out to do so in the same, orderly fashion. The pigments all exhibit a gradual change in colour towards the centre of the clusters, where the charge is finally released for splitting the water molecules. 'So you can chuck in a pile of pigments in an artificial leaf, but it might work better to arrange them in a specific order,' says Herbert Van Amerongen, professor of Biophysics at Wageningen. It also turns out that clusters on the underside of leaves have half as many pigment molecules again as clusters on the upper side, where the light falls. So plants compensate for the lack of light with increased reception capacity. 'We are studying how the light is distributed among the pigments,' explains Van Amerongen. He and his group developed measurement techniques that can be used to determine the efficiency of real and artificial leaves. The leaf is bombarded with pulses of light lasting just a few femtoseconds (10-15 s). Then the researchers measure the fluorescence that is emitted and how that changes. That shows them, for example, how efficient the energy transfer is between pigments if there is too much light on the leaf, or indeed too little.

New offensive against food waste





Food waste has proven difficult to stamp out. The fact is that just as much food is being thrown out in the Netherlands now as six years ago. Time for a bigger offensive then. ‘Industry, consumers and the government need to come up with a joint strategy.’

TEXT ASTRID SMIT PHOTO HH/MARCEL VAN DEN BERGH

In 130 Emté supermarkets in the Netherlands you can buy fresh soups sold under the label *Barstenvol* (bursting full). The soups are made from the tops and tails of tomatoes discarded by hamburger chains, or from courgettes that got damaged when pallets tipped over. ‘This week we’ve made broccoli, courgette and mushroom soup,’ says director Corien Poederbach of *De Verspillingsfabriek* (food waste factory) in Veghel. ‘Today it’s goulash soup.’ There is no shortage of surplus vegetables. ‘Since we opened our doors six months ago, a constant stream of companies and farmers have come knocking. We have a team of 15 people working here but we could easily grow to 50. Currently we make 10,000 litres of soup and sauces a week, but there is potential for 10,000 litres a day,’ says Poederbach.

De Verspillingsfabriek is a response to the vast quantities of food that get thrown out in the Netherlands: in 2014, between 1.91 and 2.64 million tons. That amounts to 114 to 157 kilograms per person per year. A large proportion of this wastage occurs on farms and at trading organizations, food processing companies, in-company caterers, hospitals and supermarkets. But consumers are responsible for some of it too, throwing away an average of 50 kilos of the food they buy per year.

NO CHANGE

Cutting down on food waste has been on the Dutch government’s agenda for years

now. The ministry of Economic Affairs (EZ) set a target of 20 percent less food waste in 2015 compared with 2009. Everyone thought that was a feasible goal but it has probably not been achieved. According to the Food Waste Monitor 2009-2014, published by Wageningen Food & Biobased Research this summer, the amount of unused food stayed the same over this period.

‘The figures for 2015 are not out yet, but we can safely assume that there wasn’t a 20 percent drop in that year either,’ says Toine Timmermans, programme manager for sustainable food chains at Wageningen Food & Biobased Research. A big disappointment, although the ministry of Economic Affairs does see a glimmer of hope. ‘At least food waste did not go up,’ says food quality policymaker Tekla ten Napel. ‘Even though agricultural production and food imports and exports did increase and supermarkets and catering companies did buy more.’

Why the target was not reached is anyone’s guess. Timmermans does have a hunch though. ‘There are numerous initiatives by companies and consumers under way, but they are all small-scale.’ So Wageningen is looking for all kinds of possibilities for tackling the food waste issue on a larger scale.

Timmermans: ‘We want to build up an ecosystem of businesses and researchers who think up solutions and put them into practice together, with the government ➤’

SUPERMARKET WASTE USED BY CHEMICAL INDUSTRY

Leftover bread from the supermarket sometimes gets a second life as breakfast cake, cookies or breadcrumbs. But leftover food can have other uses too, as a resource for the chemical industry.

Wageningen PhD candidate Mark Roghair of the Environmental Technology chair group is studying one example of this. He wants to know whether valuable fatty acids such as caproic acid can be extracted from supermarket waste. This fatty acid can be used in the refining industry, where it helps make paint easier to mix and spread, and it can also be used to make lubricants, fuels or bioplastics. 'At present, supermarket waste is often used to make biogas, but caproic acid is more lucrative,' says Roghair. 'And using this caproic acid might reduce the felling of tropical forests, since at the moment our main source of these fatty acids is palm oil.'

The PhD candidate is researching to what extent a mixture of bacteria and ethanol can transform supermarket waste (fruit, vegetables and meat) into the fatty acid in a bioreactor. Roghair: 'We want to make sure the desirable bacteria can do their work as well as possible, and that undesirable bacteria are kept at bay.' Follow-up research is planned to find a profitable way of obtaining the purest possible caproic acid from the bioreactor.



PHOTO SHUTTERSTOCK

'In three weeks, consumers learn to waste 30 percent less'

facilitating.' *De Verspillingsfabriek*, a concept thought up by Timmermans and entrepreneur Bob Hutten, is one example of this. 'This is literally a factory which processes leftover vegetables. Money is earned here with products which meet all the standards. The suppliers are paid for the ingredients, the leftover vegetables. A system has to have financial incentives for all parties involved if it is to be sustainable.'

PREVENTING WASTE

But the *De Verspillingsfabriek* cannot turn all the discarded food into soups and sauces. What to do with the leftovers at bakeries, fruit farms and supermarkets? To address this question, Wageningen teamed up in May with six partners, such as HAS applied sciences university, to form The Source Shakers. Timmermans: 'Our promise is: let us have a look around your company and we think we can prevent 25 percent of the waste and make use of another 20 percent of your leftovers in new products for the market.' The Source Shakers are now working with six companies, offering solutions in the bread, meat, supermarket and greengrocers sectors. A Brabant leek farmer, for example, asked what he could do with the large amounts of waste generated on his farm: not all his leeks reach the market. The Source Shakers proposed a technical solution, which the leek farmer is currently trialling.

One source of inventive solutions is Carve, a research project at Wageningen Food & Biobased Research. This project works with companies such as FrieslandCampina, Albert Heijn or Iglo to find ways of preventing food waste, using resources as efficiently as possible, and identifying products to make with supplies of surplus food. The goal is to give this food as much added value as possible. Companies that consult The Source Shakers can benefit from the knowledge Carve gains from this research. 'The Source Shakers are really like brokers, offering solutions. We look for a match between the solutions and the business model.'

Tekla van Napel at the ministry of EZ firmly believes these projects will contribute to the battle against food waste. That is why the government is investing in them. She has high expectations of self-monitoring too. 'Companies which monitor their food waste themselves become aware of the issue and often immediately see ways of cutting down on waste.'

Wageningen and the Alliance on Sustainable Food – a joint venture in the agrifood chain – have developed a self-monitoring tool for the industry. A pilot conducted last year showed that the tool gave companies a lot of insight, enabling them to see the waste flows and their contents, and to come up with possibilities for improvement. The hospital, the caterer and the French fries factory in Zeeland that joined in the pilot all found ways of cutting down on food waste. Timmermans: 'This year we are working on a structure for establishing the self-monitoring on a broader footing. Next year we are going to continue the work with a large group of companies.'

The government aims to use the data gained from self-monitoring to improve the national Food Waste Monitor. The EU plans to make it compulsory from 2020 for all member states to report on their food waste. Ten Napel: 'Now we still base the figures on published data from waste disposal companies. But those figures are not precise enough because we have no data from companies.' Companies are reluctant to provide such data, as they could contain sensitive competitive information. With this in mind the ministry of EZ is looking for ways of publishing the data without damaging a company's competitive edge.

COOKING TOO MUCH

Meanwhile consumers, who are responsible for the rest of the waste – about 40 percent of the total – are being encouraged to reduce the amount of food they discard because they buy too much, cook too much and often store food wrongly. Through the Nutrition centre, the government has invested in various

campaigns to raise awareness of this. Meanwhile the ministry of Economic Affairs is working on a deal with producers on the use-by dates on products. Some products such as sugar, salt and vinegar carry such dates even though they are not really necessary. This causes consumers to throw out products unnecessarily. At the beginning of October, Wageningen Food & Biobased Research started a project called *Houdbaarheid begrepen* (Understanding Shelf Life). In this project researchers study how supermarkets could bring their stock more in line with consumer demand. One way of doing this would be to analyse the digital shopping lists of big groups of consumers and adjust the stock accordingly. Research is also being done on how consumers respond to the shelf life of products, both in the supermarket and at home.

SMALLER UNITS

'In theory consumers could quite quickly reduce food waste by 30 to 40 percent,' says Timmermans. 'We saw that in Foodbattles, in which for three weeks consumers keep an eye on what they do with their food, and receive tips.' But this kind of behaviour change won't happen by itself. Timmermans: The government and the industry will have to go on drawing attention to the problem for at least five to ten years, and not just through publicity campaigns. We'll have to offer consumers real solutions and instruments that help, such as smaller units of packaging, apps for better planning, and better labelling on products.'

Refresh, a European project with a budget of 9 million involving 12 member states and coordinated by Timmermans, is currently studying which national public-

private strategies work well. In 2006 the UK launched a big anti-food waste campaign which led to a lasting 21 percent reduction in waste by consumers and 13 percent in the industry. The programme cost the British government millions. 'There isn't the money for that in the Netherlands, nor do I think it's the right approach in this day and age,' says Timmermans. 'The Norwegian model, in which government and industry split the costs 50-50, might suit us better.' Norway got good results too, reducing food waste by 12 percent. The Dutch government has invested some money in obtaining insight into the situation and facilitating solutions, but gave the industry the leading role. 'I think we've all got to do this together. Industry, consumers and the government need to arrive at a joint strategy that formulates clear objectives, which are then monitored as well,' says Timmermans. 'I am hopeful. There are a lot of initiatives under way at the moment, both in Europe and the rest of the world. The United Nations' target is to be wasting 50 percent less food by 2030. The Netherlands has a leading role to play here. That puts extra pressure on us to set a good example.' ■

www.wur.eu/foodwaste

CDI COURSE

Wageningen Centre for Development Innovation will run the English-language course Lost harvest and wasted food in September 2017. www.wur.eu/cdi/shortcourses2017

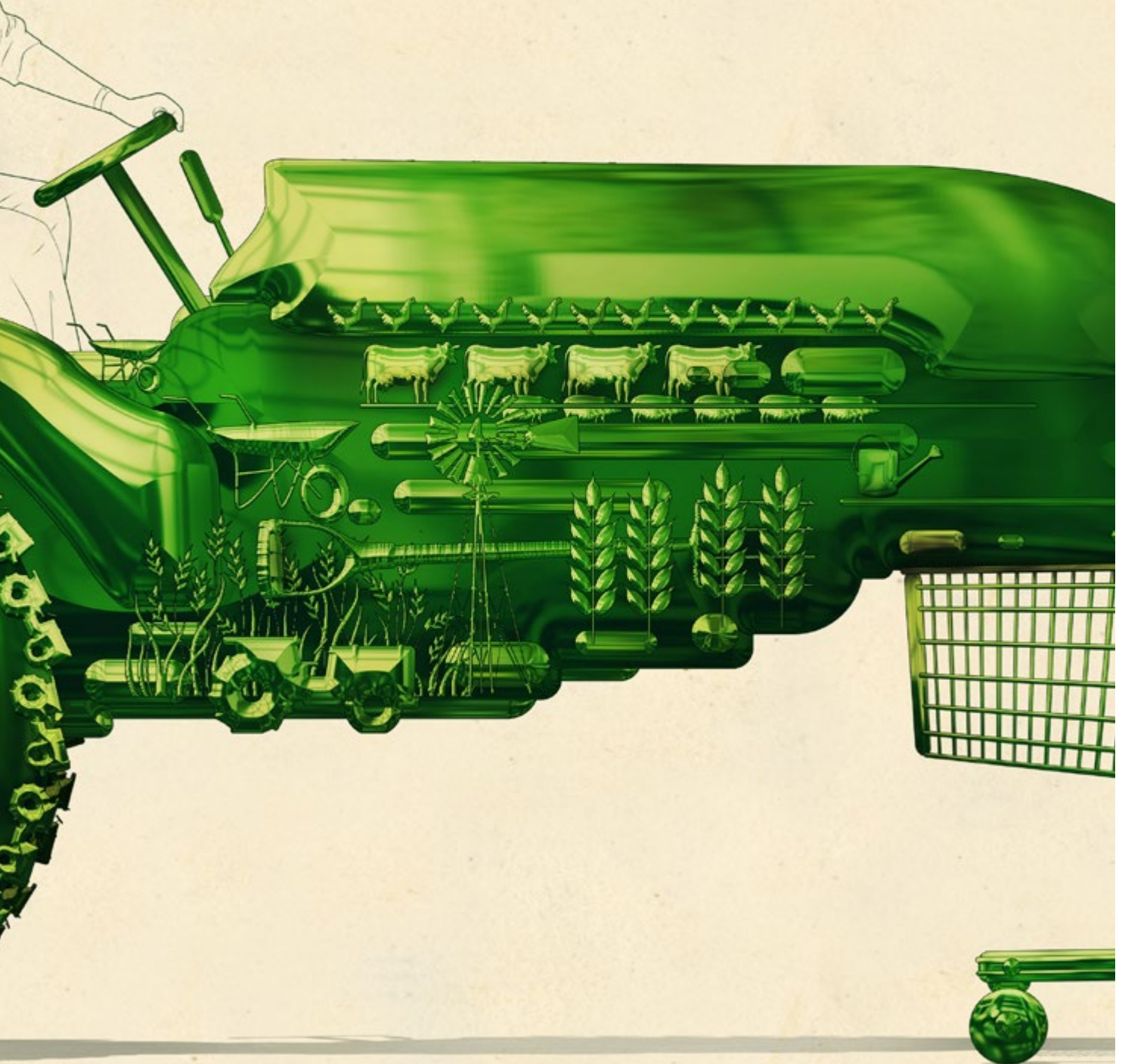
'Let us have a look around and we'll prevent 25 percent of the waste'

Wageningen appeals for Brussels food policy

European agricultural policy must stop focusing on the needs of farmers and pay more attention to consumer demands. So say Wageningen president Louise Fresco and economist Krijn Poppe. 'Scientific ideas sometimes need a bit of time but they are not just flights of fancy.'

TEXT KORNE VERSLUIS **ILLUSTRATION** RHONALD BLOMMESTIJN





Two years ago the Dutch Scientific Council for Government Policy (WRR) began appealing for a coherent national food policy. The Netherlands is a food country, wrote the council. It is a hub in the international food trade, has a highly productive agricultural sector and plays a major role in research on agriculture and nutrition. But Dutch policymaking on food is dispersed across

several different ministries and is too concerned with agricultural production and not enough with other food-related issues, noted the council.

Louise Fresco Wageningen University & Research president, and economist Krijn Poppe, research manager at Wageningen Economic Research, have drawn on the same idea for a plan for European agricultural policy. This currently suffers



from the same flaw, they say. It is overly geared towards farmers and agricultural production and not enough to the wishes of European taxpayers. These taxpayers expect to find an adequate supply of affordable food in the supermarket, but they also want food production to go hand in hand with consideration for the climate, animal welfare and a fair social system. Farmers rarely meet consumers face to face and, according to Krijn, that makes for a shaky support base for European agricultural subsidies. 'One of the main points in our proposal is to close the gulf that divides the city from the countryside.'

OUTDATED

European agricultural policy is based on outdated ideas, say the two academics. The emphasis on production had a logic to it in the 1950s and 60s, when memories of food rationing were still fresh in the minds of many Europeans, but the situation is very different now. On other points too, the EU's agricultural policy has failed to keep up with the times. Poppe: 'Take the multinationals, which have grown tremendously in recent decades. They play a very important role in the food supply, but European agricultural policy ignores them. That is not sensible if you want to make agricultural policy sustainable. Unilever, for instance, wants to play a pioneering role in making the food chain more sustainable. It probably has more impact if you make agreements with big companies like that about greening their production systems than if the EU sharpens up regulations about things like ploughing up grasslands.' Other multinationals invest large sums of money in monitoring crops. Poppe: 'Pepsico has a system for measuring the growth of their suppliers' potatoes. If the EU collaborates with the multinationals on standards, such data could also be used to provide farmers with information about the status of their crops, so they don't use too much pesticide and artificial fertilizer.'

LAKES AND MOUNTAINS

The agricultural policy has been one of the main subjects of discussion in Brussels meeting rooms right from the start of the EU. Until recently more than half the

European budget went on agricultural subsidies, and the figure is still at 40 percent. In the early years of the union most of that money went towards giving farmers guaranteed prices. When that led to overproduction and the infamous milk lakes and butter mountains, the agricultural policy was adjusted bit by bit. The latest round of changes was in 2013 when the first pillar of the common agricultural policy – production support – was 'greened' and the second pillar – rural development – was reinforced with measures to stimulate innovation. To qualify for a subsidy as of 2014, crop farmers have to select from a menu of nature-friendly measures such as flowery field verges or catch crops which help prevent too many fertilizer nutrients in the soil ending up in the water.

FURTHER EXPANSION

'We propose further expanding the policy and basing it on five pillars,' says Poppe. A first pillar with income support for farmers, intended to ensure a stable market for food; a second based on the ecosystem services farmers provide, and a third which focuses on innovations in agriculture and living conditions in the countryside. These are the subjects which are divided over two pillars in the current policy.

There does need to be a ceiling on income support for farmers. Currently a large proportion of the budget goes to a small number of big farms. Twenty percent of European farmers get 80 percent of the available funding. By establishing a maximum grant per farm, more money will be left over for the small farms. Poppe: 'That way you ensure the grant ends up with the farms which really do need a safety net.'

The policy should also address issues of nutrition and health (the fourth pillar) and monitoring and research (the fifth pillar). With European countries less and less prepared to invest in research on the food chain, the proposal argues that the EU should provide crucial infrastructure such as experimental farms. It also argues for better harmonization of the EU's research agenda and the agricultural and food policy. But it is the fourth pillar that is really new. ➤



PHOTO GUY ACKERMANS

KRIJN POPPE

Research manager at
Wageningen Economic
Research

**'The gulf between city and
countryside must be closed'**



JAN HUITEMA

VVD MEP

**'At the moment farmers
don't understand why they
do or do not get subsidies'**



HENRY UITSLAG

Campaign leader on food and nutrition at the Consumer Association

'If you leave it to the companies, salt reduction won't get off the ground'

VEERMAN WANTS A DIFFERENT AGRI-CULTURAL POLICY TOO

Poppe en Fresco are not the only people arguing for a broadening of European agriculture policy. In november a thinktank led by ex-minister and ex-WUR president Cees Veerman proposed reforming the agricultural policy to make European agriculture more climate-friendly and better able to contribute to healthier eating habits among Europeans.

The thinktank was part of a 500 million-euro package of support for European farmers, intended to soften the blow of the sanctions against Russia. Agriculture commissioner Phil Hogan promised that the package would be put together with input from experts on the position of farmers in Europe.

The thinktank, which included Louise Fresco, not only looked at the European grants but also proposed ways of strengthening the position of farmers. By creating more opportunities for collaboration, for instance. This is something farmers do not do at present because they think it is in conflict with the EU's competition.

The European Union should stimulate the food industry to get Europeans on a healthier diet, write Fresco and Poppe. But the Greek diet is different to the Dutch one, making it seem more logical to leave the member states to figure out the measures they need to put in place. Why should bureaucrats in Brussels start deciding how the Greek or Dutch diet should become more healthy?

Poppe: 'It is certainly quite a puzzle to come up with the best division of tasks, but there are areas in which it helps to adopt European-wide measures. Take a sugar or fat tax, for instance.' In 2011 Denmark brought in a tax on products containing a lot of saturated fat. The tax bit the dust a year later, however. Poppe: 'That was partly down to new political relations after elections, but it was also due to complaints that Danish shopkeepers were doing their purchasing over the border to evade the tax. You prevent that if you establish a European policy.'

A CRITICAL LOOK

Louise Fresco presented the proposal in Brussels at the beginning of September in the first Mansholt lecture. Jan Huitema, a Wageningen alumnus and an MEP from the right-wing Dutch party the VVD, was there. 'I don't know if I agree with all those new pillars. As a liberal I will certainly take a critical look at whether they will generate excessive legislation. But what I do appreciate very much about the proposal is that we have started thinking about a new basis for the agricultural subsidies. The way it works at the moment is not logical. Not for farmers, who do not understand why they do or do not get a subsidy. And not for consumers either. The next time it is revised it would be very good to have a better story.'

There were some critical noises too from people who were afraid that the proposal would siphon off money from farmers to other links in the food chain. Poppe: 'That is not what we proposed; we haven't made any proposals about the allocation of the money, only about the subjects the policy should be addressing.'

According to Poppe, policymakers in both The Hague and Brussels were impressed by

the proposal. 'I've had positive responses from all sides. From Brussels and from the ministry of Economic Affairs in The Hague.'

There are positive noises coming from another office in The Hague too: that of Henry Uitslag, the Dutch Consumers' Association's campaign leader on food and nutrition. 'This plan fits in with other initiatives. We are positive about the ideas for a food policy, especially because consumers are getting to play a bigger role in it.' Uitslag himself is often in Brussels for consultations on the labelling of food products. He and his colleagues do not focus on agricultural policy. 'That is such a big and complex subject; we choose to target other issues.'

So would he be interested in being involved in a broader agricultural and food policy? 'It depends whether anything practical is going to be achieved. You can't be against an integrated food policy but I have become suspicious of that term: 'integrated' is often used as an excuse for doing nothing. We argue, for instance, for a ban on targeting children with marketing of unhealthy food. Those who would stand to lose from such a ban like to bandy about the term 'integrated policy' because it stays nice and vague about whether anything actually has to change. To us it is important to achieve tangible results. If you leave it to the companies themselves, things like salt reduction or the curbing of antibiotic use in livestock farming won't get off the ground. If agreements can be made on that in Europe, I am keen to be involved.'

BROADER TREND

Governance expert Jeroen Candel got his PhD at the Public Administration and Policy Group in Wageningen for a study including the latest round of negotiations on the European agricultural subsidies. He too agrees with the main points of the position paper. 'This fits well with a broader trend which is especially popular in the Netherlands. The Dutch government is already working on a food agenda; in Ede there is even a municipal councillor with food in his portfolio.' But the negotiations he studied for his thesis tell a cautionary tale. All too often in such

'Grants should go to farms that really need a safety net'

negotiations, ideals end up being sacrificed to national interests.

In the previous round the concept of 'food security' played a role which could be given to Fresco and Poppe's 'food policy' in the next round of negotiations. After the food crisis of 2007 and 2008, in which food prices shot up, the fear of shortages suddenly reared its head again. So 'food security' became the buzzword in the preparations for the decision making. 'Nobody is against food security,' says Candel. 'That's why many parties used the concept as window dressing for their interests.' But at the end of the day, food security did not play a significant role in the formation of the new policy. Candel: 'In the final negotiations about budgets, countries look primarily at how much they can get out of it for their own farmers.' The term 'food policy' could, he thinks, play an important role in the next round of negotiations to decide on the policy after 2020. 'Before the final negotiations there will probably be some fine speeches made about it, but in the end it's all about how the euros are distributed.'

TAKEN SERIOUSLY

Louise van Schaik, senior research fellow at the Clingendael Institute, adds her voice to the warnings against high expectations of the plan's feasibility. 'It addresses appealing themes. I would imagine the European Commission is happy with the proposal. It does propose reforms. What is more, Fresco and Poppe are well-known names in Brussels; they are taken seriously.' But that does not mean other countries will immediately be won over to the ideas.

Van Schaik: 'It is a very Dutch proposal. We worry about the question of whether we can explain why we give subsidies to farmers. In other countries that is not an issue. A Greek doesn't wonder whether it is sensible

to give subsidies to tobacco farmers; with the economic crisis there, they've got more important things to worry about. The same goes for many countries in which the rural population is in decline: France or Portugal, for instance. They are happy that there are European subsidies. Otherwise they would have to come up with the money themselves.' Van Schaik also thinks the Netherlands' negotiation position is weakened by the approaching Brexit. 'The British supported reforms too. Now we only have Denmark, Sweden and Finland left.'

SMALL STEPS

So is the proposal nothing more than a nice academic exercise that will soon disappear into the archives of Brussels bureaucrats? Candel: 'That is not doing it justice. The discussion is worth a lot and will have an impact in the long term. The European agricultural policy has a long history. Change is often gradual. There has been talk of greening since the 1990s. that has been integrated into the system now, albeit in a way that makes it easy for farmers to use it to their own ends. It is good to work on an integrated food policy. A policy in which there is a bigger role for health, climate and other values will lead to a different type of agriculture. Just don't imagine that's something you can achieve in a hurry. But that doesn't make it okay to become cynical.'

Whether this plan will be introduced in the short term is by no means certain, confirms Poppe. 'It is a Dutch approach and there is a great deal of uncertainty for the coming years, not least because of Brexit. But that doesn't mean it's just a flight of fancy. Scientists' ideas sometimes need time. What counts now is for people to take it seriously and for the idea to stick.' ■

www.wur.eu/foodpolicy



JEROEN CANDEL

Governance expert and assistant professor at WUR

'Countries look primarily at the benefits they can obtain for their own farmers'



LOUISE VAN SCHAIK

Senior research fellow at Clingendael

'In other countries, no one questions subsidies for farmers'

Combating poverty and saving rural nature

They started International Development Studies in 2000 because they wanted to understand why people make the choices they do and from an interest in rural development. Now Maarten Voors is a development economist. He obtained a PhD for research on the victims of war in Burundi. Fellow student Max van Tilburg became a farmer and now defends diversity and nature in rural areas.

TEXT ALEXANDRA BRANDERHORST PHOTOGRAPHY HARMEN DE JONG EN ANNA VAN DIEPEN

Max van Tilburg's cattle graze on land that stretches to the centre of the town of Breukelen. They are blaarkop cows, an old Dutch breed that fits in well with the picturesque setting. When Van Tilburg graduated in International Development Studies in 2013, he decided to start a dairy farm. About a year ago, he took over a tenant farm attached to an estate in Breukelen. Woods, trees and paths criss-cross the 61 hectares of grassland where his 60 cows graze. He also has 40 bullocks. Van Tilburg is an organic dairy farmer, like his father before him. 'We grew up in Hagestein with a love of the farm but also with a love of nature. Before my father started organic farming in 1989, he was already avoiding the birds' nests when mowing. I would spend hours as a little kid looking for nests,' says Van Tilburg. He cares a great deal about the increasing scale in agriculture. 'Conventional dairy farmers are building bigger and bigger barns. The cows are

kept inside and the farmers mow the grass. The fields everywhere look like billiard tables. Many farmers think they have to expand but you can earn a pretty decent living with 80 cows.'

REDUCING POVERTY

Farming is a tough life but Van Tilburg enjoys the physical work and the countryside. It is a huge contrast with his fellow student Maarten Voors. Voors is an assistant professor in the Development Economics chair group in Wageningen. He stands in his room in De Leeuwenborch working on his laptop. Three cardboard boxes stacked on top of one another serve as a provisional desk to stand at. 'Sitting all day drives me crazy,' he explains. His group works with aid organizations, governments and companies to set up policy impact studies. 'We're looking for interesting social science questions that help us to understand the choices people make or test

a theory.' He will soon be leaving for a short stay in Sierra Leone. 'The local population is being given CO₂ compensation income for the woods left intact as a way of preventing them from hunting, mining or felling rainforest. We are investigating whether it makes a difference who manages the income: the village chief or a council of villagers. Contrary to what we expected, it seems the chief does a better job of spending the money. Chiefs are often painted as despots in the literature. The opposite seems to be the case here.'

Even as a child, Voors was concerned about injustice, war and poverty. 'I come from a family of altruistic types, with generations of pastors and social workers.' After finishing vocational secondary education (HAVO) in Haarlem, Voors spent six months doing voluntary work in a British psychiatric institution and an American summer camp for disabled children. Then he travelled to India. He wanted to understand why people in



‘You can earn a decent living with 80 cows’

India lead such a different life compared with the Netherlands, and that was why he chose International Development Studies at Wageningen. Because Voors only had a HAVO certificate, he first had to complete a foundation year (in Environmental Sciences) at the applied university in Utrecht before he could be admitted to Wageningen University.

Voors started his study in Wageningen in 2000, as did Max van Tilburg. When Van Tilburg finished secondary school in Culemborg, he spent a year working for his oldest brother, an organic goat farmer. Van Tilburg also had a HAVO school certificate; he did a foundation year in Forest and Nature Management at Larenstein university of applied sciences before switching to Wageningen. ➤

MAX VAN TILBURG

Age: 37

Studied: BSc and MSc in International Development Studies, 2000-2013

Works: Organic dairy farmer in Breukelen



‘I come from a family
of altruistic types’

MAARTEN VOORS

Age: 38

Studied: BSc and MSc in
International Development Studies,
2000-2006

Works: Assistant professor in
Development Economics at
Wageningen University

‘I wasn’t sure whether I would be up to academic university study and I stammer a bit sometimes, so it was quite nerve-wracking.’ The university turned out not to be his natural habitat. ‘I felt completely lost to start with. It got better later on, when I started to mix more with the others on my course.’ After a few months in the large block of student flats in Rijnsteeg, Van Tilburg moved to

a small student house in Renkum, where he felt more at home.

His studies progressed slowly. He often went home on Thursday evenings to help his father on the dairy farm, and he stopped entirely for six months in 2003 when his father moved to a farm in Groningen. ‘I was still working on my Bachelor’s when the others on my degree programme had nearly fin-

WHERE DO DEVELOPMENT SCIENTISTS END UP?

A total of 519 people graduated with a Master's in International Development Studies between 1996 and 2011. Data is available on the jobs of 181 of these graduates. This shows that 34 percent work for international government authorities and organizations, 22 percent work at a university and 8 percent at a research institute. Around eight percent work for engineering and other consultancy firms and a further eight percent work for welfare and other organizations and societies in the Netherlands. Seven percent have jobs with the Dutch government and the same percentage work in financial and commercial services. Source: KLV Wageningen Alumni Network

ished their Master's. Sometimes I felt ashamed to go to lectures, with all the new faces and younger students.'

Van Tilburg specialized in rural sociology in his Master's. By that time, he was living in a communal house in Utrecht, where he had a vegetable garden. He was also becoming interested in urban agriculture; he did research on this in the US state of Michigan for his Master's thesis. 'After the departure of General Motors followed by the economic crisis in 2008, the centre of Detroit became abandoned and dilapidated. Urban farming projects were started on the vacant plots, which let people earn some money, even if it was not very much,' says Van Tilburg. He wanted to continue with urban agriculture in the Netherlands but eventually decided against it. 'The production here is marginal.' Meanwhile, he did agricultural advisory jobs, for example promoting *blaarkop* cows, an old, robust Dutch breed. Talking with farmers got him enthusiastic and he decided to become a farmer himself. At his graduation party, one brother gave him a goat and his other brother, an organic dairy farmer, gave him a cow.

VISITING WAR VICTIMS

Maarten Voors, on the other hand, took to university life like a duck to water. In his Master's he felt intrigued by economics because he found it so incomprehensible. He interviewed sheep farmers in Macedonia for his thesis, asking them about the choices they made when Communism came to an end. After graduating in 2006, Voors spent nine months working for the Ministry of Agriculture, before he was able to start his PhD research in 2007 in the Development Economics chair group. He spent his first working day in Burundi. 'I would spend every day walking up and down hills to get to villages. We eventually sur-

veyed 1500 people about the consequences of the civil war from 1993 to 2005.' Many of the people we interviewed had seen others murdered or tortured during the war and had lost family and colleagues. Voors: 'The survey showed that victims were more likely to work together and trusted one another more than people in villages that hadn't experienced conflict. But we weren't sure whether the interviewees were giving socially desirable answers.'

To test this, the Wageningen development economists devised field experiments based on the money games that the psychologist and Nobel prize-winner Daniel Kahneman developed to get a better understanding of how people make choices. Voors and his colleagues set up anonymous games with real money with people in 35 villages, some of which were in former conflict areas. On average people were prepared to share 30 percent of their money with someone else, but villagers from conflict areas were ready to share much more.

'Classical economists claim that social preferences are fixed,' says Voors. 'But this study showed that they can be changed by circumstances.' Voors' research drew international attention after it was published in *The American Economic Review*. Since then, other academics have found similar behavioural patterns in Sierra Leone, Nepal, Tajikistan and Israel.

BETTER AT OBSERVING

After getting his PhD, Voors worked as a postdoc at the University of Cambridge from 2011 to 2013. He returned to Wageningen as an assistant professor and joined the tenure track, which prepares promising researchers for a professorship. In 2014 Voors received a Veni grant, a four-year grant that the Dutch Organization for Scientific Research (NWO)

gives outstanding young researchers.

He spent some of it on a six-month visit to the University of California in Berkeley with the aim of gaining inspiration and making new contacts. 'The more you learn, the better you understand what you don't know,' stresses Voors. 'I have been to Sierra Leone nearly 20 times. The first time, I was focused on my own ideas. Now my opinions are becoming less important and I'm getting better at looking and observing.'

DRAWING UP A BUSINESS PLAN

His fellow student Max van Tilburg went in search of a suitable farm to lease. When he finally found it and had to produce a business plan, his Wageningen education stood him in good stead, he says. His farm is next to a busy road and close to the town. The local residents feel involved and ask him questions. 'You have to be able to explain what you are doing. I'm better able to deal with that because of my study. I'm also able to think about issues, such as my role as a farmer in the community, in a very nuanced and analytical way.'

His new farm is still in the development stage. In the future, his girlfriend plans to start a farm shop, tea room and bed and breakfast. Van Tilburg wants to show society that farming can benefit the countryside. 'We give biodiversity plenty of room, whereas rural areas elsewhere are becoming more monotonous. In my opinion, Dutch farmers don't have to produce enough milk to feed the entire world.'

The claims for the sustainability and efficiency of either organic farming or intensive farming cannot really be backed up with figures, argues Van Tilburg. 'It's all about how you experience the countryside, whether there is room for nature on the farm. I find that is something very tangible.' ■

RESEARCH PROJECT ON MULTIPURPOSE SEA

Safely combining wind turbines and seaweed farms

How can the production of food and energy at sea be safely integrated, the British Lloyd's Register Foundation would like to know. University Fund Wageningen saw to it that a research project was set up.

TEXT YVONNE DE HILSTER PHOTO SHUTTERSTOCK



Gone are the days when humans only used the seas and oceans for cargo and passenger transport, fisheries and drilling platforms. More and more players are discovering the scope for using the sea to farm fish, seaweed or energy, or for tourism, waste disposal or mining. The potential for innovation and 'blue growth' out at sea is not lost on the European Union either.

But how can the production of food such as fish, mussels or seaweed be safely combined with, for instance, an offshore wind farm? In collaboration with the British charity Lloyd's Register Foundation (LRF), Wageningen University & Research and TNO will carry out a study in the project SOMOS (Safe production Of Marine plants and use of Ocean Space), focussing on seaweed production in amongst wind turbines. LRF has granted 500,000 pounds



PHOTO GUY ACKERMANS

FANNY CASTEL
Relationship Manager
University Fund Wageningen

sterling to the SOMOS project. This charity is linked to the Lloyd's Register Group Ltd, a global engineering, technical and business

services organisation operating in the fields of marine, oil and gas, low carbon power and assurance services. 'We support engineering-related research, training and education which improve the safety of the critical infrastructure that is crucial to our society,' explains Ruth Boumphrey, Director of Research at the foundation. 'Food production is part of that critical infrastructure. Wageningen is a top institution in the field of sustainable and safe food production. With the results of SOMOS we shall be contributing to the safe production of both food and energy.' LRF had never worked with Wageningen before. The collaboration was initiated through an alumnus with connections with a daughter concern of Lloyd's Register, and University Fund Wageningen organized the drawing up of the research proposal and the formation of the research team.



The research will start by focusing on seaweed cultivation, which has expanded tremendously in the last 50 years in response to rising demand. China and Indonesia are the world's main seaweed producers. Seaweed is generally grown on lines hung in the sea in coastal areas. It is a labour intensive production process for which the scope for expansion is mainly offshore, with the lines attached to wind turbines. But this kind of seaweed farm requires extensive mechanization, and it entails new risks. Storms may wash away the seaweed farms, workers may fall overboard, and oil slicks could cause problems. This autumn, for example, a group of 13,000 Indonesian seaweed farmers launched a 200 million dollar class action against the Australian oil company PTTEP Australia for the damage caused by the 2009 Montara oil tanker disaster in the

Timor Sea. Besides the immediate loss of income at the time, these farmers are still suffering from the impact of the oil pollution on production levels.

PREVENTING COLLISIONS

The seaweed farming would mean significant changes for the wind farms. Currently wind farms are closed to shipping and fisheries so as to avoid damage from collisions, or from anchors cutting through electricity cables when they are hauled in. 'So one of the issues to discuss is the specifications for the seaweed vessels in terms of size, construction, navigation methods and maximum speed,' says Lex Vredeveltdt of TNO. This Dutch institute brings in its expertise on the mechanics and construction of, for example, offshore drilling platforms, wind turbines and ships. Another important issue is food safety.

An alternative will have to be found to the antifouling paint applied to the pillars of the turbines to prevent mussels and dirt from sticking to them. And there is a need for guidelines for safe working conditions and emergency response plans for workers at sea.

In view of this diverse range of safety issues, a multidisciplinary team has been formed for SOMOS which includes food safety, governance, offshore, seaweed and marine experts. 'We shall start by making an inventory of the risks involved', says Wageningen researcher Marian Stuiver, who is responsible for knowledge sharing in the project. 'Next, we will analyse the cumulative effects and governance aspects of multiple use of the sea.' As far as possible, this will be done by analysing existing knowledge and tools, supplemented by a case study at a later stage. The ultimate aim is to come up with a practical framework of standards and skills as well as a set of recommended practices. The research process is as important as its outcomes, explains Stuiver. From the start, a community of stakeholders will be involved in the project, including licensing authorities, agencies that certify ships and platforms, and operators working on the site, so as to enhance skills and knowledge all down the line.

FUNDRAISING

UFW's Relationship Manager Fanny Castel supported the development of the project proposal. SOMOS project leader Luc van Hoof at Wageningen Marine Research sees a key fundraising role for UFW. 'I can find my way well enough in the world of EU funding but getting support from philanthropic foundations is a different ballgame altogether,' says Van Hoof. 'There are a lot of foundations around the world which address the same themes as Wageningen, but they all operate in their own way. University Fund Wageningen has the expertise to do the initial screening of foundations, listen to their priorities and keep track of them as the project is being set up.' ■

Info: marian.stuiver@wur.nl,
fanny.castel@wur.nl

Special donations for 25 years together

Each year, the University Fund Wageningen receives special donations for the funds it administers. That can be gifts from people invited to an anniversary celebration or the proceeds from a benefit tournament.

Last autumn, an unusual gift came from alumni Simone Cremers (Human Nutrition 1989) and Tim Tersmette (Land Development 1988) in Den Bosch. They met in Wageningen and had a large party in September to celebrate 25 years together. They asked their guests to make a donation to the Anne van den Ban Fund.

‘We are still enthusiastic about Wageningen, the degrees on offer and the research topics,’ explains Cremers. ‘Tim knew about the Anne van den Ban Fund for students from developing countries. A deciding factor for us is the fact that the fund lets foreign students take knowledge back to their home countries and make a contribution to development.’ The guests, who included many friends from their university days, raised over 1700 euros.

If you want to organize a collection, please contact ufw@wur.nl

CENTENARY

Alumni wanted for centennial celebrations

In 2018, Wageningen University & Research will be celebrating its centenary. The university wants to get as many alumni as possible involved. Do you know alumni who don't receive *Wageningen World* but would like to be kept informed, please ask them to email their contact details to alumni@wur.nl, mentioning your name as well. The person who sends us the most new alumni will get a signed copy of the book *Kruisbestuiving* by the President of the Executive Board Louise Fresco.

‘Science has become entertainment’

There is often a lack of nuance in media reports on what is and is not healthy food. Professor Ellen Kampman and journalist Hans van Maanen debated this topic in the World Lecture on 19 October in Wageningen.



PHOTO VINCENT KOPFERBAAT

Ellen Kampman, Hans van Maanen and Frans Kok (from left to right) at the World Lecture

Last year, the World Health Organization (WHO) noted a link between the consumption of processed meat and cancer. The message in the media was that sausages give you cancer. Ellen Kampman, Wageningen professor of Nutrition and Disease, had her work cut out giving a more nuanced interpretation. At the individual level, eating 100 grams of red meat or 50 grams of processed meat a day marginally increases the risk of intestinal cancer, from 5 to 6 percent. ‘That is of quite a different order to smoking.’ She also pointed to the problem that journalists are not interested in subtle distinctions and to the increasing pressure universities put on researchers to appear in the media. Journalist Hans van Maanen noted how ridiculously few people understand percentages and basic statistics. ‘Science

has become entertainment. Many editorial boards don't have science journalists who can assess the research studies. Then the articles are just reworked press releases.’ There is a danger here for science too, says Van Maanen: If researchers make more of a song and dance about their conclusions than is justified by the results, that adversely affects the credibility of science.’ Van Maanen urges his fellow journalists to be more critical. ‘Journalists should stop nonsense from getting into newspapers by checking the information and reading the report first.’ The World Lectures are an initiative by the Wageningen Ambassadors and are organized by Wageningen Academy and KLV. The lecture can be viewed in its entirety at <https://youtu.be/jON7oyhMYYM>

1966 COHORT

Heretics versus papists

In 1966 there were a lot of baldies on the lecture benches: lads who had gone through their society's hazing ritual. The alumni attending the reunion in Wageningen at the end of October for students who enrolled 50 years ago reminisced about this.

'When I came into the lecture hall as a first-year, I got a lot of disapproving looks,' says Henk Kamphuis (Land Development). 'That's because I still had my hair, and only Unitarians and nihilists had that.' Former KSV member Willem Kerkhof (Food Technology) talked about the hazing period when 100 of them marched down the street and stopped outside SSR. 'We had to stand to attention and on command shout "heretics, heretics". At first there was silence, then came the cry from SSR: "papists, papists!"' Piet Wesemael (Agrarian Economics) adds: 'You have to remember, this was at the tail end of the *verzuiling* [religious com-

partmentalization of Dutch society].'

About 135 former students attended the reunion. Alumni came to the Netherlands from Europe, Argentina, South Korea, the US and Canada especially for the occasion. They included Peter Tijssen (Phytopathology), professor of molecular virology at the university of Quebec in Canada. 'I went to Canada for my PhD research but I was offered a job and eventually stayed,' says Tijssen. It turns out that his wife also studied in Wageningen. 'We met when she was in Canada for an internship.'

Photos and more: www.wur.eu/50yearreunion



PHOTO'S GUY ACKERMAN

FUNDS

Second prize for varroa killer

A student team from Wageningen University & Research came second with 'Bee T' in iGEM, the international competition for synthetic biology, at the end of October in Boston, USA. The team developed a bacterium that produces a poison that harms varroa mites, which cause bee deaths in honeycombs. The 12 students were able to carry out the project in part thanks to the more than 20,000 euros that they received from Wageningen University & Research's crowdfunding platform. Info: crowdfunding.wur.nl/en, arianne.vanballegooij@wur.nl

FACEBOOK



Humans of Wageningen University: Jenneke van Vliet

'Coming to Wageningen to study felt like coming home,' says Jenneke van Vliet (Environmental Sciences 2008) on the Humans of Wageningen University Facebook page. 'I thought it was wonderful meeting like-minded idealists who were not afraid of getting their hands dirty.' Jenneke works for the agricultural and environmental consultancy CLM in the Netherlands but she is currently on sabbatical in the Bolivian Highlands. 'I'm working at PROINPA with local scientists and students on organic pest control for quinoa and the use of endemic parasitic ichneumon wasps as a form of pest control. I see that as typical of Wageningen too: drawing on knowledge from all over the world to improve sustainability.' If you too want to talk about your bond with the university, send an email to spreadthewurd@wur.nl.

PERSONALIA

Prof. Lars Angenent, WUR Environmental Protection (water purification) 1994, has been appointed professor of the environment and biotechnology at the University of Tübingen, Germany. 1 August 2016.

Martijn Bezemer PhD, WUR Phytopathology 1994, soil ecologist at Netherlands Institute of Ecology, Royal Netherlands Academy of Arts and Sciences, has been appointed professor holding an endowed chair in the ecology of plant-microbe-insect interaction at Leiden University. 1 September 2016.

Monique Bronkhorst-Jonker MSc, WUR Biology 1995, has published her debut novel *Lena*, based on the lives of her grandparents in Edam in 1930 to 1950. 29 September 2016.

Tammo Bult PhD, WUR Zootechnics 1991, has been appointed director of Wageningen Marine Research. 25 October 2016.

Marc Calon MSc, WUR Farming Technology 1987, has been appointed chair of the Dutch Federation of Agriculture and Horticulture. 1 January 2017.



Marc Calon

Prof. Andrew Campbell, WUR Management of Agricultural Knowledge Systems 1994, has been appointed Chief Executive of the Australian Centre for International Agricultural Research (ACIAR). 1 August 2016.

Fred Evers MSc, WUR Tropical Land Development 1975, has been appointed honorary consul in Hungary. 10 March 2016.

Prof. Walter Gerrits, WUR Zootechnics 1989, has been appointed professor holding a personal chair in the WUR Animal Nutrition group. 1 October 2016.

Prof. Jan Willem van Groenigen, WUR Soil Science 1994, has been appointed professor holding a personal chair in the WUR Soil Biology and Biological Soil Quality group. 1 October 2016.

Prof. Alfred Hartemink, WUR Soil and Water 1992, has been appointed an honorary member of the Soil Science Society of America (SSSA) and has also been given the International Soil Science Award. November 2016.

Paul Hofman MSc, WUR International Development Studies 2016, has won the Unilever Award for his Master's thesis on the spread of farming technology in Congo. 1 December 2016.

Carel Jaspers MSc, WUR Plant Breeding 1989, former KLV committee member and director of Q-Point, won the Food Valley Award with his company for the approach he developed to reduce food waste in the restaurant and catering business. 13 October 2016.

Prof. Martin Kropff, WUR PhD 1989, former WUR rector magnificus, director of CIMMYT in Mexico, has received an honorary doctorate from the Czech University for Life Sciences in Prague. 26 October 2016.



Martin Kropff

Jackline Lang'at MSc, WUR Leisure, Tourism and Environment 2014, has received a SAG-SEED award for sustainable development with her company Green Road Ltd, which builds roads using plastic waste. November 2016.

Huub Lenders MSc, WUR Economics, Management and Consumer Studies 2014, wine producer in Portugal, and his wife Wil Lenders won the Intermarché award for the best wine in Portugal for their organic Bonjardim wines. The award was set up to reward farmers for sustainability and innovation, and for production that respects traditions and the local community. September 2016.



Huub and Wil Lenders

Rob Roggema PhD, WUR Landscape Architecture 1990, has been appointed professor of Sustainable Urban Environments at the University of Technology, Sydney, Australia. 1 December 2016.

Gerda Verburg, KLV member, has been appointed Coordinator of the Scaling Up Nutrition (SUN) Movement by UN Secretary-General Ban Ki-moon. 3 March 2016.

Edze Westra PhD, WUR Molecular Sciences 2007, has received the Heineken Young Scientist Award for Biochemistry and Biophysics for his work on the CRISPR-Cas system. 29 September 2016.



Edze Westra

FAREWELL

The potato expert **Prof. Anton Haverkort**, WUR Agricultural Plant Breeding 1978, was given the Broekema medal on his retirement from Wageningen University & Research in September. Luitje Broekema, the founding father of plant breeding in the Netherlands, was one of the first professors in Wageningen.

Haverkort will continue to work as a professor at the university of Ni de (Turkey) and he is also working on a manual on potatoes.



Anton Haverkort (left)

Frans Aarts PhD, WUR Agricultural Plant Breeding 1976, founder of the experimental dairy farm De Marke in Hengelo, stopped work in September as a nutrient cycle expert at Wageningen University & Research. His departure coincided with the publication of his book on farmers in Peel and Kempen in around 1800, in which he describes how impoverished livestock farmers living on poor sandy soil depleted their surroundings in their efforts to keep the land fertile, but were still able to obtain decent yields.

Info: www.peelenkempen.nl.



Frans Aarts

Why do we first dilute urine and faeces with water and then try to extract everything? This question was the focus of the scientific career of **Prof. Grietje Zeeman**, WUR Environmental Technology 1980. She stepped

down in October from her position as professor holding a personal chair in New Public Sanitation in Wageningen. The vacuum toilet, which was developed in Wageningen, is now being used at certain locations in the Netherlands.



Grietje Zeeman

Wageningen Ambassador **Prof. Toon van Hooijdonk**, WUR Food Technology 1976, stepped down in October from his position as professor by special appointment in Dairy Sciences at Wageningen University & Research. From 1986 to 2011, Van Hooijdonk was an R&D manager at what is now the dairy company FrieslandCampina.



Toon van Hooijdonk

Prof. Lijbert Brussaard, WUR PhD 1977, stepped down in October after 28 years as a professor of soil biology and biological soil quality in Wageningen. In his farewell address, he said that the storage of carbon is declining in the Netherlands while the production of crops for biobased applications will take up a lot of farmland. That and the need to stop climate change are why levels of organic matter in the soil need to increase.

IN MEMORIAM

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

Mr G.A. Van den Berg PhD, WUR Horticulture 1972. 16 July 2016.

Mr A.M. Bloem MSc, WUR Tropical Rural Economics 1968. 8 April 2013.

Mr H.J. Boot PhD, WUR Molecular Sciences 1992. 5 December 2012.

Mr B.C. Bos MSc, WUR Agricultural Plant Breeding 1950. 19 October 2016.

Mr J.A.L. van Dixhoorn MSc, WUR Agricultural Plant Breeding 1960. 15 October 2016.

Mr J.A. den Dulk PhD, WUR Land Development B 1978. 10 September 2016.

Mr L.H. de Graaff PhD, WUR Molecular Sciences 1984. 6 October 2016.

Prof. P. Kooij, WUR professor of Rural History 1999-2010. 9 August 2016.

Mr F.T.A. van Maarseveen MSc, WUR Land Development B 1977. 30 September 2016.

Ms J.F. Makkink MSc, WUR Environmental Protection (water purification) 1984. 22 August 2016.

Mr R. Maris MSc, WUR Land Development 1951. 19 October 2016.

Mr M.C.G. Middelburg MSc, WUR Plant Breeding 1969. 13 November 2016.

Ms B. Peeters MSc, WUR Management, Economics and Consumer Studies 2009. 14 May 2016.

Ms S.M. van der Schenk MSc, WUR Rural Sociology of the Non-Western Regions 1988. 23 June 2016.

Mr A.J. Schouten MSc, WUR Rural Development Studies 1999. 22 May 2016.

Prof. W. Segeren, WUR Tropical Land Development 1961. 15 December 2015.

Mr W.B. Snellen MSc, WUR Tropical Land Development 1979. 27 June 2016.

Prof. C.J. Stigter, WUR PhD 1974. 20 May 2016.

Mr E. Ubels MSc, WUR Tropical Plant Breeding 1956. 6 October 2016.

Mr K.J. de Vries MSc, WUR Rural Economics 1957. 26 September 2016.

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



“There is always something you can contribute”

Careers afternoon reduces the networking threshold

Networking is vitally important for finding the right job, but can be a huge obstacle as well. How can you best approach it? Last autumn KLV, together with KLV Professional Match and coach and trainer Geraldine Sinnema, organised a careers afternoon about networking for recently graduated alumni. Many obstacles were overcome during that afternoon.

Recent graduates often find networking a bit scary. To some, it sounds a bit like cronyism. ‘But networking is mainly about people who are willing to help you along,’ is the view of Geraldine Sinnema. Together with study coordinator Sietse Sterrenburg, she immediately got the afternoon off to a good start. By performing sketches with KLV chair Han Swinkels as ‘the victim’, they informally demonstrated how you break into a conversation or steer a conversation towards yourself. Of course, they also showed how not to do that. It was sometimes hilarious, but also very familiar. It immediately broke the ice between the participants, who were initially somewhat uneasy.

After this introduction, the participants were free to draw up their own programme. There were plenty of options; the participants could choose between various workshops offered, as well as meet-and-greets. “This is a new approach,” says Saskia Ransijn, organiser for KLV Professional Match. “We invited a wide range of alumni for this event, ranging from starters to CEOs and from researchers to policy advisers. We drew the guests from the entire spectrum of Wageningen University and Research and from industry. Han Swinkels and Geraldine Sinnema also took part. It was possible to have a conversation with them in small groups. Although many of the participants appeared to find that a bit scary - the workshops were more popular - we nevertheless received many positive reactions, as the most interesting and

personal conversations take place in small groups. The guests with whom the meet and greets took place were also positive. They benefited from it as well: it raised their name awareness, of course, but it also got them in touch with young people who are active in an interesting world. Many people decided to meet up again!”



Hilarious and familiar: Geraldine Sinnema showed how you should and should not hold a networking conversation.

Participant Josée Vervaart submitted a positive response: ‘Thank you for a successful afternoon!’ We briefly talked to her on the phone.

Why did you attend the careers afternoon?

“I worked in the IT industry for some time, but I graduated in bio-organic chemistry. I now want to pursue a career in molecular biology. I would like to find an interesting lab job in the field of health, food quality or food safety. Of course, Wageningen is ‘the place to be’ when it comes to these subjects. This afternoon was a fantastic opportunity to meet people and gain ideas. As far as I’m concerned, it was a great success!”



Eye openers?

“During networking you often think ‘what’s in it for me?’ But there is always something you can contribute in terms of tips or advice. It was great to experience that in practice. What I also found interesting was a workshop about making smart use of the colour of your clothes to emphasise your “soft skills” such as decisiveness, expertise or helpfulness.”

Did you give any advice?

“A concrete one: I told somebody about a careers fair that she did not know about yet. She was very happy about that!”

And what advice are you going to put to use?

“Make a business card and hand it over at the start of a conversation like the Chinese do. This instantly provides person you are talking to with information about you and you can build upon that during the course of the conversation! So I am now preparing my business cards.”

Career Monitor

Did you know that since 1973 KLV has been monitoring the success of Wageningen alumni on the labour market? Once every five years, each alumnus is sent a survey. It contains questions about their education, current employer and position, managerial and other activities outside of their studies, et cetera. It is a wealth of useful information collected over more than 40 years about Wageningen graduates on the labour market and the trends therein.

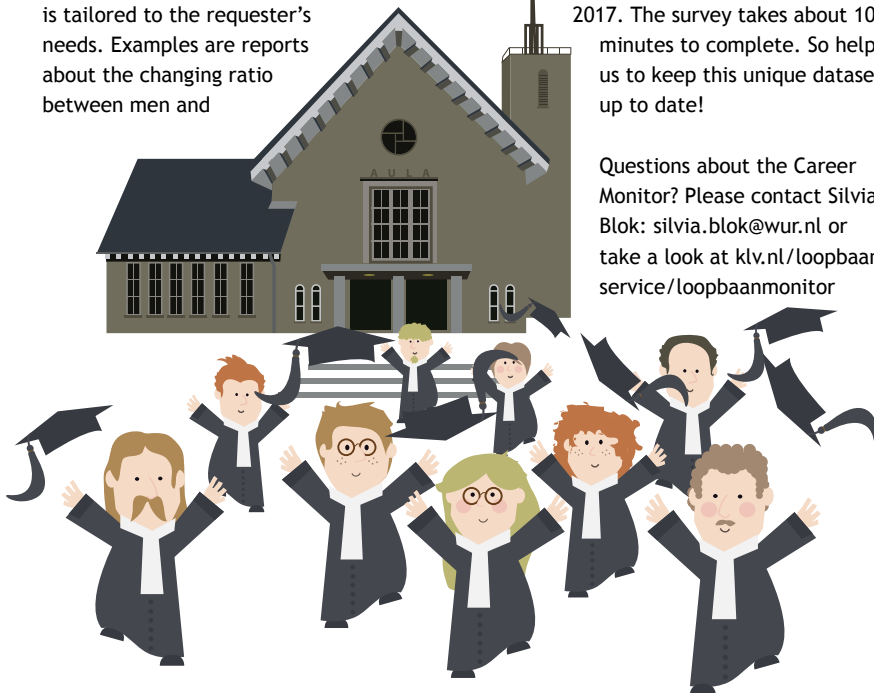
The Wageningen Career Monitor is unique. No other Dutch university has such a long-term and complete picture of the careers of its graduates. Labour market expert Silvia Blok uses these data to answer questions from KLV and the university. "Wageningen University uses the information for various purposes, such as drawing up the study programmes, informing students, and the visitations of the programmes," she says. "But a lot of the advice is tailored to the requester's needs. Examples are reports about the changing ratio between men and

women, or about the number of PhDs over the course of time." In principle, far more could be done with the information, says Blok enthusiastically. "For example, you could investigate how the required competencies have developed over the years and project that information to the future: should we specialise more or should we generalise more?"

KLV offers an extra service to its members. Blok will be happy to delve into the database to answer specific questions you may have. For example, who do people with similar degrees end up working for, or what do other alumni with a similar position earn? This is useful information if you are looking for a job or negotiating a salary.

This autumn, the survey is being held again. If you are an alumnus, then you probably received a request in your mailbox in mid-October to complete the survey. The deadline is 8 January 2017. The survey takes about 10 minutes to complete. So help us to keep this unique dataset up to date!

Questions about the Career Monitor? Please contact Silvia Blok: silvia.blok@wur.nl or take a look at klv.nl/loopbaan-service/loopbaanmonitor



INVITATION

If you check our KLV Facebook page on a regularly base, you will be informed what KLV has been up to and what we are working on. This way you will keep in touch with the alumni association of your Wageningen University. Of course you are welcome to post your own interesting status updates too.

Join KLVNetwork!



www.facebook.com/klvnetwork

ACTIVITIES

Info: klv.nl/en (unless indicated otherwise)

23 and 24 June 2017

KLV - Two day conference
'Inspired by uncertainty'



YOUNG KLV PROGRAMME

7 February 2017

WUR - Career Day 'Explore your future'

WANT TO BECOME A MEMBER?
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PHOTO JULIA EHRLICH

Looking for life below the sea ice in Antarctica

'If you dress for it and wear sunglasses, the cold in the polar region is not too bad,' says Fokje Schaafsma, a PhD candidate at Wageningen Marine Research. She has been to Antarctica twice and to the North Pole region once with the Iceflux project, for research on life under the sea ice. The main focus is on krill, but Schaafsma also studies other small creatures that are a source of food for fish, penguins and

seals. 'Krill is particularly crucial for life in the sea around Antarctica,' she says. She is studying how that krill and other small organisms get through the winter under the ice. 'Some species fatten up in the summer and live off their reserves the whole winter long; others forage for algae on the underside of the ice, where they also take shelter from predators.' It is important in Schaafsma's view to know

what role is played by the communities beneath the sea ice. And especially so, now the amount of ice is changing due to climate change. Moreover, krill are fished in Antarctica for use in fish feeds, cosmetics and medical drugs. 'To find out whether that is being done sustainably, we need insight into the organism's reproductive success.'

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