


# WAGENINGEN WORLD

MAGAZINE OF WAGENINGEN UR ABOUT CONTRIBUTING TO THE QUALITY OF LIFE

no.1 2014



‘The North Pole discussion must be based on independent scientific knowledge’

Bas Bolman, page 10

The **biochar hype** under review | Millions of **mussel seeds** | Hold on to those **minerals**  
**Chemistry as driver** | The autonomous **orchard sprayer** | **Food authenticity** is testable



# 10

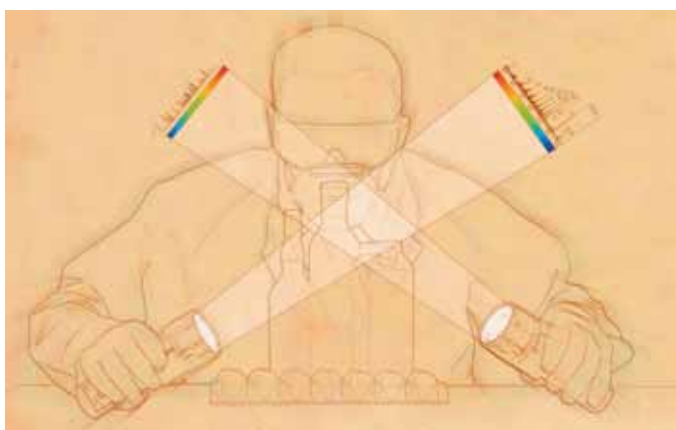
## THE NORTH POLE BECKONS

With the dwindling of sea ice in the North Pole region, the lure of new oil and gas fields is strong. Wageningen UR's Arctic Programme provides a basis for establishing the effects of extraction on the ecosystem.

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## FOOD FRAUD EXPOSED

RIKILT Wageningen UR is developing more and more tests that reveal where food products come from and whether they are genuinely organic. Coffee and eggs have proven to be surprisingly traceable.



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## THE ANCIENT SECRETS OF BLACK SOIL

An ancient method used by Amazon Indians to improve the soil using charcoal is attracting a lot of interest. The claim is that the black soil could solve the climate problem and save the rainforest. But it is not quite as simple as that.



**COLOPHON** Wageningen World is the quarterly magazine for associates and alumni of Wageningen UR (University and Research centre) and members of KLV, the Wageningen Alumni Network. A PDF version of the magazine can be found at [www.wageningenUR.nl/en/wageningen-world](http://www.wageningenUR.nl/en/wageningen-world) **Publisher** Wageningen UR, Marc Lamers, **Editorial Board** Hans Bothe, Yvonne Fernhout, Ben Geerlings, Bert Jansen, Jeanette Leenders, Jac Niessen, Erik Toussaint, Delia de Vreeze **Editors-in-chief** Pauline Greuell (Corporate Communications Wageningen UR) **Magazine editor** Miranda Bettonville **Copy editor** Rik Nijland **Alumni news** Alexandra Branderhorst **Translation** Clare McGregor, Clare Wilkinson **Language editor** Clare McGregor **Art direction and design** Jenny van Driel (Wageningen UR, Communication Services) **Cover picture** Corbis **Overall design** Hemels Publishers **Printer** Mediacycenter Rotterdam **ISSN** 2212-9928 **Address** Wageningen Campus, Akkermaalsbos 14, 6708 WB Wageningen, PO Box 409, 6700 AK Wageningen, telephone +31 317 48 40 20, [wageningen.world@wur.nl](http://wageningen.world@wur.nl) **Change of address alumni** [www.wageningenUR.nl/en/alumni.htm](http://www.wageningenUR.nl/en/alumni.htm) **Change of address associates** (mention code on address label) [wageningen.world@wur.nl](mailto:wageningen.world@wur.nl) **Change of career details** [alumni@wur.nl](mailto:alumni@wur.nl)

The mission of Wageningen UR (University & Research centre) is 'to explore the potential of nature to improve the quality of life'. Wageningen UR includes nine specialist applied research institutes and Wageningen University. These institutions have joined forces to contribute to finding answers to crucial questions related to healthy food and a sustainable living environment. Wageningen UR has a staff of 6,500, 10,000 students, 35,000 alumni and 40 sites, with a turnover of 662 million euros. Institutes of Wageningen UR: Alterra, LEI, Plant Research International, Applied Plant Research, Wageningen UR Livestock Research, Central Veterinary Institute, Wageningen UR Food & Biobased Research, IMARES and RIKILT.



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By using plants more efficiently, we can break free of fossil fuels, says departing 'Professor Biobased', Johan Sanders.

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Together with businesses, Wageningen researchers have succeeded in developing a self-propelling tractor fitted with an automatic sprayer for use in orchards.

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The dairy farming sector can significantly cut nitrogen and phosphate in manure and the environment, show research results at De Marke experimental farm. 'The key is to get more feed from your own land.'

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Kees Groot developed an alternative to catching young mussels with bottom trawls, with help from IMARES Wageningen UR. Already, one third of the catch is brought in using these Mussel Seed Capture Installations (or MZIs).

## FEATURES

**40 LIFE AFTER WAGENINGEN: THE FAMILY FARM**

Bart van den Bosch and his younger sister Petra head a family business: a large, sustainable beef tomato farm. They both studied Horticulture in Wageningen. 'The focus in the sector lay mainly on increasing production rather than on quality.'

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FOTO GUY ACKERMANS

## The city as a raw materials factory

'Cities are big consumers of water and raw materials, which are supplied from elsewhere and then discharged as soon as possible after use. That is a wasteful concept. It is bound to go wrong in the not too distant future, especially given that an increasing proportion of the global population are living in urban environments. We will need to transform cities from waste producers to raw materials factories that use the inputs as efficiently as possible. 'Water supplies are already an acute problem. Many of the world's biggest cities are on the coast but they depend on rivers for their fresh water. The mouth of the Yangtze River is currently almost dry; climate change will make river supplies more unpredictable, and salinization will become more of a problem. In many regions during this century, supplying a city, its industry and the surrounding farmland with water will become an impossible task. 'That is why we need not just to curtail water consumption, but more importantly to create a closed cycle. We need to keep hold of the water flowing into the city, purify it and reuse it.

If we do that, we kill two birds with one stone: domestic and industrial waste water is full of basic components that agriculture needs, such as nitrogen and phosphorus – a limited resource. Now we flush them away into the surface water, which causes ecological damage. Or they remain in the sludge in the water purification plant, where it is difficult to extract them. The challenge is to purify wastewater so that it can be reused, by extracting phosphorus for use as fertilizer and by removing drug residues and other chemical compounds from the water. 'We already have the technology for this, and implementation is possible now in new suburbs or the fast-growing cities of China. But it is a long-term process. In the Netherlands alone, 100 billion euros have been invested in infrastructure for the water supply and wastewater. You cannot simply replace that in the twinkling of an eye.'

Huub Rijnaarts, professor of Environmental Technology at Wageningen University and director of the Wageningen Institute for Environmental and Climate research.



## FRESCO NEW WAGENINGEN PRESIDENT

# ‘It feels like a homecoming’

**Louise Fresco has been appointed chair of the executive board of Wageningen UR. She succeeds Aalt Dijkhuizen, who stepped down on 1 March.**

For Fresco the move is a return to her alma mater. She studied in Wageningen and got her PhD there in 1986 in the field of Tropical Plant Sciences and Production Systems. Between 1990 and 1997 she was professor of Plant Production Systems at Wageningen before her career took her to the FAO, the UN's food and agriculture organization, where she gained management experience. ‘I am not a manager who just wants to focus on processes,’ says Fresco. ‘I want to base decisions on substantial considerations and get substantial results, working in a team. I learned a lot about diplomacy in Rome.’

Fresco returned to the Netherlands in 2006 as university professor of Sustainable Development at the University of Amsterdam. She has written numerous books, including *Hamburgers in Paradise*. Last year she made a six-part documentary about nutrition and sustainable food supplies.

Fresco is a member of the Dutch academy of sciences KNAW, as well as of three overseas academies. She was invited to consider the position of president. ‘If it hadn't been Wageningen I wouldn't have done it. The university is coherent in its domain, and I have an overview of most of the subject areas. It feels like a homecoming.’ In Fresco's



PHOTO JEROEN OERLEMANS

opinion, the collaboration between the university and DLO in Wageningen UR is a brilliant idea: ‘I wonder whether we cannot get more benefits out of this collaboration.’ Fresco will be resigning from her commissionership with the Rabobank, and her membership of the Social and Economic Council SER. Within one year she will

also stop as non-executive director for Corporate Sustainability at Unilever. Aalt Dijkhuizen said goodbye to Wageningen on 1 March after 12 years of service. Due to ongoing commitments in Amsterdam, Fresco will only take up office from 1 July, but will be regularly available for her work in Wageningen before that date.

## EDUCATION

## Best education employer

Wageningen UR scored the highest among educational institutions in a survey of employee satisfaction at the 200 biggest employers in the Netherlands. For the survey by business magazine Incompany, about 5000 employees from the largest companies, institutions and government bodies

were questioned. Overall, Wageningen UR came 19<sup>th</sup>; the winner was advisory bureau Arcadis. Incompany noted that staff satisfaction in Wageningen UR has been growing since 2010, while the national trend has been downward.

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PHOTO PETRA APPELHOF

## FOOD CHAIN

## Smart expiry sensor wins prize

The 'Pasteur sensor tag', a smart sensor for detecting the shelf life of fresh foods, has been awarded the Food Valley Award. The models for calculating the food's quality were developed by Wageningen UR Food & Biobased Research.

The 'sensor tag' is a flexible card that can be stuck onto a box or slid into a slot on the outside of a transport crate. There are three silicon chips on the card, and printed batteries with a shelf life of several weeks. The chips register atmospheric humidity and temperature during transport and storage. Their special feature is that they then calculate the quality of the product, thanks to the models for shelf life calculation developed by Food & Biobased Research for fresh produce such as strawberries, avocados, meat and roses.

When someone scans the chip with a mobile phone, for example, they can immediately see the information about the production quality and remaining shelf life. Moreover, at a cost price of between 25 eurocents and 1 euro, the Pasteur sensor tag is much cheaper

than regular sensors without built-in quality predictors. The chip was developed in the Pasteur project (2009-2012) by a consortium of 16 high-tech companies and research institutes led by NXP Semiconductors.

'This innovation tackles major chain problems such as food waste, efficiency and traceability in an innovative way,' said the jury. 'It could therefore offer many advantage for all the links in the fresh food chain. This innovation is also a fantastic example of two sectors collaborating – high-tech and agrifood.' The prize was awarded on 24 October during the Food Valley Expo in Arnhem.

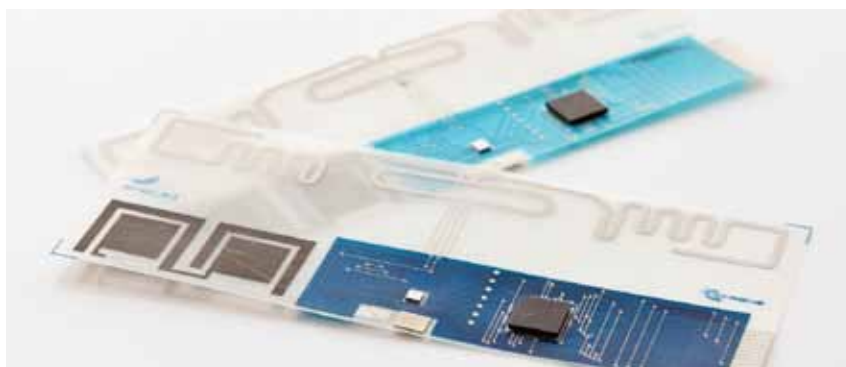
Meanwhile, the Pasteur tag is ready for introduction in wholesale packaging. In the future the technology can also be used to tag individual items. Info: [toine.timmermans@wur.nl](mailto:toine.timmermans@wur.nl)

## ENTOMOLOGY

## Mosquitoes by post to Wageningen



After putting out an appeal, Wageningen University received more than 1500 dead mosquitoes by post for its research. Most of the insects were winter mosquitoes. Researchers on the Muggenradar (Mosquito radar) project called for help from the general public so they could find out whether and where mosquitoes are active in the winter, which species they are and whether people are bothered by them. They are particularly curious about the distribution of *Culex pipiens molestus*, which remains active in the winter, unlike its cousin the ordinary house mosquito. Initial analyses showed that almost one third of the mosquitoes sent in were of the second type; a DNA analysis should reveal which variety they are. Of the 2500 people who filled in a form on [muggenradar.nl](http://muggenradar.nl) by the end of January, approximately half were bothered by mosquitoes, either by their bites or by their whining. Info: [muggenradar.nl](http://muggenradar.nl)



## WAGENINGEN ACADEMY

### Cooperatives theme day

It is hard to imagine Dutch society nowadays without its co-operatives. They are promoted as the new business model which offers a solution to problems currently facing the socio-economic system. But what are cooperatives, actually? What are their historical roots? And is this form of organization suited to a role in a complex society like the Netherlands in 2014? What are the roles of the public, the market and the government? And what are the challenges facing cooperatives

in future? These and several other questions will be addressed during this theme day. At the end of the day you will have gained an insight into the various developments, bottlenecks and opportunities related to cooperatives as a business model.

**Wednesday 9 April 2014 / Course leader: Jos Bijman**

**For the full range of courses see: [www.wageningenacademy.nl](http://www.wageningenacademy.nl)**

## All Wageningen publications

This year the Wageningen UR library has established a full overview of articles and books by its staff: the most complete publications overview of any university in the Netherlands. The database, Staff Publications, includes more than 200,000 publications, one quarter of which appeared in open access journals. The database can be searched by name, chair group and institute and also shows citation and impact scores.

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## HEALTH



## Depression can be predicted

The theory that critical slowing down is a predictor of a tipping point applies to depression as well as other things, wrote researchers from Wageningen University and international colleagues in December 2103 in PNAS. For the study, healthy and depressive people gave regular scores over the course of a week for various aspects of their mood. From their mood swings, the researchers could estimate the chances both of a depression and of a recovery. In healthy people who later went into a depression, their moods changed more slowly than is normal during the study; in people who were already depressed, this kind of delay was a predictor of recovery.

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# Dangerous shortage of pollinators

**The worldwide drop in numbers of bees and other pollinators has serious consequences for food security. Any further deterioration in their living conditions could lead to the sudden extinction of pollinating insect species.**

Many different plants are visited by just as many different pollinators, forming between them a robust interacting network with a structure that is characteristic for a habitat. A tipping point can be reached, however, warn scientists at Wageningen University, part of Wageningen UR, in an article published in January in *Ecology Letters*. With the help of mathematical models, they show that the nature of the interacting network of pollinators and plants can cause the community of pollinators to collapse once the conditions reach a critical low point.

A shortage of honey bees for pollinating agricultural crops is already looming in Europe. The demand for pollinators is growing faster than the supply of bee populations, especially through the increasing amount of land used to grow energy crops such as oilseed rape, sunflowers and soya. This conclusion was drawn by an international group of scientists including David Kleijn and Jeroen Schepper of Wageningen

UR, following research on the supply and demand of bee populations in 2005 and 2010 in 41 European countries. In 22 countries the bees were not able to properly pollinate more than 90 percent of the crops, which can lead to suboptimal harvests, says Kleijn. Because it is European policy that the cultivation of biofuel crops should expand, while the number of beekeepers is in decline, the expectation is that the gap between supply and demand will only grow.

In order to maintain the vitality of bee populations, the international Coloss network of scientists, beekeepers and students has started a study of precisely which pollens bees collect. 'Variation in pollen is one of the keys to a healthy life for a bee,' explains Sjef van der Steen of Wageningen UR. Thirty beekeepers in the Netherlands are already participating in the research, but there is room for more (see: [coloss.org](http://coloss.org)). More financiers are wanted too. Info: [jelle.lever@wur.nl](mailto:jelle.lever@wur.nl), [david.kleijn@wur.nl](mailto:david.kleijn@wur.nl), [sjef.vandersteen@wur.nl](mailto:sjef.vandersteen@wur.nl)



PHOTO: HOLLANDSE HOOGTE

## BIOBASED

## LIVESTOCK CHAIN



PHOTO WAGENINGEN UR

## Mobile exhibition on biobased economy

**There are still not many people who have much idea about the concept of a biobased economy. So Wageningen UR Food & Biobased Research got together with Applied Plant Research (PPO) to develop a mobile exhibition called Bio-Based.**

The heart of the exhibition is a glass ball which depicts the transition from an oil world to a green world in which most products can be composted or recycled thanks to chemical and agricultural processes. The idea is that once people realize that there is more to a bio-economy than using biofuels, they will more readily switch to using biobased products. The exhibition displays plant-based raw materials, refining processes, end prod-

ucts and closed cycles, and includes films for on smartphones and a 3D printer with threads made of maize or potato. The exhibition also explains how to prevent the use of crops and agricultural land for biobased products causing a drop in food production.

*The Bio-Based exhibition can be rented at a cost-covering price, and the contents can be adapted to the client's interests.*

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## Pigs like cool trucks

Transporters who care about the welfare of pigs should install a climate control system in trucks used to transport them. On longer trips, mechanical ventilation is more important to a pig than a little more space. This conclusion was drawn by Marien Gerritzen of Livestock Research, part of Wageningen, on the basis of a study of pig transportation. On a journey of 550 kilometres, taking 8 hours, he monitored the body temperature, heartbeat, blood values and behaviour of the animals. The drivers' breaks are particularly unpleasant for the pigs. On a car park, without ventilation that catches the wind from the truck's momentum, the temperature in the truck and the animals' pulse rates quickly soar. If they are given a little more space, pigs generally lie down earlier. Gerritzen did the research for the ministry of Economic Affairs and published his findings in November in *Animal*.

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PHOTO STOCK

## NUTRITION &amp; HEALTH

## Better health with less salt

If all the Dutch were to systematically cut their salt intake, almost 4.8 percent of heart attacks and 5.8 percent of strokes would be prevented over the coming 20 years. By 2033, 7 in 1000 deaths would have been avoided. This was calculated by researchers at Wageningen University, part of Wageningen UR, and the health policy institute the RIVM in a study on the health



benefits of less salt in processed foods.

The Dutch eat too much salt: on average 9 grams a day. The recommended limit is 6 grams a day.

Overconsumption of salt leads to high blood pressure, with a higher risk of cardiovascular disease as a result. The study was published in December in the *American Journal of Clinical Nutrition*.

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## Super-freezer keeps office warm

Together with the company BERG Koudetechniek & Klimaatbeheersing, Wageningen UR has developed a low-energy ultra-low temperature cooling cell for storing plant material such as DNA, plasmids and proteins at minus 80 degrees Celsius. The new freezer, consisting of two table-height, extremely well insulated freezers each 12 by 12 metres, replaces 34 conventional ultra-freezers and cuts energy consumption by 80 percent. The heat produced by the new super-freezer is used to heat the office.

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## FISHERIES



PHOTO HOLLANDE HOOGTE

## New rule costs fisheries millions

A new obligation to bring ashore undersized fish and unwanted bycatch of species under quota will cost Dutch fisheries between 6 and 28 million euros a year, depending on the size of the quota and the prices for bycatch. This finding came out of a study by LEI Wageningen UR. The reason for these extra costs is that the extra sorting, cooling, transport and levies cost more than the bycatch brings in. The costs of on-board control by CCTV cameras or by passengers are not included in the calculations.

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PHOTO NATIONALE BEELDBANK

## Algae fill airplane tank

**For the airline Arke, Wageningen Ur is exploring the possibilities for producing biokerosene from microalgae. A unique research project in Europe.**

The air traffic industry is badly in need of a climate-neutral, sustainable alternative to kerosene. The advantage of algae above other forms of biomass is that they can be fed on waste flows such as nutrients from waste water, and they can be bred on locations that are unsuitable for agriculture.

But before biofuels can viably be produced from algae, the costs will have to go down by a factor of at least 10. To achieve this it is important that valuable by-products such as proteins and chemicals are extracted as well.

So Wageningen UR is doing research at its AlgaePARC on the refining of algae. The economic side of extracting biokerosene from algae is being studied for Arke too, and the savings in CO<sub>2</sub> emissions and water and energy consumption are being analysed. If biokerosene really does turn out to be technically and economically feasible and competitive as an alternative to oil-based kerosene, Arke wants to produce the fuel on a large scale for use as airplane fuel.

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## RESEARCH

### Professors receive Gravity Grant

Three Wageningen professors are participating in projects awarded funding to the tune of millions of euros in December by research funding body NWO. Professor Marten Scheffer is involved in research that looks at the climate of the past, present and future together in order to improve forecasting of future climate conditions on earth. This research is to receive 28 million euros for the coming 10 years.

A group including professors and microbiologists Fons Stams and Willem de Vos is

to receive 23 million for research on microorganisms that can survive without oxygen, targeting benefits for human health as well as the production of biogas, organic acids and bioplastics. These Gravity Grants are intended by the NWO to enable top Dutch scientists from different disciplines to collaborate intensively and over a long period with a view to generating new scientific insights.

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## NUTRITION &amp; HEALTH

# Six extra years on Mediterranean diet

**Men born on the Greek island of Crete at the beginning of the 20th century lived six years longer than their counterparts in Zutphen in the Netherlands. The reason lies in differences in diet and lifestyle.**

These results were presented in December at a UN conference on healthy aging by professor of Public Health Research Daan Kromhout of Wageningen University, part of Wageningen UR.

As part of the Seven Countries Study, 686 Cretans and 878 Zutphen residents were monitored from 1960, when they were between the ages of 40 and 59. The mortality figures collected on Crete and in Zutphen up to 2010 were made available for analysis last year. They showed that the average age of death of men on Crete was 82, while that of men in Zutphen was 76.

The longer lifespan of the Cretans was also reflected in the length of their telomeres. Telomeres are protein structures which protect chromosomes against deterioration. In 2000, telomere length was measured in the surviving men on Crete and in Zutphen, who by then averaged 84 years of age. In the Cretans the telomeres proved to be longer, on

average. Other studies have shown that this difference corresponds with five more years of life.

The diets of the group of Cretan men changed little in those 50 years. They ate a mainly plant-based diet with lots of olive oil, dark fibre-rich bread, fruit, vegetables and pulses, a little fish and very little meat or dairy produce. Combined with the occasional glass of wine and a lot of physical activity, this diet is associated with low death rates from heart attacks and high life expectancy.

Compared to the Cretans, around 1960, the Zutphen men ate little fruit, few vegetables or pulses and a lot of margarine, meat and dairy produce. In 2000 they ate more fruit, vegetables and meat, and just as much dairy produce. In comparison with 1960, wine consumption had gone up significantly. There were no significant differences in smoking habits between Crete and Zutphen.

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## FOOD SECURITY

## Cutting food waste frees up farmland

If European household and retailers were to throw out 40 percent less food by 2020 – a realistic target – a land surface nearly the size of Belgium, or 1.6 percent of European farmland, would be freed up for growing crops for export or biofuels. Throwing out less dairy produce, vegetables, fruit and meat, in particular, would reduce the amount of farmland needed in Europe. What is more, consumers would save an average of 123 euros per person. If everyone in the EU starts eating more healthily, consuming less red and white meat and dairy produce, land use would be more efficient as well. This would have a small positive effect on global food security, too, through rising incomes and falling global market prices. These conclusions were drawn by LEI Wageningen UR in a scenario study conducted for the European Commission.

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## WAGENINGEN UR

## Dairy centre in China

Together with dairy company FrieslandCampina and the Chinese agricultural university CAU, Wageningen UR is going to set up a dairy knowledge centre aiming at boosting milk production in China and improving efficiency and quality. Due to the need to import feed concentrate, the cost price of Chinese milk is now higher than it is in the Netherlands. The research centre will focus on small farmers, who between them account for 80 percent of dairy production. Info: paul.geurts@wur.nl



PHOTO LINEAR

An aerial photograph of an oil rig in the Arctic region, showing a large platform with numerous lights and structures on a snowy, icy landscape. The background features a range of snow-covered mountains under a clear sky.

INCREASING ENVIRONMENTAL PRESSURE ON NORTH POLE

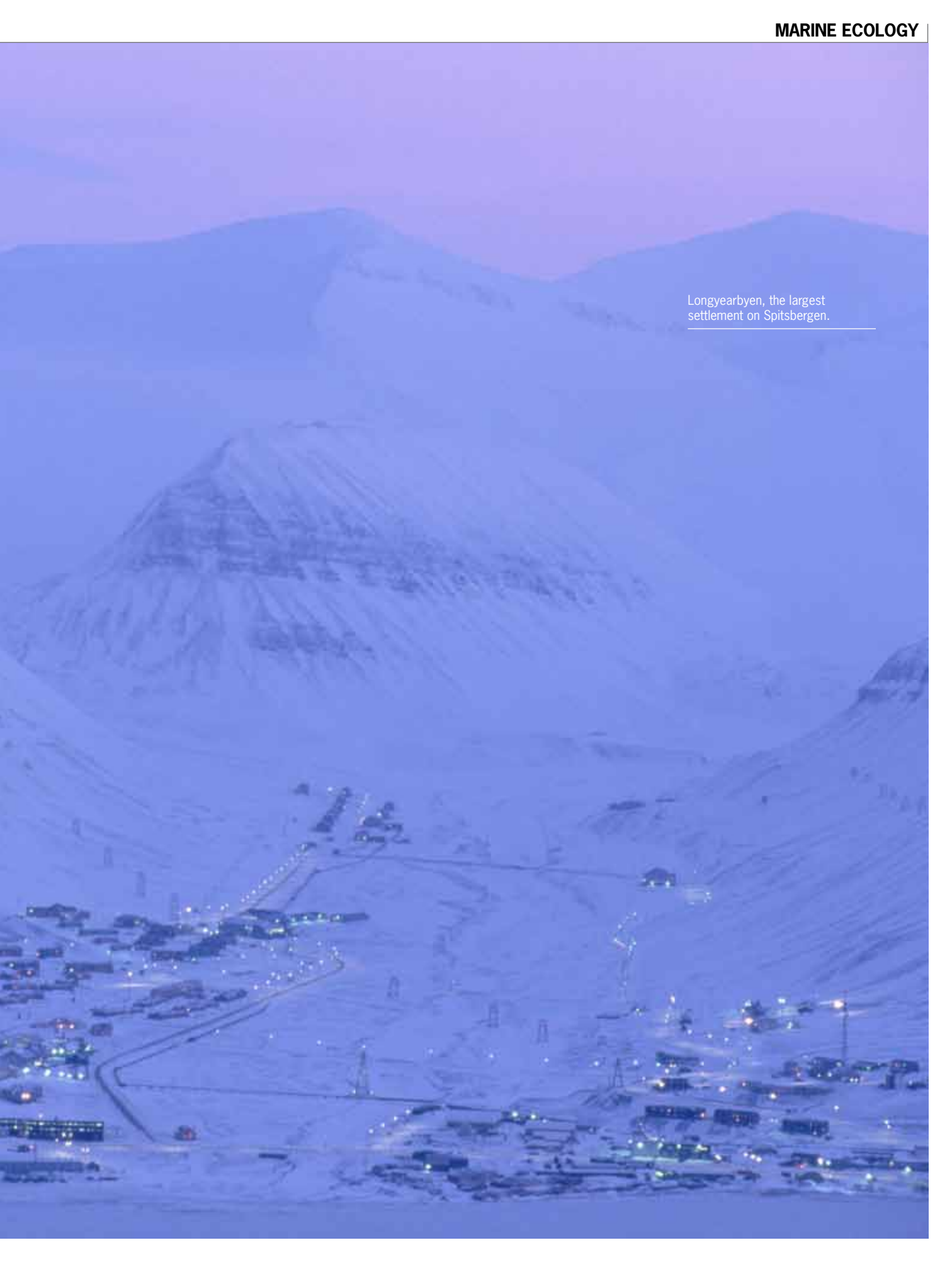
# Of polar bears and oil

The disappearance of the ice in the North Pole region is opening up new prospects for oil and gas extraction. Wageningen UR's Arctic Programme is laying the foundations for an understanding of the effects of new activities on the ecosystem. 'Where is it OK and where is it not? This discussion must be based on independent scientific knowledge.'

TEXT ARNO VAN 'T HOOG ILLUSTRATION MARTIJN BOUDESTIJN PHOTOGRAPHY CORBIS AND HOLLANDSE HOOGTE

Longyearbyen, the largest  
settlement on Spitsbergen.

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**T**he summer of 2013 was wet in Ny-Ålesund, in the northwest of Spitsbergen. Researcher Martine van den Heuvel-Greve and programme manager Bas Bolman, both from IMARES Wageningen UR, regularly got soaking wet. So much is clear from the documentary Knowledge for a sustainable North Pole, by cameraman Ruben Kocx.

Rain is a sign that something is changing on this bleak archipelago, which lies about 1200 kilometres from the North Pole. More rain is part of climate change, as are the receding glaciers around Ny-Ålesund, which are now more than 500 metres shorter than they were 40 years ago.

Gradually rising temperatures are also the reason why the amount of sea ice around the North Pole in the summer is rapidly shrinking. This is leading to new shipping routes being opened up, and northern countries laying claims to the sea bed way beyond their territorial waters. They want their share of the treasures that may lie hidden there.



**MARTINE VAN DEN HEUVEL-GREVE,**  
Researcher IMARES  
Wageningen UR

**'To acquire really relevant knowledge you do need to work in the region itself'**

The urge to explore the northern regions is nothing new in itself, says Bas Bolman. 'People have been coming here for hundreds of years. Willen Barentsz discovered Spitsbergen during his search for a northern passage; the Dutch set up whale oil refineries in the 17th century.' An old steam train in Ny-Ålesund is a reminder of the coal mines that were in operation there between 1916 and 1962.

But the interests that are at stake today are considerably bigger. 'At a guess, 13 percent of the world's oil stocks and 30 percent of its gas are at the bottom of the Arctic Ocean,' says Bolman. 'Less ice means better access, while rising gas and oil prices make it increasingly profitable to invest in extraction in the region. These trends are bringing extreme areas more and more into the picture.'

This carries risks that are not present in more temperate regions. Bolman: 'An iceberg can scrape the seabed and damage a pipeline if it is not buried deep enough. The oil that is released gets locked up in the ice in the winter. The ice moves and can melt somewhere else in the summer, bringing the oil to the surface elsewhere. We don't really know yet how to deal with that.' The environment in cold regions is often fragile, too, says Bolman. 'The North Pole has many different ecosystems which are all coming under pressure from climate change. Human activities come on top of that. There is a debate going on about which activities are permissible here. Where is an activity OK and where is it not? And if it is OK, under what conditions and at what time of year? That discussion must be based on independent scientific knowledge. And that is precisely our role.'

#### **CHEMICALS IN SEABEDS**

Most research begins with collecting data about the current state of a region. Martine van den Heuvel-Greve has completed an initial study of the pollution of Spitsbergen

harbours with chemicals from ships' hulls. These toxic substances – organotin compounds – were added to marine paint for decades in order to deter algae and shellfish from growing on the hull. However, the toxins leak from the paint, thus polluting the beds of harbours and along busy shipping routes, disturbing the reproduction of slugs living there. An international treaty banning these substances has been in place since 2008, but it has not been ratified by all shipping countries.

Studies of sludge from harbours along the east coast of Spitsbergen have indeed revealed traces of organotin. 'But the levels are low compared to large European ports,' says Van den Heuvel. 'We haven't seen any effects on the slugs we examined on the spot. We took these measurements primarily to have them as a reference point for the future.' All the indications are that shipping traffic in the North Pole region will increase when new shipping routes thaw out. 'If monitoring shows that the organotin level goes up, that provides a basis for intervening. With a ban on the use of this kind of paint on ships plying northern routes, for instance.'

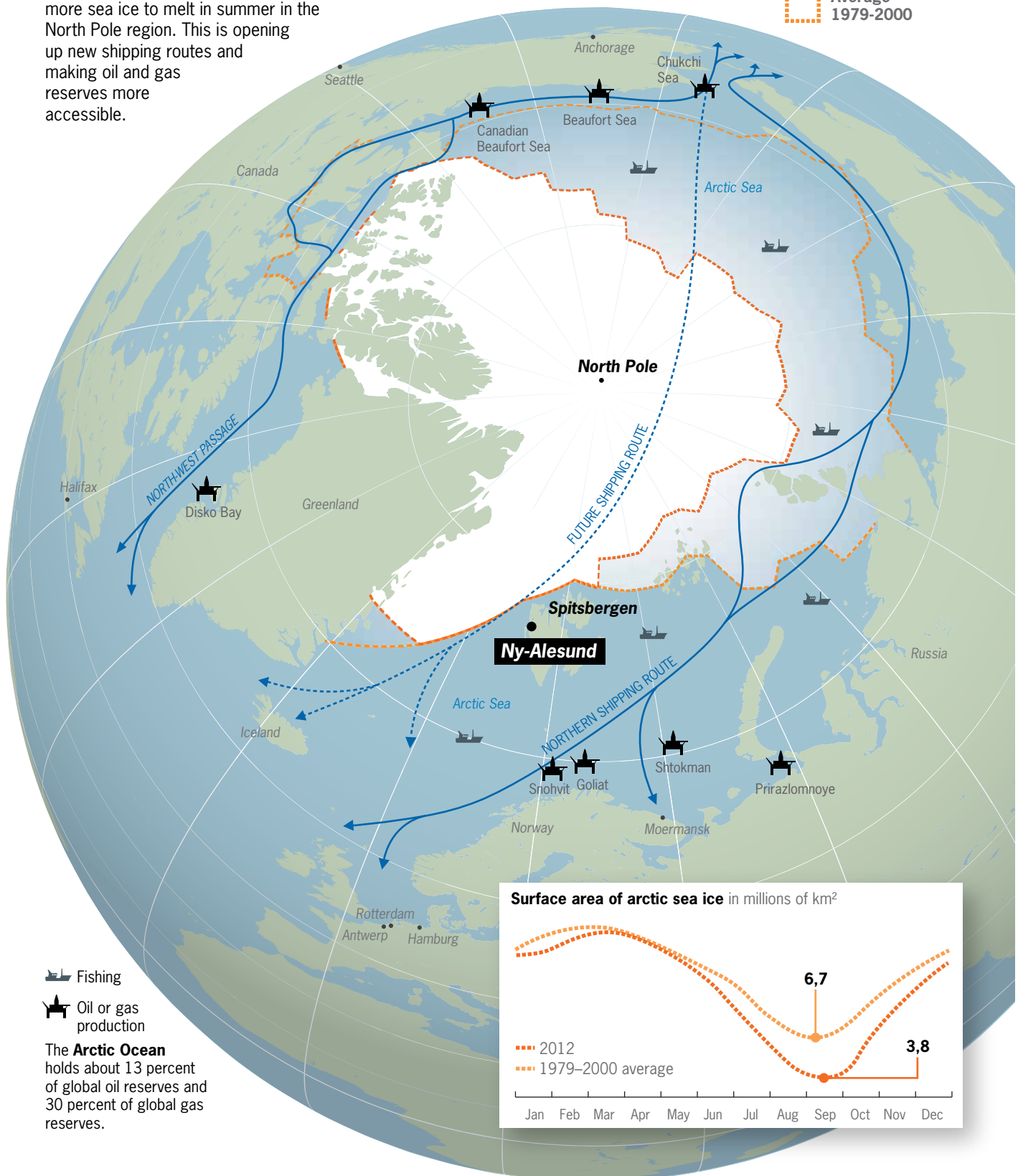
PhD student Ariadna Szczybelski at Wageningen University, part of Wageningen UR, worked on another project to develop so-called bio-indicators for the effects of oil and gas extraction. To do this, over the past year, Szczybelski sank a mud sampler to the seabed at several locations around Spitsbergen, collecting sea soil and animals such as various species of marine worms and shellfish.

These data are now being analysed. The aim is to develop a monitoring instrument, with marine fauna serving as living measuring instruments. If the condition of species deteriorates or their numbers drop, this could be a sign of pollution or stress. Van den Heuvel: 'First of all we collect the seabed samples in order to find out which substances are found in the seabed. ➤'

## THE NORTH POLE BECKONS

Warmer temperatures are causing more and more sea ice to melt in summer in the North Pole region. This is opening up new shipping routes and making oil and gas reserves more accessible.

Limit summer ice   26 August 2012  
New all-time low  
  Average  
1979-2000



Then we do targeted experiments in the lab to study what the effects are on the common species there. They could be combinations of stress factors such as pollution and warming.'

### ARMED WITH A GUN

The Dutch research station in Ny-Ålesund, managed by Maarten Loonen of the Arctic Centre at the University of Groningen, plays a key role, as the IMARES researcher is at pains to emphasize. 'You can do a lot in the Netherlands, but in order to acquire really relevant knowledge, you do need to work in the region itself. There is a big international community there, all working on the science, and that collaboration is very stimulating. People exchange information and you go out for meals together to discuss your research; it is a sort of continuous scientific conference.'

Ny-Ålesund is one of the few research areas where a gun is a compulsory part of a researcher's fieldwork equipment. You never know when a hungry polar bear is going to show up. For the same reason, researchers always go out in pairs at least, and one of those present must have passed the polar bear and shooting course.

Most of the research focuses on the life in the seabed around Spitsbergen. At first glance, the fauna on the bottom of the Arctic Ocean is not very different to that in the North Sea, but the food web works very differently due to the extreme conditions. Food chains are often shorter, Van den Heuvel explains. 'There are shellfish living in the seabed, for instance, which eat algae and waste particles. Those shellfish are on the menu of walrus. So there is only one step between the alga and the walrus. If the shellfish disappear from an area, the walrus has to look for other food. In other words, the dependencies in feeding relationships are bigger than they are in the North Sea. Another factor is the extremely short growing season. There is no autumn or spring, only a long



‘If the shellfish disappear  
the walrus has to look for  
other food’



Walrus, a whale and a polar bear in the North Pole region. Their habitat is under pressure from climate change and receding ice.

dark winter and a short summer with a lot of light and a brief period when temperatures rise. One way of adapting to that is that species grow slowly and can get very old.'

### TREATING BALLAST WATER

Freezing temperatures also mean that tried and tested strategies in the maritime sector work differently. One example is the chemical treatment of ballast water. Big ships fill tanks with seawater in order to stabilize the hull. In the process, small fish, algae and crab larvae can be sucked into the tanks. When they are emptied when the ship loads cargo in a port on another continent, undesirable exotics can get a foothold. On order to prevent that, the ballast water is often treated with chemical biocides to kill off any life present. 'It is questionable whether a chemical treatment of this kind works as well in severely cold conditions,' says Van den Heuvel. 'We don't know whether the sea life here is just as sensitive to biocides and whether the biocide is broken down as quickly after it has done its work. It is important that it is deactivated before it is dumped in the sea, otherwise it will damage the local marine fauna. Our initial experiments suggest that the biocides are just as effective at low temperatures. But there are indications that they break down more slowly, so you should wait a bit longer before dumping the ballast water.'

There is a lot of uncertainty surrounding the consequences of gas and oil extraction, too. Environmental organizations are concerned about what would happen if there was an oil disaster. Cold and ice make oil and chemicals much thicker, so it is not certain that standard methods of dealing with such disasters would work. The use of dispersants on oil seems to be less effective in cold tem-

peratures; and the question remains of precisely what happens when oil particles and dispersant reach the bottom of the Arctic Ocean.

That is one of the research questions Wageningen professor of Toxicology Tinka Murk is involved in addressing, on the strength of her research on the effects of the cleanup operations after the oil spill in the Gulf of Mexico. She is one of many Wageningen experts contributing to the Arctic Programme, on which about 2 million euros will be spent between 2012 and 2016. Bolman: 'IMARES may be leading the programme but there are many other institutes taking part. For example, agricultural economics institute LEI Wageningen and environmental institute Alterra Wageningen UR are studying the impact of developments on people in the polar region. This includes an overview of the rules and regulations and of the interests of indigenous and foreign residents. Actually you study the impact of developments in the area in the same way as the research on nature does, only in this case it focuses on people and society.'

### LEAST DAMAGING TECHNIQUE

The aim of one of the projects is to create a Handbook for Arctic Operations. This Joint Industry Project, as it is called, is drawing up guidelines for offshore and marine engineering activities in northern regions. 'This partly revolves around the question of how to get the measure of environmental pressure. This means a company can work through a checklist of relevant points for attention in evaluating activities in a region. In the end, that should help companies and those issuing licenses to select the least damaging techniques,' says Bolman. One of the participants is Boskalis, a maritime contractor and dredging company which is not yet active in the polar region. According to Peter Hendrickx, engineer and Arctic expert with Boskalis's consultancy bureau, finding and then extracting oil and gas in the polar



**BAS BOLMAN,**  
Programme manager IMARES  
Wageningen UR

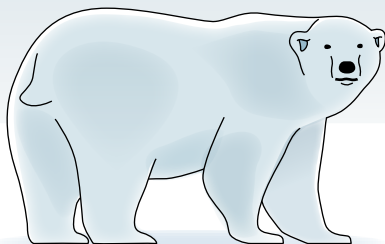
**'An iceberg can scrape the seabed and damage a pipeline if it is not buried deep enough'**

region is a long-term project. 'It will take many years yet before it really happens.' Until then there are various questions to be answered, thinks Hendrickx. 'There are international norms for the design of offshore installations in the polar region, but there are no guidelines for how they are installed. That is all about the implementation: how you do the dredging, how you look out for the environment. In the Handbook for Arctic Operations we want to line up the available knowledge and experience, partly also to get a sense of what is still missing.' According to Hendrickx, there is still a fundamental lack of ecological knowledge. 'Before we can set to work somewhere, we want to have an impression of what is going on there. For many areas, that is still not known, which is part of the problem. A second issue is ice and extreme weather: there can be heavy storms in the polar region in the summer. You are far from civilization and in winter there is very little daylight. These conditions call for all sorts of new >

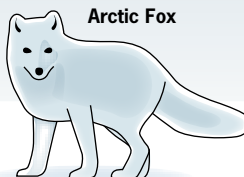
## INVESTIGATING EFFECTS OF NORTH POLE EXPLOITATION

The North Pole has several ecosystems, characterized by short food chains, which make them extra vulnerable. Climate change is putting them under pressure. Human activities come on top of this.

Polar bear

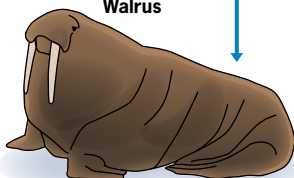


Arctic Fox



Research should show what effects pollutants have on the animals.

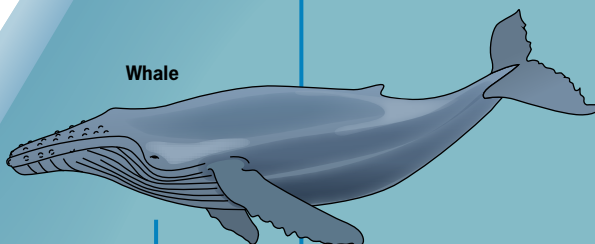
Walrus



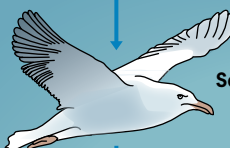
Seal



Whale



Sea birds

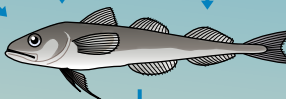


Shellfish

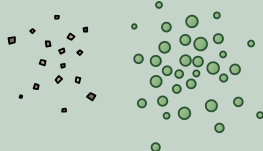


Research is being done on which animal species could serve as indicator species for the state of the ecosystem.

Fish



Algae and waste particles



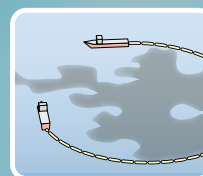
Krill



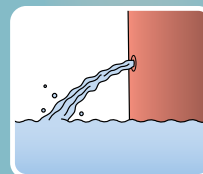
### Threats



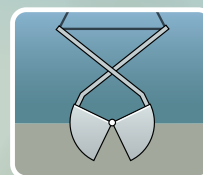
Shipping and oil and gas extraction carry risks for the ecosystem.



Research is being done on whether standard oil-clearing techniques work under cold and icy conditions.



The behaviour in cold conditions of substances that clean ballast water is being studied, as is their effect on marine life.



Research should clarify which chemicals occur in seabeds and seabed life.

facilities and safety measures for our staff, such as medical facilities.'

### CAMPAIGNERS ARRESTED

The search for oil and gas around the North Pole is attracting plenty of interest from the public, especially since Greenpeace campaigners climbed onto a northern drilling rig in September in protest, and were arrested. 'Of course you can dispute whether erecting infrastructure isn't fundamentally in conflict with sustainability,' says Diana van Minnen - de Kroon, senior communication advisor at Boskalis. 'The issue of principle as to whether or not to extract oil and gas in the Arctic region is a social and political one.' If you want infrastructure, we are the people to ask. We can do it in a way that at least minimizes the environmental impact of the implementation, and which lim-

its the long-term effects of it as well.'

Scientific research and smart assessment instruments do not in themselves deliver licenses, certification or a stamp of approval for activities. Research cannot tell us what is the most desirable line of action in developing the polar region – insofar as there is any consensus about that. 'We deliver the knowledge, and the client can take decisions on the basis of that knowledge,' says researcher Van den Heuvel. Bolman adds: 'It is of course in the interests of companies and governments to demonstrate that they are dealing with the environment responsibly, for example by showing that they leave certain areas in peace because they are too easily disturbed.'

In heated public debates, research is often the target of criticism, such as accusations that research results are influenced by the

client. According to Bolman and Van den Heuvel, the Arctic Programme will be able to forestall that criticism by laying a firm foundation with a self-funded research programme.

Bolman: 'Where possible in contract research you involve parties which have the opposite interests, like companies and nature conservation organizations. Like that you can weigh up different points of view and opinions. But even then, all we can do is measure the potential effects on the ecosystem. Whether they are permissible is not for the scientists to decide. We try to understand the system and where possible to make predictions. After that it is up to the international community to put our findings to use.' ■

[www.wageningenur.nl/arctic](http://www.wageningenur.nl/arctic)

‘Whether the effects on the ecosystem are permissible is not for scientists to decide’

Film 'Kennis voor een duurzame Noordpool', in Dutch:



### ARCTIC PROGRAMME

Wageningen UR's Arctic Programme focuses on identifying and limiting the potential pressure on societies and environments in the North Pole region resulting from oil and gas extraction, shipping, tourism and fisheries.

The subject matter of the projects varies from governance and the use of natural resources, to climate predictions and bio-indicators. They include both applied research projects involving companies, environmental organizations, governments and knowledge institutions, and more fundamental research by PhD students on subjects such as the management and use of natu-

ral resources and innovative ways of measuring the quality of the Arctic marine environment. There are also educational projects, such as courses for Russian and Dutch companies, or a guest lecture on the Minor in Oil & Gas at NHL University of Applied Sciences in Den Helder.

The Arctic Programme is funded to the tune of about 2 million euros between 2012 and 2016 by the Dutch research organization NWO's Polar Programme, the Maritime Campus Netherlands, the European Fund for Regional Development, the Dutch ministry of Economic Affairs, TripleP@Sea and the business world.



JOHAN SANDERS, 'PROFESSOR BIOBASED'

# 'The chemical industry is the driving force'

**Our prosperity is increasingly fueled by farmland. By making more efficient use of plants, we can break free of fossil fuels, says departing professor Johan Sanders. The biobased economy is within our reach, he believes. 'And that will contribute to better food supplies as well.'**

TEXT RENÉ DIDDE PHOTOGRAPHY TESSA POSTHUMA DE BOER



**'P**rofessor Biobased' has reached retirement age. 'I am past my use-by date, but I am going to re-invent myself,' jokes Johan Sanders. He said goodbye to Wageningen University at the end of January, but he is not stopping work. 'I am going to work 20 metres down the road at the Food & Biobased Research institute, which is part of Wageningen UR too.'

So the change is not as big as it seems. Throughout his career, the last 12 years of which were spent at Wageningen University, Sanders has been committed to the idea of a biobased economy: an economy no longer dependent on oil but largely based on plant

products. Bioplastics that provide packaging, for example, and agricultural waste that is converted into refined chemicals for the chemical industry. The raw material for these things grows in the fields, a product of sunlight, says Sanders.

'The biobased economy produces materials which do not emit any greenhouse gases such as CO<sub>2</sub> during their lifetimes, and therefore do not contribute to the climate problem,' explains Sanders. 'The CO<sub>2</sub> that is generated during production or after the biomass products are discarded has already been fixed from the atmosphere by the plant, so the balance is more or less zero.'



**‘The biobased economy is coming, slowly but surely’**

Johan Sanders, retiring professor of the Valorization of Plant Production Chains, on the Wageningen UR campus.

***People in the Netherlands have been spoiled for a long time because of the country's reserves of natural gas. Has this led to a failure to pursue innovations?***

‘Through our wealth, due to the natural gas among other things, we are well on the way to exhausting the basis of our economy. There are loads of valuable substances of which we do not make optimal use. Take the problem of manure: we haven’t managed to solve that in 30 years. We have calculated that it would be possible to earn 450 million euros a year instead of spending 150 million euros on spreading 6 million cubic metres of muck on the land. If you fail to solve 10 of these sorts of problems optimally, it can easily mean the sort

of budget shortfall of 6 billion which the government had last year.’

***How can you make money from manure?***

‘By making better animal feeds! Animal feeds are a brilliant driver for the Dutch economy. Currently we import huge quantities of soya and maize through Rotterdam harbour, to be used as feed for pigs and other livestock. The proteins and fibres they contain are valuable, and the imported overdose of nitrogen, potassium and phosphate is just excreted unused by the animals. This is the source of the manure problem. Not only that, but these minerals are often a burden to the animals, which >

## ‘Politicians are not aware enough of the chemical industry’

### JOHAN SANDERS

Johan Sanders (b. 1948, Eindhoven) studied biochemistry at the University of Amsterdam, where he also obtained his PhD for molecular biological research. From 1977 Sanders led the research group at biotechnology company Gist-brocades which achieved the genetic engineering of enzyme production. In the 1990s he moved to innovative potato starch company AVEBE, as director of research. Since 2004 Sanders has been professor of the Valorization of Plant Production Chains, which became a full chair of Biobased Commodity Chemicals in 2011.



have to get all that urea out of their systems.

‘If we start using biorefinery to separate the substances in feed ingredients that are useful for the animals, such as proteins, from the components that are of no use to them, such as minerals, we will get better quality feed mixes plus large quantities of substances that can be used in chemical processes.

‘What is more, we could make many of the food proteins for our pigs and cows ourselves, without importing all those undesirable minerals from other countries. Proteins from Dutch grass have an amino acid composition which is highly suited to a monogastric animal like the pig, while maize protein is of less value to pigs. Yet pigs eat maize and cows eat grass,

which actually contains proteins that are too high quality for the cow. We should do it exactly the other way round, producing suitable grass proteins for pigs and feeding maize protein to cows. While we are at it, we can extract the overdose of minerals and make those sugars, organic acids and amino acids available to the chemical industry. This would create 30,000 new jobs and all these organic components would double the efficiency of one hectare of grass or maize. ‘The costs of this biorefinery would be covered by the profits from animal feed proteins, coming from the other components. What is more, the manure problem would be solved and soya imports would be slashed.’



### **So why isn't this happening?**

'Refining grass costs about 180 euros per tonne of dry material. The protein sells for 120 euros. That is not enough to cover the total costs of the biorefinery. As long as fossil fuels were cheap the byproducts were of very little value. That is changing now. And the Chinese are very interested in these substances, so the byproducts, such as fibres and grass juice, with all its components, have gained in market value. The process can now raise about 205 euros in all. So I do expect biorefinery to get off the ground soon.'

### **Will the third world benefit too?**

'Production in the third world is lower, making it particularly attractive to make more efficient use of the harvest in those parts of the world. Most biorefinery technology can be applied on a small scale, so that minerals can be returned to the fields at relatively little expense.

'The tragedy was the way we used to dump European agricultural surpluses on the Third World – the butter mountain and the milk lake, for instance. This has prevented farmers in Africa, for instance, from developing their businesses. European farmers are now getting into a similarly dependent position in relation to countries like Brazil. We shall have to make up for our higher cost price by being smart, and by getting more added value out of biomass.'

### **Sounds nice but the Dutch government has mainly focused on biofuels up to now.**

'Fuels are on the lowest rung of my F ladder: Food, feed, functional chemicals and materials like fibres definitely take priority over biofuels or electricity, given their added value. Fuels are the last F you should extract from biomass.

'Politicians, including the last three ministers of Economic Affairs, are not aware enough of the chemical industry. That sector can help us meet our obligations to reduce CO<sub>2</sub> emissions much more effectively than the transport sector and at less expense. The Dutch chemical industry accounts for more than 10 percent of the gross national product. And this sector is going to appreciate the tremendous value of biomass more and more. 'What works against us is that the national gas company NAM, with its annual turnover from natural gas of 12 billion euros, has nothing to gain from a biobased economy.

And as a shareholder, the government shares its interests. Instead of forming a nice trio of arable farming, livestock and chemical production, the Dutch government makes an energy agreement which prioritizes wind turbines and electric cars that can go for a maximum of 50 kilometres on electricity from coal-fired power stations. And then only thanks to heavy subsidies in the form of tax advantages for the car buyer. This is putting the cart before the horse.'

### **This is not really a very good moment to be leaving.**

'Luckily my successor, Harry Bitter, has a sound chemical background. And I will remain active myself as well. I will be working half the time for the Food & Biobased research institute. There is a lot more research to be done, a lot to explain and a lot of knowledge to pass on to a new generation so that biobased becomes a shared vision. It's coming, you know, slowly but surely. And the chemical industry is the driving force.

'I'll be spending the other half of my time on small start-up companies. Byosis is one example, which is working on products from maize and optimizing a biogas process from maize waste products. And a consortium called Grassa! is working on making better use of grass.

### **NGOs think there is too little agricultural land in the world, and that a biobased economy will cause hunger.**

'That is sheer populism, and based on panic. Luckily that is calming down. People exploited the fear that replacing 30 percent of fossil fuels, the target set at the time, would require three times as much biomass, leading to the use of three times as much farmland and three times less food. That fear was unfounded. There is still so much space in the west, so much land lying fallow. With the exception of the Netherlands, almost every country in the world – in Africa to start with – could raise productivity enormously.

'If we do more biorefining, we will also make much more efficient use of biomass. A biobased economy does not have to pose any problem at all for food production. On the contrary, it could contribute to better food production in the third world because minerals would be re-used there and plant materials would be used more efficiently. Increasingly, NGOs are starting to see this.' ■

[www.wageningenur.nl/biorefinery](http://www.wageningenur.nl/biorefinery)

**‘WE ARE 10 YEARS AHEAD OF THE REST OF THE WORLD’**

# New: the autonomous orchard sprayer

**In collaboration with a group of companies, Wageningen researchers have succeeded in developing a self-propelling tractor fitted with an automatic sprayer for use in orchards. This could save a fortune in labour costs and in pesticides – sparing the environment into the bargain.**

**TEXT** ALEXANDRA BRANDERHORST **PHOTOGRAPHY** NATIONALE BEELDBANK AND WAGENINGEN UR

**F**rom spring until picking time, between April and September, fruit growers spray their orchards at least once a week. On a fruit farm of 20 hectares that will keep one person busy for at least two days, says Marcel Wenneker, researcher at Applied Plant Research department PPO Fruit, part of Wageningen UR. ‘Looking for ways of cutting labour costs, the fruit growing sector came to us with the request to develop a self-steering, automatic spraying machine.’

PPO Fruit and Plant Research International, another part of Wageningen UR, sought collaboration with KWH Holland, among whose products are spraying systems for fruit farms, with mechanization company Abemec, and with Probotiq, a robotics company which created an autonomous mower for golf courses. The Dutch Fruit Growers’ Association helped think it through and the funding came from the Horticulture marketing board, closed down from 2014, and from the EU. In the space of three years, the researchers and companies have succeeded

in developing a self-propelling tractor with an automatic sprayer for semi-dwarf apple and pear tree orchards.

## **DETACHABLE SPRAYER**

It is the combination of a tractor with a detachable sprayer that is particularly innovative. It means the fruit growers can use the tractor at other times, attaching a mower to it, for example. ‘The greatest difficulty was communication between the two components. We needed Probotiq for that,’ emphasizes Wenneker. Meanwhile the system is in use both in the Netherlands and abroad. ‘Both growers and researchers everywhere are enormously impressed,’ says the researcher.

Pear grower Johan de Ruiter in Erichem tested the system last year. To begin with he hung around the tractor, says Wenneker. ‘But he quickly gained confidence in it and became very enthusiastic.’ In a film by TV Gelderland about the orchard robot, De Ruiter says the system exceeded his expectations. He even goes so far as to describe it as

‘perfect’. ‘The question was how we could get a system to navigate autonomously through the orchard. Using magnets or GPS navigation systems was too elaborate and not precise enough. In an orchard you must not stray more than 20 centimetres from the path, otherwise you might damage the trees and the fruit,’ explains Wenneker. In the end the developers opted for a ‘teach and playback’ navigation system. The fruit grower has to demonstrate the route and the actions once, and the system records it and can then do it itself. Its memory has space for the routes in up to 10 orchards. For safety reasons the tractor is equipped with a camera and a bumper with sensors. If an obstacle looms, it automatically slows down. ‘Thanks to the camera the grower can keep track of the tractor with his smartphone. If there is a problem he gets a call and he can go and see what the trouble is.’

## **SCANNING TREES**

The sprayer works entirely automatically too, and uses no more pesticide than strictly

### Automatized cabin with

- navigation computer with GPS
- sprayer computer

bumper brace for emergency stop    ultrasound sensor    camera for monitoring via website



'Teach and play' navigation system.

Memory for ten orchards.

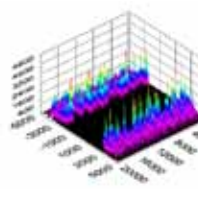
### Sprayer installation with

- Wind metre
- Laser scanner
- GPS receiver

Adjusts spraying volume to number of leaves and type of tree.

Uses automatic drift-limiting techniques when there is water nearby.

### Laser data



The grower can see the camera's image on a smartphone and gets a message if there is an obstacle.

Remote control with pause button and emergency stop function.

## 'In an orchard you must not stray more than 20 centimetres from the path, to prevent damage'

necessary, thanks to a laser scanner. The scanner scans the trees as it goes for species, size and shape. It also registers where there are leaves and where there are not. Wenneker: 'New spraying systems often use infrared sensors to detect crops, but a laser scanner is far more precise. Crop-specific spraying easily delivers savings on pesticides of 25 to 30 percent, which is that much less to end up in the environment. In this respect we in the Netherlands are 10 years ahead of the rest of the world.'

The sprayer can also help prevent pesticide from drifting on the spray. For fruit growers whose land borders water it is already compulsory to minimize this 'drift'. The new orchard sprayer can be fitted with a GPS map

with data on whether and where waterways run alongside the orchard. The sprayer then automatically uses drift-limiting techniques. In the near future, Wenneker expects this system to become relevant to all fruit growers. Rules and regulations are getting tighter in response to public concern about the effects of pesticides on local residents and the environment. 'Within a few years all farms, even those not bordering on water, will be obliged to use spray drift-limiting techniques.'

### RECOUPING COSTS

Companies can buy the tractor and the sprayer separately. If a company already has a good tractor, for instance, it can invest in

the sprayer first. Or, if it already has a tractor with an automatic transmission, the autonomous steering system can be built in. The automatic sprayer is twice the price of a standard sprayer. 'But with the savings on labour and pesticides, growers recoup their costs within four or five years,' thinks Wenneker. 'With a view to the forthcoming legal requirements on drift, they are going to have to work with these kinds of sprayers anyway.' ■

[www.wageningenur.nl/orchardrobot](http://www.wageningenur.nl/orchardrobot)

Film on Dutch tv:



# Hold on to those

**Research results from De Marke experimental farm show that dairy farms could reduce surpluses of nitrogen and phosphate in manure and the environment considerably. That is good for the environment and for the farmer's wallet. 'The key is to get more feed from your own land.'**

**TEXT** MARION DE BOO **PHOTOGRAPHY** MARCEL VAN DEN BERGH **ILLUSTRATION** JENNY VAN DRIEL



Cows in the barn at De Marke experimental farm, with the biodigester in the background.



# minerals

**T**hey raise their black and brown-and-white heads in curiosity as the visitors approach. The cows at De Marke, the experimental farm in the small Gelderland town of Hengelo, are lined up along the feed fences eating the roughage. Some of them have wandered to the back to chew the cud calmly on the two rows of beds. One cow gets a back massage from a rotating brush. Three more of the animals are waiting hopefully at the automatic concentrates dispenser. 'The feed computer recognizes them from their collars,' explains researcher Koos Verloop from Wageningen UR. 'The dosage system knows exactly how much milk each cow is producing and how much concentrate it needs.' He inspects the gleaming cows with a look of approval. 'They are in good condition. Not too fat and not too thin. It was only when we had children ourselves and my wife was breastfeeding that I realized what huge amounts of energy it takes to produce milk. The cows have to perform well, but they must not become overfed, because that's a waste of money and results in surpluses of nitrogen and phosphate in manure and the environment.'

## MILK QUOTA

The milk quota system will end in 2015, which will lead to more intensive milk production. That will make proper mineral management even more important. 'Every kilo of nitrogen that disappears into the environment is lost grass,' argues Zwier van der Vegte, the farm manager at De Marke. 'The trick is to create a closed mineral cycle. We are getting better at this thanks to a whole range of extra measures.'

Making optimum use of manure and minerals reduces dairy farming's ecological footprint. The newest acquisition in this effort is the biorefinery plant. It converts raw manure into a 'digestate', from which pure minerals are extracted that can then be used as fertilizer on the same farm. The advantage of using biorefining to process the manure on your own farm is that it avoids the need for expensive, energy-guzzling transportation on public roads in trucks full of watery manure where the dry matter content is only about nine or ten percent.

De Marke has also taken many other measures to avoid mineral losses, such as the use of low-emission stall floors that cause less ammonia to evaporate, good quality manure storage, fewer calves on the farm and the optimization of milk production. In addition, more concentrates are grown on the experimental farm itself—

such as maize cob silage in which the entire cob and stalk are processed, not just the kernels. Italian ryegrass is grown between the rows of maize as a 'catch crop' to prevent the leaching of minerals after the maize harvest. After the winter, the ryegrass is ploughed in to help increase the organic content of the soil.

Furthermore, the cows are regularly moved from one field to another to make sure they keep the grass short and do not trample very long grass, and to prevent too many urine spots accumulating. 'Frequent rotation in grazing is easiest to arrange on farms with conveniently positioned plots,' says Verloop. He bends over to pick up a handful of roughage, rubs it between his fingers and sniffs at it. 'They find this really tasty: tender and not too tough.'

## PUTTING IT INTO PRACTICE

In the Cows & Opportunities (Koeien & Kanssen) project, De Marke is collaborating with 16 innovative dairy farms spread across the Netherlands, to put the research results into practice. A closed cycle tool (KringloopWijzer) for good mineral management was developed as part of the project and is now already being used by five to six hundred farmers. The closed cycle tool shows a farmer the mineral balance sheet for his own farm.

The research results are also communicated to dairy farmers through open days and study groups. Van der Vegte: 'Once the milk quota is abolished, dairy farmers who are able to achieve high production levels per hectare on their land will also be allowed to use more fertilizer. That encourages entrepreneurship. Someone who is able to produce more feed with the same minerals rather than buying in extra feed will be able to produce milk at a much lower cost. That business model has real potential.' 'We know from experience that ordinary farmers rapidly adopt three-quarters of the measures we take here and implement them on their own farms,' says Jouke Oenema of Wageningen UR. 'As far as environmentally friendly farming is concerned, there is less and less of a gap between the experimental farm and actual practice.' The closed cycle tool will probably be introduced nationwide in 2015 for all dairy farmers with a phosphate surplus on their farm.

In November 2013, Verloop and Oenema got PhDs for their research results in the Cows & Opportunities project. Verloop examined where exactly the leaks are in the closed cycle for nutrients and how you can prevent those leaks. In the 1980s and 1990s, only about 14 per cent ➤



## MINERAL CYCLE IN LIVESTOCK FARMING

Research on De Marke experimental farm aims to discover how to close the mineral cycle in dairy farming so as to prevent surpluses of nitrogen and phosphate in manure and the environment.

### Feed production

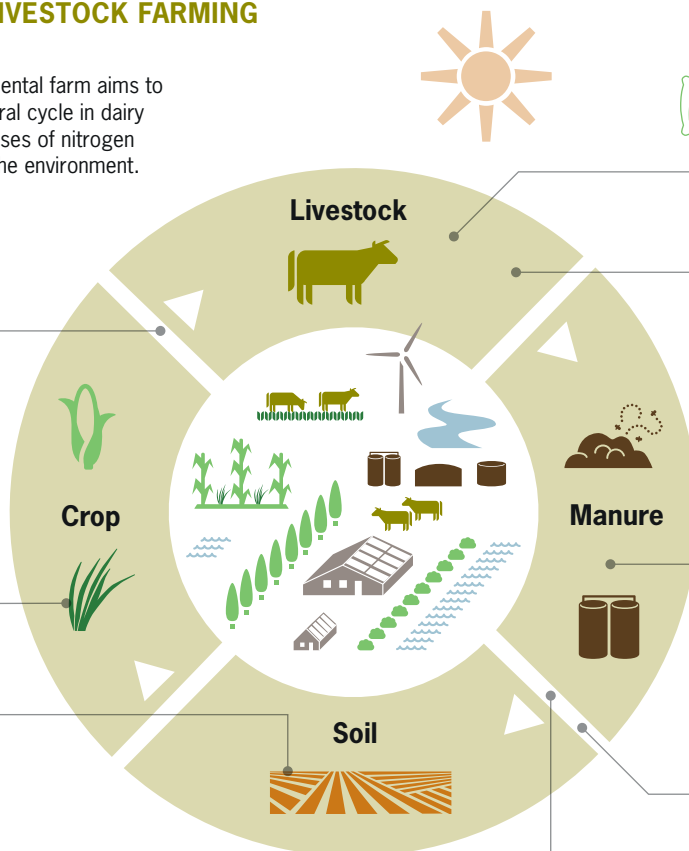
Feed such as maize is grown on the farm itself as much as possible.

### Using grass

The cows are shifted to new fields regularly so they keep grass down and do not trample long grass.

### Preventing leaching

With optimal harvests (producing as much as possible), smaller amounts of minerals are lost to the environment. 'Catch crops' prevent leaching of minerals after harvest.



### Livestock



### Concentrates

The amount and composition of concentrate is optimally adjusted to demand.



### Transportation

Transportation of milk and meat.

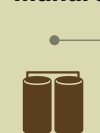


### Emissions

Thanks to low-emissions barn floors and good manure storage, less ammonia is given off.



### Manure

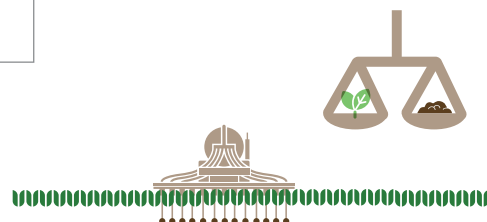


### Own manure used to full

All the manure produced is used on the farm in the meadows or the maize, using low-emissions techniques.

### Minimal artificial fertilizer

Ideally, phosphate-based fertilizer is not brought in from outside.



## NITROGEN AND PHOSPHORUS EFFICIENCY

On livestock farms about 15 years ago, only 20% of the nitrogen (N) in manure and feed was used on the land, and 45% of the phosphorus (P). The rest disappeared into the environment. Meanwhile,

efficiency levels have risen across the country. Innovative farmers get better results with extra measures and supervision, and come close to the results obtained at De Marke experimental farm.



		Nitrogen (N)		Phosphorus (P)	
		Leached into environment	use on land	Leached into environment	use on land
1998	Average Netherlands	80%	20%	55%	45%
2014	Average Netherlands	70%	30%	40%	60%
	Innovation in companies	62%	38%	15%	85%
	De Marke	55%	45%	0%	100%

## 'The trick is to create a closed mineral cycle'

### DE MARKE

De Marke was established in 1992 as an Experimental Farm for Dairy Farming and the Environment. These days, it calls itself Knowledge Transfer Centre (KTC) De Marke. It has 81 dairy cows plus 6 to 10 calves. The farm has 55 hectares of light sandy soil: 11 hectares is permanent grassland and 44 hectares is for crop rotation, alternating between the cultivation of maize and of grass and clover. Little to no artificial fertilizer is used and all the slurry produced is used on the farm by applying it to the sods on grassland or using band application for maize. The farm is in the heart of the Achterhoek region, in a sparsely populated area of woodland, fields, hedge banks and ponds. The farm also has 1.2 hectares of nature boundaries with a path running alongside.

of the nitrogen from manure and animal feed was being used. The rest disappeared into the environment in the form of nitrate and ammonia — about 484 kilos per hectare every year. That affects the water quality and makes nature areas wilder due to the excess fertilizer in the environment.

Oenema analysed the results for the 16 innovative dairy farms and concludes that the model farms achieved some very good results, in part thanks to the intensive assistance they were given. 'They are making much better use of the animal manure on their own farm. They are hardly buying in any phosphate fertilizer anymore. On top of that, they are making much better use of the animal feed and they are more critical in their purchases, paying close attention to the composition.'

### LONG DISCUSSIONS

That is good for the environment and for the farmer's wallet. Between 1998 and 2011, the efficiency of nitrogen utilization on the 16 model farms rose from about 30 per cent to 38 per cent. De Marke itself achieves 45 per cent. Nationally, nitrogen utilization efficiency on an average dairy farm increased from 20 to 30 per cent in the same period. The utilization rate for phosphorus on the Cows & Opportunities farms went up from 45 per cent in 1998 to 85 per cent in 2011. De Marke even achieves a rate of 100 per cent in good years. Phosphorus utilization efficiency increased nationally too in that period, from 45 to 60 per cent.

Oenema: 'If you tell farmers they won't need phosphate fertilizer any more, they sometimes give you a really strange look because they've been doing that all their lives. But you convince them when you show them the figures. And that includes the older farmers. Some remember the days when their own father didn't use much phosphate fertilizer either. They've also often had long discussions with a son or daughter about the benefits of being economical with minerals. The key is that you need to get more feed from your own land. There is still

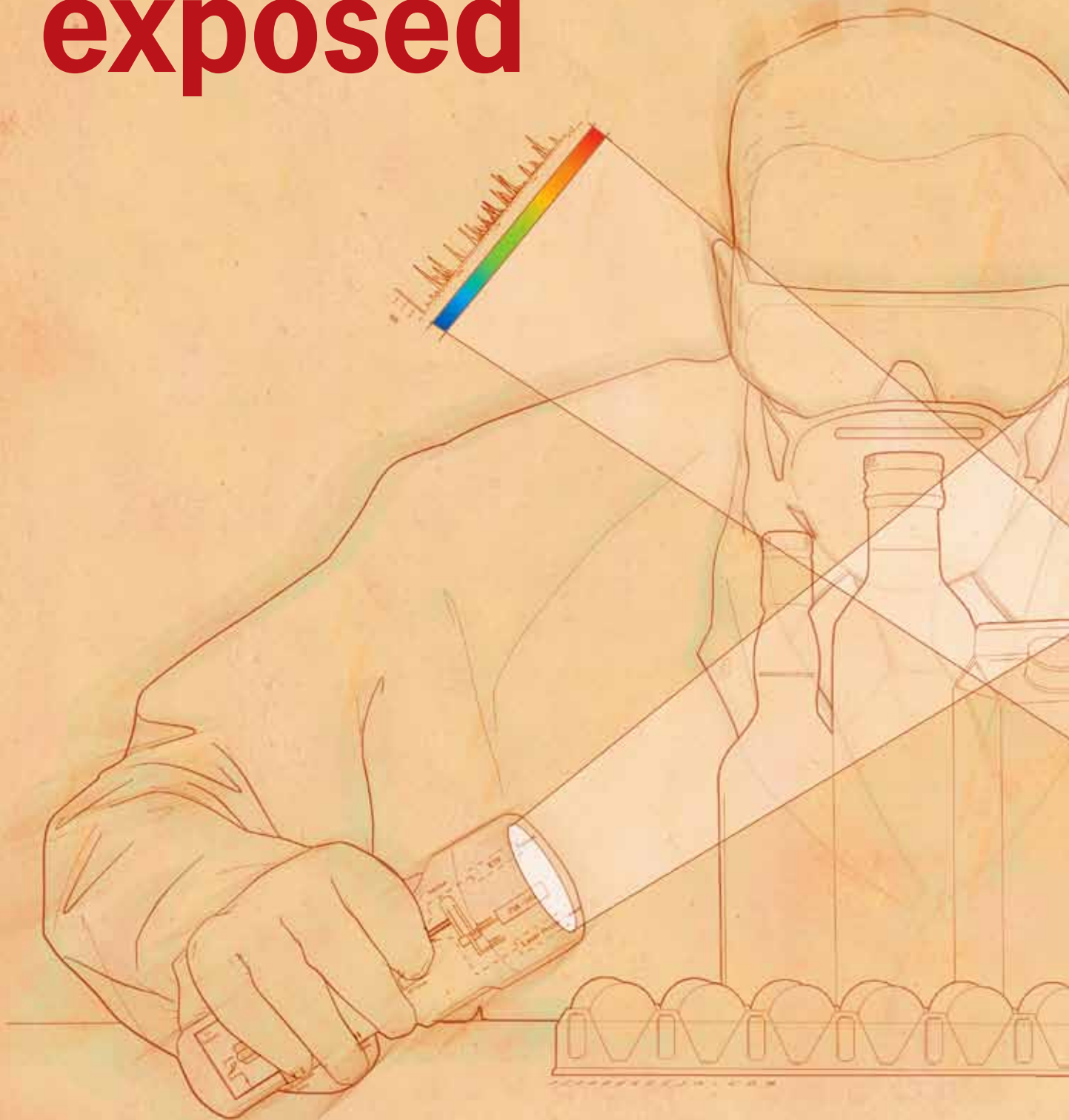
plenty of room for improvement here. And if you can cut down the loss of minerals in your farming practices, you can use up more of the manure on your own land, which saves you lots of money.'

Van der Vegte: 'The interesting thing is that everything is interrelated. Changes in the fertilization of grass or maize have an immediate effect on the feed quality. Farmers can still make big improvements here. You want to get the feed just right, without scrimping at the expense of the cows and their milk production. The grass still needs to be tasty and nutritious. The cow needs to be able to digest the feed quickly and get enough energy out of it.'

The role of the experimental farm is to test the limits. Van der Vegte: 'Twenty years ago, farmers were giving their grassland such an excess of manure that the grass had pretty much turned toxic for the cows: it contained far too much protein. If the cows were allowed to eat unlimited amounts, it made them sick.' Partly thanks to the Cows & Chances project, farmers now have a pretty good idea of what cows need and what the best approach to feeding them is. But according to Van der Vegte, there is still a lot of room for improvement in terms of soil fertility and the application of fertilizer. 'All farmers basically give their grassland the same fertilizer treatment, based on the rules in current manure legislation. But the same dosage of fertilizer could give one farmer six tons of dry matter in grass per hectare while another could achieve a yield of fourteen tons or more.' It depends partly on the soil type, but management certainly also plays a role, says Van der Vegte. 'It's a question of carrying out measurements to get information: what's the quality of my soil, what crop do I want to grow, what's the composition of the manure from my cows, how much artificial fertilizer do I need to add? A farmer who gets a low yield is polluting the environment unnecessarily while a farmer who gets a really high yield is impoverishing the soil and therefore not in fact getting the most out of his valuable land either.' ■

[www.wageningenur.nl/en/demarke](http://www.wageningenur.nl/en/demarke)

# Food fraud exposed





**Producers who lie about the origin of foodstuffs can be brought to book more often nowadays. RIKILT Wageningen UR is developing more and more tests which reveal where the ingredients come from as well as whether they really were grown organically. Coffee and eggs have proven to be surprisingly traceable. TEXT ASTRID SMIT ILLUSTRATION RHONALD BLOMMESTIJN**

Consumers are willing to pay a few cents extra for certain foods. For extra virgin olive oil, for instance, because they believe it is healthier and tastier, and for organic food, because the producers do not use any pesticides and the animals enjoy more space. This puts temptation in the path of producers who are out to make a fast buck. Passing off a force-fed chicken as an organic one earns you a couple of extra euros per kilo. And indeed, companies have been known to be economical with the truth. Last year in the Netherlands, horse-meat was sold as beef on a large scale, while German poultry farmers marketed standard eggs as organic ones.

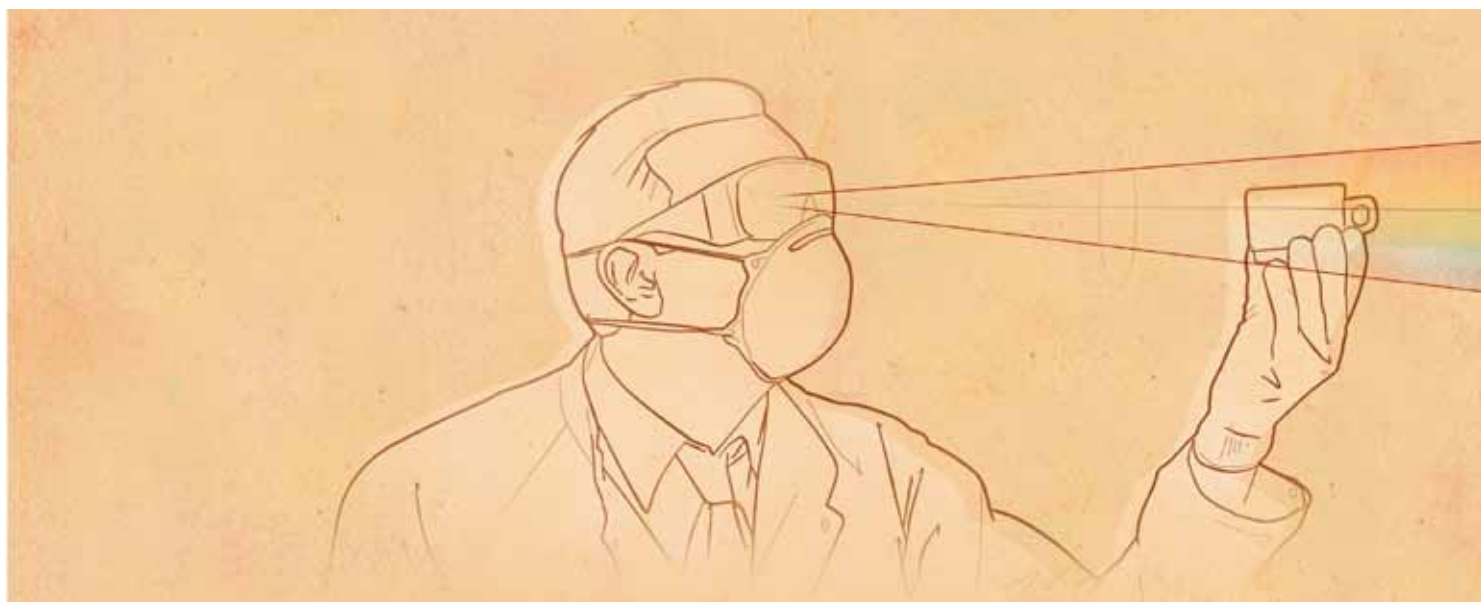
But how do you establish whether you are getting what you think you are getting? An organic egg looks no different to a free-range one, and the milk of pastured cows tastes the same as any other milk. Until recently there was no easy way of verifying whether products were bona fide.

Controllers can try to trace the route the product has travelled to the supermarket shelf. They can visit the suppliers and check the paperwork, but what if that has been falsified?

### GENUINE OR FAKE

In order to support this monitoring, better methods are being developed for distinguishing the genuine from the fake – partly thanks to the research of RIKILT Wageningen UR, one of the frontrunners in this field in Europe. ‘Ten years ago the possibilities were still limited. Thanks to the combination of statistics and better analytical tools, we can do a lot more now,’ says Saskia van Ruth, professor (by special appointment) of Authenticity and Novel Foods at Wageningen University, part of Wageningen UR. Her research group is >





able to evaluate the authenticity of more and more foods: olive oil, palm oil, animal fats, coffee, eggs and soon perhaps milk and cocoa.

Van Ruth's research group tries to identify the substances in foods that betray their origins. 'By identifying proteins, pigments or volatile substances such as aromas, you hope to be able to say: Hey, that profile is typical of, say, organic cocoa, and that one is typical of standard cocoa,' explains Van Ruth. In the lab, analyst Rita Boerrigter-Eenling demonstrates how this works. We are standing by a PTRMRS. This mass spectrometer measures the levels of volatile substances such as aromas in the air above a food. Her colleague Michiel Wijten has attached a pot of whisky malt to it. 'First we heat up the malt. The substances which are released go through a tube to the mass spectrometer, which registers how much of a particular molecule with a particular weight is present.' On the computer screen of the PTRMRS, a graph appears with bars at varying heights. 'This is in fact a fingerprint of this whisky malt. We compare that with a large database which contains the fingerprints of all sorts of whisky malts, and we try to isolate their characteristics. There are a lot of statistics involved. We cannot tell which malt this is just by looking at it,' says Boerrigter.

### CIVET CAT EXCRETA

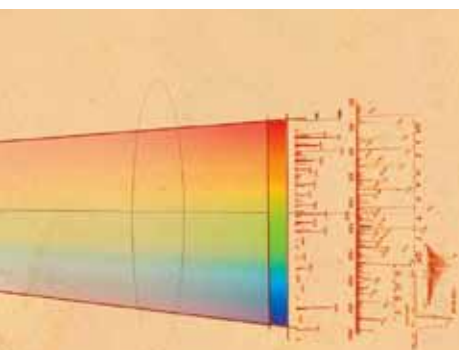
Last year, RIKILT Wageningen UR succeeded in distinguishing between standard and

organic coffee, using this mass spectrometer. The institute screened 110 kinds of coffee, including 43 organic coffees and 67 standard ones. As many as 900 different volatile substances are released from ground coffee, which means there is a fair chance of one coffee having a different aroma profile to another one. One of the coffees was instantly identifiable: kopi luwak, which at a couple of hundred euros a kilo is the world's most expensive coffee. The beans of this coffee are first eaten by civet cats and then excreted. No too surprising that this coffee should have its own unique aroma profile. Yet Van Ruth and her colleagues were pleasantly surprised when they found that organic coffee, too, had a really different profile to standard coffee. Using the test they were able to identify 98 percent of the organic coffees and 95 percent of the standard ones. What is not yet known is which elements in the organic crop cause this. The fact is that organic coffee is grown using natural manure and without pesticides. 'Apparently that has an effect on the aroma, but how exactly we are still researching,' says Van Ruth. Her group had further success last year in their research on the difference between organic and standard eggs. In this case it is the type of pigment – certain carotenoids in the egg yolk – that is a suitable indicator. The colour of the egg yolk is heavily dependent on the type of feed, and on cultural preferences. Northern Europeans prefer yellow egg yolks, while southern Europeans prefer orange ones. Poultry farmers bear this in

mind in putting together their feed mixes. An organic farmer does this by giving the chickens pigment-rich crops such as maize, alfalfa and grass, while the regular poultry farmer adds artificial yellow pigments. The yellow pigments in the egg yolks are easily identified using high-pressure liquid chromatography (HPLC). 'This way we can easily see the difference. It is not so much the kind of pigment that matters as the proportion of it present in the egg yolk,' says Van Ruth. Her research group first investigated this for Dutch eggs and then for eggs from the whole of the European Union, Canada, Israel, Norway and Turkey. 'In most of the countries studied, we could tell with almost 95 percent certainty whether eggs were organic or not. Except for Turkey. We don't know why that is; that needs further investigation.'

### ORGANIC MILK

It is not always so easy to differentiate organic products from standard ones. A study of the difference between pasture milk, standard milk and organic milk drew a blank in the first instance. Standard milk comes from cows that do not go outdoors, pasture milk from cows that are put out to graze, and organic milk from cows that are both put out to graze and fed on organic fodder. 'We looked first at specific fatty acids, such as phytanic acid, which get into the milk when the cow eats fresh grass. We hoped that you could see from the amounts of these fatty acids whether the milk is



## ‘Organic farming methods affect the coffee’s aroma’

standard, organic or pasture.’ But it was not possible to differentiate between the three types of milk just by using these markers. Next, amounts of triglycerides and cholesterol in the milk were measured. The difference between standard milk and milk from cows that are put out to graze (whether pasture milk or organic milk) can be fairly reliably measured using these substances, but the difference between pasture milk and organic milk cannot. So the search goes on. And there are other foods being studied. PhD student Valentina Acierno is trying to identify the origins of cocoa. Queen Maxima was given a sneak preview after the opening of the academic year last September. RIKILT had had a chocolate model of the new education building Orion made, and used an aroma profile to demonstrate to the queen that the chocolate almost certainly came from Africa. ‘The PhD researcher has only just started but she can already say this on the basis of her research,’ says Van Ruth. ‘She will be publishing on it soon.’ The lab sometimes also used isotopes to discover the origin of a product. Isotopes are variants of chemical elements. Hydrogen, for example, exists in a light and in a heavy form, as does carbon. Both forms are often found in a product but in proportions that vary per region or continent. Van Ruth points to a sugar sample that her lab has analysed. ‘The question was: does it come from cane or beets. There is no point in using DNA analysis or a fingerprint to find that out because both sorts of sugar are

pure sucrose. But with isotope research you can look at the proportions of carbon 12 and carbon 13. They are different in cane and beet sugar.’ Isotope research offers good prospects for pinpointing the origin of fish and of palm oil too. Isotope ratios in palm oil indicate whether the oil was produced in South America, Africa or Asia. It is only a rough indication, but even that can be useful, given that sustainable production methods are unlikely in some parts of the world.

### MORE CHECKS

The list of products whose authenticity can be verified is getting longer. But are all the tests being used regularly? Van Ruth: ‘Up to now, the government left the responsibility for checking products with the companies themselves. It is important that they take their responsibilities seriously and that they pick up on these new testing possibilities. That is happening, but it could certainly happen more often.’ Van Ruth expects that the government will do more checking itself in future, partly in response to the recent food frauds involving horse-meat and organic eggs in Germany. Hans Beuger, coordinator and specialist safety inspector at the Dutch Food and Water Authority, confirms that his organization has put the authenticity of food back on the agenda. ‘Up to now, we concentrated on food safety and monitoring was up to the companies. But we are going back on that, partly due to recent developments.



PHOTO FRED VAN WELIE

**SASKIA VAN RUTH,**  
Manager Authenticity and  
Novel Foods at RIKILT  
Wageningen UR, professor  
(by special appointment) of  
Food Authenticity,  
Wageningen University

Last year we and the industry formed an Action Plan Taskforce on confidence in food, and we are going to devote more energy and attention to the authenticity of food. How we are going to go about it, we are not quite sure yet. That partly depends on the amount of money allocated to this work.’ Van Ruth: ‘We will just carry on developing the methods. We have just received another European grant for research on food authenticity and olive oil. Our main task is to develop new, scientifically sound methods and to give advice. And we are certainly doing that.’ ■

[www.wageningenur.nl/foodauthenticity](http://www.wageningenur.nl/foodauthenticity)



# Always a guaranteed mussel

**Inventor and entrepreneur Kees Groot developed an alternative to catching young mussels with bottom trawls, with help from IMARES Wageningen UR. Already, one third of the catch is brought in using these Mussel Seed Capture Installations (or MZIs), providing mussel fishers with greater income security.**

TEXT HANS WOLKERS PHOTOGRAPHY HOLLANDSE HOOGTE, RWS, MZI.NU

Mussel farmers 'sow' newborn mussels, known as mussel spat or seed, in special spots allocated as nurseries in the Wadden Sea and the Eastern Scheldt estuary off the Dutch coast. There the mussels grow to adult, marketable size

in one to three years. 'Traditionally fishers caught their mussel seed using a kind of trawl on natural mussel banks in the Wadden Sea,' explains Pauline Kamermans, a researcher at IMARES, Wageningen UR. 'This method produces

highly variable catches, because the amount of mussel seed varies a lot from year to year.' The trawling also does a lot of damage to the sea bed, say nature conservation organizations. Anticipating stricter regulations which might ban bottom trawl-





# seed catch

ing, the sector went looking for alternative fishing methods.

Inventor and mussel seed expert Kees Groot was involved in this process in the late 1990s. Because very young mussel larvae still float, Groot decided to develop a floating capture system. IMARES provided expertise and skills in the field of mussel biology, and tested a range of prototype nets and different catch periods.

## BRUSHED OFF THE NET

About 10 years later, in 2012, more than 30 percent of the mussel seed was being caught with the alternative to the trawl, says Kamermans. The new Mussel Seed Capture

Installation, or MZI, consists of floating nets 3 metres deep by 100 metres long. 'The microscopically small mussel larvae attach themselves to the net in the spring,' explains Groot. 'There can be 4 million of them on one square metre of net.' In July the mussel seed fishers harvest the by then much bigger mussels by brushing them off the net with big machines. The shellfish are then taken to the nurseries. A second harvest is often possible, just before the end of the fishing season on 31 October.

The new system is extremely effective. In years that the traditional trawls brought in meagre catches, the MZIs caught plenty of mussel seed. 'With the MZI fishers now al-

ways have a guaranteed catch,' says Groot. 'That gives them more income security.' The disadvantages of the MZI are the extra work and investment it entails. A net of 100 by 3 metres costs 10,000 euros. Per season it delivers a catch of up to 60,000 euros' worth of edible mussels.

The sector is opting for this new approach, partly under pressure of protests by nature conservation organizations. The Dutch ministry of Economic Affairs, the mussel sector and nature organizations have agreed that the transition to mussel seed fishing with MZIs should be completed by 2020. ■

[www.wageningen.nl/en/mzi](http://www.wageningen.nl/en/mzi)



**‘Four million little mussels on one square metre of net’**








Excavations in the Amazon region  
expose fertile black soil.





FINDING OUT HOW BIOCHAR WORKS

# The ancient secrets of black soil

**An ancient method used by Amazon Indians Americans to improve the quality of soils using charcoal is coming in for renewed interest. Claims are made that the black soil could solve the climate problem and save the rainforest. Research findings suggest it is not quite as simple as that.**

TEXT RIK NIJLAND PHOTOGRAPHY GETTY IMAGES ILLUSTRATION JENNY VAN DRIEL

**A**ll is quiet in the World Soil Museum's almost completed new home on the Wageningen campus. The museum is only due to be opened officially at the beginning of April, but if you knock at the door now you can already get access to the soil profiles on display. Among them *terra preta de índio*: Indian black soil from the Amazon.

Most soils in the Amazon are old and very weathered, and no longer contain many nutrients. Terra preta is the exception. Ever since the mid-19<sup>th</sup> century, Americans were lured to Brazil by the prospect of being able to farm this fertile black soil. Charcoal particles – probably from trees burnt when clearing ground – give the soil its sometimes coal-black colour.

The profile in the museum looks much like any other soil sample at first glance: a grey-black upper layer which gradually gives way in the first metre to a yellow underlying layer. There are some fragments of pottery sticking out in a few places, remnants of the Indians who created this soil. For centuries they enriched their fields with charcoal, fish-bone, bones (often of tortoises) and other household waste. Together with the humus acids and the products of decomposition of waste, the charcoal retains the nutrients in the soil, in the face of one tropical down-pour after another.

## ANCIENT CIVILIZATIONS

‘The question for a long time was: is that combination of fertile soil with remnants of human habitation evidence that old civilizations settled on fertile ground to farm, or that fertile ground was actually created by those people?’ explains Thom Kuyper, soil biologist, fungus expert and professor at Wageningen University, part of Wageningen UR. ‘Ever since the early 20<sup>th</sup> century, archaeologists have been convinced that these soils were formed by human beings, but that idea had not penetrated into the soil science literature.’ Since then, radiocarbon dating

on organic material has suggested that these soils were developed by the ancestors of today's Indian tribes, living roughly between 2000 BCE to 1500 CE.

According to one recent inventory, about 4 percent of the land surface of the Amazon consists of terra preta – an area the size of Germany. It is almost unimaginable that Indian tribes in the sparsely populated rainforest had such a big impact on soil formation in the region. But until Columbus set off for the New World, there were probably about 10 million Indians living in the Amazon basin, in villages of up to 10,000 inhabitants. The influx of European fortune-hunters put an end to that: the Indians had no resistance to new diseases such as smallpox and the measles.

## FELLING RAINFOREST

Soil scientist Wim Sombroek (1934-2003) drew terra preta to the attention of the soil science community in the mid-1960s with his dissertation at the then Agricultural College in Wageningen. Later, as director of soil science institute ISRIC, where the Soil Museum is housed, he campaigned all his life for research on this soil type.

Kuyper has adopted Sombroek's baby, and is currently coordinating a research project on terra preta in which nine Wageningen research groups are participating. The project is funded by INREF (Interdisciplinary Research and Education Fund), a Wageningen University fund for stimulating interdisciplinary work in research and education, with an emphasis on knowledge transfer to developing countries. Within the project eight PhD students have been working in South America over the last few years to subject terra preta to closer scrutiny: which physical and biochemical processes occur in the soil? The PhD researchers also consider socio-economic aspects, and not just out of academic curiosity. In 2003, Sombroek proposed that new terra preta soils should be developed by putting

charcoal in the ground. The assumption was that in tropical countries this could lead to a more sustainable, intensive form of agriculture for which the farmers would no longer have to fell a new tract of rainforest after every harvest. The approach would also put the brakes on the greenhouse effect; the CO<sub>2</sub> that is stored by trees is not released but stays in the ground for a very long time in the form of charcoal. In just over 10 years, this idea has grown into a worldwide hype. Even some Dutch farmers have been heard talking about ploughing charcoal – now rechristened ‘biochar’ – into the land. In future it might be possible to make money from the process, by selling carbon credits obtained for carbon storage to companies seeking to compensate for their CO<sub>2</sub> emissions. Biochar fans also see opportunities not only for using charcoal, but also other substances such as chicken manure or sludge from purification plants, after they have been carbonized by pyrolysis (burning without oxygen).

## NATURAL BIOCHAR

Tess van de Voorde, at the Nature Management and Plant Ecology chair group, shows me a pot of biochar: sour-smelling, black flakes, the end-product of pyrolyzed hay. She is using this biochar on the Veluwe moorlands in the Netherlands. Not to improve the agricultural value of the soil, but as a nature management measure. Van de Voorde is a postdoc working on an interdisciplinary study – a collaboration between Wageningen UR and the NIOO-KNAW – of the use of biochar in the conversion of former farmland to a nature reserve. She hopes to kill several birds with one stone. ‘This land has been ploughed and fertilized year in year out. In order to make it more bare and therefore more suitable for

Right: Production of biochar in Mexico.



interesting wild plants, it must be mown regularly to remove nutrients. The mown grass used to be sold as horse feed, but that is no longer possible because of the way the poisonous St James ragwort is spreading.' Van de Voorde considers the question of whether the hay could be profitable in the form of biochar. 'If you mix it into the soil, it might provide a new source of income through carbon credits.' She hopes that the biochar will increase the soil fertility, so that the vegetation will flourish and the removal of nutrients – through the annual mowing – will go faster. And biodiversity might benefit as well.

Van de Voorde got her PhD for a study of the interaction between soil organisms and wild plants. She is working within the biochar project with postdoc Simon Jeffrey of the

soil quality department at Wageningen University. Jeffrey's task is to study the abiotic and soil-physics aspects of the topic.

#### **PLOUGHED INTO THE SOIL**

At Planken Wambuis, a nature area near Arnhem belonging to national nature conservation organization Natuurmonumenten, the researchers have marked out a trial field with 24 plots of 4 by 4 metres. Two years ago, on half of the

## **'The effect of biochar was not noticeable a year later'**

plots, two types of biochar (made from hay from the area carbonized at different temperatures) were ploughed into the soil to a depth of 15 centimetres. By way of comparison, on six plots the soil was only ploughed over, while on six other plots the hay was ploughed into it. On all the trial plots a mix of 18 wild plant species was then sown.

'In the first year we could pick out the plots with biochar right away: red clover was >



PHOTO BOSQUE VILLAGE

## TERRA PRETA AND BIOCHAR

### Terra preta

Terra preta was developed by Indian tribes in the Amazon region between 2000 and 1500 years CE.

For centuries Amazon Indians enriched their fields with:

Charcoal



Fishbone



Bones



Organic waste



Potsherds



Nutrients in terra preta

Carbon Calcium Iron Magnesium Nitrogen Phosphorus Silicon



### Biochar

Since 2003, new terra preta soils have been developed all around the world by putting charcoal into the ground. That charcoal, which now goes by the name of 'biochar', is made by carbonizing biomass.

Biochar was expected to help create a more sustainable, intensive form of agriculture in tropical countries, so that farmers would not have to fell a new tract of rainforest after every harvest. It was also expected to slow down the greenhouse effect: the CO<sub>2</sub> absorbed by the trees is not released but stays in the ground in the form of charcoal.



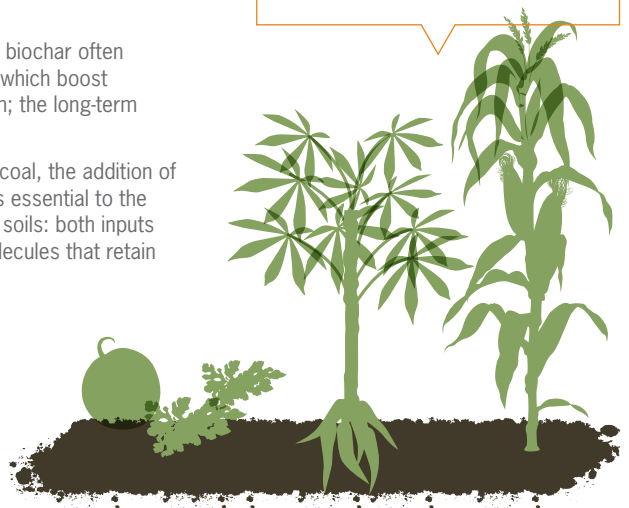
Biochar



### Research

Research has revealed that biochar often contains ash with nutrients which boost production in the short term; the long-term effects are not yet clear.

It is likely that besides charcoal, the addition of fishbone and other bones is essential to the development of terra preta soils: both inputs are needed to form the molecules that retain the nutrients.



**‘It sounds too good to be true:  
the climate problem solved, waste  
recycled, soil fertility improved  
and the rainforest saved’**

dominant on them,' says Van de Voorde. 'In the lab we discovered that this was an effect of a bit more potassium in the biochar. That effect was no longer noticeable the next year.' There is no question of extra biomass production to date, says the researcher. So it does not seem to be a faster way to deliberately degrade land. Even the nematodes, springtails and earthworms in the soil and the insects above it seem to take no notice of the biochar after two years.

Van de Voorde still plans to look at whether the interactions between plants and the soil fauna are affected by the added charcoal. 'You mix a kind of activated carbon into the soil. How will that affect the chemical substances with which plants communicate with fungi and bacteria? Can a symbiotic fungus still locate the plant root then? That is what we are working on.'

### PREDICTING CONSEQUENCES

The researcher warns against the random application of biochar. 'Once you have put it in the ground, it doesn't get out again. We work with a simple, natural base material and even then it is not predictable quite what will happen. Let alone being able to predict the consequences of using pyrolyzed household waste, for instance.

This is a warning Thom Kuyper fully endorses. 'Most biochar researchers claim successes in the form of higher yields, for example in maize cultivation in Zambia, but these are usually studies lasting one or two years,' he warns. 'Biochar often contains ash, with nutrients which boost production in the short term. That is an easy result to book but we don't have any sense of the long-term effects yet.'

And then there remains the question of whether this kind of approach to soil improvement will catch on among farmers in tropical regions. In spite of the great fertility, it is not a foregone conclusion, thinks PhD student and ethnobotanist André Braga Junqueira from Brazil. In the Wageningen

terra preta project, he is studying the use of terra preta by farmers along the Madeira river, a major tributary of the Amazon, near Manaus in northern Brazil.

'My impression is that we scientists have a higher estimation of the value of these soils than the farmers do,' says Junqueira. His conclusion from 200 interviews is: 'They do see that terra preta gives them more scope, because they can grow both water melons and maize, for instance. They can't do that elsewhere. But there is a flip side to it: weeds flourish in the fertile soil too, so that it is labour-intensive to farm. Many farmers are wary of it, therefore, and even avoid terra preta locations.'

### BITTER CASSAVA

The users of these soils also try to shorten the growing season in order to stay one step ahead of the weeds. Normally a key crop such as bitter cassava takes one to even two years to grow, but on terra preta the farmers opt for varieties which are productive after only six months, Junqueira explains.

Because this cassava does not keep as long, like water melon, it is only a viable crop if a big city market is easily accessible.

Whether terra preta can play a role in the transition from shifting cultivation to more intensive agriculture, thereby sparing the rainforest, is far from certain, says the PhD researcher. 'It depends on local conditions. Terra preta gives the farmers more scope to adapt because they can start growing other crops. It increases their chances of making use of new development such as the creation of new road connections, but the farmer does need to be able either to buy pesticides or to put in a lot of labour.'

Kuyper hopes that the PhD students' broad research on terra preta will generate new insights and lead to the biochar discussion being informed with facts. 'To be honest I think a simplistic approach based only on carbonized material doesn't work.'

At the beginning of 2014 he and his col-

### TERRA PRETA ELSEWHERE

Soil types comparable with terra preta have been found in Sierra Leone and in Liberia, as well as on Kalimantan, albeit on a small scale. The fact that 'black soil' is mainly found in the Amazon is assumed to be related to differences in the technology available to the populations. Almost all rainforest cultures practise slash-and-burn agriculture, but the Indians of South America were the only population that did not have access to iron for making machetes. It is difficult to chop down a tree with stone tools, which made it more important here than in other parts of the world to find sustainable ways of exploiting a field that has been cleared.

leagues published a critical article to this effect in the journal GCB Bioenergy. 'The biochar hype makes use of the terra preta argument that goes: 'we are just copying what the Indians did centuries ago.' We dispute that: we think the input of both charcoal and fishbone and other bones was crucial to the development of these soils. Both are necessary for forming the right molecules for retaining nutrients.'

Kuyper is afraid this warning will fall on deaf ears. 'It will take time to convince everyone that there is more to it than just adding biochar. It does sound too good to be true, anyway. Adding carbonized pig manure to the soil was going to solve the climate problem, recycle our waste, improve soil fertility and save the rainforest. A win-win-win situation. That's never the way it works in the real world.' ■

[www.wageningenur.nl/en/terrapreta](http://www.wageningenur.nl/en/terrapreta)

## HORTICULTURALISTS IN THE FAMILY BUSINESS

# Beef tomatoes and international ambitions

**The FAO has declared 2014 the international year of family farming. Dutch Wageningen Bart van den Bosch and his two year younger sister Petra head just such a family farm, together with another brother. Their business is a large, sustainable beef tomato farm. They both studied Horticulture in Wageningen. 'The focus in the sector lay mainly on increasing production rather than on quality.'** TEXT ALEXANDRA BRANDERHORST PHOTOGRAPHY HARMEN DE JONG

**'M**y father did ask, don't you want to go and work somewhere else first?' says Petra van den Bosch. Just like her brother Bart, two years older than her, she studied Horticulture in Wageningen. After graduating in 1997, both Petra and Bart started working in the family firm, A+G van den Bosch. Their father started this tomato growing company together with his brother back in 1970 on two hectares of land in Berkel en Rodenrijs, near Rotterdam. Now the company has 25 hectares of greenhouses and two sorting locations. In the winter 55 people work there, in the summer 155. The company only grows beef tomatoes and supplies all the Dutch supermarket chains bar one. 'But the Dutch market is relatively small for us: 5 percent of our turnover. Most of our


produce goes to England, Germany, Italy and other countries,' explains Bart in the canteen of the headquarters in Bleiswijk.

### HIGH GAS BILLS

Petra explains proudly that in 2007 they were the first horticulture company to install a geothermal heating system, with another following suit a few years later. 'Our greenhouses have no lighting. The only issue in terms of energy consumption was our high gas bills for heating the greenhouses. When we heard about the potential of geothermal heat, we thought straightaway that it sounded promising.' Water is brought up from a spring 1800 metres deep at a temperature of 65 degrees Celsius. The heat is extracted and the

cooled water goes back deep into the earth. The company no longer emits any carbon dioxide, and even has to purchase it in order to stimulate the growth of the plants in the greenhouses. The company's CO<sub>2</sub> footprint has shrunk by 74 percent. Ten other horticulture companies have now followed their example. So was their investment a piece of Wageningen idealism? No, says Petra matter-of-factly. 'The decision to go for geothermal heat was a business one. We dared to spend so much money on it because you save so much on gas. But of course it is wonderful for horticulture if you can bring down the gas consumption and forestall criticism of the sector. Geothermal heat really is a sustainable solution.' The tomatoes are grown as sustainably as





‘One disadvantage of a family business can be that you are always talking about work’



possible, too. Insect pests such as whitefly are controlled biologically, not with pesticides but with predator insects. ‘This is the best method for the consumer, for our workers and for the bumblebees we use for pollinating the tomatoes,’ explains Petra. Even the rock wool the tomatoes are grown on is recycled. The main reason the beef tomatoes are not organic is that organic products have to be grown in soil.

Their decision to do a degree in Horticulture came as no surprise to anybody. Bart and Petra were already helping around the business as small children. They put paper in the bottom of the tomato trays for 2 cents apiece. Later they helped with the sorting too. Petra says about Bart: ‘When he could only just walk he already wanted to be a market gardener.’ Bart did well at school and went to Wageningen in 1990. ‘The freedom of >

### BART VAN DEN BOSCH

**Age:** 41

**Studied:** Horticulture 1990–1996

**Works:** Production manager at beef tomato company A+G van den Bosch





## PETRA VAN DEN BOSCH

**Age:** 39

**Studied:** Horticulture 1990–1996

**Works:** as financial director at beef tomato company A+G van den Bosch

‘Our tomatoes  
must be that  
bit tastier’

## WHERE DO HORTICULTURALISTS END UP?

Between 1982 and 2000, 343 people graduated in Horticulture. There is data on the careers of roughly half of these graduates, which shows that one third of Horticulture alumni are directors, managers or head of department. About 14 percent are self-employed entrepreneurs; 11 percent work as consultants, advisors and in extension. At least 20 percent of the graduates work in agricultural or plant breeding companies, and 10 percent in technical and advisory bureaus; 10 percent work in 'other industry and trade', 9 percent in finance and 8 percent in agricultural services. *Source: KLV Wageningen Alumni Network*

choice and the international atmosphere in Wageningen were the decisive factors. Plus the idea that knowledge will never do you any harm,' he says. It soon became clear that Bart was 'not precise enough' for fundamental research, so he did more courses on social issues or business studies. An internship in England made a big impression on him. 'The horticulture companies there were more large-scale and ambitious than those in the Netherlands. They were ahead of us when it came to hygiene and listening to what the customer wants.'

In 1992, Petra came to Wageningen too. 'The horticulture sector interested me because it was international and dynamic,' she explains. She already knew she wanted to go into business and she got a lot out of the courses on Cooperatives and on Integral Logistics Management. 'The visits to companies when you sat around the table with the director or chairman were particularly interesting.'

Her first room in Wageningen was on Bart's corridor in the Dijkgraaf student flats. 'That was practical but we did our own thing. In my year there were 12 students doing Horticulture, and most people came from the same sort background so we soon got on well,' says Petra. At weekends the brother and sister went home to help in the business. They kept up their social life and sport commitments at home too. In Wageningen they were both active on the board and committees of the Horticulture study association. Bart also rowed with Argo rowing club. When they were studying Horticulture in Wageningen, sustainability was not yet on the agenda, and not for them either. That only came later. What she gained from Wageningen was above all to develop a broad and critical outlook, says Petra. And

she learned to interpret research and to ask questions. That sounds familiar to Bart too. His way of expressing it: 'If people cannot explain something properly, it probably isn't a very good plan.'

### BUYING MORE LAND

As a student Bart was already sure he wanted to set up his own horticulture business. 'My main motive was that you could carry out your own ideas and that you would be in charge and accountable yourself. That motivates you to want to achieve things in the long term, and get involved in nice new developments.' After graduating, Bart started a horticulture company on one hectare in Berkel en Rodenrijs, close to his parent's business. He was soon doing a lot together with his father and uncle. So much that one year later they merged their companies when an opportunity came up to buy more land and expand.

At that point Petra had just obtained her Wageningen degree and was raring to join the business too. Their uncle gradually cut down his hours and over the years, Bart and Petra carved out their own territories. Petra is responsible for the commercial and financial side of things. Bart is the 'growing man' and responsible for the day-to-day running of the production side. Their father plays an advisory role and is busy every day as a jack of all trades. Besides which, he loves babysitting his grandchildren. In 2001, Petra and Bart's youngest brother joined the company. He studied Logistics in Breda and concentrates on purchasing and on overseas projects.

'We take all decisions together, the three of us. We complement each other very well,' emphasizes Bart. They are a close-knit family outside their work as well. Bart and Petra

are both married and both have two children under four years old. They pick up each other's children from the crèche and can drop them off with each other unannounced.

Does a family business have its disadvantages as well? 'Maybe that we are very similar. We are not so very organized; we are more artists. But we have organized things so that other people make sure everything is tidy and the staff know what needs to be done,' says Bart, adding, 'In a family business it can be a disadvantage that you are always talking about work.'

When the business expanded for the second time 15 years ago, everyone was living at home for a while. Petra: 'At some point my mother asked if we could talk about something other than tomatoes. There is more variety now. During Christmas dinner the conversation is about the kids, sport, the business and trade. And bell peppers.'

Petra's husband grows bell peppers.

It has been plain sailing so far, says Bart. 'Of course that could change at any time. You should remember that now and then, but not dwell on it for too long.'

Bart and Petra's ambitions are to develop the company. Bart is learning French because the company wants to internationalize with beef tomato projects in France and Africa, with the aim of being able to supply customers all year round and with more local produce. One of the challenges the brother and sister see for the horticulture sector is to be market-oriented. Bart: 'You should start from the wishes and expectations of consumers. The focus should lie on good products, including taste and health factors. That way you can build up a strong position as a company. The focus in the sector has mainly been on increasing production rather than on quality. ■

## FUND RESURRECTS ECOLOGICAL VIROLOGY

# ‘Lute Bos is still contributing to virology’

**Harvest losses can be prevented by applying ecological knowledge about plant viruses in horticulture and agriculture. Endowed professor René van der Vlugt is going to breathe new life into research and education in this field. Thanks to a legacy from the Wageningen plant virologist Lute Bos.**

TEXT ALEXANDRA BRANDERHORST PHOTOGRAPHY NEIL PALMER (CIAT)

**P**athogenic viruses such as HIV, Ebola and the bird flu all made the leap from animals to humans at some point. Something similar happens in the case of plant viruses, which get transferred from wild plants to agricultural crops. Sometimes with disastrous consequences. ‘A couple of years ago a virus spread like wildfire through cassava crops in East Africa, causing famine,’ says René van der Vlugt. He is a researcher at Plant Research International, part of Wageningen UR, and since 1 January 2014, endowed professor of Ecological Plant Virology at Wageningen University, part of Wageningen UR. Farmers cannot combat plant viruses with pesticides. The only thing that does help is thorough preventive measures such as using clean propagation material and keeping close checks so as to identify diseased plants or seeds in good time. ‘That is well organized in the Netherlands. But it still goes wrong sometimes. In 1999 a new to-

mato virus turned up which led to such major infestations for some growers that they had to clear out whole greenhouses, sometimes as big as 10,000 square metres,’ says Van der Vlugt.

### DISASTROUS CONSEQUENCES

In spite of the sometimes disastrous consequences of plant viral infections, they have not come in for the attention they deserve in recent decades. ‘There has been much more emphasis on molecular and cellular research,’ explains Van der Vlugt. ‘Ecological plant virology, which studies the place of viruses in farming systems and in nature, got squeezed out.’

That ‘green’ plant virology was precisely the field that Lute Bos (1928-2010) worked in, and was his passionate interest. Back in 1957, Bos was the first PhD student at the Wageningen Virology chair group. In the course of his career as a researcher at the former DLO institute Plant Virology

Research (IPO), he wrote more than 300 scientific articles, as well as several standard works such as *Symptoms of Virus Diseases in Plants*, and *Introduction to Plant Virology*. After retiring in 1993, Bos remained active and was a regular visitor at IPO, where René van der Vlugt succeeded him in 1994. ‘We often had lively discussions. Lute was extremely passionate about his work and he took a holistic view of things. He wanted to know how the environment, plants, the virus and the virus carrier influence each other,’ says Van der Vlugt. Bos was very sorry to see the declining interest in his field.

### IDENTIFYING VIRUSES

Bos, himself a farmer’s son, believed that knowledge about plant virology was crucial to food security in developing countries. Regions he worked in included Africa, Syria and the former eastern bloc in Europe. ‘People from all over the







Cassava in Thailand damaged by viruses.

**LUTE BOS (1928-2010)**

world came knocking at Bos's door to learn how to identify viruses. Everyone was always welcome to consult him and he had a vast knowledge of the literature,' says Just Vlak. Vlak is personal professor of Virology at Wageningen University, and led the Virology chair group until he retired in 2013.

Lute Bos died of a heart attack in 2010 while in Norway, giving a lecture on potato viruses. With a legacy from his estate, his relatives established the L. Bos Fund for Ecological Plant Virology. The fund promotes research and education in ecological plant virology by facilitating the appointment of René van der Vlugt as endowed professor for one day a week. For the next five years he will lecture in the Virology chair group and recruit and supervise MSc and PhD students.

'It is fantastic that ecological plant virology is being put back on the map in

Wageningen,' says Just Vlak. 'We often had to turn away students who wanted to do something in this area, and there was no more research on it going on because of cutbacks. Now the entire field is covered again.'

Plant virology will gain in importance, Vlak expects, due to climate change and to globalization, which makes it easy for viruses to hitch lifts.

One of newly appointed endowed professor Van der Vlugt's projects is a PhD study in Uganda which focuses on both virological and socio-economic issues. Farmers in Uganda are used to eating the large, healthy potatoes and using the small 'diseased' ones for seed. Van der Vlugt: 'We train the farmers to recognize healthy plants as well as to change their habits. It has been shown that planting healthy tubers increases the yield of a field by 30 percent in just one year.' ■

### SETTING UP A FUND

You can support the Wageningen University Fund (WUF) with a one-off or a regular donation, or with a legacy. There is also the possibility of establishing a fund whose name and purpose you decide yourself. Such a fund should fit within the WUF's objective of promoting excellent education or research at Wageningen University.

Information:

[www.wageningenur.nl/en/Donors](http://www.wageningenur.nl/en/Donors),  
monique.montenarie@wur.nl

## NETWORKS

### University Page on LinkedIn

Wageningen University has its own University Page on the professional network site LinkedIn. These pages are a new service offered by LinkedIn. The page brings alumni into contact with other alumni and students of Wageningen University, and keeps them up to date with developments at the university. The page has links to the data for the more than 31 thousand LinkedIn members who have specified Wageningen University as their educational institute in their profile. It also shows what jobs, sectors and companies alumni work in. Photos, film clips and messages about Wageningen University are also placed on this platform for students and alumni. The page can be found by searching for Wageningen University within LinkedIn.



## APPEAL

### Ideas for the centenary?

Wageningen University will be celebrating its centenary in 2018. Last year, the 95th anniversary was commemorated by an international series of debates on food security and a reunion with activities on campus and in the town.

The centenary will also be celebrated in style. 'The programme is still completely undecided. So we are calling on people to contribute ideas about what we should do,' says Caroline Bijkerk from the Alumni Office. Ideas? Email [alumni@wur.nl](mailto:alumni@wur.nl).

## ALUMNI ACTIVITIES

### On city farming, the weather and fiction

**The regional meeting of the Hague/Rotterdam alumni group on 12 November in Rotterdam was all about city farming. This was a theme that tied in nicely with the series of debates on food security in Wageningen University's anniversary year.**



PHOTO UIT JE EIGEN STAD

Arnold van der Valk, professor of Land Use Planning at Wageningen University, explained that city farming is important from an ecological, social, cultural and spatial perspective. He talked to a group of 85 alumni about city farming in New York, from the organic farmers along the Hudson River and residents growing vegetables in their gardens to city farming projects for children and disadvantaged New Yorkers. And yet city farming has not taken off in this American city as it has done in some developing countries, said Van der Valk. None of the city farming projects in New York is a commercial success. The financial aspect was also discussed at

the start of the meeting, during a tour of the city farm and restaurant *Uit je eigen Stad* in Rotterdam. At the end of the evening, the alumni chatted further while enjoying organic drinks.

Other alumni groups also organized activities in the autumn. The meeting of the Utrecht alumni group at the Royal Netherlands Meteorological Institute on 25 November attracted nearly 90 alumni. There were talks by meteorologists plus a virtual tour of the weather centre. The meeting of the East alumni group on 24 October in Wilp, on 'Facts and fiction about healthy eating', was attended by 80 graduates.

Each alumni group – The Hague/Rotterdam, Utrecht, North and East — organizes two meetings a year. There are meetings scheduled in the spring for the Utrecht alumni group at PepsiCo, for the North alumni group at the Provincial Hall in Assen, and for the Hague alumni group at Koppert Biological Systems.

A new regional group for Brabant and Limburg is in the process of being set up. If you would like to make an active contribution to the South alumni group, email [alumni@wur.nl](mailto:alumni@wur.nl).

## FUNDS

### Alumni from 1963 donate to guest lesson scheme

At the reunion for the alumni from 50 years ago on 18 October, those present donated 1,430 euros to the Global Guests programme run by the OtherWise foundation. In this programme, international students give guest lessons about development issues to secondary-school children in and around Wageningen.

Wageningen University Fund (WUF) also made a contribution, bringing the overall amount to 2,500 euros. 'This fits in really

well with our objectives,' says Arianne van Ballegooij from WUF. 'This lets the school-children get to know the international students they may see around town, and gives them a better idea of Wageningen topics such as international cooperation, globalization and sustainability.'

In 2014, the reunion is on Friday 17 October for the alumni of 1964 and on Saturday 1 November for the alumni of 1989.



## AWARD

# Huub Savelkoul best teacher

**A student jury has pronounced Huub Savelkoul, professor of Cell Biology & Immunology, the best teacher of Wageningen University, part of Wageningen UR. Students appreciate his enthusiasm and commitment in particular.**

At the ceremony for the Teacher of the Year Award 2014, which was held on 14 January in the student cafe in the Orion teaching building on Wageningen Campus, some of the jury members recalled Huub Savelkoul running across the lecture room pretending to be an antibody. The student jury praised Savelkoul's methods for getting students actively involved in the course material and his use of modern digital teaching aids. He uses input from students to improve the courses. The enthusiasm he brings to teaching is also appreciated. Furthermore, the jury praised Savelkoul's efforts to develop a programme for teachers in which experienced, committed lecturers supervise lecturers who are just starting out. Savelkoul had been nominated for the award six times before. In his acceptance speech, he said he was 'extremely honoured and extremely pleased' to have finally won. 'As my wife always says: you are a professor, an educator, so it's your job to transfer your knowledge.'

Savelkoul was given a small replica of

The Tutor, the sculpture by Jan Praet that stands in front of De Leeuwenborch. Like the other four contenders, he also received a certificate and 2,500 euros for teaching activities. The other nominees were André van Lammeren, Ute Sass-Klaasen, Ingrid Visseren-Hamakers and Marthijn Sonneveld. The last of the four, an assistant

professor in Land Dynamics, died of cancer at the end of 2013. Consequently, the ceremony was somewhat different this year to take account of that.

The Teacher of the Year Award was established in 2004 by the Wageningen University Fund (WUF) to boost lecturers' teaching skills.



André van Lammeren, Ute Sass-Klaasen, Suzanne Sonneveld (for Marthijn Sonneveld), Huub Savelkoul and Ingrid Visseren-Hamakers.

PHOTO GUY ACKERMANS

## WAGENINGEN IN THE WORLD

## Greetings from Gulu!

Toon Defoer is posing with his film crew and Wageningen World in front of Gulu University in northern Uganda. In 2000, he got his PhD from Wageningen in Communication and Innovation Studies. Now he is a senior consultant in agribusiness coaching for the NGO ICRA and he runs the film company MOOV-ON Productions. Defoer has been making a docudrama for a Nuffic project aimed at encouraging secondary-school girls to study agriculture at Gulu University. 'Farming is still seen too much as digging and hard work. If that's the case, why study agriculture?' explains Defoer. The film follows 14 pupils as they pay visits to women working in the agricultural sector, from an entrepreneurial farmer to researchers. *Are you reading this magazine a long way from Wageningen too? Email your photographic evidence to [Wageningen.world@wur.nl](mailto:Wageningen.world@wur.nl).*



## PERSONALIA

**Hubert Andela MSc**, WU Zootechnics 1987, has been appointed chair of ANEVEL, the Dutch Association of Egg Traders. 29 November 2013.

**Prof. Ewout Frankema**, professor of Rural and Environmental History at Wageningen University, has been appointed one of the ten new members of the Young Academy of the Royal Netherlands Academy of Arts and Sciences (KNAW). 8 November 2013.

**Prof. Louise Fresco**, WU Rural Sociology of the Non-Western Regions 1976, professor at the University of Amsterdam and honorary professor at Wageningen University, has been appointed chair of the executive board of Wageningen UR. 1 July 2014. See also page 4.



PHOTO: HOLLANDSE HOOGTE

Louise Fresco

**René Geurts PhD**, WU Plant Breeding 1992, working at the Laboratory of Molecular Biology at Wageningen

University, has received a Vici grant of 1.5 million euros from the Dutch Organization for Scientific Research (NWO) for research into plants and bacteria that fix nitrogen from the air. 27 January 2014.

**Hady Hadiyanto PhD**, WU Biotechnology 2003, researcher and lecturer in Chemical Engineering at Diponegoro University in Indonesia, has been pronounced the fourth best lecturer nationwide in Indonesia. 2013.

**Prof. Dick Heederik**, WU Environmental Protection 1984, has been appointed chair of the expert panel of the Netherlands Veterinary Medicines Authority (SDa). 1 January 2014.

**Ms Koos Kingma MSc**, WU Rural Sociology of the Non-Western Regions 1987, lecturer in Development Studies at VHL Wageningen, has received a PhD grant from the NWO for her research plan entitled 'Interplay of rural livelihoods, gender and policies during the last 25 years in Tanzania'. 22 January 2014.

**Rien Komen PhD**, WU Economics of Agriculture and the Environment 1995, has been appointed director of Windesheim Flevoland University of Applied Sciences. 1 March 2014.

**Arie Kuyvenhoven PhD**, WU PhD 1978, emeritus professor of Development Economics at Wageningen University, has been appointed guest professor at Nanjing Agricultural University, School of Public Administration, College of Land Management, in Nanjing, China. 2014.



Arie Kuyvenhoven

**Prof. Leo Marcelis**, WU Horticulture 1987, has been appointed professor of Horticulture and Plant-Product Physiology at Wageningen University. 1 December 2013.

**Prof. Michael Müller**, University of Freiburg Chemistry 1983, former professor of Nutrition, Metabolism and Genomics at Wageningen University, has been appointed a professor at the University of East Anglia in Norwich, UK, and director of the Food and Health Alliance. January 2014.

## THESIS PRIZE

# Important for the food industry

Ties van de Laar (WU Food Technology 2013) received the Thesis Award on 12 February for his Master's thesis on the separation of suspensions. The jury said that he had written an excellent thesis that was 'very important for the food industry'. The thesis, which his supervisor had already given a 10 out of 10, concerns a method for separating extremely concentrated suspensions by forcing them through microchannels. 'A breakthrough,' says the jury. Van de Laar is now working at the university as a PhD student.

The thesis prize is awarded annually to the best Master's theses in each teaching domain by the Wageningen University Fund and the KLV Wageningen Alumni Network. Van de Laar was given the overall prize of 1000 euros, while the other three prizewinners – Margot Andrieu (WU Hydrology and Water Quality 2013), Patrick Ilg (WU Urban Environmental Management 2013) and Walinka van Tol (WU Biology 2013) – each received 500 euros. In addition, they all received a bronze statuette of the Wageningen Tree by Sjoerd Buisman.



PHOTO: GUY ACKERMANS



## PERSONALIA



PHOTO GUY ACKERMANS

Michael Müller

**Prof. Henk van der Plas**, emeritus professor of Physical and Organic Chemistry and former rector magnificus of Wageningen University, has received an award from the Polish Chemical Society for his contribution to heterocyclic chemistry and his collaboration with Polish chemists. 16 September 2013.

**Tashi Samdup PhD**, WU Animal Science 1997, has been appointed director of the Department of Livestock of the Ministry of Agriculture and Forests in Bhutan. 7 November 2013.

**Prof. Johan Sanders**, professor in the Biobased Commodity Chemicals chair

group within the Agrotechnology & Food Sciences group of Wageningen University, gave his farewell address on 23 January 2014. See also page 18.

**Coco Smits MSc**, WU Environmental Sciences 2012, won the IEMA Award (Institute of Environmental Management and Assessment) for the best recent graduate in environmental sciences globally. 21 November 2013.

**Hendrik van Veen PhD**, WU Molecular Sciences 1988, Teaching Fellow at Clare College and Senior Lecturer at Cambridge University (UK), has been appointed a Reader in Molecular Pharmacology. 1 October 2013.

**Arnold van Vliet PhD**, WU Biology 1996, working in the Environmental Systems Analysis group at Wageningen University, has won the third prize of 15,000 euros in the Climate Adaptation Business Challenge, organized by Knowledge for Climate, for his idea to make an international version of a nature news site. 15 November 2013.

**René van der Vlugt PhD**, WU Phytopathology 1987, has been appointed professor by special appointment of Ecological Plant Virology in the Virology chair group at Wageningen University. 1 January 2014. See also page 44.

**ArndJan van Wijk PhD**, WU Plant Breeding 1971, working for Naktuinbouw, has received the Friendship Award from the People's Republic of China. 30 September 2013.



ArndJan van Wijk

**Albert Zwijgers MSc**, WU Food Technology 1975, has been appointed lecturer in Technology and Ingredients at the HAS university of applied sciences in Den Bosch. 10 October 2013.

## IN MEMORIAM

**X.D. Aguirre Davila**, WU MSc student Organic Agriculture, passed away at the age of 30. 21 December 2013.

**Prof. G.H.T. Blans**, emeritus professor in the Philosophy group, passed away at the age of 66. 11 January 2014.

**W.J.A.A. Dales MSc**, WU Agricultural Economics 1976, passed away at the age of 64. 21 October 2013.

**J. van Dijk MSc**, WU Economics 1950, passed away at the age of 89. 13 December 2013.

**J. Geervliet MSc**, WU Horticulture 1982, passed away at the age of 57. 7 December 2013.

**J.C. Glerum MSc**, WU Agricultural Plant Breeding 1948, passed away at

the age of 90. 16 December 2013.

**Ms C.M.V. Haenen MSc**, WU Land Development A 1987, passed away at the age of 52. 26 January 2014.

**J. van den Hil MSc**, WU Agricultural Plant Breeding 1958, passed away at the age of 82. 4 October 2013.

**S. Huijberts MSc**, WU Forestry 1960, passed away at the age of 81. 17 November 2013.

**Ms M. Joerink PhD**, WU Molecular Sciences 2001, passed away at the age of 34. 5 December 2013.

**Prof. H. van Keulen**, WU Soil and Fertilisation Sciences 1970, passed away at the age of 67. 9 December 2013.

**P.D. Krijger MSc**, WU Land Development 1951, passed away

at the age of 88. 21 March 2013.

**A. van Leeuwen MSc**, WU Animal Husbandry 1942, passed away at the age of 98. 26 November 2013.

**R.A. Pot MSc**, WU Farming Technology 1966, passed away at the age of 74. 3 December 2013.

**J.L.Th. Siepman MSc**, WU Land Development 1950, passed away at the age of 89. 23 December 2013.

**M.P.W. Sonneveld PhD**, WU Soil, Water and Atmosphere 1999, passed away at the age of 38. 28 December 2013.

**Ms Y. Yusdiana MSc**, WU International Development Studies 2010, passed away at the age of 45. 18 December 2013.

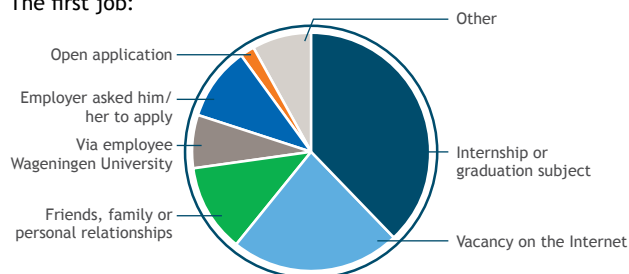


# HOW SUCCESSFUL ARE GRADUATES ON THE LABOUR MARKET?

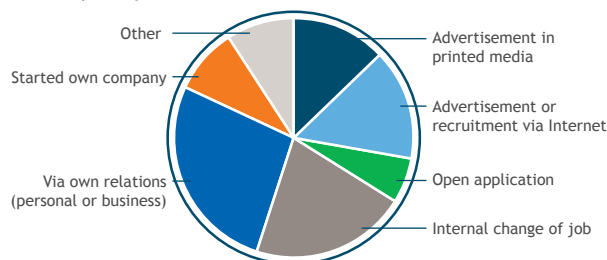
The most important trends from KLV's labour market survey

## How do graduates find a job?

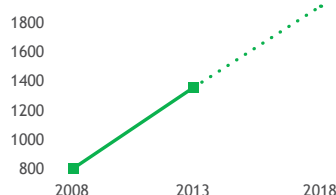
### The first job:



### A subsequent job:

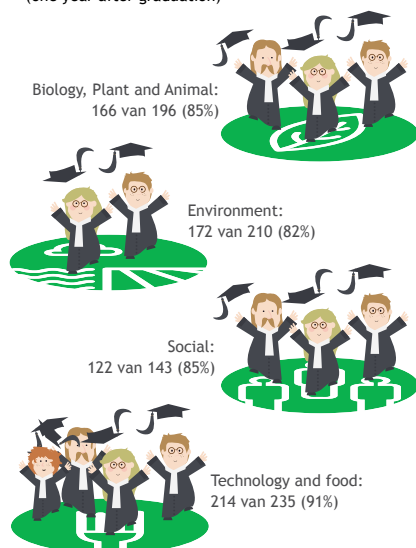


## Number of graduates per year



## Job found per domain

(one year after graduation)



## Starting salaries



Environment: € 1954  
Social: € 1855  
Technology and food: € 2300  
Biology: € 1968

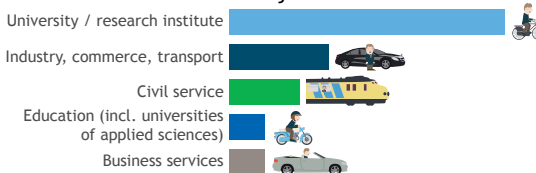
Average € 2030  
Later in the career (graduates 1970-2011): average € 4000

## Job-seeking period (first job)

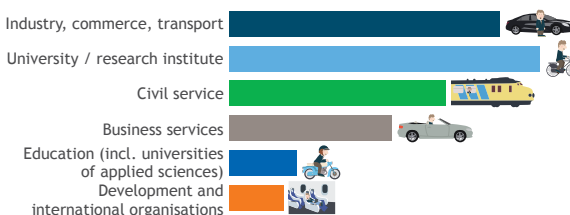
Average: 3.2 months  
Fastest: Masters Food Technology (1.1 months)  
Slowest: Masters Forest and Nature Conservation (4.4 months)

## Job found per sector

### First job:



### Later in the career:



## What do jobseekers encounter?



Recession



Delayed retirement seniors



More competition

Sources: Msc Programme evaluation 2012/2013, Education Monitor 2012/2013, WO Monitor 2012, Career Monitor 2012 and KLV's career data. For further information please see [klv.nl/arbeidsmarktonderzoek](http://klv.nl/arbeidsmarktonderzoek) or contact Silvia Blok directly ([silvia.blok@wur.nl](mailto:silvia.blok@wur.nl)).

# OPPORTUNITIES ON THE LABOUR MARKET

That starters on the labour market - the new alumni - face difficulties in finding a job is old news. This trend started recently and there are no signs of things changing quickly. The retirement age is increasing, so fewer jobs are becoming available for the younger generation. The number of graduates is growing each year and consequently there is more competition for the jobs available. Yet are there positive things to report as well? Yes there are, thinks Silvia Blok, labour market researcher at KLV. A few rays of hope.

“The general trend is still: fewer jobs for a growing number of people”, says Silvia. “But if you zoom in a bit then the facts are of course more nuanced. The number of people graduating is increasing but the number of graduates on the labour market is not growing quite so fast. Further the picture differs per discipline. As a result of government cutbacks in particular, there

are fewer jobs for graduates in forestry and nature management and I do not see that situation changing quickly. But for plant breeders or food technologists plenty of work is available. This also ties in with wider global trends, such as the growth in the world population. That is resulting in a greater demand for food and therefore crops with a high yield and resistance against diseases. At the same time there is a growing demand in the emerging economies for luxury goods, such as meat, dairy products and processed foods, and for more quality and food security. I also think that the Dutch government’s top sectors policy is providing opportunities. Besides the world food problem, themes such as water management and the effects of climate change are global issues of growing importance and these are areas that Wageningen excels in. If we can manage to profile ourselves well in these areas then I can see new opportunities on the labour market, also internationally.”

## **How do you increase your chances on the labour market, whether you are a recent graduate or further along your career path?**

### **A few recommendations from Silvia Blok:**

- A vacancy is only advertised if a suitable person has not been found through informal channels. Therefore make sure that people get to know you. Profile yourself at interesting meetings including those not directly in your own discipline. Examples are our world lectures or the meetings of the KLV networks and study circles.
- Ensure that you are optimally deployable with knowledge and experience that is up-to-date. Work on your competencies, such as effective networking, presenting yourself, and selling your ideas.
- Seek a mentor or coach. He or she can help you with useful tips and also give you access to his or her network.

## ACTIVITIES

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

17 March

Young KLV - Training Debating

20 March

KLV & StartLife - Wageningen Business Cafe

24 March

Young KLV - CV writing course

25 March

Young KLV - Workshop Social entrepreneurship

1 April

Young KLV - Training Presentation skills

8 April

Young KLV - Work search cafe for young professionals

9 April

Young KLV - Course Networking & personal branding

17 April

KLV & StartLife - Wageningen Business Cafe

23 April

Young KLV - Course How to find a job in the Netherlands

14 May

Young KLV - BCF Career Event 2014

15 May

KLV & StartLife - Wageningen Business Cafe

21 May

Young KLV - Training Interview techniques

12 June

VWI - Female Leadership & Ambition with a workshop in English

**WANT TO BECOME A MEMBER?**  
Go to [klv.nl/membership](http://klv.nl/membership)



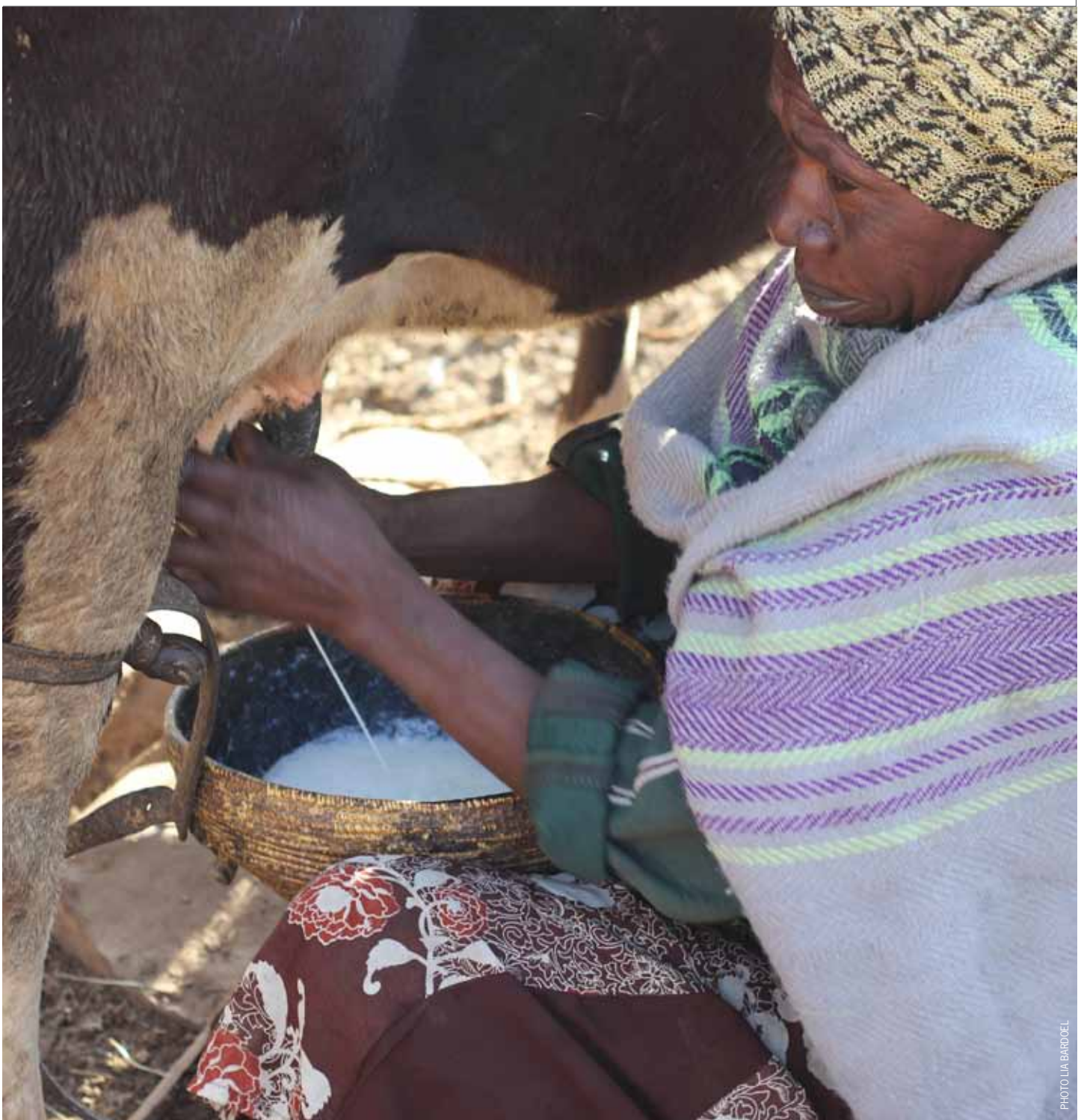


PHOTO LIA BARDOEL

## Using solar energy to cool milk in Ethiopia

Small-scale dairy farmers in Ethiopia have to walk along unpaved roads for hours every day to transport their fresh milk to the processing companies. The milk that is produced in the evening can only be dealt with the next day. In the meantime, it is kept at the company in unrefrigerated storage. This delay in processing and the resulting limited shelf life means the loss of healthy food, and of income for Ethiopian

farmers. A solar-powered milk cooler is set to change that. It was developed in the Solar Cooler Ethiopia project by the Dutch company Mueller, with support from LEI Wageningen UR. During the day the machine produces ice, which can then be used during the night to cool eight 40-litre milk cans down to four degrees Celsius. The Base of the Pyramid Innovation centre made the project possible, with funding from

the Ministry of Foreign Affairs. LEI carried out the market research and facilitated the collaboration between the Ethiopian and Dutch businesses. 'A key to success is to see what people throughout the supply chain stand to gain, not just the farmers. Social innovation is at least as important as technological innovation,' says Olga van der Valk, a sustainable markets researcher at LEI. Info: [www.wageningenur.nl/milkcooler](http://www.wageningenur.nl/milkcooler) ■