Environmental Sciences 2014

WAGENINGEN UR
For quality of life

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Foreword

Welcome to the 2014 Yearbook of the Environmental Sciences Group (ESG) of Wageningen UR. It features a cross-section of activities, including those of research institute Alterra and ISRIC World Soil Information, and of the Environmental Sciences department of Wageningen University.

This yearbook focuses on change. Our living environment is experiencing rapid change. These changes are often perceived as a threat when they can actually be a source of opportunities. As a research institution, we aim to address both aspects – and this yearbook is laid out with this in mind.

The central issue is our research into the consequences of the changes in our physical, economic, natural and urban environment, including various solutions we have developed. This illustrates the strength of the scientific research at Wageningen as we work with stakeholders to find solutions to problems: local to international, spatial to social, fundamental to applied. Together with local residents and government as well as worldwide organisations such as the UN and World Bank, we aim to safeguard the quality of our global environment.

The second part of the yearbook features our organisational information, and provides a clear insight on everything from the composition of the employee database to our international position.

If you would like to be kept up to speed with the developments in our domain over the coming year, see the news messages on our websites and follow us on social media. All the information you need is listed in the colophon.

February 2015,
The board of directors

Content

Changes in our physical environment

Better and cheaper solutions for climate adaptation

Climate adaptations should be combined with other goals as much as possible, says Climate Professor Pier Vellinga, responsible for the Knowledge for Climate research programme. "We want to ensure climate change is in the minds of everyone involved in infrastructure and spatial planning."

"The theory is correct: the earth is warming up and the emissions of greenhouse gases have continued to grow worldwide," says Pier Vellinga, professor in Climate Change. "The Netherlands is also feeling the results of climate change and the need to be prepared has only increased." The climate panel of the UN, the Intergovernmental Panel on Climate Change (IPCC), gave clearer warnings in 2014 than ever before. A temperature rise of one degree Celsius is the critical limit before the polar caps start to melt and this limit has almost been reached. What's more, the temperature could increase by three to five degrees Celsius by the end of the century if mankind continues on its current path.

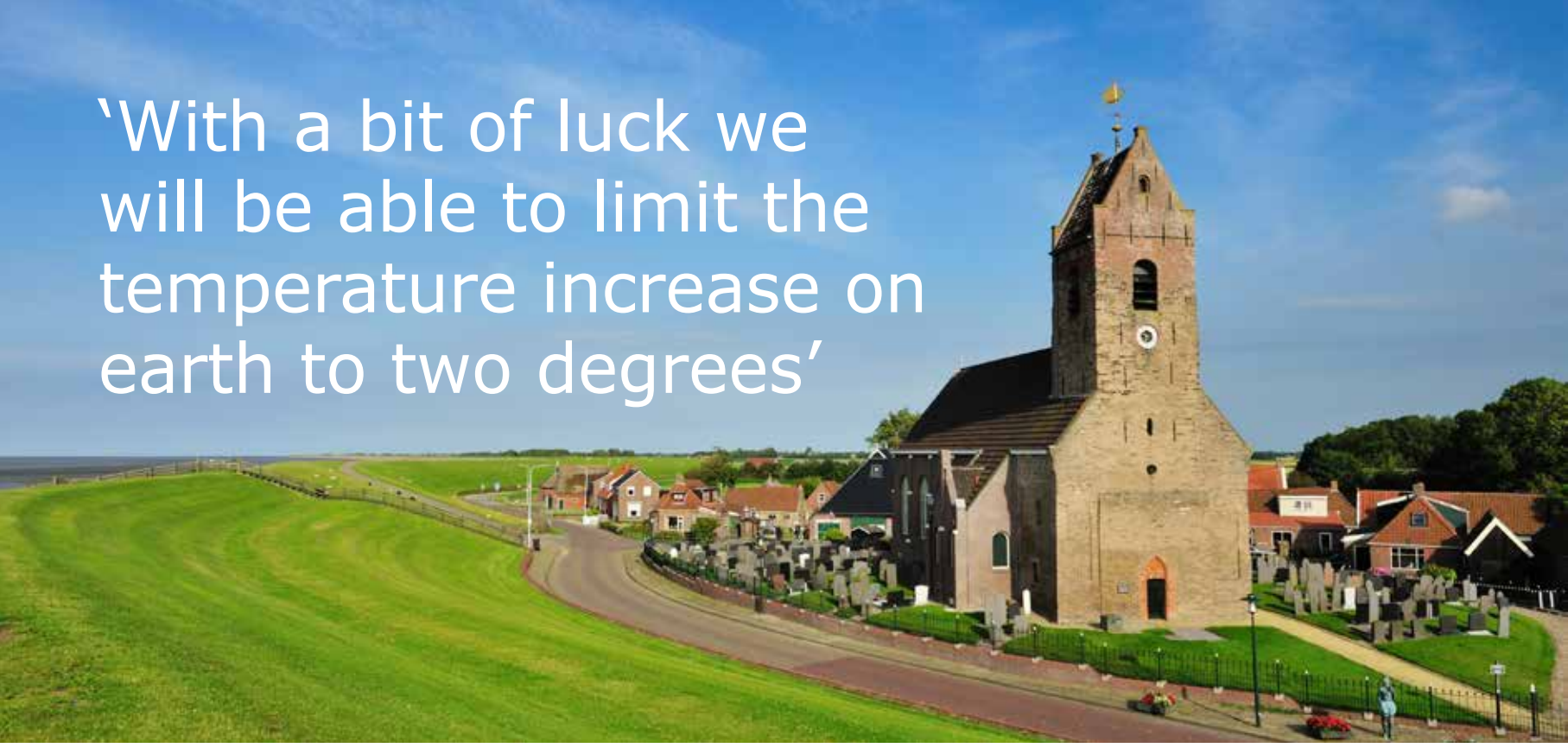
Despite this, the Climate Professor remains hopeful. "We've succeeded in reversing the damage to the ozone layer and the energy transition is in full swing." Over half of all new investments in electricity generation in the US, Europe and China are now sustainable. Germany is running on over 20 percent renewable energy. "With a bit of luck we will be able to limit the temperature increase on earth to two degrees," Vellinga explains. "This will still lead to severe damage. Even with an increase of two degrees the sea level will continue to rise for the next 1,000 years, but at least we will have a chance to adapt."

Having obtained his doctorate in the erosion of beaches and dunes by storms in Delft, Vellinga recognised the dangers of climate change at an early stage. In 1988 he was one of the initiators of the IPCC, which won a Nobel Prize in 2007. Since 1991 he has been professor in Climate Change at the VU Amsterdam, and has been with Alterra as Extraordinary Professor and leader of

the Knowledge for Climate programme (see sidebar) since 2007.

Peak showers and drought

The Netherlands is not yet climate-proof, Vellinga continues. "The climate is changing faster than we can adapt. Although we're investing a quite substantial amount we are running behind. We are quite well prepared with regard to protection against sea and river water thanks to the planned investments of the Delta Programme. But the cities and rural areas are not yet able to cope with much heavier peak showers or heat and drought."



‘With a bit of luck we will be able to limit the temperature increase on earth to two degrees’

According to Vellinga, climate research was stuck at the academic level for far too long. There was also the question as to how far investments in infrastructure and spatial planning took climate change into account. For this reason, the government decided to boost research with the Knowledge for Climate programme, which started in 2007. Vellinga: “Our main mission was to ensure climate change is in the minds of everyone involved in infrastructure and spatial planning, including district water boards, government ministries, provinces, municipalities and the Department of Waterways and Public Works as well as consultancy bureaus and contractors.”

Tidal marshes and wide dykes

Approximately 15 percent of the research carried out in Knowledge for Climate was performed by Wageningen UR. Of the sixty doctoral students involved, nearly a quarter studied in Wageningen. Knowledge for Climate focused on eight themes, from water safety to governance and future predictions. It also looked into eight so-called hot spots; vulnerable areas such as the Rotterdam region, the peat marsh areas, the river region in the heart of the country and the Wadden Sea. From a water safety perspective, further research was performed into unbreachable dykes, one of Vellinga’s favourite subjects. “If we make the dykes wider instead of higher, they will become unbreachable.” These wider dykes can be used in a multifunctional way, including for bicycle paths, golf courses and other recreational activities, or for construction.

Another idea from Wageningen involved the reinstatement of tidal marshes and osier beds – wooded areas bordering on the sea or rivers which are flooded in case of storm or high water. Expanding the tidal marshes and osier beds means the dykes require less reinforcement, which is a cheaper solution that can be combined with the development of new nature or recreational areas.

Salty potatoes

At least as innovative are the plans for underground water storage in the horticultural region in which reservoirs beneath the greenhouses temporarily store rainwater which can be used by farmers in times of drought. Another issue is that the groundwater will become much more saline in the coastal areas. With this in mind, scientists studied how much salt certain flowers, plants and agricultural crops can take. "Potatoes and carrots grow surprisingly well in saline soils," says Vellinga.

Wageningen was also involved in research into the climate in cities. Urban areas are six to eight degrees Celsius warmer than rural areas in summer. Scientists cycled through cities with a heat meter and determined that the temperature was five degrees Celsius lower in a park. "But instead of providing cooling, water seemed to actually retain heat," reveals Vellinga. "This is an absolute eye-opener for architects."

Within the governance theme, Wageningen scientists looked at the organisation of climate adaptations. For example, district water boards are responsible for dykes but not for their escape routes. "Another instance is how smart legislation can ensure that cities capture more rain, for example by reducing water taxes for those who unpave their gardens."

The Climate Professor is very satisfied with the progress and results of the Knowledge for Climate programme. "In 2010/2011 we had some issues with climate sceptics. Climate change was a no-go area for politicians. Now we can see that the climate sceptics were involved in a rearguard action." Within the Climate Adaptation Services (CAS) foundation, Wageningen UR and other knowledge institutes are actively marketing the legacy of the research programme. Meanwhile, several government parties are combining their ongoing research in the National Water and Climate Programme as a follow-up on Knowledge for Climate. Vellinga: "Our research showed that climate adaptations can be attractive and relatively low cost. We now need scientifically supervised experiments to demonstrate this further."

Climate adaptation should be combined with other goals as much as possible, the scientists found. "If you need to renovate a dyke, neighbourhood or road anyway, why not put the climate into the mix as well. The Betondorp neighbourhood in Amsterdam needed a new sewerage system and streets. It turned out to be cheaper to realise this in a climate-proof manner." There is much to be done in urban areas in particular, according to Vellinga. "Wageningen has achieved its position due to its knowledge of agriculture and the rural economies. Now the cities determine the political priorities. We must therefore focus on urban areas, and combine it with themes such as food, health, energy, climate, economy and quality of life."

Knowledge for Climate

To make the Netherlands climate-proof in a timely and affordable way, the Dutch government, industry and science developed applied 'knowledge for climate'. With participants such as Wageningen UR, VU Amsterdam, Utrecht University, Delft University of Technology, the Royal Netherlands Meteorological Institute (KNMI), the Netherlands Organisation for Applied Scientific Research (TNO) and Deltares, the research programme ran from 2007 to 2015. The Economic Structure Enhancement Fund (FES) funded the project to the tune of 50 million euros, supplemented by 50 million euros from the EU, Dutch government and industry.
See www.knowledgeforclimate.nl for more information.

Wadden Islands poorly prepared for floods

The Delta Programme introduced the concept of multilayer security, stipulating that the Netherlands should not only rely on strong dykes, but also organise the land behind the dykes in such a way that the consequences of a breach would be minimal. Alterra and consultancy company HKV applied this concept to the islands and coastline of Friesland and Groningen provinces.

There are three coastal security layers distinguished within the concept of multilayer safety: dykes, adapting the land behind the dykes, and disaster management plans. Alterra scientist Judith Klostermann explored the possibilities for layers 2 and 3 in Groningen and Friesland. "We looked at risk reduction measures in the area, and, where possible, the economic benefits that could be generated with the same measures." This included taking into account the value of the Wadden Sea to agriculture and tourism, for example, as well as the critical infrastructure for gas and electricity production in the northern Netherlands.

High public confidence in the safety of dykes has meant that there are few preventive measures related to possible floods in the Netherlands, Klostermann concludes. The study implies that the islands in particular should be better prepared. They must be almost entirely self-reliant in case of a flood and they can be visited by many ill-informed tourists at any given time. While moving people to a safe place on the island is the only constructive reaction to a flood, there are still no maps detailing the risks for each island.

Carbon dioxide does not make tropical rainforest grow faster

Trees in the tropics have not started to grow faster during the past century, despite greatly increased concentrations of carbon dioxide. This is bad news for those hoping that accelerated growth of tropical forests could slow climate change, forest ecologists from Wageningen University wrote in the December 2014 issue of *Nature Geoscience.*

Plants need water, sunlight and carbon dioxide to grow. Many climate models assume that a higher concentration of carbon dioxide in the atmosphere will act as a fertiliser for plants, causing them to grow faster. Scientist Pieter Zuidema examined this assumption for tropical forests and found no evidence of faster growth – on the contrary. "None of the woods showed evidence of increased tree growth over the last 150 years." The carbon dioxide content in the atmosphere increased by 40 per cent in that period.


The ground
beneath our feet

It is essential that we protect the soil and tackle soil degradation worldwide. This requires awareness, according to Professor Coen Ritsema, who leads several large EU projects aimed at finding local and global solutions to erosion, salinisation, pollution and desertification.

Climate change is finally high on the international political agenda, along with deforestation and increasing desertification. An equally important threat is soil degradation. "The soil plays a regulating role and is linked to all these problems," says Coen Ritsema, professor in Soil Physics and Land Management at Wageningen University. "Although specific soil management contributes to the solution, many policy makers have yet to grasp soil's importance."

A healthy soil filters and stores water, retains carbon and enables food production. But the ground beneath our feet is disappearing in many regions due to water & wind erosion and flooding. In some coastal areas the soil is becoming more saline, while other areas are desertifying. Agriculture, industry and mining often result in deterioration, compaction or pollution of the soil. The loss of organic matter is threatening soil fertility, while the excessive use of crop protection products may threaten the biodiversity as well as the quality of the soil and water.

Hundreds of years

Approximately one billion people in over 100 countries are experiencing the consequences of soil degradation and desertification. According to the UN, over 20 million hectares of fertile soil is lost to desertification each year, says Ritsema. "This cannot be restored and has serious consequences. We have to put a stop to soil degradation. The soil system is very resilient, but when used carelessly and taxed too far it loses many of its functions. The soil can also be physically lost due to water and wind erosion processes." Creating one centimetre of soil may take hundreds of years, but farmers can lose this layer in only a fraction of this time. Restoring the deteriorated soil costs a great deal of money and effort. "Prevention is cheaper and smarter, but it requires awareness. We should always ask whether we're using and managing the land wisely or whether it is slowly being exhausted and degraded," says the professor.

Overgrazing

Gradually the issue is gaining more attention, with the UN making 2015 the 'international year of the soil' and the EU, in particular, focusing on soil degradation over recent years. In various research projects with

European and international knowledge institutions (see sidebar), scientists are working with local stakeholders such as farmers and governments to find solutions to soil problems in various regions: from forest fires, salinisation and landslides in Southern Europe to erosion and vegetation loss in Botswana.

Tested local solutions include less ploughing, halting the use of crop protection products or crop rotation. Other examples involve drip irrigation, building clay banks or terraces, and planting olive and almond trees. "We are trying to solve problems in their specific context. At the same time we are developing and disseminating generic knowledge which can be applied worldwide," Ritsema explains.

The EU is focused on combating soil problems in Europe and further afield. There are project activities in Latin America and Africa. as well as in the loess area along the Yellow River in China, where the soil was deteriorating due to careless land use and overgrazing by goats. The research convinced the Chinese government to change its policy. Within a period of ten years, the region has become extremely green with fertile valleys, says Ritsema. "It is amazing how quickly nature recovers."

Connection

Scientists work closely with local people in the research regions. "They know the area and have their own ideas," Ritsema continues. "Whatever technical solutions we come up with must be socially acceptable and economically feasible. People have to believe in them - for instance, seeing that a method increases yield in addition to reducing erosion. Otherwise nothing will happen after the project is concluded."

Wageningen UR is the coordinator of the various European soil projects. Managing large projects such as DESIRE with 28 partner organisations and over 300 stakeholders is no easy task, underlines Ritsema. "Wageningen has an excellent scientific reputation, but we are also able to deal with the administrative and organisational aspects of these projects. This is certainly of considerable added value." Wageningen UR is also an expert in integrating knowledge from various disciplines. "Theoretical and practical innovation is often the result of making connections between, for instance, technological and social-economic knowledge."

Visionary

The policy makers in Brussels are looking to establish a European framework guideline for the soil, as they previously did for water. "Unfortunately this was unsuccessful due to the opposition of several crucial member states. National governments often apply short-term politics. The EU usually applies more long-term goals to benefit humankind and the environment. This is a wise and visionary perspective which will hopefully contribute to a better world," says Ritsema.

The EU is also a frontrunner in the global arena and countries like China look to Europe for their environmental policies. "The huge economic growth in China was partially due to foreign investors who were not so particular about possible negative impact on the environment," Ritsema continues. "China now has sufficient clout to reign in these polluting practices and establish proper legislation. The regulations in the EU serve as an example to China of how they can proceed with the organisational and regulatory aspects."

Ritsema hopes that the cooperation with other countries and institutions will continue to increase. "International cooperation in global soil problems such as soil deterioration is crucial. These issues deserve the attention of other institutions than the European Commission alone. We all live on this planet together and should therefore work together to find solutions to our problems."

EU soil research projects

RECARE www.recare-project.eu

Running from 2013 to 2018, RECARE involves 27 European knowledge institutions in analysing the current soil threats. Within this framework scientists are developing a method to determine the impact of soil degradation on soil functions and, based on both scientific and local knowledge, determining innovative solutions to prevent further soil degradation. The project involves 17 research areas throughout Europe, from Iceland and Scandinavia to the UK, Spain, Poland and Cyprus.

CASCADE www.cascade-project.eu

Running from 2012 to 2017, this project involves 14 knowledge institutes from nine EU countries. Scientists are studying and analysing ecosystems in dry regions in Southern Europe in the hope of being better able to predict sudden shifts that affect biodiversity and ecosystem services. They are also researching how this knowledge can help policy makers and soil users manage the soil in a more sustainable way. The project focuses on eight research locations in Portugal, Spain, Italy, Greece and Cyprus.

iSQAPER www.isqaper-project.eu

In this project scientists are developing an interactive instrument to determine the quality of the soil. The project runs from 2015 to 2020 and is focused on sustainable agricultural practices and the impact of agricultural land use on the soil and ecosystem services. It involves 22 European and four Chinese knowledge institutes and 14 research locations in varying regions in Europe and China.

DESIRE www.desire-project.eu

Preventing desertification was the focus of this major European research project, which ran from 2007 to 2012. It involved 28 global research institutes, NGOs and governments. The problems in the 18 research areas in Mexico, Argentina, Southern Europe, Tunisia, Botswana, Turkey, Russia and China ranged from soil erosion to salinisation, drought and sudden flooding. The scientists worked with locals to develop feasible methods for preventing land degradation and establish practical guidelines for responsible land use.

Helping people to adapt to climate change in the Himalayas

Together with institutes in Nepal, India, Pakistan and Bangladesh Alterra is studying the consequences of climate change on impoverished communities in the river basins of the Indus, Ganges and Brahmaputra.

The institutes cooperate in the programme HI-AWARE (Himalayan Adaptation, Water and Resilience), which started in 2014. Until 2018, they will investigate how the poorest inhabitants of the region can best prepare themselves for the consequences of climate change. Climate models predict shifts in the availability of water for agriculture and an increased likelihood of heatwaves. Hester Biemans (Alterra): "We will map the consequences of this in twelve trial locations and will consider ways in which the population can adapt to the new circumstances."

Boundary layer makes heatwave more extreme

The extreme heatwaves in western Europe in 2003 and in Russia and eastern Europe in 2010 came as a surprise to experts. Scientists Ryan Teuling and Jordi Vilà-Guerau de Arellano from Wageningen University found an explanation for the high temperatures in the interaction of dry soils with the lowermost segment of the atmosphere.

The massive heatwave of August 2003 in western Europe broke a number of records, with temperatures reaching 40°C in France. There were thousands of fatalities due to the heat in Paris alone. Scientists thought that this was a one-off, exceptional occurrence, until new records were set in 2010, this time in eastern Europe and Russia.

Wageningen scientists found an explanation for the heat in 2014. The interaction between the lowermost layer of the atmosphere and the drying ground played an important part. The so-called boundary layer, the lowermost part of the atmosphere, ranges in thickness from scores to hundreds of metres at night and several kilometres during the day. The ground dried out over a period of days and weeks. This neutralised the cooling effect of water evaporation and the layers of hot air became increasingly thick, causing temperatures to keep rising.

The scientists explained how the role of the boundary layer was insufficiently considered in existing weather models in the journal *Nature Geoscience* in April 2014. They calculated that extreme heatwaves with temperatures up to 40 degrees are possible in north-western Europe. But 45 degrees Celsius, which is sometimes measured during heatwaves in Melbourne, for instance, remain unlikely in northern Europe.

Water and green space make Netherlands climateproof

The Delta Programme, which commenced in 2010, has two objectives: to protect the Netherlands against flooding and ensure a sufficient supply of fresh water. Alterra's expertise was indispensible during the development of the Delta Programme's knowledge programme, says Delta Programme Commissioner Wim Kuijken.

According to an American myth from 1865, the eight-year-old Hans Brinker used his finger to plug a hole in a dike. Nowadays it will take more than that, however, to protect the Netherlands against the threat of flooding. The Delta Programme will continue to introduce measures aimed at making the Netherlands climate proof all the way through to 2050.

While people generally consider themselves safe in this country, ongoing adjustments are essential to combat subsidence and climate change, thus ensuring the continued existence of the Netherlands, emphasises commissioner and leader of the Delta Programme, Wim Kuijken. Almost 60 per cent of the Netherlands is below sea level, an area that includes the country's biggest cities, ports, countless companies and lots of infrastructure. Amsterdam Schiphol Airport, for example, is four metres below sea level. Kuijken: "Climate change increasingly means that we will be forced to deal with extreme rainfall and storms, but also with drought, salinisation and a rapidly rising sea level."

Flood protection, climate-proof spatial planning and sufficient fresh water for drinking, agriculture, industry and nature: these are the spearheads of the Delta Programme. Measures to be implemented in vulnerable areas, alongside rivers, and along the coast and Wadden zee include reinforcing dikes, river widening and strengthening coastal defences through sand replenishment. TU Delft, Deltares, and Alterra and other Wageningen institutes are supplying the necessary expertise.

"Viewing flood protection and supplies of fresh water as two halves of the same problem, such as in Rijnmond and the IJsselmeer, was completely new to us," admits the commissioner. "The same thing applies to efficient water management for agriculture and horticulture through the retention of water in the landscape." Alterra is also conducting research into saline agriculture in coastal areas and climate adjustment in cities. Kuijken: "Plenty of knowledge is available on all of these subjects but it's interesting to see how the domains of water and green space overlap with each other." The implementation of the Delta Programme begins this year and € 20 billion will be invested in the delta over the coming three decades.

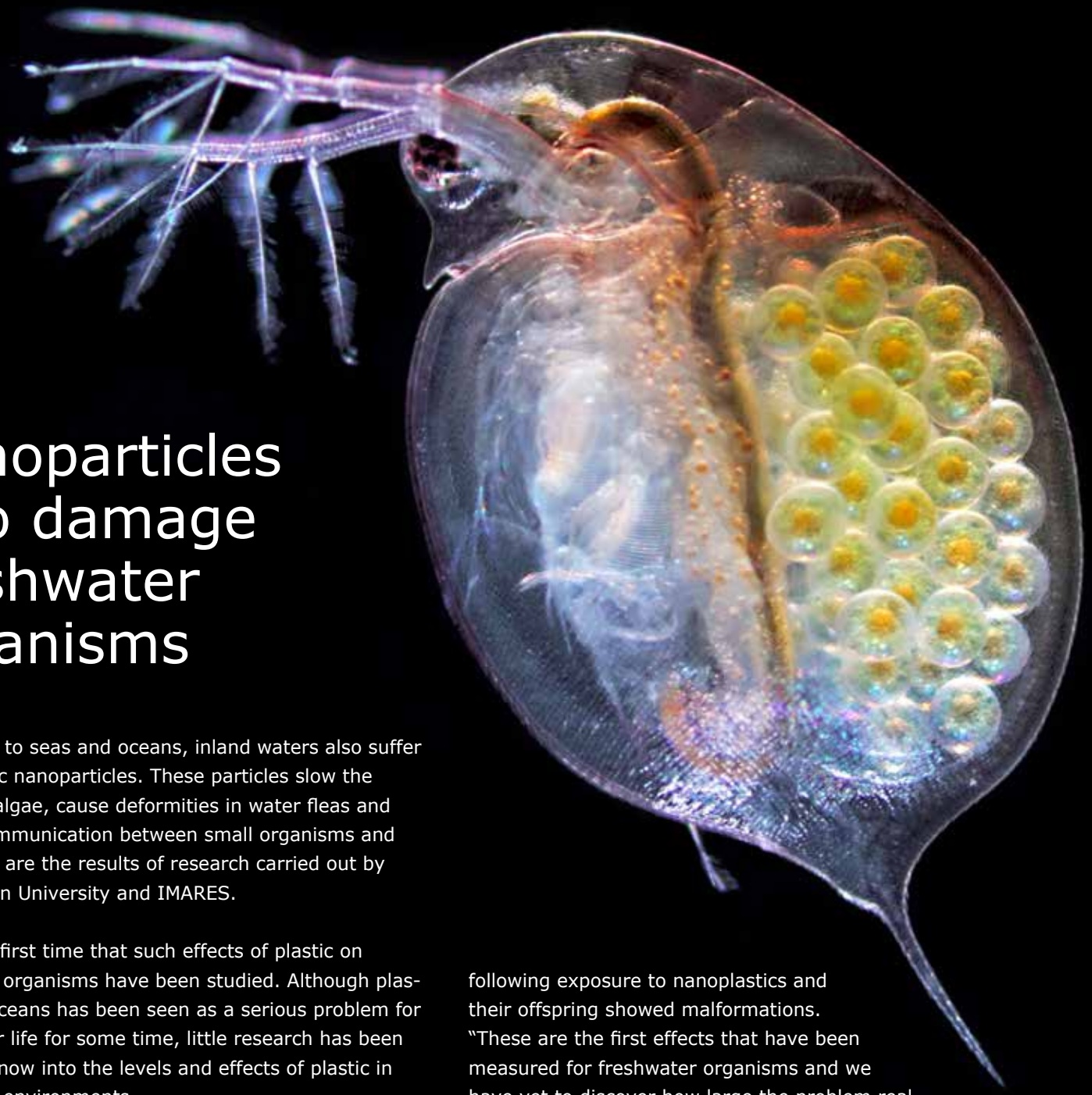
Alterra also has a role to play in the international marketing of Dutch expertise, Kuijken suggests. "Other regions with river deltas, in North America and Southeast Asia, for example, are experiencing the same problems. We have a great deal of substantive and application-oriented knowledge on the combination of water management, agriculture and green space, based on our own experiences as a delta country. We also have expertise in the field of governance, the organisation of flood protection. "Just like TU Delft and Deltares, Alterra is a leading international knowledge institution in the field of delta issues. It has expertise in everything to do with nature, food and green space, and thanks to its multidisciplinary approach, this can be used to connect with the outside world."


‘20 billion euros
will be invested
in the Dutch
delta over
the coming
30 years.’

New home for the World Soil Museum

The largest collection of soil monoliths and maps in the world found a new home in 2014. On 7 April, the World Soil Museum of the ISRIC institute opened the doors of its new building on the Wageningen Campus.

The museum houses in a turf-shaped new building, and is led by curator Stephan Mantel. He manages a thousand soil monoliths from around the world, some of which are prepared and exhibited on the walls. ISRIC is the only institute in the world with a collection of soil monoliths that covers the entire world. Samples from Spain, Jordan, Morocco, Chile, Ghana and Indonesia are among the latest additions to the collection.



Nanoparticles also damage freshwater organisms

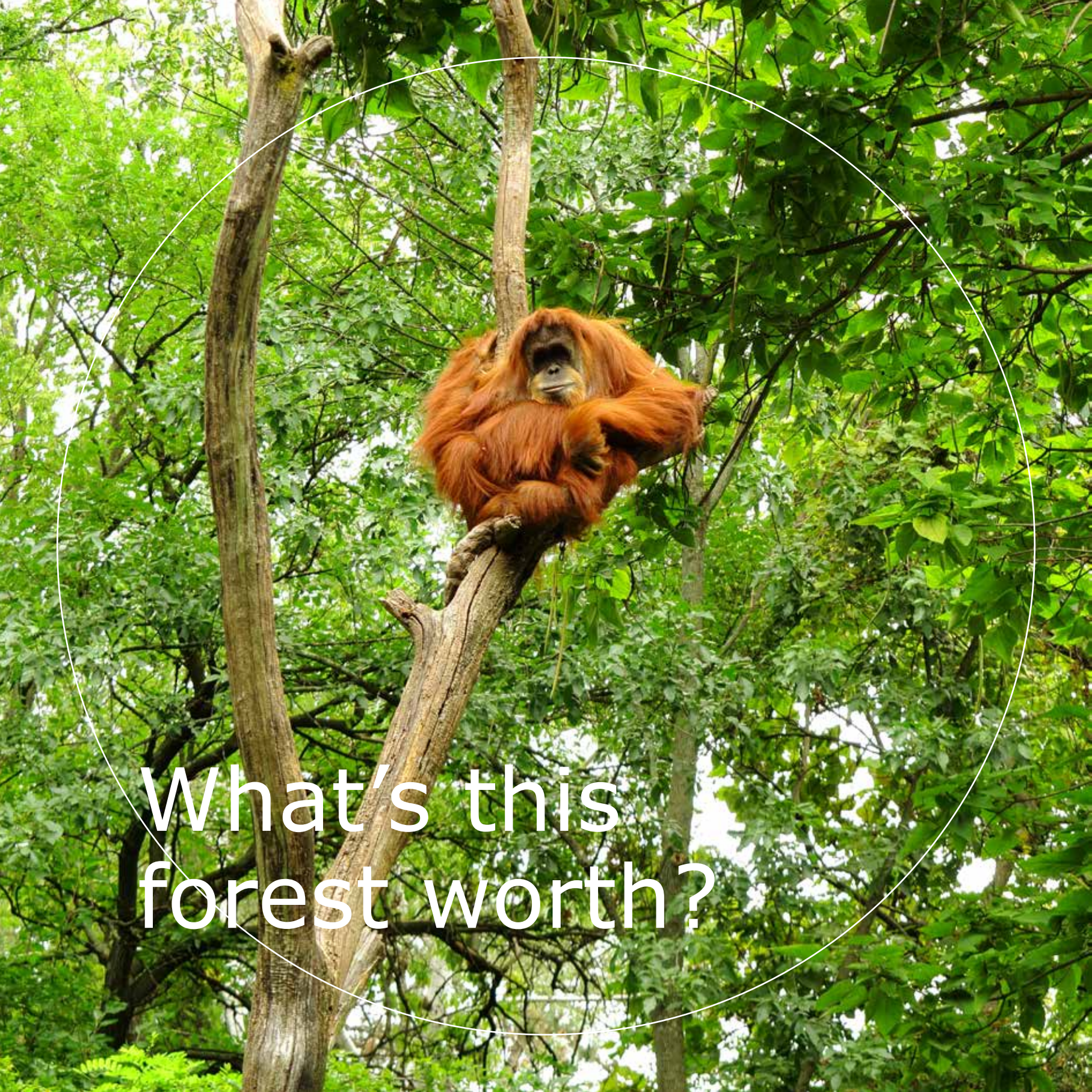
In addition to seas and oceans, inland waters also suffer from plastic nanoparticles. These particles slow the growth of algae, cause deformities in water fleas and impede communication between small organisms and fish. These are the results of research carried out by Wageningen University and IMARES.

This is the first time that such effects of plastic on freshwater organisms have been studied. Although plastic in the oceans has been seen as a serious problem for underwater life for some time, little research has been done until now into the levels and effects of plastic in freshwater environments.

In the study, scientist Ellen Besseling and student Bo Wang exposed water fleas in the laboratory to various concentrations of nanoplastic. At higher concentrations, algae growth declined. Water fleas were also smaller following exposure to nanoplastics and their offspring showed malformations. "These are the first effects that have been measured for freshwater organisms and we have yet to discover how large the problem really is," Ellen Besseling says.

The study into the nanoparticles appeared in the scientific journal *Environmental Science and Technology* in October 2014.

Changes in our economic environment


What's this
forest worth?

Lars Hein aims to use ecosystem accounting to map the contribution of an ecosystem to the economy. This no-nonsense calculation could, for instance, help the Indonesian government determine the best locations to give licenses for palm oil plantations, or indicate where an investment in the Dutch Ecological Network would have the most effect.

Calculating the services that an ecosystem provides to humans, for example via the production of wood or crop pollination, is not a new idea. A small group of scientists have been working on the notion of ecosystem services since it was first formulated in the 1970s. Attention for the concept has grown exponentially over the last decade, however, with hundreds of scientific publications on this topic every year. One of the crucial questions is how best to assess the monetary value of services linked to the environment. Based on the same statistical methods used to calculate gross domestic product (GDP) and other national accounts, ecosystem accounting is one of the proposed ways of doing this.

In cooperation with a number of partners, Lars Hein, professor of Ecosystem Services and Environmental Change, is working with a group of PhD students on a method to identify the economic value of ecosystems in several different countries. They convert the worth of ecosystem services provided by a hectare of forest, swamp or cropland to figures that fit into national accounts as accurately as possible. One hectare of arable land planted with potatoes, for instance, yields a harvest with a certain value at the end of the year. Ecosystem accountants quantify the contribution of soil & water as well as that of the labour & capital invested by the farmer. The worth of services provided by a forest can be calculated in the same way by converting into euros the value the forest contributes to recreation, water storage and CO_2 reduction. "We are working on achieving a consistent calculation method, whereby the measurements are comparable across the board and consistent with the procedures used to determine the GDP of countries," says Hein

The method is explicitly not intended to express the full value of nature in monetary terms. Rather than putting a price tag on species or landscapes, it attempts to measure the services provided to the economy by ecosystems. By accounting for services such as clean water, clean air and fertile soil in the same way as they do for factories, or the value of services provided by insurers, authorities can make rational decisions about land use. Where does an investment in the natural environment yield the most, for instance, or which areas in the tropical rain forest of Kalimantan are the most useful to people?

The Central Statistical Office of the Netherlands calculates the country's GDP every quarter. A complex set of accounting rules decides what is counted in GDP and what not. Hein is currently working on a similar set of models and rules to determine the contribution of ecosystem services over a given period – and, especially, the extent to which 'ecological capital' has changed – along with the capacity of different ecosystems to contribute to the Dutch economy.

Sustainability

"I hope that we will soon be able to see how the ecological capital of the Netherlands has evolved over a given period," Hein explains. "There is much talk about sustainability, and this is one way to measure it in a relatively broad way – by showing that we lost, or gained, two per cent of our ecological capital in 2015, say. Our method provides a way to identify whether society as a whole is becoming more sustainable or not. After all, a sustainable society does not consume its ecological capital."

Scientists from Wageningen UR are working on an exercise to demonstrate the value of ecosystem accounting. They are applying the calculation methodology to maps of land use in Limburg, and to data on the state of ecosystems. Hein expects the results to be published in 2015.

"The figures could help us calculate which route of a new road makes the most sense, or where investments in the National Ecological Network have the highest yield," Hein states. "A standardised system for determining the value of ecosystem services can also be a fair and economical fair basis for a social cost-benefit analysis. I have high expectations."

Kalimantan

There is a great deal of interest for ecosystem accounting outside the Netherlands, too. Hein worked together with environmental scientist Elham Sumarga on a map of Kalimantan that tracks a number of ecosystem services: wood and rattan production, palm oil production, rice production, CO_2 storage, and the contribution to the preservation of orang-utan habitats. "The Indonesian government was very interested in our data."

'A sustainable society does not consume its ecological capital'

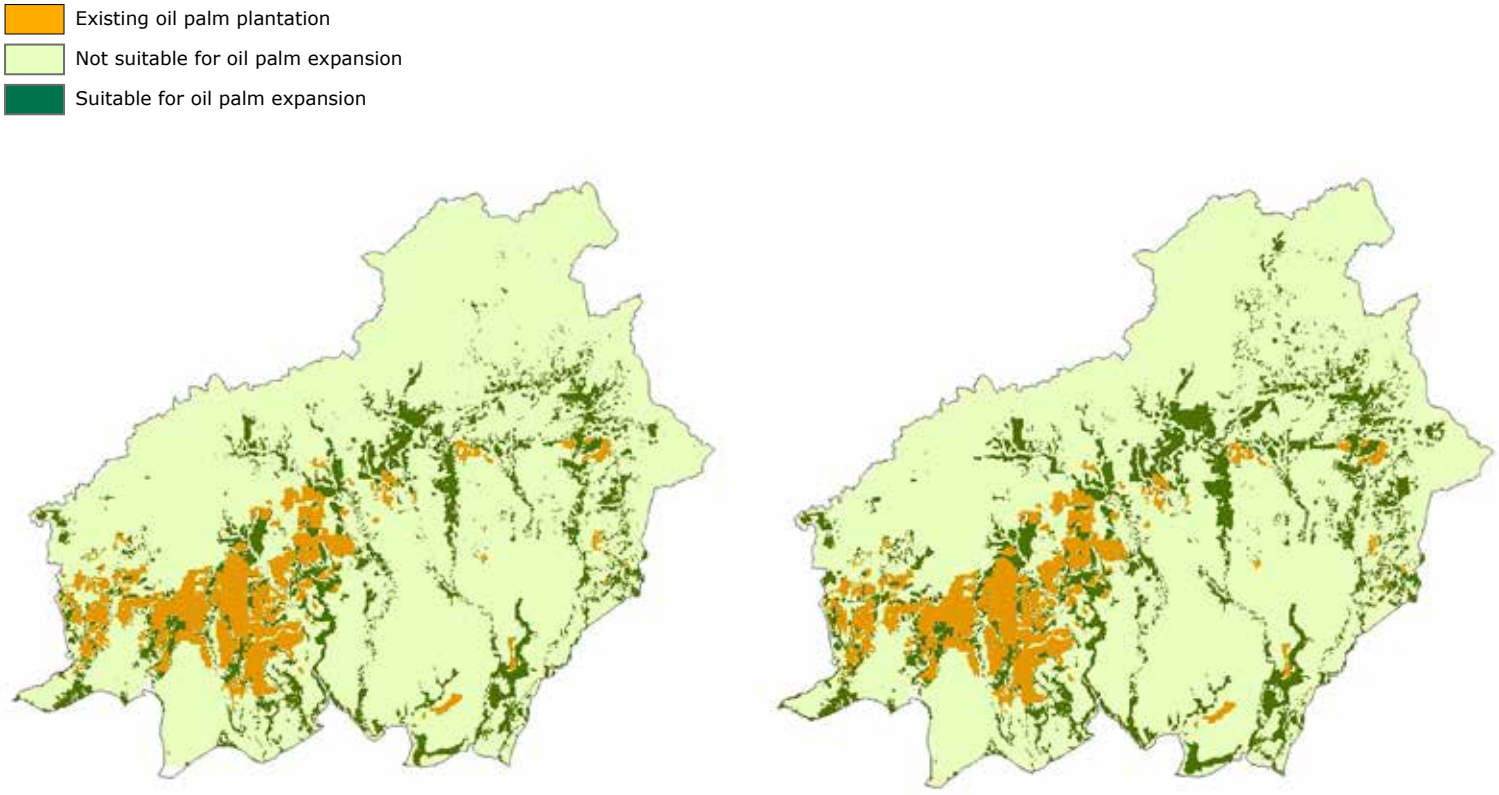
As well as looking at existing natural features, the computer models also take into account future developments. The establishment of oil palm plantations on bogs is a notorious environmental problem as the required drainage process results in significant emissions of CO_2 from the soil. As in the west of the Netherlands, the drainage also leads to subsidence, which has serious consequences for future ecosystem services. "Subsidence is so intense in many areas that plantations will be flooded and no longer productive within a few decades."

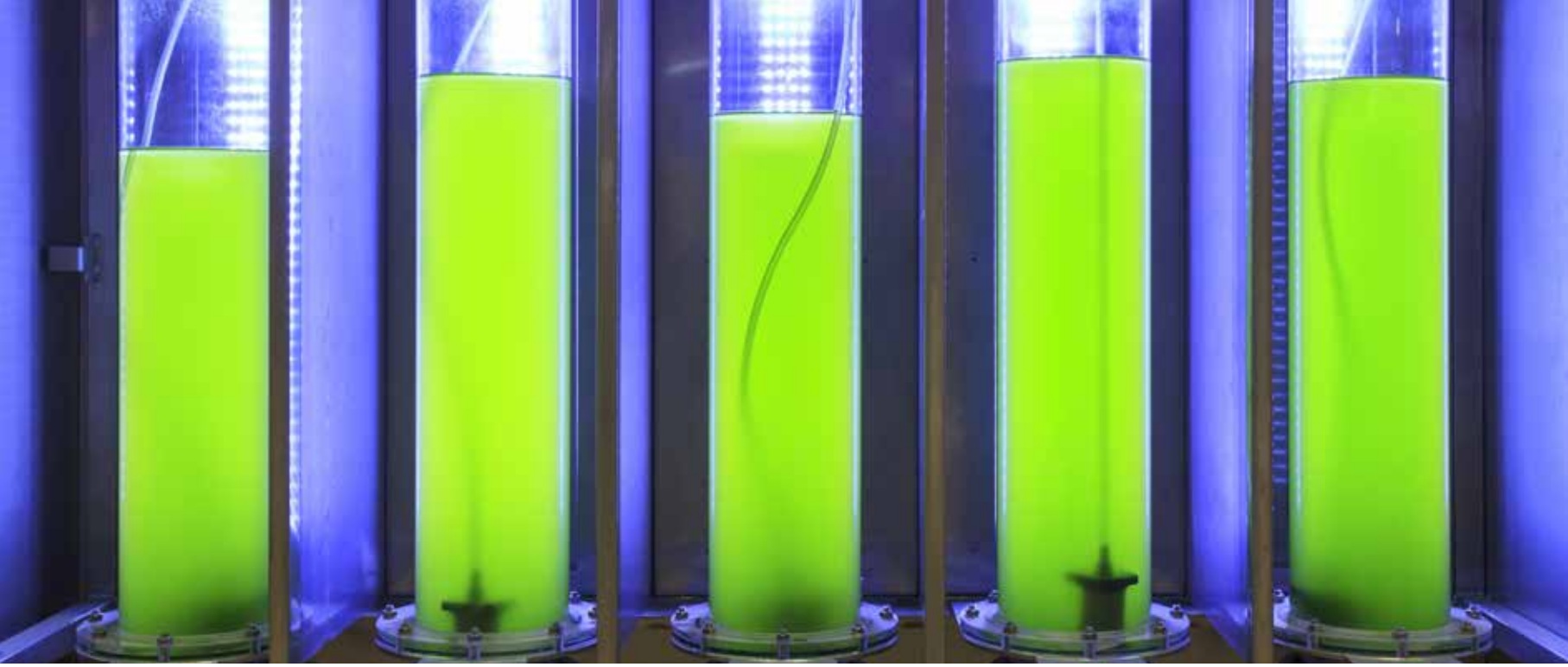
The oil palm plantations in Kalimantan are infamous throughout the world. "It's not a new story, but it bears

repeating. Around a quarter of the oil palm plantations in Indonesia are in bog areas and produce enormous greenhouse gas emissions. Although the oil palm is a highly productive crop which can basically be grown in a sustainable way, there are insufficient guarantees at this time to exclude cultivation in bogs."

Many conservationists would prefer to see no economical development at all in Kalimantan so as to protect the rainforest. "This does not take into account the complex reality," Hein objects. "Oil palm cultivation can make a major contribution to economic development, and environmental risks can be reduced by creating new plantations on already degraded land, while leaving the bogs alone. More sustainable land use can be achieved by looking at ecosystem services, and ensuring that areas which are important for capturing carbon, biodiversity and other environmental functions are not used for new plantations. Our maps and models can help with this."

Maps of planning for oil palm expansion based on environmentally sustainable scenario (left) and mixed sustainable-rapid development scenario (right).





Toolbox to support regions with biobased economy

Alterra is working together with other institutes of Wageningen UR on a toolbox for regions wishing to boost their biobased economy activities. Appropriate data and analysis methods will help policy makers choose the right tools for this purpose.

BERST (BioEconomy Regional Strategy Toolkit) is the name of the European research programme which brings together eight knowledge institutes and seven regional organisations linked to the EU. LEI Wageningen UR, Alterra and Food & Biobased Research will cooperate on the Dutch segment of the programme. Alterra is working on forging a European network by organising conferences and meetings on the biobased economy. "We want to hear directly from the people involved which issues they are facing and what information they need," scientist Remco Kranendonk explains.

At the end of 2015, BERST will provide data and tools that will enable regions to better compare their strengths and weaknesses with those of other European regions. For the Netherlands, the data will be particularly relevant for the Biobased Delta (Zeeland, South Holland and western Brabant). This region in estimated to be one of the most important in Europe, among other things thanks to the close proximity of the two major ports of Antwerp and Rotterdam and the associated chemical industry.

BERST is funded by the seventh Framework Programme of the European Union.

Insurance for Indonesian rice farmers

A new project will see Alterra provide technical assistance to Indonesia's Ministry of Agriculture in the implementation of a new law to insure crop yield. Some 200,000 rice farmers in Indonesia should benefit from the new insurance.

Aart Schrevel from Alterra will help in the introduction of the new law in East Java, one of the main rice growing areas in Indonesia. His activities will include helping devise a method for assessing farmers' claims. The assessment itself will be done by means of satellite images. "This makes it possible to monitor the development of crops and assess any claims without ever having to examine the field," Schrevel explains.
This three-year project was commissioned by the Netherlands Space Office. The consortium comprises seven other partners, including four from the private sector.

A lick of green for 220 million

Farmers, officials and conservationists have attended meetings and lobbied about the greening of the European agricultural policy for years. Nobody is really happy with the result. Scientist Anne van Doorn cannot blame the sceptics, but sees growing enthusiasm for making agriculture more eco-friendly.

The first effects of the greatest change to the European Common Agricultural Policy (CAP) in decades should be visible in the Dutch countryside from the summer of 2015. Since January, farmers will only receive the full amount of their European subsidies if they adhere to a list of measures to make their business greener – for instance, by reserving five per cent of their land as an Ecological Focus Area.

The measures are the result of a long negotiation process which was initially followed with optimism by officials and environmental organisations alike. This is understandable, especially given the magnitude of the numbers in the budget. In 2015, Europe will spend some 220 million euros on green agricultural subsidies for Dutch farmers. "This huge amount led to high expectations among many conservation organisations with plans of their own," says Anne van Doorn, coordinator of Alterra's knowledge programme for nature-inclusive agriculture.

The conservation organisations may be disappointed for now. The measures for making farms greener include sowing catch crops, i.e. plants which retain the fertilisers that remain in the fields after cultivation. This prevents nitrate and phosphate from ending up in the dykes. While sowing catch crops is the most attractive measure for most farmers, it has only a limited effect on the environment. Van Doorn expects that the most visible effect of the policy change will be the widespread sowing of ryegrass in the autumn of 2015. It will then stand for a few months before being worked into the soil. "More than seventy per cent of the farmers will probably opt for catch crops – that is, subsidised grass on a large scale which doesn't help the environment much," she says.

Feeding godwits

It makes no sense to blame farmers, Van Doorn says. "Many of them have a hard enough time keeping their business running as it is. We can't live from feeding godwits,' someone recently said to me. Most farmers simply choose the measure that is the easiest fit for their existing operations."

Moreover, the government has not made it easy to take more drastic measures with a larger impact on

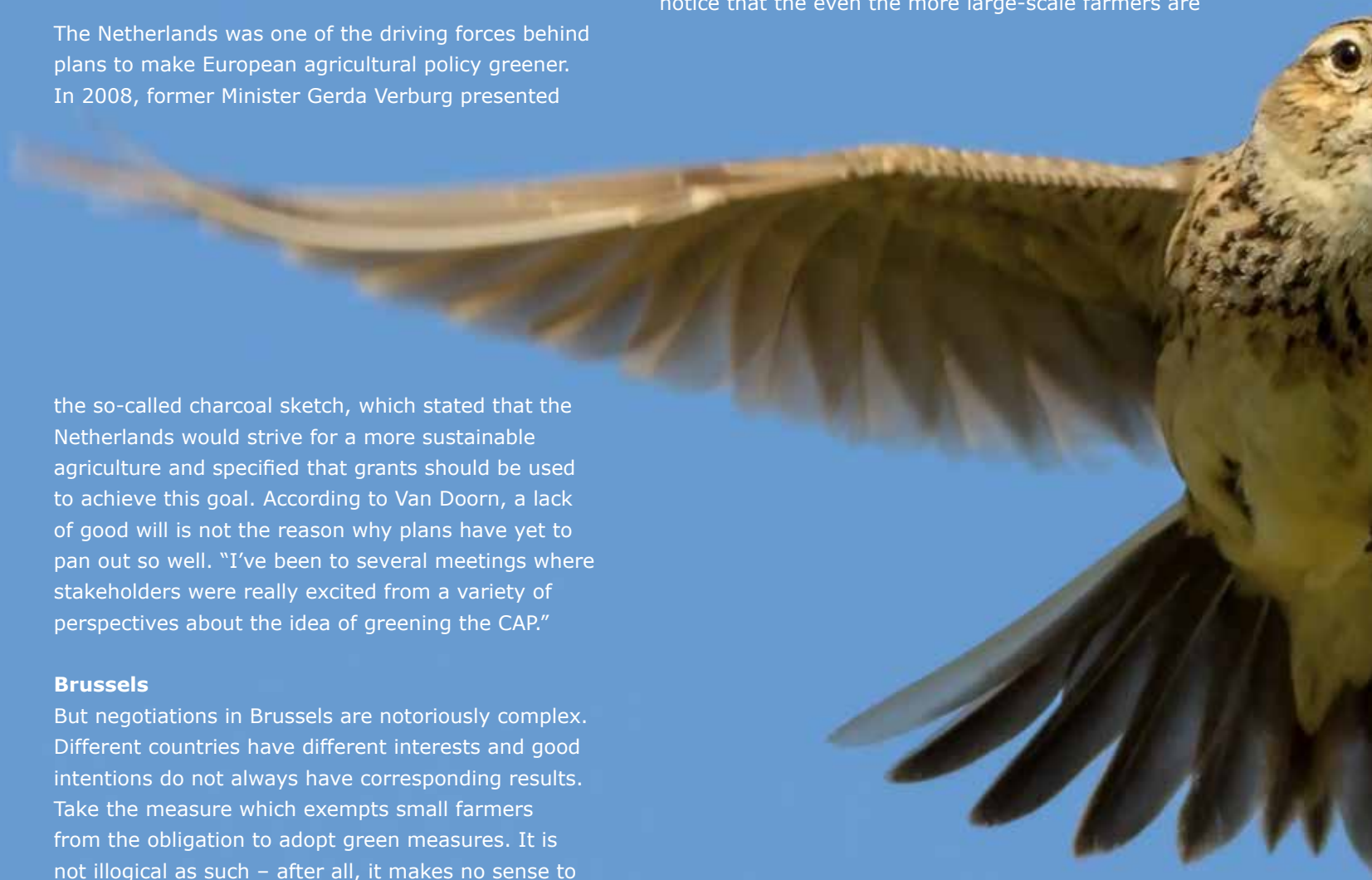
nature. There has long been uncertainty about the list of approved green measures, which came into force on 1 January 2015. "If you are only told at the last moment what does and does not count, it's no wonder that you choose a low-threshold measure. That means the catch crops."

The Netherlands was one of the driving forces behind plans to make European agricultural policy greener. In 2008, former Minister Gerda Verburg presented the so-called charcoal sketch, which stated that the Netherlands would strive for a more sustainable agriculture and specified that grants should be used to achieve this goal. According to Van Doorn, a lack of good will is not the reason why plans have yet to pan out so well. "I've been to several meetings where stakeholders were really excited from a variety of perspectives about the idea of greening the CAP."

Brussels

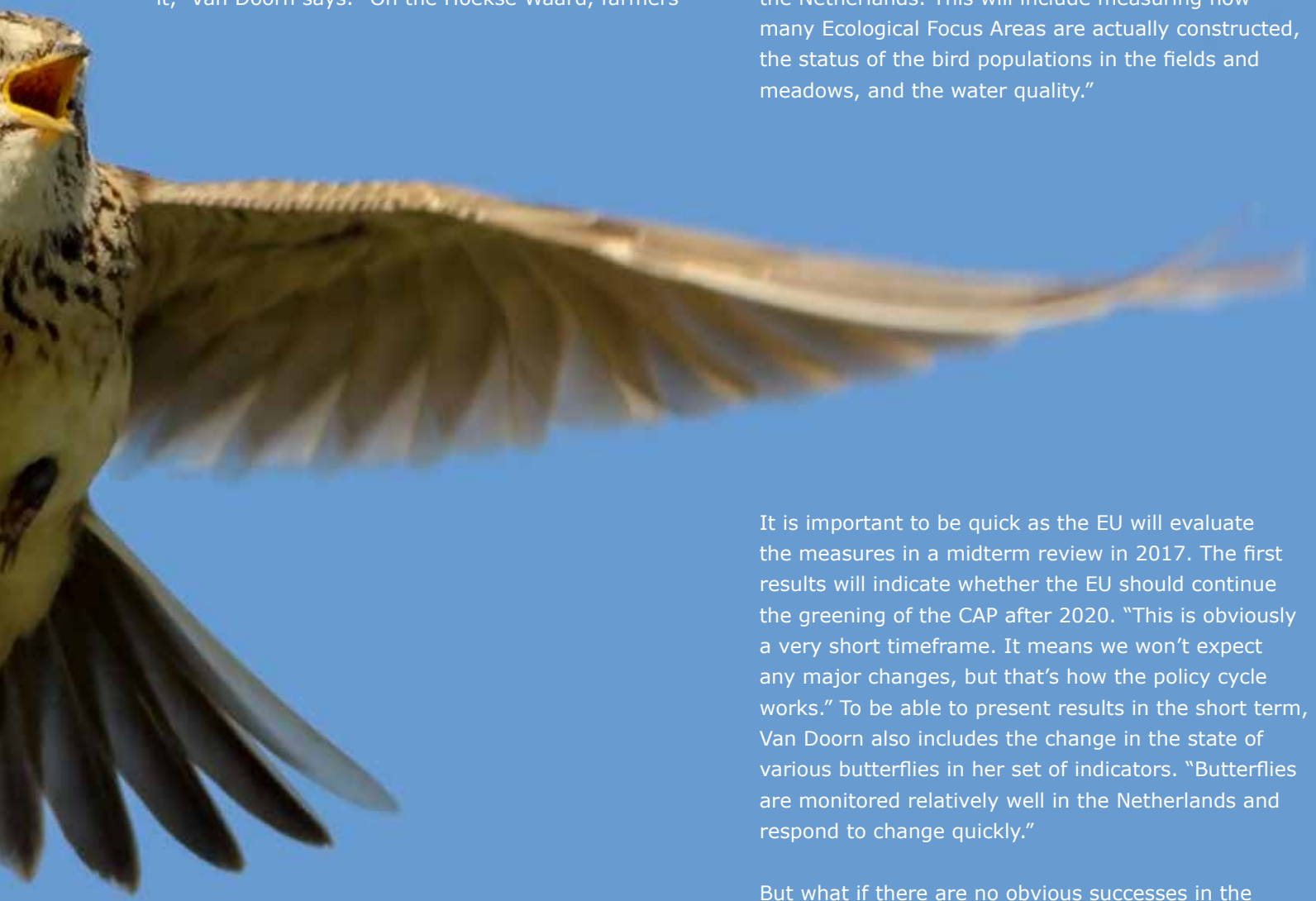
But negotiations in Brussels are notoriously complex. Different countries have different interests and good intentions do not always have corresponding results. Take the measure which exempts small farmers from the obligation to adopt green measures. It is not illogical as such – after all, it makes no sense to saddle small farmers in Eastern Europe with so much paperwork. Yet even in the Netherlands, it ensures that half of all farmers need do nothing, as they have less than fifteen hectares of arable land.

Van Doorn remains optimistic as there are hopeful signs for the long term, such as the way meetings about the plans have caused a mental shift in many stakeholders. "When talking to officials you now really feel a change of course. Green is between the ears. Most farmers have also become convinced that greening is necessary in the long term. There was always a group which found it important, but now you notice that the even the more large-scale farmers are thinking about ways to promote sustainability and climate policy."



A growing number of farmers also wish to go beyond the minimum requirements set in Brussels and The Hague. The Agricultural Nature Management Associa-

tion East Groningen, (ANOG) will, for example, create bird fields, i.e. flowering margins along arable fields with plants such as lucerne, which should improve opportunities for the skylark and other birds. "The members of ANOG were distressed by the decisions regarding the CAP, but decided to make the best of it," Van Doorn says. "On the Hoekse Waard, farmers



continue to work on the flowering field margins as an extension of the Ecological Focus Areas."

"The greening of the CAP may be a small step, but it goes in the right direction," Van Doorn insists. "Public money is used to allow farmers to work on public goals, which gives them the opportunity to farm two-thirds of the Dutch land in a responsible way."

Van Doorn is currently working on a set of indicators which should make the effects of a greener CAP clearer. "We look for metrics that are meaningful to the Netherlands. This will include measuring how many Ecological Focus Areas are actually constructed, the status of the bird populations in the fields and meadows, and the water quality."

It is important to be quick as the EU will evaluate the measures in a midterm review in 2017. The first results will indicate whether the EU should continue the greening of the CAP after 2020. "This is obviously a very short timeframe. It means we won't expect any major changes, but that's how the policy cycle works." To be able to present results in the short term, Van Doorn also includes the change in the state of various butterflies in her set of indicators. "Butterflies are monitored relatively well in the Netherlands and respond to change quickly."

But what if there are no obvious successes in the short term? Should the subsidies then be cut, as some British politicians advocate? "I think not, as long as no other mechanism is found to ensure that farmers get a fair price for their product," answers Van Doorn. "As long as that is not the case it's only logical that public money is used to serve public purposes."

Consequences of a Frisian mouse plague visible on satellite images

The mouse plague that struck Friesland at the end of 2014 could be detected on satellite images by Groenmonitor.nl. The pictures showed that at least 12,000 hectares of Frisian grassland had been affected by mice.

The mild winter of 2013/2014, followed by a mouse-friendly hot summer, caused an explosion in the mouse population in Friesland. The mice colonies caused so much damage to the grassland that it is clearly visible on satellite images of the region, which show a lot less green on the Frisian meadows.

Groenmonitor.nl allows anyone to follow the evolution of green spaces in the Netherlands throughout the year. Three times a week, Alterra analyses satellite images of the Netherlands. This data enables farmers to follow the growth of their crops. FrieslandCampina is running tests with the monitor to see if it can predict future milk supply using data on plant growth.

Practical guide for active citizens

Alterra presented the book *Burgers en hun Landschap* ('Citizens and their Landscape') at the end of 2014. This practical guide includes examples of people who start projects on their own initiative, and discusses the problems they encounter.

Less management, fewer rules and allowing people to take the initiative has been the creed of central government for some years. Whether this is primarily a means to reduce expenditure or not, it is consistent with the fact that citizens have long since stopped waiting for the authorities to take the lead or provide information, preferring to take the initiative to do the things they find important.

Sometimes this goes well, and sometimes it fails, such as when people's plans do not fit within existing policy frameworks. The book demonstrates that cooperation among all actors in an area is vital to success. For this reason alone, every policymaker – in government authorities and (nature) organisations – should read it.

Copies of the book are available from Rosalie van Dam via rosalie.vandam@wur.nl.

Working together for farmers in Burundi

Together with Alterra and HealthNetTPO, the Achmea Foundation is looking for ways to improve life in a number of villages in Burundi. Alterra aims to enhance agriculture, HealthnetTPO wishes to improve healthcare provision, while Achmea is seeking opportunities to provide villagers with financial security.

The Achmea Foundation receives half of one per cent of Achmea's net profit every year. Its brief is to use the funds at its discretion to improve the lives of socioeconomically disadvantaged people. It can also draw on expertise from Achmea. The Foundation mainly supports initiatives in developing countries, where it focuses on sustainable improvements in agricultural productivity, food security and healthcare, while anchoring these improvements financially.

"Of course, this is a very broad field," says Marjolein Verstappen, who became director of the Achmea Foundation at the end of 2014. "We recently decided to restrict ourselves somewhat, and only continue to fund projects in a limited number of countries." Burundi is on the list, as are India, Cambodia, Indonesia, Mali, Ethiopia and Kenya. We strive to focus on larger projects in order to increase the likelihood of a sustainable impact. Burundi is a good example of this."

Since 2014, Alterra, HealthNetTPO and the Achmea Foundation have been working together in several village communities in Makebuko and Bukirasazi. The goal is to deploy a comprehensive approach which will increase agricultural production, improve the health of the inhabitants and stabilise the financial situation.

"These three topics are related in many ways," Verstappen explains. "People who are sick cannot work and earn no income. If they don't have enough money, they can't afford healthcare or quality seed. This is why we aim to adopt a comprehensive approach." The interrelationship between the development issues is not yet entirely clear to Verstappen. "We don't want to show up with pre-designed solutions: the preference is to observe and see where we can do the most good given local needs and possibilities. The ultimate goal is, of course, to structurally improve the self-reliance of farmers."

In 2014, Alterra held a briefing in which eighty farmers who had participated in an experiment with improved farming methods presented the results to other villagers. Alterra experts expect the farmers to be able to generate a higher yield with just one third of the quantity of seed used so far. "The challenge for us is to really work together and not close ourselves within our own field too much. We can also learn a lot from this project."

"Our goal is to enable farmers to invest in their business," Verstappen continues. "Money is required to buy more expensive seed, and farmers should also have a financial buffer in case of disappointing harvests. We look for ways to make this possible." There is already an old system in the smaller villages in which participants contribute to a shared fund, and a participant in distress can access the saved money. "This looks like a cooperative approach of the kind on which Achmea is also based. We can build further on such initiatives."

Achmea has no plans to make money by selling insurance in Africa, and there is no commercial purpose to these activities. "For Achmea, this is simply a great way to offer employees the opportunity to contribute to society," concludes Verstappen. "It suits our idealistic roots."


‘The ultimate goal is, of course, to structurally improve the self-reliance of farmers.’

Stricter requirements on pesticides to protect the environment

Research by Alterra and Wageningen University has ensured that more stringent requirements are placed on pesticides containing imidacloprid.

In 2013, Ivo Roessink, Lemessa Merga, Hans Zweers and Paul van den Brink published a study on the effects of the plant protection product imidacloprid on seven different freshwater organisms. The study found that for instance mayflies are more susceptible to chronic exposure to the product than was previously thought. The Alterra study, among other things, incited the Board for the Authorisation of Plant Protection Products and Biocides (*College voor de toelating van gewas-beschermingsmiddelen en biociden*, CTGB) to announce stricter requirements for the use of these products in early 2014.

Sustainable logging is also more profitable

Wood production which minimises the damage caused to tropical forests may yield less for forest managers in the short term yet be more profitable in the long term than conventional logging. This is the thesis of Eric Arets and Frank Veeneklaas, who compared three modes of tropical wood production on behalf of the Netherlands Environmental Assessment Agency (Planbureau voor de Leefomgeving, PBL).

Logging in tropical forests is currently largely selective. Conventional logging, which sees only the most valuable trees being cut, is the most common way to harvest timber. This is usually done without much care for the remaining forest. An important aspect of sustainable forest management is to use a harvesting method that limits the damage to the surrounding trees. With this method, the first round of logging generally delivers less wood, but the damage to the remaining forest is minimised, and future harvests produce relatively more wood.

What is new in Arets' and Veeneklaas' study is that forest ecosystem services other than timber harvesting have also been quantified, so as to determine the benefits of making the process more sustainable. This includes revenues from natural products, such as nuts, rattan, game and fish, as well as water management, carbon sequestration and biodiversity.

One striking result is that the net financial benefits in South America are higher than those of conventional harvesting methods. Mitigating harvests is commercially preferable even without taking into account the gains from other forest services. In Southeast Asia, however, mitigating harvests is only commercially viable if the value of other forest services is also taken into account.

Changes in our urban environment

A country full of empty barns

A prediction by Edo Gies about the future desertion of agricultural buildings attracted a great deal of media attention in the summer of 2014. The sustainable planning expert has calculated that the impending rate of abandonment of spaces in rural areas far exceeds the equivalent figure expected for shops and offices.

The number of farmers in the Netherlands is in continuous decline, while the number of farms remains virtually unchanged. Until ten years ago, this was not a major problem. Those farmers who closed up shop had smaller businesses built around old farmsteads that could easily be converted to residences, if not for the farmers themselves, then for space-loving urbanites who felt like investing in a cosy farmhouse. The small barns behind the houses were often pleasant enough to be refurbished, or small enough to not get in the way. But all this is changing, Edo Gies warns.

In the coming decades, the number of farmers in the Netherlands will continue to decrease. However, the farmers who are quitting now will be leaving behind not cosy farmsteads, but houses with huge barns built in the 1970s and '80s. This was an era that focused on efficiency and economies of scale, in which cheap square metres, not architectural beauty, were the main consideration.

Datasets

Edo Gies is a senior scientist in the sustainable use of space at Alterra's department for regional development and land use. He was tasked by the InnovatieNetwerk with predicting vacancy rates in the countryside in 2030. To achieve this, he combined a number of datasets provided by Wageningen UR: data from the geographical farm information system GIAB, the Dutch agricultural census, and BAG, the basic register for addresses and buildings of the Dutch cadastre. Wageningen UR is making an inventory of over 200 operating characteristics for all farms in the Netherlands together with Statistics Netherlands. "This file tells us how old the farmer is and whether there is a successor in the picture," Gies points out. "The other registers subsequently indicate which types of buildings are present in the barnyard."

Gies estimated the number of vacant buildings by combining data about the buildings and the age of the farmer. "We expect that farmers over fifty who have no successor will stop working in the near future. There should be around 22,000 of these cases." Some of the buildings will not be abandoned as they will be used by the economic operator who buys the land or by other companies. "Past experience shows that twelve to

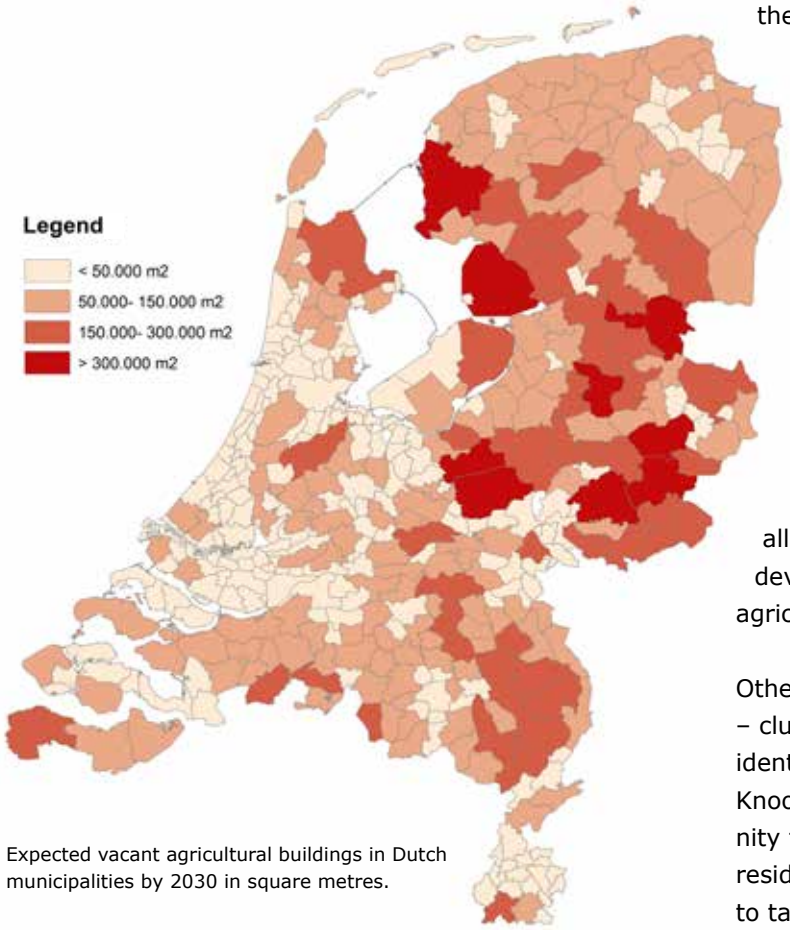
fifteen per cent of the buildings are repurposed. This means that there will be 32 million vacant square metres of agricultural buildings by 2030. And that's a lot of empty space."

Megacorporations

According to this calculation, the number of companies likely to cease their activities is an almost seamless continuation of the decades-old trend which has seen the number of farms fall in the Netherlands. "There are now more than 250 agribusinesses with more than 250 cows," Gies says. "In 2000 there were only a few." Many people outside the agricultural sector lament this development and some political parties would like to set limits on megacorporations. According to Gies, however, this is a losing battle as economies of scale are inescapable. "The mainstream agribusiness is serving the world market, where the margins are small. There is great pressure to achieve efficient large-scale production. Proposals to broaden agriculture close to cities are likely to remain niche initiatives and most of the acreage will continue to focus on the world market."

The report on the future emptying of barns and other buildings in the countryside attracted considerable attention. Provinces and municipalities in the eastern Netherlands, the region where this problem is the most acute, were especially keen to put the forecast on the meeting agenda. Gies expects it to stay there for a long time as there are no easy solutions to this problem.

"I read somewhere that the empty barns were referred to as eco-cathedrals. The originator of the term wanted to leave them alone so they could gradually collapse and be reclaimed by nature. But I see very little resemblance to cathedrals, and I think local residents would agree." Inhabitants of the surrounding area would see the dilapidated buildings as decay. And regions which are already dealing with the effects of a falling population need to stay as attractive as possible to potential new residents.



Expected vacant agricultural buildings in Dutch municipalities by 2030 in square metres.

In many cases, therefore, the logical option is to tear the buildings down. But who will finance this? "Public authorities won't simply volunteer the funds, and many business owners don't want to demolish their buildings. Sometimes this is due to emotional attachment, but more often they fear that the value of their property will decrease." When a barn is demolished, it is removed from the zoning plan, and the farmer loses the opportunity to renew the business permit without potentially costly bureaucratic difficulties.

"This is in fact no longer true in most cases today – however, the idea that you shouldn't just demolish things has taken root in people's minds," Gies explains. "The only reason for which farmers might decide to demolish their barns themselves is if they are shown that their house is worth more money without the offending structures than it is with them. In this case, the value increase must, obviously, outweigh the costs of demolition, which can easily reach tens of thousands of euros."

Caravan storage

In the past, various municipalities have tried to prevent vacancies in the countryside with policies such as banning agricultural activity on farmsteads. Gardening, caravan storage and metal workshops have replaced agriculture. But now that lots are vacant due to the economic downturn, municipal councils are very cautious about allowing such developments. "Municipalities should develop a coherent policy for industrial terrains and agricultural buildings," Gies says.

Other, more creative solutions, such as the *knooperven* – clusters of barns around a farmyard converted to residential use – in Twente seem to be no more successful. Knooperven were meant to give farmers the opportunity to build housing on their property, and the new residents of the farmyard were expected collectively to take care of the surrounding landscape. This was a promising concept until the housing market collapsed, making it difficult to implement plans for these converted farmyards. At the same time, municipalities are less willing to contribute to new housing in rural areas as they are already expecting the centres of villages and towns to lose population. They will also be more prudent about licensing residences in rural areas.

So can nothing to be done? "There are no remedies without drawbacks," says Gies. "But one idea is to look for a contribution from the businesses which are looking to expand in the relevant areas. In return for planning permission for a new barn, say, the authorities could ask for a donation to a scrapping fund. You could see this as a kind of disposal fee. Whether politicians can ask this of companies will depend on their political vision."

Green community projects successful

Scientist Joke Luttik has identified the factors which decide whether neighbourhood vegetable gardens and natural playgrounds are successful. The enthusiasm and determination of the initiators appear to be decisive.

In 2012, the Dutch nature education institute IVN initiated a programme to support existing green neighbourhood projects. They selected 12 iconic projects in 2012, followed by another dozen in 2013. All of these projects aim to improve social cohesion in their neighbourhoods.

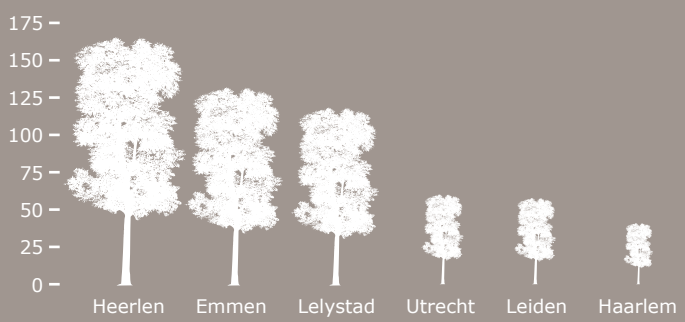
Joke Luttik carried out research aimed at identifying the factors that lead to the success or failure of a project. The enthusiasm and determination of the project initiators plays the greatest role, according to Luttik. It also helps if a pleasant spot is available and the participation of the municipality is another key factor. Failures can often be put down to arguments or initiators becoming overly possessive about the garden or playground, making it difficult to attract sufficient numbers of new people to build and maintain the green neighbourhood projects.

The 12 iconic projects chosen in 2012 are all doing very well, with most involving gardens of around 2,000 m^2 on former brownfield sites. In all cases the effects have been positive, resulting in more green space and an increase in the variety of plants and animals. By engaging in green neighbourhood projects, users have more contact with their neighbours. People greet each other much more often and engage in conversation far more frequently. The green neighbourhood projects also bring different groups in contact with each other when they would otherwise have had little interaction, such as senior citizens and primary schoolchildren, and immigrant and indigenous residents.

Heerlen greenest Dutch city

'Heerlen is the Netherlands' greenest city in 2014, followed by Emmen and Lelystad. Residents of Heerlen have four times more green space in the vicinity of their homes than people who live in Haarlem.

Peter Visschedijk (Alterra) calculated the green surface area per home in the 31 largest Dutch municipalities in 2002, 2003, 2009 and 2014. In most cities this figure has remained virtually unchanged but some cities have increased their green surface area. Rotterdam, Utrecht and The Hague have become 10 per cent greener since 2009.

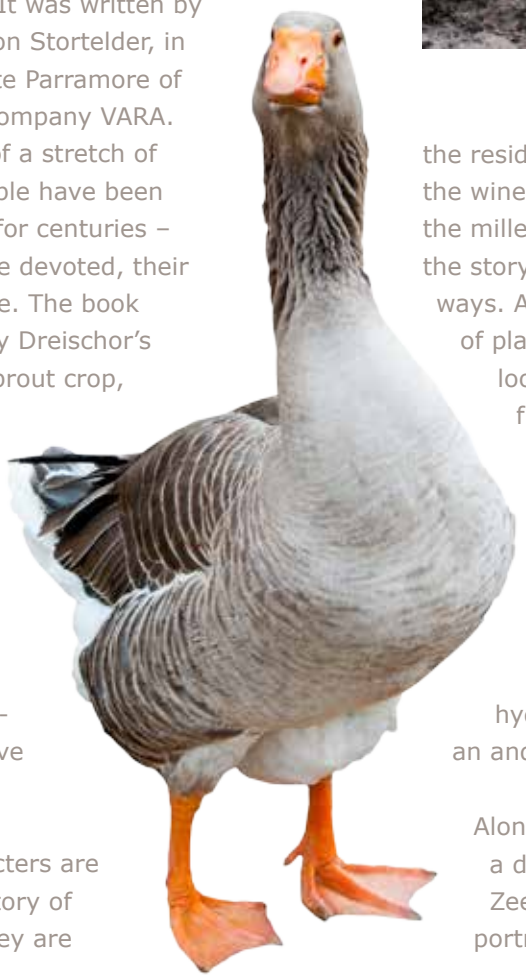


Green spaces in a city have a positive effect on people's health and contribute towards improvement of the environment by reducing air and noise pollution. A high proportion of green vegetation helps to store water, allowing municipalities to make savings on water storage and keeping cities cooler during heat waves. Heerlen was the clear leader among the list of 31 cities, with 164 square metres of green space per residence. Haarlem is the Netherlands' least green city with only 43 square metres per residence.

One square kilometre under the microscope

Alterra has examined a single square kilometre of the Netherlands in precise detail. From the consequences of the flood disaster to the sprout crop and traditional dress of an area close to the Dutch village of Dreischor.

'Venster op Dreischor' (Window on Dreischor) is the name of the book in which precisely one square kilometre of the Zeeland landscape, to the south of Dreischor, has been examined by scientists and residents in great detail. It was written by Joop Schaminée and Anton Stortelder, in partnership with Jeannette Parramore of the Dutch broadcasting company VARA. The book tells the story of a stretch of countryside of which people have been trying to make the most for centuries – the land to which they are devoted, their own nature and landscape. The book includes stories related by Dreischor's residents, covering the sprout crop, the flood disaster of 1953, the sawmill, the flax crop, the wine industry and the traditional 'Zeeuwse' attire. Alongside the village resident's stories, various experts have also examined the square kilometre from the perspective of their own specialism.



The book's leading characters are the people who tell the story of this square kilometre. They are the residents of this region, like the sprout farmer and the wine grower, the volunteers who run the museum, the miller and the wood sawyer. The experts also tell the story of this small chunk of Zeeland in their own ways. A botanist shines a light on the different types of plant and vegetation found there. A bird expert looks at the large flocks of geese, which arrive from northern climes each year. A soil expert gets his hands dirty in the sticky clay soil and confirms that it is it eminently suitable for grape growing. A sociologist examines the quality of life in the square kilometre from different perspectives. An expert on insect infestations recounts his tale, as does a scientist specialising in tree-bark lichens, a hydrologist, an agricultural economist, a historian and an expert in the field of recreation.

Alongside the book, this project has also produced a documentary film, articles in De Provinciale Zeeuwse Courant newspaper, a series of radio portraits and an art exhibition.

New ideas for the metabolism of the city

Landscape architect Sven Stremke studies the energy management of Amsterdam. He sees unexpected possibilities in many places, including a city park heated by residual heat from a power plant.

Sven Stremke lives in Amsterdam, and shares his time between there and Wageningen. His work in the capital city is original: Stremke is the principal investigator for energy for the Amsterdam Institute for Advanced Metropolitan Solutions (AMS), a research institute established in 2014 that seeks new solutions to issues related to water, energy, waste, food and mobility. Within the Urban Pulse project, which is supported by AMS, Stremke and his colleagues have started collecting data on energy flows through the capital. Over the next few years, they aim to gather data about the 'metabolism' of the city, such as what comes in, what happens to it, where does it happen, and where do the residual products go. Databases for water, energy, food and building materials will be searched and cross-linked, and should together provide the most detailed picture of the city possible.

According to Stremke, a preliminary analysis of the data from these partners shows that Amsterdam mostly runs on coal – two thirds of the electricity produced in the city comes from coal plants. Much more coal arrives in the port as Amsterdam is one of the largest coal transshipment points in the Netherlands. Stremke hopes to receive data on power consumption in the city from the grid operator Alliander. "As well as knowing how much energy consumers use per year, Alliander can show how consumption changes over time."

Heated park

But what use are these figures for Amsterdam? "We don't know yet, exactly – but we're pretty sure that a better picture of the metabolism of the city will result in improved new plans." Stremke has asked one of his students to do a feasibility study on a heated city park in the new district of IJburg. "I think that this could be interesting, and the power station in Diemen could supply the heat." The plant in Diemen, just outside the borders of the municipality of Amsterdam, has been supplying heat to the IJburg district and the city of Almere, but still discharges a lot of heated water into the IJsselmeer lake. "There are already pipes running from the plant to Amsterdam which we can make better use of," adds Stremke. "I don't know if a heated park would work, but the point is that you only see this type of opportunity when the data is readily available. Who knows what other ideas will surface if

we can make the relevant transversal connections."

At one of the AMS meetings, a representative of the Port of Amsterdam ended up talking with the contact from Alliander about the opportunities for large-scale generation of solar energy in the port. "Although the port, the water supply company and power provision in the city are currently still worlds apart, bringing them together automatically gives rise to new ideas. I think Waternet and Alliander will both have more to offer each other once they have access to each other's data." In a similar manner, better understanding of other flows could provide new ideas related to food and water, for example. "Food is an important factor in the ecological footprint of a city. If you are serious about making a city like Amsterdam climate neutral, you need to have information about it."

Twitter

Amsterdam is not the first city to set up a research institute dedicated to urban issues. New York, for example, has a similar institution. The cities hope that scientists can help make the city more sustainable. They make use of big data: information from existing databases, but also from social media. "Twitter could be very useful in case of flooding or traffic incidents,"

'New times call for a new kind of landscape architect'

Stremke points out. "If there is a flooded street, someone will probably tweet a photograph. This can be more accurate than the rain radar. If you are creative about the way you search, there is a lot of data available – the trick is simply to find and interconnect the right data."

Stremke studied landscape architecture, and works for a research group that focuses on this field. A good landscape architect combines beauty and function, especially in these times of climate change and energy transition. But how does building databases and thinking about energy flows fit into this? "New times call for a new kind of landscape architect," Stremke says. "When times were good ten years ago, there were more than enough jobs for landscape architects. Those days are now gone and we need to develop new ideas, co-create, and find new opportunities. We used to primarily occupy the final segment of the process: someone else thought up a plan, and we made it pretty and ensured it would fit within the given environment. But if you develop plans yourself, you need to have a better understanding of what's behind the process."

Stremke and his colleagues designed sustainable energy landscapes for regions in Limburg and Zeeland, for instance. "This wasn't just about finding the best spot for a windmill. A big part of what we did was considering novel solutions. Where are bioenergy and other renewable resources available? Where can we save energy? We must now think along in a whole other way than before, and this makes the work much more challenging and fun."

Cooperation
The AMS is an initiative by the City of Amsterdam. The municipality issued a tender for this in 2013 and the contract was eventually awarded to a consortium comprising Delft University of Technology, the Massachusetts Institute of Technology and Wageningen UR. These three partners now deliver experts to AMS. One of their first tasks is to create databases about life in the city, with the resulting files being made available for research and for teaching at AMS. In 2017, Delft and Wageningen will together offer an MSc in Metropolitan Solutions within the framework of the institute. In addition to the universities and the municipality, several commercial and public or semi-public partners based in the city also took part in the study, including the Port of Amsterdam, grid operator Alliander and water supply company Waternet.

Alterra helps lay Maastricht's green carpet

The office window of Brunssum mayor Luc Winants looks out over a large pond. The water reminds him of the mining industry in his municipality as the pond was once an open-pit coal mine. Winants is proud of the transformation. "After the pit was flooded, the village residents didn't know how to proceed. I'm glad they didn't drain the pit as we now a have beautiful oasis in the centre of Brunssum."

The Brunssum district is part of the Parkstad, an urbanised region of South Limburg. Just like neighbouring municipalities, Brunssum is preparing to down-scale. The two schools have recently merged within one building, and the municipal authorities plan to demolish 700 houses worth a quarter of a billion euros, says alderman Eric Geurts.

The establishment and maintenance of green spaces is an important part of the plans to accompany the contraction of the municipality. "We know that a failure to demolish will leave empty houses in a number of neighbourhoods," Geurts explains. "And no one wants to live in an area with lots of empty houses. Things go downhill fast from there. We also know that parks have considerable appeal and give a significant boost to real estate prices. This is why we decided to invest heavily in green spaces despite the financial downturn." The municipality (together with the province) is, for example, investing millions in restoring the Rode Beek, a stream that partly flows through a concrete tunnel under a thirty-metre hill of mining rubble.

Winants was an alderman in Maastricht, the capital of Limburg province, until early 2013. His portfolio included plans for a tunnel for the A2 motorway, which opened his eyes to the opportunities for using green spaces to breathe new life into neighbourhoods. Maastricht is currently in the middle of building a tunnel for the noisy motorway, above which a so-called green carpet – an elongated urban park – will be built.

"When I joined the planning team in Maastricht in 2006, this issue was principally being viewed through a real estate prism," he remembers. The plan was for something similar to Céramique, the Maastricht city centre district which features several award winning buildings. A workshop session by Alterra scientist Peter Visschedijk moved the decision making process in a new direction. The tunnel was an opportunity to enrich the compact city of Maastricht with more green spaces. "Without Peter we wouldn't have embarked on this path," Winants says. Visschedijk took directors, contractors and architects from the consortia which were competing for the contract to build the tunnel to Paris on visits to successful examples of green investments in the city. "This did wonders," Winants adds. "One next plan was even greener than the other."

Back in Brunssum, Geurts and Winants are now trying to support an ambitious plan by the entrepreneur Jean Gelissen to build a large park on the former mine site in the municipality. 'Nature Wonder World' is set to include, among other things, a replica of the Grand Canyon, and will, according to the plans, be set up according to the cradle to cradle principle, energy-neutral and respectful of the environment. "If this goes through, we'll certainly come back to Alterra for ideas," Winants concludes.


‘If this goes through, we’ll certainly come back to Alterra for ideas’

Blessing in disguise at Egyptian holy site

During an investigation into a waste water problem in an Egyptian village, scientist Joop Harmsen (Alterra) discovered that a monastery was in danger of collapsing. The unexpected threat turned out to be a blessing in disguise: while other villages lack funding for water purification, the threat to the monastery led to swift action.

The Deir El-Adra monastery is located in the Egyptian village of Deir Gebel El-Tair. The monastery was built above a cave in which Jesus, Joseph and Mary were said to have spent three nights during their flight to Egypt. The monastery is visited by around two million pilgrims each year, both Christian and Muslim. Research by Alterra revealed that the cave was in danger of collapsing, not because of its age but due to unpurified waste water. The monastery is situated on the edge of a chalk plateau and looks out over the Nile. Infiltrating waste water was reducing the stability of the soil and could have led to the monastery's collapse in the future. In a similar situation in Cairo, in 2008, a section of chalk plateau collapsed on top of the houses beneath, resulting in around 100 fatalities.

The poor economic situation in Egypt means that little funding is available to tackle waste water in villages and political priorities are focused on the larger cities. But the threat to the monastery proved to be an immediate motivation to improve the water situation in Deir Gebel El-Tair. Both residents and the authorities were willing to contribute. Joop Harmsen: "Together with Dutch and Egyptian partners, we are tackling this problem. Fortunately, Deir Gebel El-Tair's surroundings offer us the possibility to purify the waste water inexpensively and to use the purified water for irrigation. As well as benefitting the villagers' health and agriculture, this will also save the monastery."

Mini gardens for Syrian refugees

During his internship, Masters student Robert Kruijt worked at a refugee camp in Jordan. Together with residents, he created small gardens that purify waste water and improve the quality of life there.

Kruijt ended up in the Zaatari camp, home to some 100,000 Syrian refugees, more or less by chance. Kruijt was serving an internship and was asked to visit Jordan. Once there, he invited the camp's residents to manipulate photos of the camp using Photoshop, enabling them to tell their stories. Most complaints concerned waste water flowing through the camp in an open sewer and the lack of green space. "This led us to think about grey water gardens," Kruijt told *Resource*, the magazine for students and employees of Wageningen UR. "The idea is that waste water, or grey water, should be separated from water containing human excrement, known as black water. Black water should be channelled to a septic tank, allowing you to capture grey water in the soil and use it to grow plants and trees."

Creating the small gardens was more difficult than expected. The hard ground first needed to be made suitable for planting and not all plants can survive the desert climate. Nevertheless, the test site quickly proved a success. Many of the refugees participated in the project, not only because it alleviated the water problem but also because their living environment was improved by the small gardens. Ninety per cent of refugees were involved in farming in Syria so knew how to grow plants.

Changes in our natural environment


‘It’s the people who give form and meaning to the landscape’

Changes to the agricultural industry and climate change are threatening semi-open landscapes in Europe, warns professor of System Ecology Joop Schaminée. In the Netherlands, municipalities, residents and businesses can all play a greater role in the management of small nature areas. "You feel more familiar with nature in your everyday surroundings."

"We are very privileged that the Netherlands is situated in the delta of four rivers, namely the Rhine, Scheldt, Maas and Eems. By definition, this ensures an enormously varied landscape and we often fail to see how unique that situation is. Some of our natural species are rare or non-existent in other parts of Europe, including those in species-rich dune grasslands, sand drifts and wet heathlands," says Joop Schaminée enthusiastically. Since 2006 he has been an Associate Professor of System Ecology at the Radboud University and Wageningen University. He also works for Alterra, as a vegetation expert.

Within Europe, Schaminée is working on the European Vegetation Archive (EVA), which stores data on vegetation that can be linked to spatial data. "These data are incredibly important," he says. "It allows us to see which plants emerge together in which places at any given time, providing a picture of the movements and development of different types of plant and vegetation. This provides a good impression of the effects of climate change and changing agricultural practices, but also of the spread of plant types in protected nature reserves."

Schaminée himself is the driving force behind the development of biological information systems and is responsible for the National Vegetation Database. He has written numerous books on nature and vegetation. He also advises the government on the protected Natura 2000 districts. In 2009, Schaminée was awarded the prestigious Prince Bernhard Cultural Fund prize for nature for his work.

Paradise

"A significant factor in the quality of our landscape can be attributed to its centuries-long usage by man," Schaminée emphasises. "Cultivating, burning, clearing, ploughing, mowing and grazing the land has resulted in a much more varied landscape. Without that intensive management, the north-western European lowlands would be overgrown with thick forest."
People tend to prefer semi-open landscapes. "Just look at the Tuscan landscape and The Hague School's Dutch landscape paintings, which we all admire. We also imagine paradise as a semi-open landscape. People

are sight seekers. It's no coincidence that our eyes are in the front of our heads. We find dense forest threatening; in fairytales such as Little Red Riding Hood the forest is always full of danger."

The semi-open landscapes of European culture are disappearing fast. Intensification of the agricultural industry has made traditional methods of landscape management outdated and expensive. The number of hedgerows, hayfields and alder avenues in the Netherlands is constantly falling, resulting in a decline in biodiversity. But the opposite is also a big problem in Europe, in regions where populations are abandoning the countryside and in mountainous areas. In Eastern Europe, for example, traditional agriculture and the associated hayfields and river valleys have all but disappeared. Wageningen scientist Anton Stortelder has been studying the 'holm oakification' of the Tuscan landscape: the traditional mountainside terraces where olive trees, vegetables and grapes once grew have been neglected and are now populated by holm oaks.

Increased growth

Alongside the changes in the farming industry, climate change has also had a major influence on biodiversity and nature. Higher rainfall and temperatures are encouraging plant growth. The growing season is starting earlier and lasting longer. "We can expect an increase in biomass," Schaminée predicts. "Dutch nature areas will become overgrown and their managers will be unable to keep up, also due to increasing management costs. Take the forests of South Limburg, where you could once collect firewood and where orchids and other rare plants once grew in the open forest. These beautiful plant species have been lost due to the lack of effective management."

Nature organisations, such as the Forestry Commission and the Society for preservation of nature monuments in the Netherlands, focus mainly on the big picture in the dunes, peat bogs, forests and river landscapes, Schaminée points out. "Through land consolidation, the Forestry Commission has acquired many small and widespread parcels of land, which require a more individual approach to their maintenance, using old-fashioned tools such as scythes. There is no funding for this so they gradually become overgrown by tall grass and become a breeding ground for bushes and trees. There will come a time when we are no longer able to manage our landscape. In this respect, climate change will have a negative effect but almost no-one seems to see that."

Local initiative

Municipalities have no influence over land managed by the Forestry Commission and Society for preservation of nature monuments in the Netherlands, even though they could involve local people in the maintenance of smaller nature areas, suggests Schaminée. "The focus will be increasingly on doing things yourself." Alterra is conducting research in five municipalities on these kinds of local initiative. The municipality of Peel and Maas is working together with a group of companies which want to give something back to society. In a place called Tytsjerksteradiel, an agrarian nature collective is managing small nature areas and Stein, in South Limburg, is searching for a solution for the maintenance of the old hayfields surrounding Castle Elsloo.

The threats to nature management, the cutbacks of recent years and a changing society require a different form of organisation and new revenue models. "The focus must be on the nature reserves themselves and less on the organisations. Nature management needs a fresh approach and the national government must accept its responsibility in bringing this about." Together with Pieter van Vollenhoven, member of the Dutch Royal House, and André van der Zande from the National Institute for Public Health and the Environment (RIVM), Schaminée is working on a plan for municipal, provincial and national nature reserves (see page 28). Parts of the management could easily be delegated to other departments but the national government must keep hold of the reins, in his opinion.

"Everyone thinks that nature matters and we should also be proud of our nature reserves," continues the vegetation expert. "Iconic picture postcard nature is needed to inspire people and show what can be achieved. A good example is the beaver which, following its reintroduction, can now be seen again in Biesbosch and Gelderse Port. People get a good feeling when they realise that cranes are again breeding in Fochteloërveen and sea eagles have been spotted in Oostvaardersplassen."

Squirrel

Nature closer to home, where people walk their dogs or go jogging, is just as important, in Schaminée's opinion. "You feel more familiar with nature in your everyday surroundings and feel touched by it. Everyone enjoys seeing a robin in the garden or a squirrel in a tree."

The relationship between man and nature forms the basis of the multimedia project 'Window on the world', which shines a light on a carefully chosen square kilometre of Schouwen-Duiveland. Inhabitants tell their stories about that specific place and its historic windmill, saw mill and old flax barn. In addition, experts from a range of scientific disciplines share stories about the soil, the agricultural economy and the region's history. The stories have been collected in a richly illustrated book. "These stories touch us and create an impression of both place and time. It's the people who give form and meaning to the landscape. Each place matters and we don't pay enough attention to such things. Of course, motorways, companies and cities all need to expand. But the careless way in which senior officials completely disregard the significance of a place is sometimes embarrassing. We have to be more respectful to people and the places in which they live."

Tropical forests not as old as believed

While tropical forests may seem ancient and unspoilt, this is not always the case. In a protected forest area in Thailand, Wageningen University scientists found indications that entire swathes of forest were felled on numerous occasions within the last 150 years – not by humans, but by hurricanes.

The scientists conducted their research in the forest of the Huai Kha Khaeng Wildlife Sanctuary in Thailand. This area is a UNESCO World Heritage Site rich in endangered plants and animal species, including a large population of tigers. The scientists looked at the tree *Afzelia xylocarpa*, which was found to have a distinctive age distribution: there were 160-year-old individuals and 60-year-old ones, but fewer younger trees. In other words, there were a few peak years in which many trees grew up at the same time.

"These peak years are a strong indication of large-scale disruption in the forest, when many large trees died and new trees became established," Mart Vlam of Wageningen University explains. Vlam suspects that the forest was hit twice by a passing hurricane which felled many trees. It is possible that this was followed by severe forest fires, caused by the large amount of dead wood left after the storm.

"Measuring tree rings allows us to get a better understanding of the natural recovery process of this tree species. We also discovered that this seemingly untouched forest had actually undergone severe disruptions – and not so long ago."

Vlam published the study in *Forest Ecology and Management* in January 2014.

Wilderness tourism reduces poverty

Tourists visiting Kenya to see elephants and giraffes are also unwittingly helping tackle poverty, Arjaan Pellis and Machiel Lamers of Wageningen University discovered.

Pellis examined the effect of support by the Dutch government for four Kenyan conservation organisations. The organisations in turn invested in projects that promote, for instance, sustainable tourism.

Around 400 to 450 people found work directly in the tourism sector as a consequence, Pellis calculated. In addition, 100,000 people indirectly benefit from the work of the four organisations, as they also help improve infrastructure, water supply, cattle farming, safety and healthcare.

More otters, less diversity

Research by Alterra has shown that the number of otters in the Netherlands grew again in 2014. The Netherlands now houses 140 otters, although no fresh blood appears to be entering the population, Loek Kuiters and Hugh Jansman say.

Otters appeared in new habitats during 2014, such as the Nieuwkoopseplassen, Leekstermeer and Ooijpolder. Genetic analysis has shown, however, that the genetic diversity of the Dutch otter population continues to drop. Dutch otters are isolated from other populations, which means there is no fresh blood coming in.

While negative effects of this declining diversity have yet to be identified, research on other mammalian species shows that it can be detrimental to the fertility of females or the survival rate of young animals, as they can become less resistant to diseases.

‘People threaten wildlife and wildlife threatens people’

Nature conservation efforts ensure that diverse environments are reserved and enhanced in our rapidly changing world, points out Professor Herbert Prins. Good management is also essential for the containment of dangerous diseases, which increasingly make the leap from animals to humans.

'Biodiversity down by half over the past forty years' exclaimed the front pages after the Living Planet Index of the World Wildlife Fund was published in the autumn of 2014. Environmentalists called the index an unreliable mishmash of data. Herbert Prins, professor of Resource Ecology at Wageningen University, is among those who resolutely reject the index. "In the 20th century species disappeared from parts of Europe. Species do die out locally, but do you look at your backyard, at Europe or the world as a whole."

Of course, this does not diminish the fact that species do indeed die out. "The last northern white rhino living in the wild was killed last year in South Sudan. This species was 4,5 million years old and everyone finds this tragic. However, the problem of child soldiers is much worse," Prins says. "The world can go on just fine without orang-utans. The extinction of mammoths has made us no worse off. The only reason to save species from extinction is ethical – they have the right to continue to exist."

Fences around the Serengeti

But some species do have a key role in their ecosystem. "The white rhino shortens tall grass, creating living space for species such as impala and the African ibex," the professor points out. "Southern white rhinos are also very few now. In South Africa, three are poached per day." Prins's research group is involved in major experiments in which scientists look at how the actions of rhinos can be mimicked in order to create meadows on the savannah and how poachers can be traced.

Until today, the conservation vision in East African nature reserves such as the Serengeti rested on the concept of laissez-faire. Human intervention and management were seen as unnecessary, and nature was best left to its own devices. But this view is no longer tenable, Prins insists. The population in Africa is growing and agriculture is expanding with it. "The pressure on nature is becoming more intense. Just look at the bushmeat crisis in West Africa. Gorillas and bongo's are simply being eaten. This is exactly what happened in Europe with the wild boar."

It is only by making agriculture more intensive that certain protected nature reserves can be maintained, Prins

believes. "There will be a fence around the Serengeti and beyond it will be cultivated land. We will also need to do more targeted nature management. However, even with the best of good will, species will be lost as the nature reserves and ecosystems are too small. The small reserves will become poorer."

Shooting elephants

In South Africa and Zimbabwe, former farmers have joined forces to found economically profitable nature reserves. Many large landowners, for whom agriculture was no longer profitable, collectively manage their land in wildlife parks and make money on tourism, conference centres and hunting. "People with a big wallet and a big ego pay 100,000 euros to shoot a buffalo or elephant, perhaps an old or weak individual which has been earmarked in advance by the administrators," Prins emphasises.

The private reserves have been very successful and provide a tremendous amount of employment – the community also benefits, Prins points out. "The trick is to ensure that the public importance of the environment outweighs the private interest. This is the only way to preserve nature."

Bears in the city

In many parts of the world the opposite is taking place. Rural exodus and migration to the cities is causing nature to come back with a vengeance in rural areas. This return to a wild state is ongoing in parts of Europe, Russia, Japan, China, New Zealand, Australia, Chile, Argentina, Canada and the US. "Maine, Vermont and upstate New York are completely forested. It has reached the point where cougars have been seen in city streets in New York and black bears in Princeton," Prins says.

The problem with this massive natural expansion, according to the professor, is that it is not easy to 'sell' because the areas returning to a wild state are full of dense and monotonous forests. "The return to a wild state was called 'desolation' in the Middle Ages for a

reason. To achieve high biodiversity in an area, you really need to manage it. This applies to nature reserves in the Netherlands, too. If you do nothing, the balance of nature is lost, and you get things like alder woods everywhere around the Naardermeer lake. It's terrible."

Money could still be made in the abandoned areas with nature tourism, for example by means of rewilding, i.e. bringing back large animals such as wolves and bears in American and European nature and mountain regions. "This definitely requires external management so as to create opportunities and counter outside threats."

Spanish flu

But biodiversity also has its drawbacks, Prins warns. "There is a difficult relationship between nature and diseases, and it seems to be getting worse." As examples, he cites Ebola in Africa and SARS in Asia as diseases which were passed on to humans who ate game, respectively gorillas and civets. In 2008, twenty people died from the tick-borne Crimean–Congo haemorrhagic

fever in Turkey. Bangladesh is affected by the Nipah virus, which is transmitted by bats and leads to inflammation of the brain. And the bird flu threatens not only chicken and poultry farms, but, from time to time, people as well.

"People threaten wildlife and wildlife threatens people. Biodiversity is not always a good thing," Prins says. "People and animals live together in increasingly close quarters. The climate is becoming more humid and there is more carbon dioxide in the atmosphere. It's almost like the environment is receiving fertiliser and functioning like a greenhouse. Vegetation is thriving and diseases occur more quickly. Intensive farming and globalisation foster the emergence and spread of animal diseases. Measles was once a cow disease, but it made the leap to humans some 8000 years ago. The influenza virus now circulates among birds, pigs and humans. Every thirty years a completely new form emerges – sometimes a really ugly one, like the Spanish flu."

Good resistance

Wageningen scientists from different disciplines such as epidemiology, climate change, food science, ecology, agriculture and economics will investigate this issue under the heading Global One Health. "It's a huge challenge, but the Wageningen approach is well suited to it," Prins states. "Everything is connected. Healthy nutrition ensures good resistance to disease, for instance, but this is often not feasible for poor people. Ecologists are indispensable in this project. For example, we understand the population dynamics of mice, and know what ticks do if there are fewer mice. The relationship between people, nature and diseases clearly indicates the importance of nature management."

'The only reason to save species from extinction is ethical'

Tundra collapses after disturbance

Removal of shrubs on the tundra literally causes the environment to collapse and release the greenhouse gas methane. This is shown by research conducted, among others, by Ake Nauta and Monique Heijmans of Wageningen University. The study was published in *Nature Climate Change* in November 2014.

"Tundra is much more sensitive to disturbances than we assumed so far," Monique Heijmans says. "The permanently frozen subsoil thaws if the protective shrub layer is damaged, and self-reinforcing processes accelerate the thaw."

The scientists demonstrated this by removing the shrub layer in an experiment. Once the ice in the top layer of the soil melted, the soil collapsed, creating pits that filled up with water and snow and reinforced the thaw. Snow accumulation in the pits accelerated the process because it functions as a blanket that insulates the substrate, thus causing the thaw to set in a year earlier. This also creates ponds, which further speed up the process: water is darker than ice, causing it to absorb more energy from the sun, and making the soil thaw faster.

"Our measurements show that these collapsed wetlands emit a lot of methane, while undisturbed dwarf shrub vegetation actually absorbs it," Heijmans underlines. "And methane is a greenhouse gas with an effect as much as thirty times stronger than carbon dioxide."

Buffer strips fail to help skylarks

Current agricultural nature management practices are insufficient to ensure that birds remain in arable areas. For instance, it appears that buffer strips along the edges of fields do little to help skylarks. This is the conclusion of the PhD thesis of Marije Kuiper, which she presented on 9 January 2014.

The number of skylarks in the Netherlands has dropped by as much as 97 per cent in recent decades. The bird is therefore one of the target species for agricultural nature management. Scientists looked at the province of Groningen, an area with many buffer strips, to see how successful these strips were in providing more food for farmland birds. The buffer strips did not appear to improve the larks' chances.

While skylarks growing up in a buffer strip did seem to have a more varied diet, this did not increase their chances of survival. Most skylark nest losses are the result of agricultural work and predators. Grass mowing was found to be especially harmful in areas with mixed farming, as it meant that few youngsters were able to achieve adulthood in grasslands. In the study area, the population of skylarks dropped by 40 per cent over the course of six years.

The results of the study are consistent with findings from other countries, such as the United Kingdom and Switzerland. Here, too, buffer strips were found to have only a moderate positive effect on bird populations. More targeted measures are needed for truly successful management. Adapted mowing of grasslands could offer a solution for the skylark and other grass-nesting birds. An increase in areas planted with lucerne would probably also be beneficial for the skylark.

Is cultural heritage protection a source of inspiration for conservation?

In February 2014, Professor Pieter van Vollenhoven advocated a new approach for nature policy in the Netherlands. Together with Joop Schaminée and André van der Zande he presented his ideas in a working paper called 'Cultural heritage protection: a source of inspiration for nature?' The title derives from the work Van Vollenhoven carried out for the National Restoration Fund. Below Pieter van Vollenhoven explains how this paper was established and why he feels so strongly about nature.

"My father was a great animal lover and my education at home focused much more on nature and the animal kingdom than on historical buildings. After I married, my areas of expertise became issues of safety and assistance to victims. At some point I was asked, completely unexpectedly, whether I would like to preside over the Dutch National Restoration Fund. To be perfectly honest, I initially knew absolutely nothing about heritage, but ultimately became very enthusiastic about this domain – to everyone's surprise, I might add.

The 1980s saw deep cuts in funding to heritage protection and our mission became to squeeze two guilders out of every one, as it were. A distinct feature of national heritage protection was, and remains, private initiatives. It was only in the 1960s that the government took this into account and formulated the first relevant law in a long time. The National Restoration Fund soon published a study that showed that the government actually earned from subsidising heritage, since the money spent worked as a driver, a multiplier. After all, restoration subsidies were accompanied by large investments from the owners of the buildings themselves.

With the support of the Ministry of Finance, we managed to ensure that the maintenance and restoration of 70 per cent of all cultural heritage sites could be funded off budget through a lending system organised via the Revolving Fund of the National Restoration Fund. Given my interest in nature, I decided to examine from the outset whether a system like this could also be used for conservation purposes. This was also the reason behind the creation of the National Green Fund at the time.

I found the domain of heritage protection, with its clear classification of national, provincial and municipal heritage sites, and the existence of the well-known Dutch Heritage Day, much clearer than nature conservation, with its Natura 2000 areas, the National Ecological Network, etc. Since the latter was only confronted with cuts – which turned out to be radical – the National Green Fund did not get the opportunity to evolve in the same way as the National Restoration Fund. At my request, State Secretary of Economic Affairs Sharon Dijksma has agreed to carry out further research. Once more, we are looking at the question as to whether cultural heritage protection might be a source of inspiration for nature conservation. This is a discussion not only about the concept of clarity, but also of the potential involvement of private initiative or other new funding possibilities."

Pieter van Vollenhoven, André van der Zande and Joop Schaminée are authors of the working paper 'Cultural heritage protection: a source of inspiration for nature?' Despite the current financial limitations, they managed to suggest solutions that could result in a fundamental improvement in Dutch nature policy. The Dutch landscape consists of a jumble of small, medium and large nature areas, each with different owners, statuses, subsidies and management goals. In accordance with the cultural heritage protection policy, the authors aim for a clear three-way divide of nature areas: namely as national nature heritage, provincial nature heritage and municipal nature heritage.

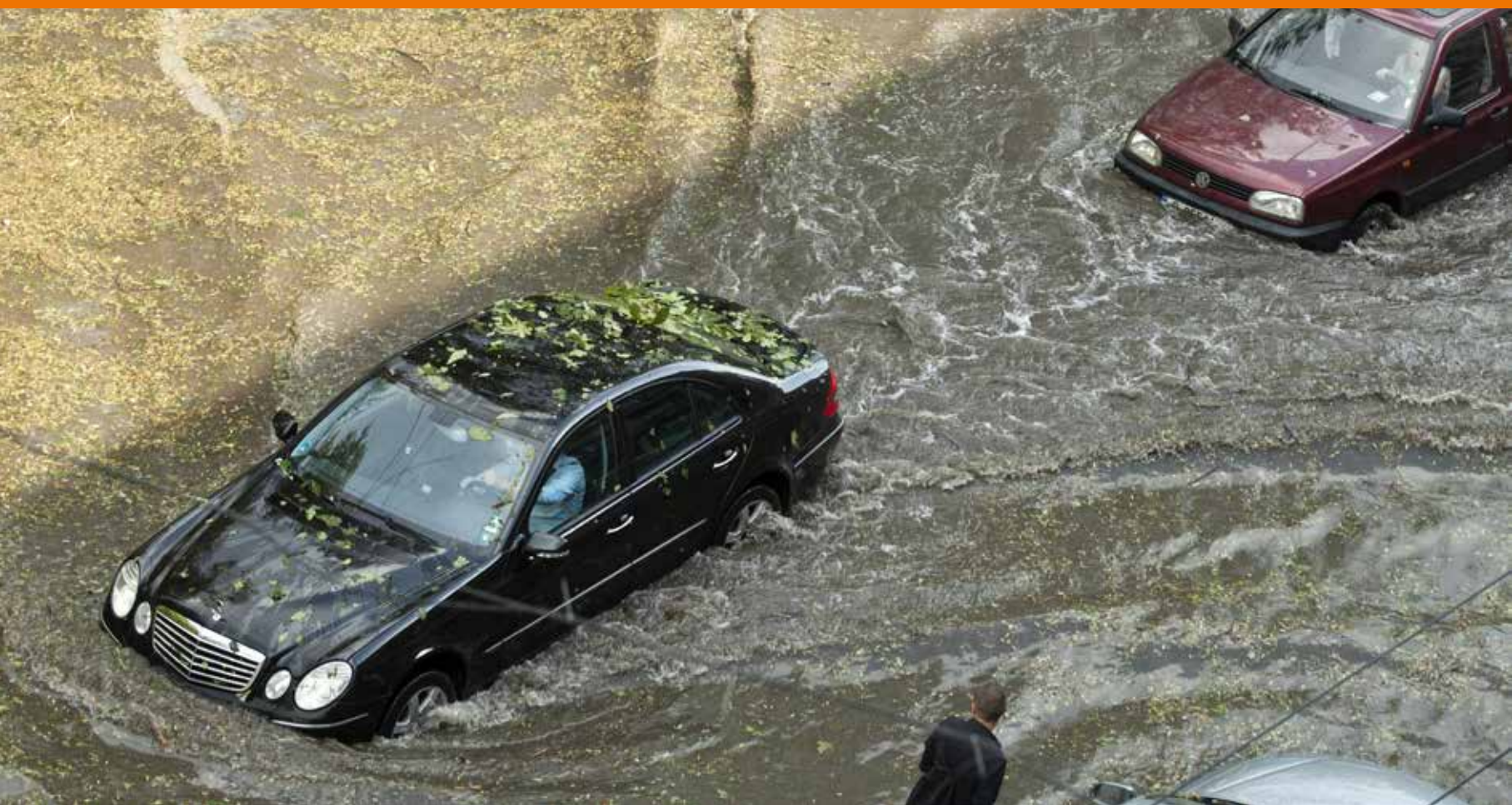
Evaluating ecosystem services

The national *Environmental Balance* report included figures on services provided by ecosystems in the Netherlands for the first time in 2014. Scientists Joep Dirkx of WOT Nature & Environment and Bart de Knegt of Alterra pooled the data and wrote the analysis for the Netherlands Environmental Assessment Agency (PBL).

The first report shows that the Dutch ecosystems have provided more services than before in a number of areas. Food production and water storage capacity increased, for instance. The capacity of the environment to suppress pests actually fell, however, as did water purification.

The latter figure shows that ecosystem services can be difficult to evaluate. The services provided by the natural environment were not reduced because ecosystems did not have the capacity, but rather due to water treatment plants taking over the work on their behalf.

"This has already been a very worthwhile enterprise, but we are far from finished," Dirkx underlines. "The biggest question is how the ecological capital of Netherlands can best be mapped. How can we weigh food production and pest suppression against each other, for instance?" Dirkx used the results of Professor Lars Hein, among others, who is also drawing up accounting rules for ecosystems (see page 29).



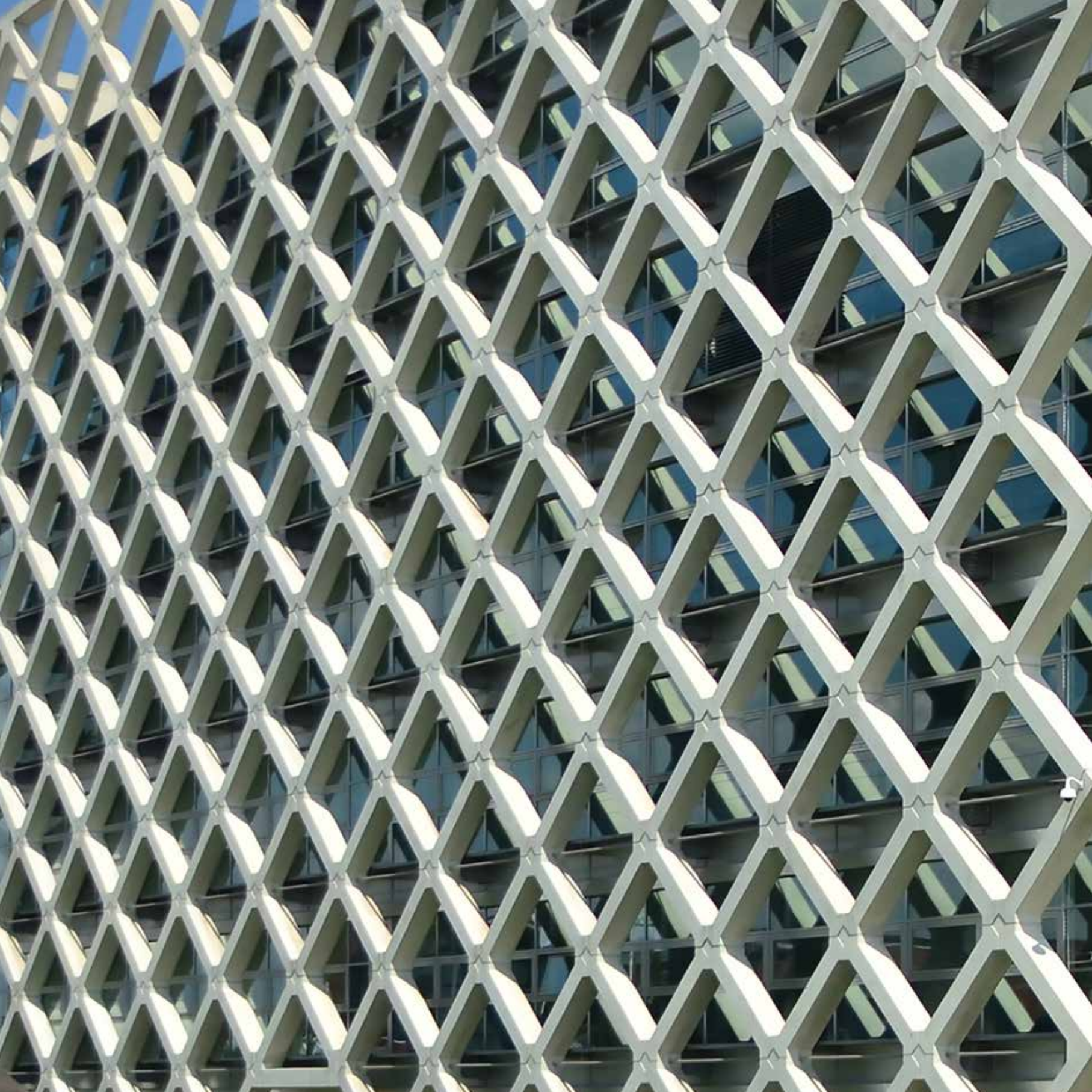
DNA betrays aquatic animals

Scientists from Alterra can use DNA to track down various aquatic organisms. All they need is traces of DNA in water samples so tracking down the animals themselves is no longer necessary, saving water managers a great deal of time and money.

Alterra has tests available for four organisms: the northern crested newt, the garlic toad (or common spadefoot), the European weather loach and the red swamp crayfish. The first three are protected species, while the red swamp crayfish is an unwelcome exotic species. Water managers want to keep this exotic species out as it can severely damage ecosystems.

They also have a best-effort obligation for sustainable preservation when it comes to the protected species.

According to ecologist Arjen de Groot, who developed the tests and validated them for Dutch conditions in cooperation with colleagues, there is a significant demand for the tests. "It is a quicker and cheaper screening method than previous techniques, in which scientists would track down the animals using hoop or scooping nets." Fifteen millilitres of water is all that is required. While it is yet to become entirely clear how long the DNA remains traceable, the period is at least several weeks.



About the Environmental Sciences Group

Profile

Environmental Sciences Group

The Environmental Sciences Group (ESG) is one of the five science groups at Wageningen UR (University & Research Centre), which is the partnership between Wageningen University and the Wageningen research institutes. The ESG is made up of the university's Department of Environmental Sciences, the ISRIC foundation and the specialised research institute, Alterra.

The focus of the ESG is on the broad domain of environmental sciences, including the fields of sustainable soils, nature & biodiversity, spatial planning & land use, water management & governance, and climate & the living environment. Our strength lies in the collaboration among varied disciplines, specialised research institutes and the university, resulting in swift practical application of scientific breakthroughs.

Department of Environmental Sciences

Fundamental research and education are provided by the chair groups of the Environmental Sciences department. Each of our 19 chair groups is headed by a professor and has its own expertise.

For more information and an overview of our chair groups, see www.wageningenuniversity.eu

ISRIC

ISRIC – World Soil Information is an independent science foundation. The institute was founded in 1966 following recommendation by the International Soil Science Society (ISSS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The ISRIC mandate is to provide the international community with information on soils in order to address solutions for large-scale, worldwide problems such as the global food supply. Since 1989, ISRIC has had formal status as an International Council of Science World Data Centre for Soils.

For more information on ISRIC, see www.isric.org

Alterra

Alterra is the research institute for our green environment. Alterra provides expertise on issues of green space and its sustainable, public use. We conduct strategic and applied research to facilitate policy, management and design of green space on a local, national and international scale. On the one hand, this concerns innovative, interdisciplinary and interactive research on complex problems in the realm of green space; on the other hand, we deliver ready-to-apply knowledge and expertise for solving practical

problems quickly and appropriately. We can pursue meaningful research thanks to our access to a broad palette of expertise and a range of facilities including laboratories, databases and DNA techniques.

For more information about Alterra, see www.wageningenur.nl/en/alterra

Strategy

Worldwide developments generate many sustainability issues in our domain and call for innovative and sustainable solutions, both regionally and on the world stage. As a World Class Research Institute, and through its expertise and knowledge, collaboration with other parties, and creative and enterprising approach, Alterra delivers lasting added value for government authorities, organisations and businesses.

In the Netherlands, we are the market leader in our field. In order to retain our position nationally and to expand it internationally, we strive for further growth and a greater international market position. To this end we place special emphasis on a physical presence in the regions and provinces of the Netherlands, in other Western countries and in developing countries.

Members of the ESG Advisory Council

Sylvo Thijsen (chair)
director, Staatsbosbeheer (Forestry Commission)

Rob van Brouwershaven
director of Nature and Biodiversity,
Ministry of Economic Affairs

Gilles Bouwmeester
global head Food and Agri coverage,
Rabobank International

Eric Luiten
government advisor on Landscape and Water,
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Johan Osinga
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head, Remote Sensing Laboratories,
University of Zürich

Maarten Smits
director, Deltares

Chris Zevenbergen
professor of Flood Resilience of Urban Systems,
UNESCO-IHE,
professor, TU Delft

Sustainability

We assume our social responsibility by aiming for a balance between economic, ecological and social interests. Our ambition is to contribute to a high-quality, sustainable, green environment in which to live.

In conducting fundamental and applied research, and in providing academic education, the quality of our work is paramount – work in which the interdependent interests of both humans and the environment are considered. In policy decisions, personnel, students, clients and other stakeholders can count on the inclusion of such aspects as safety, health, welfare and the environment.

Social Responsibility in accordance with ISO 26000

By adopting the international standard NEN-EN-ISO 26000, we are shouldering our social responsibility in a positive and transparent fashion. The principles and topics described in this standard are important points of departure for decision-making at the ESG. By means of a self-declaration (following the method of the NPR 9026+C1:2012), we periodically assess the degree to which the standard is met.
Main points of focus for the near future are: active engagement of stakeholders, the civic role of the ESG vis-à-vis policymakers, and social responsibility aspects in the preparation of international project proposals.

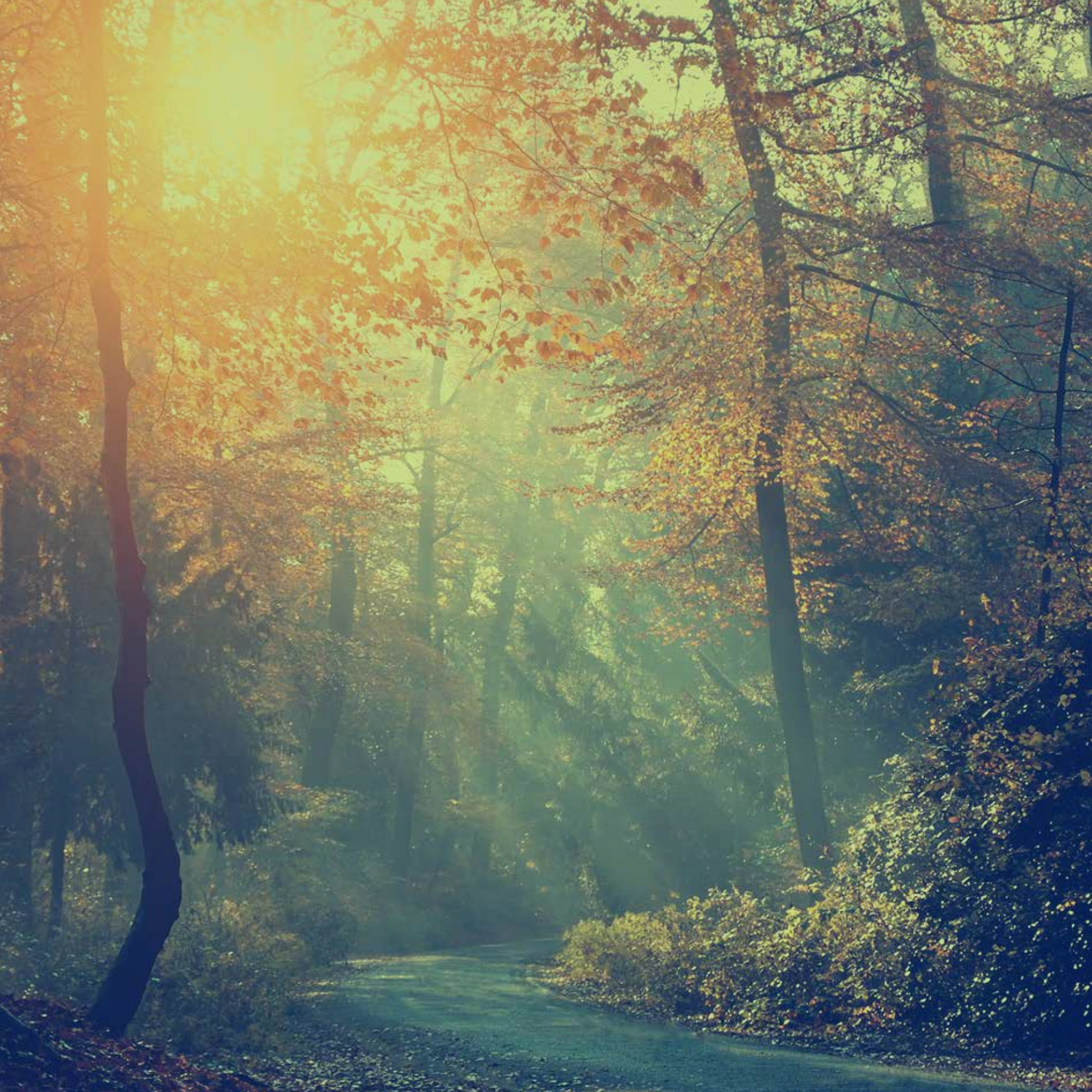
The ISO 26000 self-declaration has been assessed and posted on the NEN publication platform.

Aspiring highest standards

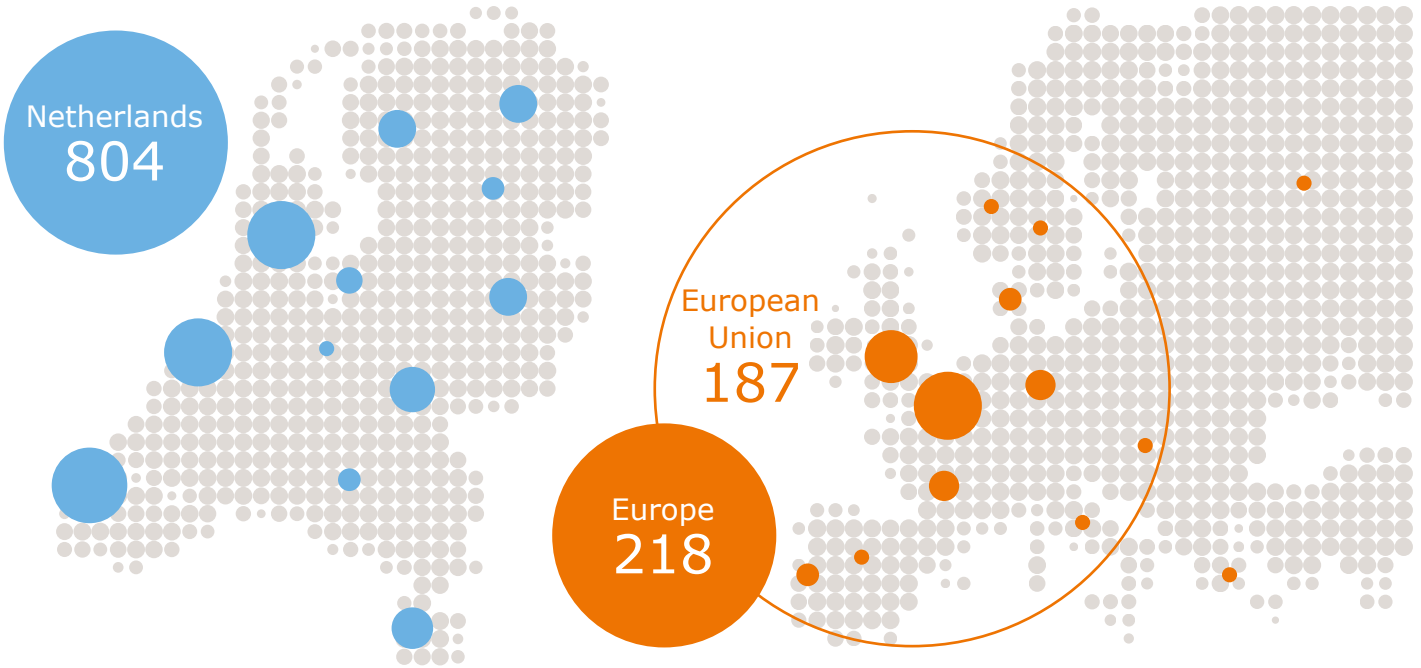
Alterra maintains an ISO certified quality management system, according to the standard ISO 9001:2008 that ensures that the quality aspects of all our assignments are planned for and managed in a systematic and measurable way. Alterra works with an environmental management system that satisfies the requirements of ISO 14001:2004. In addition we adopted the international standard NEN-EN-ISO 26000 'Social responsibility of Organisations' to shoulder our responsibility in a positive and transparent fashion.

Environmental data (ton CO_2-equivalent)

Business travel	3938
Electricity	1501
Fuels	642
Hazardous waste	348
Waste	116
Office paper	14
Water & waste water	9
Total	**6568**
CO_2 compensation	**4000**



Our international impact



Distribution of projects in the Netherlands
ESG was involved in 804 projects in the Netherlands in 2014, 672 of which were national and 132 regional.

Distribution of projects in Europe
In 2014 ESG was involved in 218 projects in Europe: 31 in individual countries and 187 for the European Union.

In 2014 the ESG was involved in some 1190 projects, distributed over nearly 60 countries. This is a reduction of around 3% compared to 2012. Approximately 70% of the projects took place in the Netherlands, which is about the same as in previous years. Around 20% of the projects in the Netherlands were regional and mostly took place in the western coastal provinces.

Of the international projects some 57% were in Europe, 15% in Africa, 12% in Asia and 4% in North and South America. This is more or less the same as previous years, with the growth in the number of projects in Africa continuing, while those in North and South America continue to decline. Around 11% of the projects were global or non-specific to one location. This involves, among other things, projects in the field of climate change and biodiversity.

Distribution of projects in Africa, Asia, North and South America and Oceania
In 2014 ESG was involved in 58 projects in Africa, 48 in Asia, 18 in North and South America, and 45 global projects.

Education

QS World University ranking

Environmental sciences

1. University of California, Berkeley
2. Harvard University
3. ETH Zürich
4. University of Camebridge
5. Stanford University
6. Massachusetts Institute of Technology
7. University of Oxford
8. **Wageningen University**
9. Imperial College London
10. University of Michigan

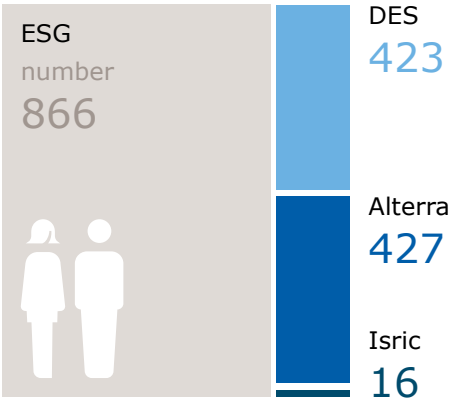
BSc-students

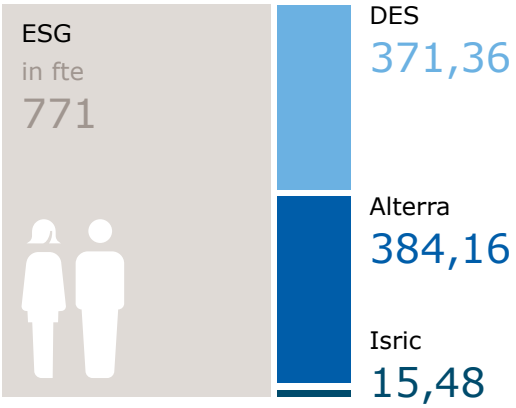
Environmental Sciences	100
Forest and Nature Conservation	222
International Land and Water Management	196
Landscape Architecture and Spatial Planning	206
Soil, Water, Atmosphere	227
Tourism	97
Total Environment and landscape	**1048**
Total Wageningen University	**4477**
ESG share	**23%**

MSc-students

Climate Studies	66
Earth and Environment	130
Environmental Sciences	288
Forest and Nature Conservation	224
Geo-information Science	96
Hydrology and Water Quality	5
International Land and Water Management	125
Landscape Architecture and Planning	128
Leisure, Tourism and Environment	77
Meteorology and Air Quality	1
Soil Science	0
Urban Environmental Management	113
Total Environment and landscape	**1253**
Total Wageningen University	**4605**
ESG share	**27%**

Staff

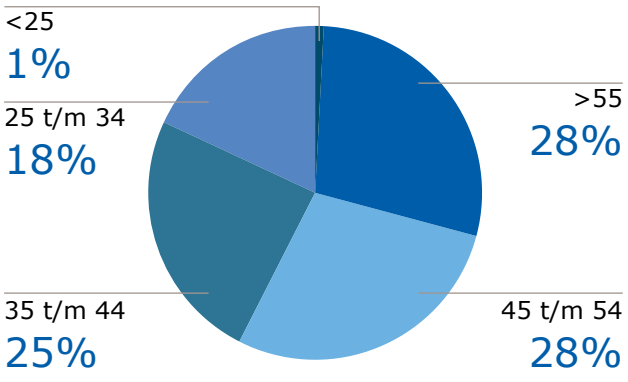


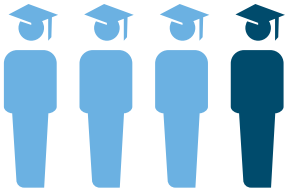


male
62%

female
38%

average age
46 years old





74%
graduate
degree

of which
51%
doctorates

PhD degrees

60

Professorial appointments

7

PhD candidates

440

of which 101 contracted

nationalities

44

nationalities

741

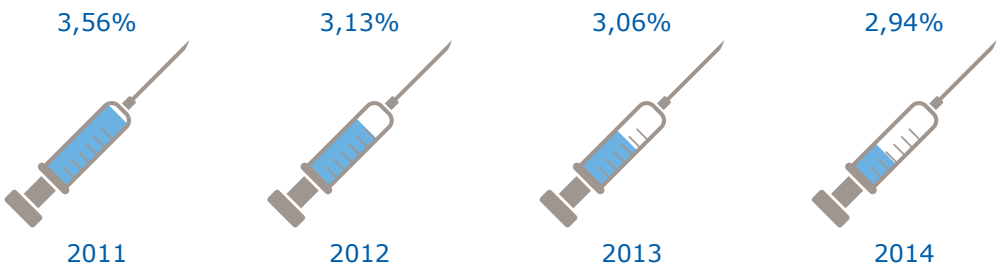
Dutch

125

non-Dutch

USA, Croatia, Finland, Poland, Turkey, Ukraine, France, Portugal, Australia, Slovenia, Hungary, Romania, Belgium, Russia, Ireland, Senegal, Brazil, Canada, Indonesia, Singapore, England, Chile, Iran, Spain, Bulgaria, China, Italy, Vietnam, Bangladesh, Colombia, Mongolia, Sweden, Denmark, Namibia, Honduras, Germany, Ethiopia, The Netherlands, Israel, India, Costa Rica, Mongolia, Kenya.

sick leave (average)



Colophon

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Compilation and editing
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Production
Lijn 24, Wageningen (www.lijn24.com)

Interviews
Korné Versluis, Alexandra Branderhorst

Design
Tim Jacobs

Text editing
Anja Janssen

Print
Propress, Wageningen

English translation
Writewell Quality Text, Amsterdam

Photography
Bart de Gouw, Joris Schaap, Shutterstock,
employees Environmental Sciences Group

Project links

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For quality of life