



Wageningen Institute for Environment and Climate Research

# WIMEK UPDATE

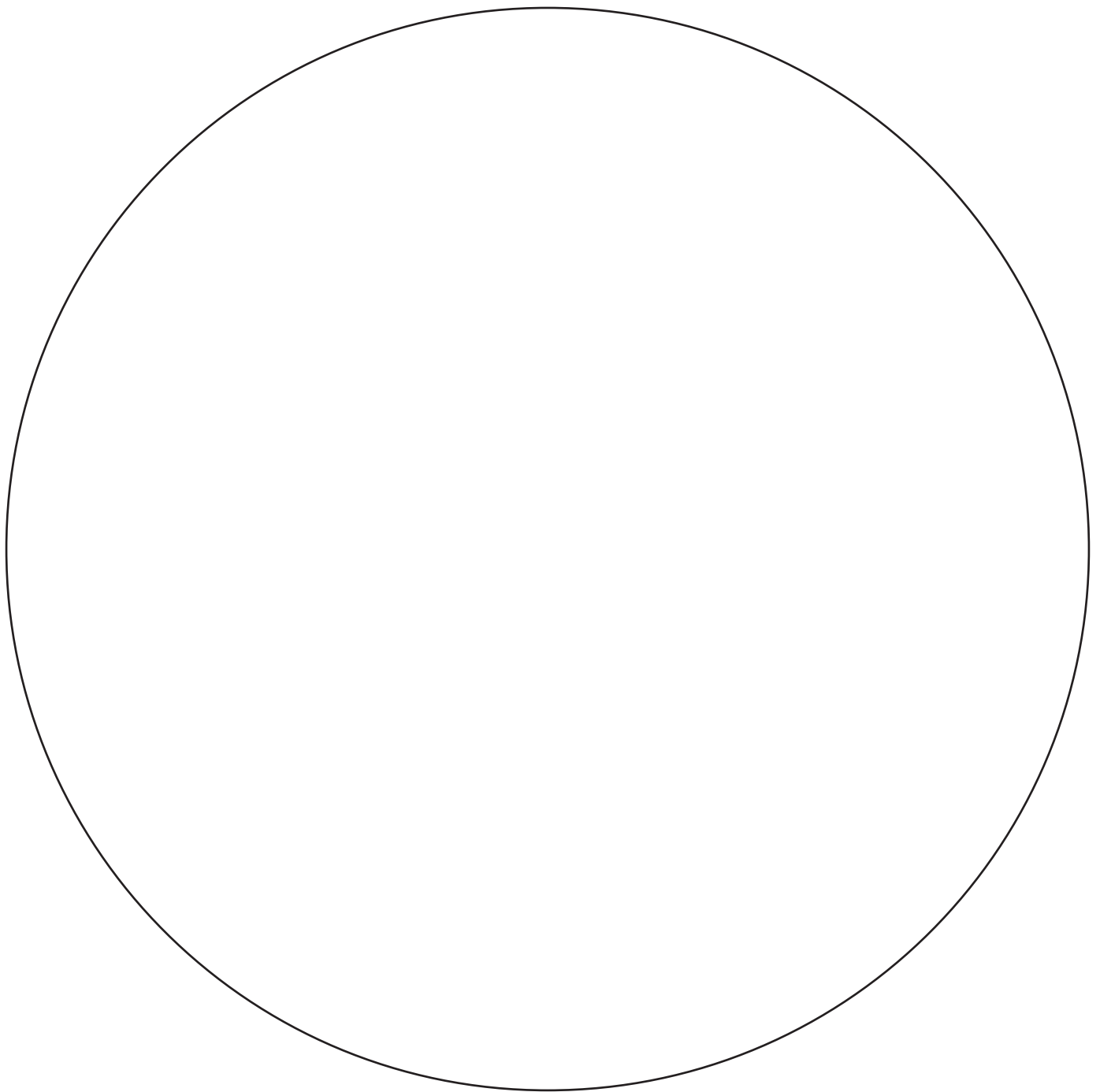
2013 \* 2014 \* 2015



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# WIMEK UPDATE

2013 \* 2014 \* 2015



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# Our Position

The Wageningen Institute for Environment and Climate Research (WIMEK) is one of the six Graduate Schools at Wageningen University (WU). WIMEK was founded in 1993 to coordinate the research activities and PhD education of the WU chair groups involved in this research field. WIMEK aims to develop an integrated understanding of environmental change, its impact on the quality of life and sustainability, and offers solutions for environmental improvement by (i) conducting innovative scientific and technological research, (ii) offering PhD training and education, and (iii) disseminating emerging insights, recent research results and novel technological & policy approaches to companies, regulating authorities and society.

At present, sixteen chair groups participate in WIMEK, eight with their full research capacity and some other with a few senior researchers, postdocs and PhD candidates (see annex 1).

Currently, about 320 PhD candidates are enrolled in WIMEK, of which about 68% come from abroad. WIMEK aims to support these PhD candidates in their personal and scientific development by offering them a challenging scientific research environment, a national and international scientific network of environmental researchers and an advanced training and education programme. Moreover, WIMEK is co-founder of the national Dutch inter-university network of environmental research groups SENSE (Netherlands Research School for the Socio-Economic and Natural Sciences of the Environment). At present, environmental research groups from nine Dutch universities and UNESCO-IHE collaborate in SENSE. WIMEK is by far the largest participating institute and acts as the SENSE secretariat.

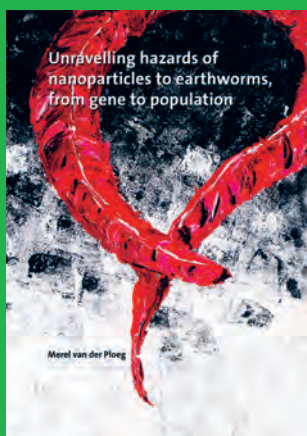


**Figure 1: Word cloud of dissertation titles, highlighting the major focus of WIMEK research ([www.wordle.nl](http://www.wordle.nl)).**

Since its foundation in 1993, the research quality and the PhD Education & Training Programme, offered by the WIMEK Graduate School and the SENSE Research School have all been evaluated very positively by international peer review committees.

## External review 2014

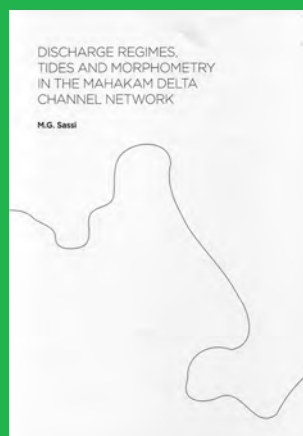
The WIMEK Graduate School was evaluated by external peers in 2014, as part of the SENSE review. The WIMEK chair groups scored in general very good to excellent on the criteria Scientific Quality (Q), Scientific Productivity (P), Societal Relevance (R) and Viability (V). At WIMEK Graduate School level the external review committee concluded: "This is an excellent overall programme with high performing faculty and PhD students. It has a very commendable international and national reputation. It succeeds in its performance measures for the review period, and it more than succeeds in its outreach and community involvement." The review committee recommended (i) to set-out a clear vision for the coming research period and (ii) to pay more attention to the societal impact of PhD research and the interaction with stakeholders.



30/01/2013 | **Ploeg, M.J.C. van der**  
Unravelling hazards of nanoparticles to earthworms, from gene to population



01/02/2013 | **Kupryianchyk, D.**  
Activated carbon in sediment remediation: benefits, risks and perspectives



11/02/2013 | **Sassi, M.G.**  
Discharge regimes, tides and morphometry in the Mahakam delta channel network



22/02/2013 | **Brugh, J. Aan de**  
Aerosol processes relevant for the Netherlands

# Our research

WIMEK combines fundamental, strategic, applied and participatory research in environmental, climate and sustainability sciences, both from a social sciences and a natural sciences point of view, focussing on pressing environmental problems and sustainable solutions with local to global significance.

Our research programme strongly concentrates on the following research themes:

Theme 1: Environmental contaminants and nutrients, including biotechnological and physico-chemical processes for sustainable use and reuse of water, energy, minerals and materials.

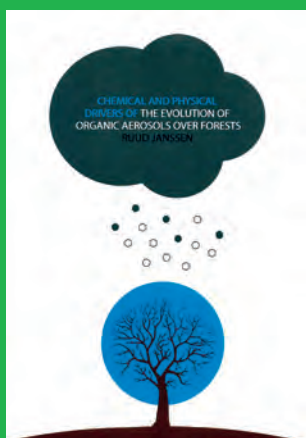
Theme 2: Environmental processes and ecosystem dynamics

Theme 3: Global and regional environmental change

Theme 4: Sustainable development and social change: actors, institutions and governance

In the vision of WIMEK, fundamental disciplinary research efforts and innovative inter- and transdisciplinary (including stakeholders) research efforts are both needed to contribute to real solutions for the current emerging complex environmental issues. In the past period WIMEK has promoted the transdisciplinary research approach by the publication of the booklet "Challenges and successes in interdisciplinary and transdisciplinary research and education", presenting inspiring examples of transdisciplinary approaches from WIMEK staff.

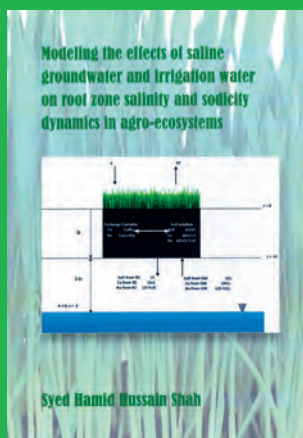
WIMEK puts its vision into practice by initiating and participating in some large transdisciplinary initiatives, such as (i) the Amsterdam Institute for Advanced Metropolitan Solutions (Wageningen UR, TUD, MIT, local government and business partners) and (ii) Water Nexus: a new NWO-STW research programme of 6 Million Euro, that will run from January 2015 to 2020, and is supported by 25 partners from multinational and small/middle sized companies, consultancy firms, research institutes, water boards, and the Ministry of Infrastructure and Environment.



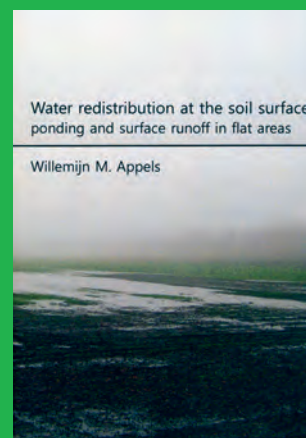
01/03/2013 | **Janssen, R.H.H.**  
Chemical and physical drivers of the evolution of organic aerosols over forests



08/03/2013 | **Jansen, O.E.**  
Fishing for food: feeding ecology of harbour porpoises *Phocoena phocoena* and white-beaked dolphins *Lagenorhynchus albirostris* in Dutch waters



19/03/2013 | **Shah, S.H.H.**  
Modelling the effects of saline groundwater and irrigation water on root zone salinity and sodicity dynamics in agro-ecosystems



19/03/2013 | **Appels, W.M.**  
Water redistribution at the soil surface: ponding and surface runoff in flat areas

## Scientific output & impact

The scientific output of WIMEK researchers is presented in figure 2. On average 45 PhD candidates defended their PhD thesis successfully each year. The number of refereed articles in scientific journals fluctuated between 330 and 424 per year.

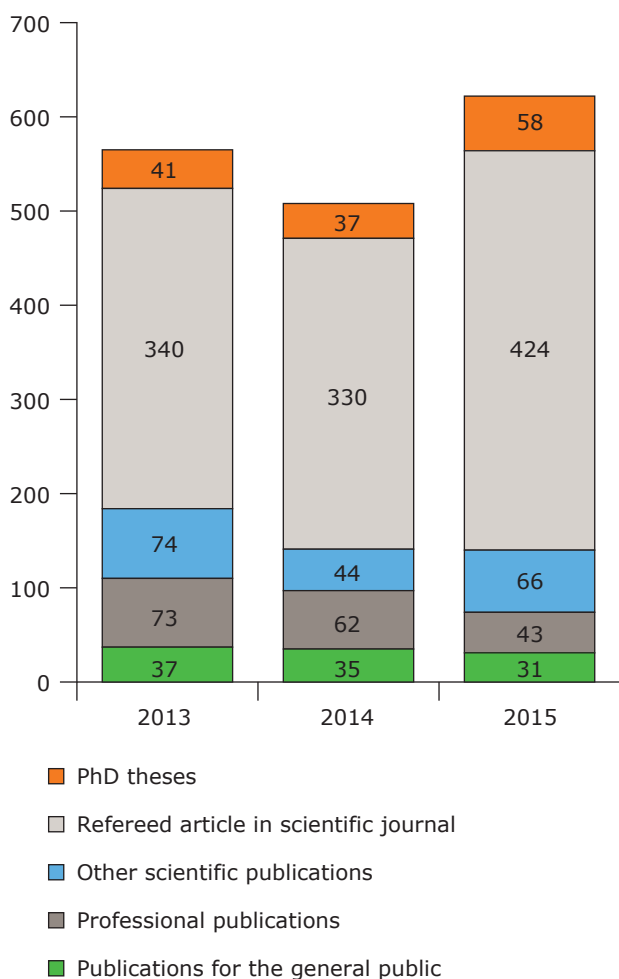


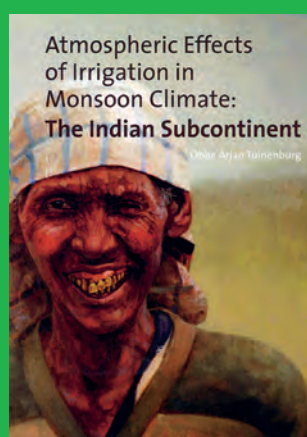
Figure 2: Number of WIMEK publications 2011 – 2015

The scientific impact of WIMEK publications is constantly at a high level. Table 1 shows that the Relative Impact of all WIMEK publications is on average 2.4, which is more than two times the world average. The same holds for the top 10% publications of WIMEK. The number of top 1% publications is even 6 times the world average.

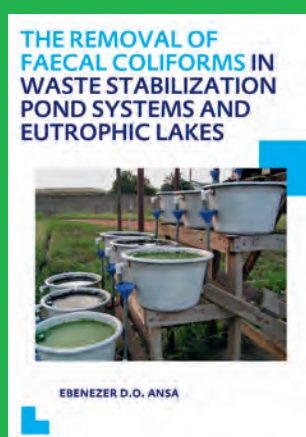
Table 1: Scientific impact of all WIMEK publications

Year of publication	N	C	RI	%T10	%T1
2009	261	9938	2.49	25% (64)	6% (15)
2010	328	8538	2.30	26% (84)	5% (18)
2011	272	6041	2.32	28% (77)	6% (15)
2012	318	4951	2.25	26% (84)	7% (22)
2013	309	2753	2.45	31% (96)	6% (17)
<b>All years</b>	<b>1488</b>	<b>32221</b>	<b>2.36</b>	<b>27% (405)</b>	<b>6% (87)</b>

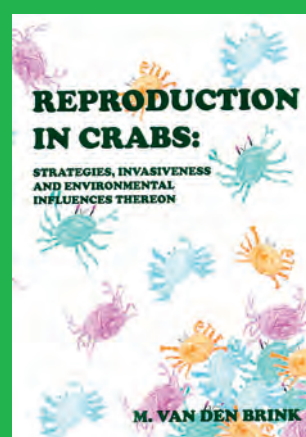
- N Total number of publications in a series that is analysed.
- C Total number of citations to the N publications.
- RI Relative impact or the item oriented field normalised citation score. This indicator corresponds to the number of citations to publications from a unit during the analysed time span, compared to the world average of citations to similar publications (of the same age and within the same research areas as for the group's publications). The term "item oriented" indicates that the normalisation of the citation values is done on an individual article level after which the average over all articles gives the score of RI.
- %T10 Percentage of the 10% best cited papers compared to total number of publications (Total number of publications within the top 10% best cited publications in their field).
- %T1 Percentage of the 1% best cited papers compared to total number of publications (Total number of publications within the top 1% best cited publications in their field).



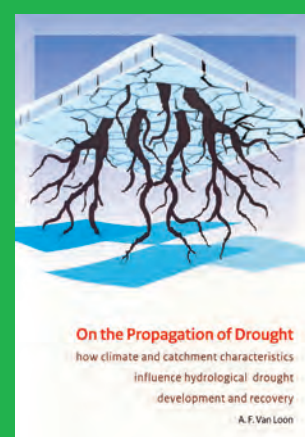
15/04/2013 | Tuinenburg, O.A. Atmospheric effects of irrigation in monsoon climate: the Indian subcontinent



16/04/2013 | Ansa, E.D.O. The removal of faecal coliforms in waste stabilization pond systems and eutrophic lakes



16/04/2013 | Brink, A.M. van den Reproduction in crabs: strategies, invasiveness and environmental influences thereon



26/04/2013 | Loon, A.F. van On the propagation of drought: how climate and catchment characteristics influence hydrological drought development and recovery

## Some research highlights

### AEW: Aquatic Ecology and Water Quality Management

#### *Creating a safe operating space for iconic ecosystems*

You cannot easily fend off climate change, but you can make key nature areas more resilient to a warming climate, argued Professor Marten Scheffer in an article in *Science*<sup>1</sup>. Scheffer and an international team of ecologists have already studied the examples of the Great Barrier Reef, the Amazon rain forest and the Donana Wetlands in Spain. Climate change threatens the survival of these important nature areas. But that is not the only threat to them. Local activities such as pollution, overfishing and tree-felling make the situation worse. That local stress is far easier to tackle. Scheffer: 'Using local measures it is quite possible to improve an ecosystem's resilience so that it copes with climate change better. By reducing the local pressure on it, an ecosystem gets a chance to breathe.'

Take the Donana Wetlands, Europe's main overwintering place for water birds. Waste water and artificial fertilizer are affecting the water quality, giving poisonous algae a chance to grow. The warming up of the climate stimulates the growth of these algae. If you reduce pollution, the toxic algae have less chance to flourish, even if warming continues. So the trick, according to Scheffer, is to take steps to minimise the impact of local activities before the system reaches a tipping point and collapses. 'We have the knowledge. There is no excuse for countries to let this opportunity pass them by.'

Source: *Resource Magazine Wageningen UR*<sup>2</sup>

#### *The world's first model for engineered nanoparticles in surface waters*

AEW researchers developed the world's first spatiotemporally explicit model that simulates the behaviour and fate of engineered nanoparticles (ENPs) in surface waters.

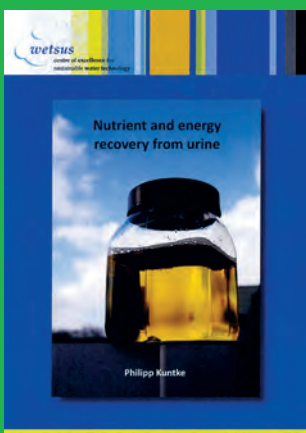
Nanotechnology is developing fast, with the fast growing emission of less than 100 nm engineered nanoparticles as a consequence. ENPs are hard to measure in the environment so that exposure assessments have to rely on modelling. Previous models could only predict average background concentrations on a continental or national scale. The new NanoDUFLOW model however, developed by Joris Quik, Jeroen de Klein and Bart Koelmans and described in *Water Research* magazine (September 2015)<sup>3</sup>, is capable of simulating the concentrations of ENPs, and their homo- and heteroaggregates in space and time, for any hydrological flow regime of a river. Bart Koelmans: "This is important in order to assure safe nanotechnology. We do need to have an assessment of the risks of ENPs to man and the environment."

#### *Measuring minuscule plastic nano particles*

Over the next four years the Technologies for the Risk Assessment of Micro plastics project (TRAMP) will research how minuscule plastic nano particles can be measured. The extent to which Dutch freshwater bodies are polluted with plastics and how the harmfulness of that pollution can be determined will also be investigated. Moreover, the researchers also intend to develop calculation models to forecast how the level of plastics pollution will follow the production of plastics.

'We observe a great need for more clarity regarding plastics pollution', states prof. Bart Koelmans, the project manager from Wageningen UR. 'Many people want to know how great the problem really is, why plastic particles could be dangerous, and whether the problem is also evident in the Netherlands.' Together with the research group run by prof. Annemarie van Wezel, an affiliate professor at Utrecht University and KWR Watercycle Research Institute, Koelmans expects that the TRAMP project will bring about a greater understanding of the problem.

Source: *Website NanoNext*



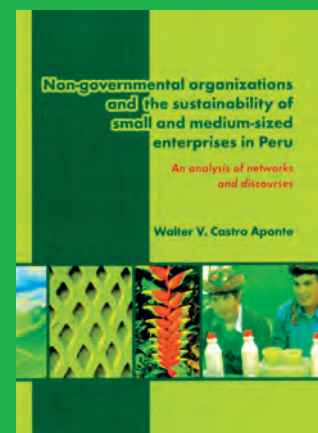
26/04/2013 | **Kuntke, P.**  
Nutrient and energy recovery from urine



13/05/2013 | **Bélangier, P.**  
Landscape infrastructure: urbanism beyond engineering



12/06/2013 | **Beek, C.Z. van de**  
Rainfall variability in the Netherlands from radars, rain gauges, and disdrometers



17/06/2013 | **Castro Aponte, W.V.**  
Non-governmental organizations and the sustainability of small and medium-sized enterprises in Peru: an analysis of networks and discourses



### *Perturbations of system earth: reading the past to project the future*

Bringing together research into the climate of the past, present and future to improve the predictions about future climate conditions on our planet. The Netherlands Earth System Science Centre (ESSC) has received a € 28 million award from the Dutch Gravitation Programme to do so. AEW chair Marten Scheffer is involved.

Palaeoclimatologists, biogeoscientists and climate modellers will jointly work on research into the mutual interactions between geosphere, biosphere, hydrosphere and atmosphere on different timescales. The consortium will mainly focus on the influence of the carbon cycle to determine how warm the earth will become due to current disruptions to the carbon cycle and how sudden changes in the climate can take place.

### **BCT: Biobased Chemistry & Technology**

#### *Modelling studies of biological gas desulphurisation under haloalkaline conditions*

Dr Johannes Klok graduated in 2015 on this PhD thesis. Biogas, synthesis and natural gas streams often require treatment because of the presence of gaseous hydrogen sulphide (H<sub>2</sub>S). About 25 years ago, a biotechnological gas treatment process was developed as an alternative to the conventionally applied technologies where H<sub>2</sub>S is oxidised to elemental bio-sulphur and sulphate. However, in order to enable cost effective large scale applications, the selectivity for sulphur production should be increased.

This PhD study focused on biological reaction kinetics and biological pathways for sulphide oxidation that occur in the process at haloalkaline conditions. It was found that two different sulphide oxidising enzyme systems are present in haloalkaline sulphide oxidising bacteria. Both enzyme systems were taken into account to propose and validate a new physiological mathematical model that can handle multi-substrates and multi-products.

Finally, the developed kinetic models have been incorporated in a full-scale bio-desulphurisation model that includes the effects of turbulent flow regimes and mass transfer of oxygen. This enables us to better understand the overall process. Moreover, the model can also be used as a tool to design model-based control strategies which will lead to better overall process performance, i.e. maximise sulphur production and minimise chemical consumption rates.

### **ENP: Environmental Policy**

#### *Arctic environmental governance*

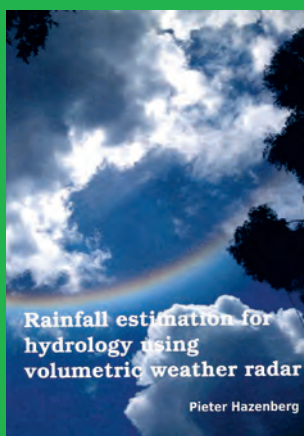
ENP has expanded further into arctic related research. In August 2015 Machiel Lamers and Linde van Bets were on board the NWO SEES scientific expedition to Spitsbergen. During the trip they investigated, amongst other things, the opportunities of interdisciplinary environmental science. Further research into the arctic is being conducted by Maria Tsyachnyuk, also with NWO support, on the governance oil exploitation and indigenous peoples.

#### *Seafood certification and improvement projects*

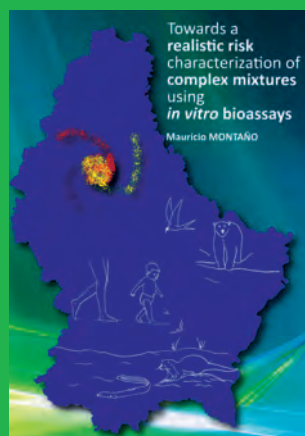
Simon Bush and Peter Oosterveer continued their work on seafood certification with two key publications in the journal *Science* <sup>4,5</sup>. These papers identified key limitations in the current private certification model and identified key changes for more effective implementation in developing countries. These papers were published in collaboration with a global network of authors working on fisheries and aquaculture social science.

#### *Climate transparency*

ENP's research on transparency in environmental governance gained international visibility through Aarti Gupta's book on this topic published by MIT Press in 2014, with her work on climate transparency also profiled by *Nature Climate Change* as a research highlight. With the 2015 Paris Agreement emphasizing transparency, ENP is also



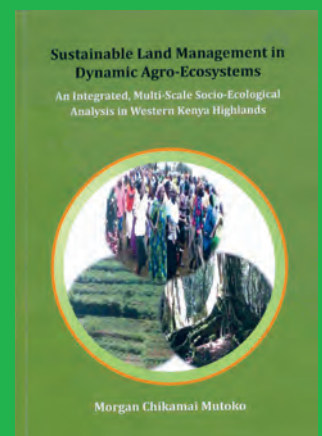
24/06/2013 | **Hazenberg, P.**  
Rainfall estimation for hydrology using volumetric weather radar



05/07/2013 | **Montano Garces, M.**  
Towards a realistic risk characterization of complex mixtures using in vitro bioassays



04/09/2013 | **Salukele, F.M.**  
Innovative landfill bioreactor systems for municipal solid waste treatment in East Africa aimed at optimal energy recovery and minimal greenhouse gas



09/09/2013 | **Mutoko, M.C.**  
Sustainable land management in dynamic agro-ecosystems: an Integrated, multi-scale socio-ecological analysis in Western Kenya highlands

stimulating cross-WUR dialogue on this timely topic, with a recent opportunity provided by the graduation of ENP PhD Marjanneke Vijge and her work on innovative modes of climate governance.

### Urban Climate Governance

Dr J. (Jennifer) Lenhart graduated in 2015 on a thesis "Urban Climate Governance: The Role of Local Authorities". Cities are growing at unprecedented rates, home to over half of global population for the first time in history. While there are economic, environmental and other benefits to urban living, there are also consequences, among which cities' major contribution to climate change. Within this field of urban climate governance this dissertation examines the role of local authorities, and their interactions with stakeholders, to govern climate change mitigation and adaptation in cities. To do so, it develops a conceptual framework based on the governing capacities that local authorities employ, the governing modes they apply to address climate change, and how local authorities influence and are influenced by vertical and horizontal actors within a multilevel governance system.

### ENR: Environmental Economics and Natural Resources

#### Improving the economic analysis of flood risk management strategies

Dr T.D. (Thomas) van der Pol graduated in 2015 on a PhD thesis entitled "Climate Change, Uncertainty and Investment in Flood Risk Reduction". Economic analysis of flood risk management strategies has become more complex due to climate change. In this thesis Thomas van der Pol investigates the impact of climate change on investment in flood risk reduction, and applies optimisation methods to support identification of optimal flood risk management strategies. He provides an overview of cost-benefit analysis (CBA) of flood risk management strategies under climate change uncertainty

and new information. CBA is applied to determine optimal dike heights under climate change uncertainty and new information. Furthermore, the impacts of rainfall variability and changing return periods of rainfall extremes were studied on cost-effective adaptation of water systems to climate change given a flood protection standard. Starting from expected cost minimisation the maximum regret minimising flood risk management strategies were identified under the arrival of new climate impact information. The thesis concludes that the modelling of new climate-related information may improve an economic analysis of flood risk management strategies.

### ESA: Environmental Systems Analysis

#### Observed impacts of anthropogenic climate change

Dr G.E. (Gerrit) Hansen graduated in 2015 on a PhD thesis entitled "Assessing the observed impact of anthropogenic climate change".

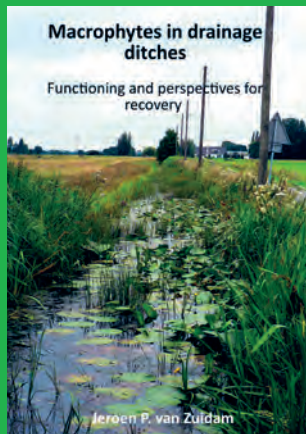
The overarching goal of this thesis is to elucidate to what extent the impacts of anthropogenic climate change can be detected and attributed worldwide, in particular within human and managed systems. This is achieved by assessing current impacts of anthropogenic climate change and by addressing the sources of uncertainty, assigning confidence levels and discussing the knowledge differences across a range of relevant climate variables, regions, systems and research disciplines. While the impact of anthropogenic climate change on natural and – to a lesser degree – human systems is confirmed by this analysis, its extent and magnitude cannot be summarised across all climate variables and sectors. Gerrit's thesis contributed with a map of worldwide impacts and their probably attribution to anthropogenic climate change to the synthesis report of the Intergovernmental Panel on Climate Change (IPCC).

#### Evidence based management of coral reef ecosystems

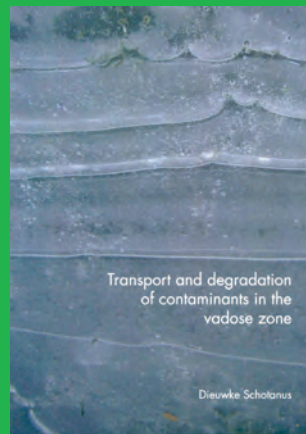
Dr. M. (Mariska) Weijerman graduated in 2015 on a PhD thesis "An integrated ecosystem model for coral reef



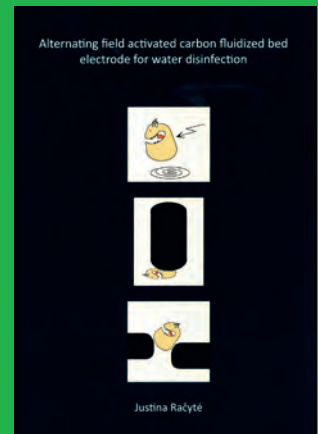
10/09/2013 | **Zhao, R.**  
Theory and operation of capacitive deionization systems



11/09/2013 | **Zuidam, J.P. van**  
Macrophytes in drainage ditches: functioning and perspectives for recovery



16/09/2013 | **Schotanus, D.**  
Transport and degradation of contaminants in the vadose zone



20/09/2013 | **Racyte, J.**  
Alternating field activated carbon fluidized bed electrode for water disinfection

management where oceanography, ecology and socio-economics meet”.

Widespread coral reef decline, including decline in reef fish populations upon which many coastal human populations depend, have led to phase-shifts from the coral-dominated systems, found desirable by humans, to algal-dominated systems that provide less ecosystem services, and the loss of functionally important species. Marine resource managers are challenged with providing strategies that can mitigate or prevent such phase shifts and losses and promote the sustainable use of marine resources.

The main objective of her thesis was to develop an integrated model of this complex reef system and to quantify the effects of watershed management and fishery regulations on coral reef ecosystem services against a backdrop of climate change impacts. For this model development, the Atlantis ecosystem model framework has been selected and applied to a case study of the coral reef ecosystems around Guam to evaluate the performance of alternative management strategies against identified ecosystem metrics. This model provides a tool for assessing and quantifying a range of questions in support for evidence based management for coral reef ecosystems.

#### *Developing cross-boundary skills in environmental science education*

Dr K.P.J. (Karen) Fortuin graduated in 2015 on a PhD thesis “Heuristic principles to teach and learn boundary crossing skills in environmental science education”.

With this thesis, Fortuin aimed to explore and develop heuristic principles for teaching and learning activities that enable university level environmental science students to especially acquire boundary crossing skills. These skills are needed to develop sustainable solutions for complex environmental problems.

This research revealed that acquiring boundary crossing skills requires learning activities that involve a combination

of experience in concrete interdisciplinary or transdisciplinary projects, close interaction and debate with persons with other scientific or cultural backgrounds and interests, theory training and explicit moments of reflection. Obtaining concrete experience in addressing a complex environmental problem and developing and executing an interdisciplinary or transdisciplinary project is an excellent starting point. Going through all the stages of an interdisciplinary or transdisciplinary project, having to deal with incomplete data, addressing uncertainty and complexity, contribute to acquiring boundary crossing and reflexive skills, specifically. Switching perspective, fieldwork and intensive group interaction enhance the acquisition of boundary crossing skills. Switching perspectives involves for instance working as a disciplinary expert, integrating disciplinary knowledge and empathising with non-academic stakeholders. Notwithstanding the importance of experience in interdisciplinary or transdisciplinary projects and interaction with others, such experience alone seems insufficient to acquire boundary crossing skills. Students need theoretical training and they need to be stimulated to reflect.

#### **ESS (WGC): Earth System Science (Water Systems and Global Change)**

In the course of 2015 the Earth System Science group changed its name into Water Systems and Global Change group to underline its research focus on the understanding of anthropogenically driven changes in water cycles in relation to interactions between climate, water, energy and agricultural systems.

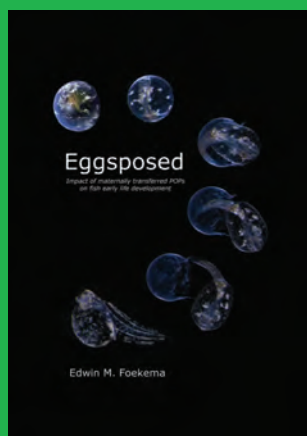
#### *Chinese rivers full of nitrogen and phosphorus*

Chinese rivers are polluted with nitrogen and phosphorus because of agricultural transitions, writes Maryna Stokol together with her Chinese and Wageningen colleagues in the journal *Environmental Research Letters*<sup>6</sup>.

Transitions in Chinese agriculture resulted in industrial animal production sectors, disconnected from crop pro-



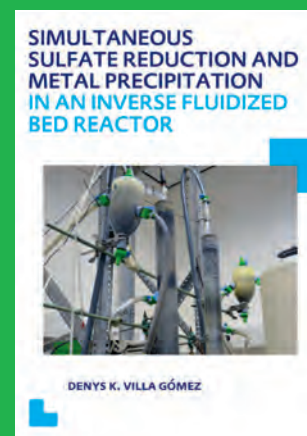
02/10/2013 | **Banerjee, S.**  
Colloids in ultra-low dielectric media: surface forces and self-assembly



04/10/2013 | **Foekema, E.M.**  
Eggsposed: impact of maternally transferred POPs on fish early life development



18/10/2013 | **Acheampong, M.A.**  
Sustainable gold mining wastewater treatment by sorption using low-cost materials



18/10/2013 | **Villa Gomez, D.K.**  
Simultaneous sulfate reduction and metal precipitation in an inverse fluidized bed reactor



The polluted reservoir receives manure directly from the nearby pig farm (located uphill) and disconnected from the other reservoirs (thus they are not very polluted)

duction. This means that farmers do not often use animal manure to fertilize soils for crop production, indicate the researchers. In 2000, when transitions were ongoing, between 30 and 70 percent of all animal manure was directly discharged to rivers. In 1970, before the transition, this was only 5 percent. Meanwhile, animal numbers more than doubled in those 30 years. As a result, inputs

of nitrogen and phosphorus to Chinese rivers increased by a factor of 2 - 45 between 1970 and 2000.

The researchers emphasise that environmental concern is growing in China. However, direct discharges of animal manure to rivers may increase in the coming years. Therefore, the authors suggest recycling animal manure in arable farming to avoid nutrient pollution of Chinese rivers in the future.

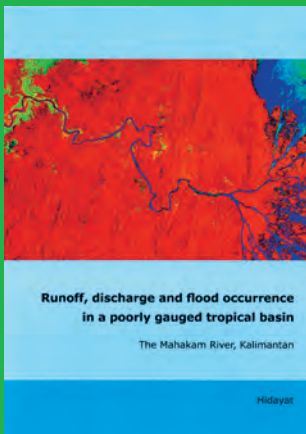
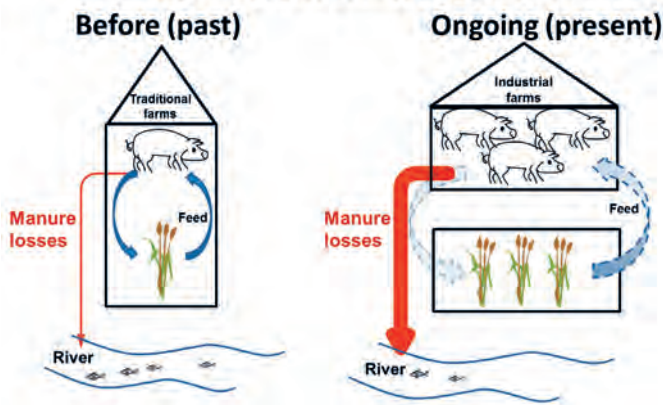
*Worldwide electricity production vulnerable to climate and water resource change*

Climate change impacts on rivers and streams may substantially reduce electricity production capacity around the world. A new study<sup>7</sup> by researcher Dr Michelle van Vliet et al from Wageningen University in the Netherlands and IIASA in Laxenburg, Austria, calls for a greater focus on adaptation efforts in order to maintain future energy security.

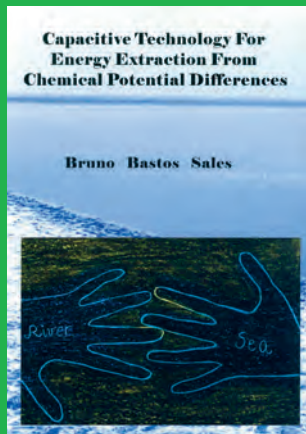
This is the first study of its kind to examine the linkages between climate change, water resources, and electricity production on a global scale. It clearly shows that power plants are not only causing climate change, but they might also be affected in major ways by climate change. In particular the United States, southern South America, southern Africa, central and southern Europe, Southeast Asia and southern Australia are vulnerable regions, because declines in mean annual streamflow are projected combined with strong increases in water temperature under changing climate. Van Vliet: "This reduces the potential for both hydropower and thermoelectric power generation in these regions".

We show that technological developments with increases in power plant efficiencies and changes in cooling system types would reduce the vulnerability to water constraints in most regions. Improved cross-sectoral water management during drought periods is of course also important. In order to sustain water and energy security in the next decades,

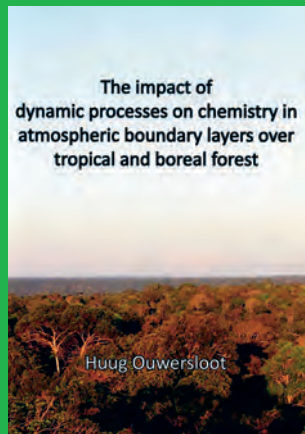
**Transitions in Chinese agriculture**



23/10/2013 | **Hidayat**  
Runoff, discharge and flood occurrence in a poorly gauged tropical basin: the Mahakam River, Kalimantan



01/11/2013 | **Bastos Sales, B.**  
Capacitive technology for energy extraction from chemical potential differences



08/11/2013 | **Ouwensloot, H.G.**  
Impact of dynamic processes on chemistry in atmospheric boundary layers over tropical and boreal forest



22/11/2013 | **Boer, M.N. de**  
Elusive marine mammals explored: charting under-recorded areas to study the abundance and distribution of cetaceans using multi-method approaches and platforms of opportunity

the electricity focus will need to increase their focus on climate change adaptation in addition to mitigation.

### Climate Change and Crop Production

Dr I. (Iwan) Supit (WGC) participates together with Joost Wolf (PPS) in the Agricultural Modelling Intercomparison and Improvement Project, AGMIP with the Lintul4 crop growth model. In this project they assess the effect of climate change and climate variability and work on model improvement. In the framework of this project various papers have been published, among which two in Nature Climate Change.

### Rising temperatures reduce global wheat production<sup>8</sup>

Many models simulated yields well, but were less accurate at higher temperatures. The model ensemble median was consistently more accurate in simulating the crop temperature response than any single model, regardless of the input information used. Extrapolating the model ensemble temperature response indicates that warming is already slowing yield gains at a majority of wheat-growing locations. Global wheat production is estimated to fall by 6% for each degree Celsius of further temperature increase and become more variable over space and time.

### Uncertainty in simulating wheat yields under climate change<sup>9</sup>

A greater proportion of the uncertainty in climate change impact projections is due to variations among crop models than to variations among downscaled general circulation models. Uncertainties in simulated impacts increases with CO<sub>2</sub> concentrations and associated warming. These impact uncertainties can be reduced by improving temperature and CO<sub>2</sub> relationships in models and better quantified through use of multi-model ensembles. Less uncertainty in describing how climate change may affect agricultural productivity will aid adaptation strategy development and policy making.

### ETE: Environmental Technology

#### Phosphate and organic fertilizer recovery from black water

Dr T. (Taina) Tervahauta graduated in 2014 on a PhD thesis regarding the phosphate and organic fertilizer recovery from black water.

Soil degradation is one of the most crucial problems humanity is facing. This is induced by the use of artificial fertilizers that disregards the input of organic matter in soil. Moreover, phosphate fertilizers are predominantly sourced from phosphate rock – a resource that is declining in both quantity and quality. In this thesis the integration of treatment systems for black and grey water was investigated to improve resource recovery within source-separated sanitation concepts. Special focus was set on phosphate and organic fertilizer recovery from vacuum collected black water.

A novel approach to simultaneously recover phosphate and energy was introduced by precipitation of calcium phosphate granules in anaerobic treatment of black water. Without any addition of chemicals, high purity calcium phosphate granules (≥95%) were produced in the sludge bed of the UASB reactor.

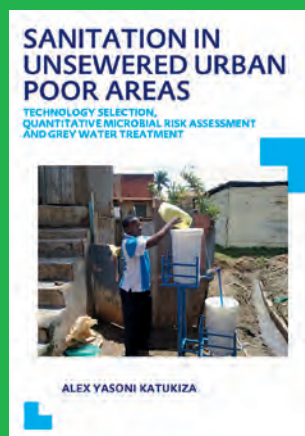


Photo: Hans Walkers

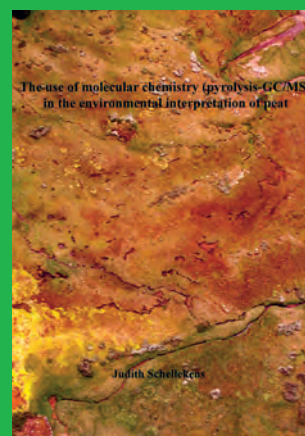
Taina Tervahauta at work in the laboratory



29/11/2013 | **Mburu, N.**  
Experimental and modeling studies of horizontal subsurface flow constructed wetlands treating domestic wastewater



29/11/2013 | **Katukiza, A.Y.**  
Sanitation in unsewered urban poor areas: technology section, quantitative microbial risk assessment and grey water treatment



04/12/2013 | **Schellekens, J.**  
The use of molecular chemistry (pyrolysis-GC/MS) in the environmental interpretation of peat



06/12/2013 | **Grootsholten, T.I.M.**  
Development of a mixed culture chain elongation process based on municipal solid waste and ethanol

*New remediation strategies for contaminated locations*  
 Dr N.B. (Nora) Sutton graduated in 2014 on a PhD thesis  
 "Microbiological and Geochemical Dynamics of the Sub-  
 surface: chemical oxidation and bioremediation of organic  
 contaminants"

The subsurface is a system comprising organic, inorganic, and microbiological components, which function together to support processes including nutrient cycling, carbon sequestration, and water filtration.

Contamination of the subsurface due to urban and industrial activities represents a serious environmental risk, requiring the development of efficient remediation technologies that can restore these sites into functional areas. However, the presence and treatment of these contaminants also offer a scientifically advantageous system for investigation of more fundamental topics of microbial ecology and soil geochemistry. This dissertation investigates in situ chemical oxidation (ISCO) and in situ bioremediation (ISB) of organic contaminants.

The outcomes of this dissertation provide insight into the dynamics of subsurface microbiological and geochemical processes. The value of coupling ISCO with ISB is supported by the improved remediation efficiencies achieved when chemical oxidation is applied rather than bioremediation alone. Studies with chemical treatment illuminate microbial resilience, as microbes are not only able to regenerate following harsh oxidation, but in many cases a slight enrichment in biodegradation capacity is also observed.

The results of this dissertation are an important new step towards examining contaminated locations and remediation from a fundamental scientific perspective.

#### *Nutrients and energy recovery from urine*

Dr P. (Philipp) Kuntke graduated in 2013 on a PhD thesis  
 "Nutrients and energy recovery from urine".

In conventional wastewater treatment plants large amounts of energy are required for the removal and recovery of

nutrients (i.e. nitrogen and phosphorus). Nitrogen (N) compounds are removed as inert nitrogen gas and phosphorus (P) is for example removed as iron phosphate. About 80% of the N and 50% of the P in wastewater originate from urine, but urine only contributes about 1% to the volume of this wastewater. High nutrient concentrations can be found in urine when it is collected separately from other wastewater streams. In this thesis, the nutrient and energy recovery from urine was investigated. At first, urine samples were analysed for their composition. This characterisation showed that the composition of the organic fraction in these samples was always similar. The differences between the concentrations of specific organic compounds were caused by dilution, due to individual consumption patterns of people. Two alternatives to the state-of-the-art nutrient recovery concepts are evaluated. These alternatives are on the one hand membrane capacitive deionization (MCDI) and on the other hand struvite precipitation combined with a microbial fuel cell (MFC). The evaluation of the MCDI system showed that nutrients can be concentrated from diluted urine. With its relatively low energy demand, MCDI could be an alternative to electrodialysis. The evaluation of the phosphate recovery by struvite precipitation combined with ammonium recovery and energy production by an MFC showed that this concept is most promising. Predictions show that approximately 5.1 kg struvite and 7.3 kg ammonia-nitrogen can be recovered from one cubic meter of urine, while producing approximately 20 kWh. A comparison to state-of-the-art technology showed that this process can be a good alternative for nutrient recovery from urine. Furthermore, ammonium recovery and energy production by an MFC can possibly be applied to other wastewater streams.

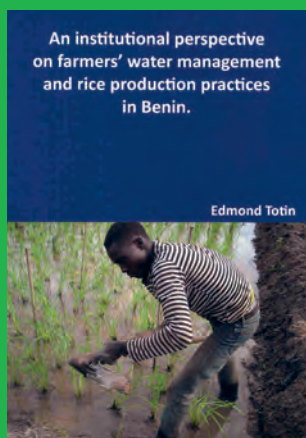
#### **HWM: Hydrology and Quantitative Water Management**

##### *Propagation of drought*

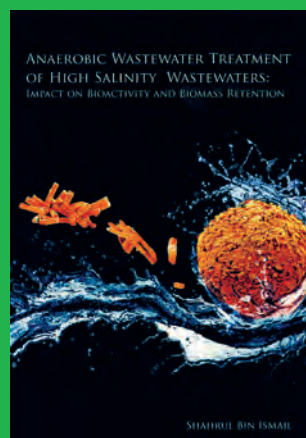
Dr A.F. (Anne) van Loon defended in 2013 her thesis 'On



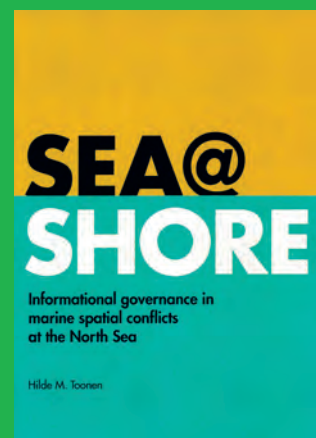
10/12/2013 | **Nijhuis, J.O.**  
 Consuming mobility: a practice approach to sustainable mobility transitions



10/12/2013 | **Totin, G.G.E.**  
 Institutional perspective on farmers' water management and rice production practices in Benin



11/12/2013 | **Ismail, S.B.**  
 Anaerobic wastewater treatment of high salinity wastewaters: impact on bioactivity and biomass retention



11/12/2013 | **Toonen, H.M.**  
 Sea@shore: informational governance in marine spatial conflicts at the North Sea

the propagation of drought. How climate and catchment characteristics influence hydrological drought development and recovery’.

Drought does not only occur in Africa, but also in humid climates where a lack of water compared to normal conditions also causes problems. Therefore, drought is defined as a below-normal water availability. Anne studied the development of hydrological drought (in groundwater and/or river discharge) in five study areas and on the global scale using data and models. Hydrological drought is often caused by a prolonged lack of rain. However, there are more causes, for example, a long period of frost, resulting in snow instead of rain and, therefore, no infiltration to the groundwater. Another severe type of drought is caused by the combination of these processes: a lack of rain in summer followed by frost in winter. A classification was made of hydrological drought types, which have specific characteristics that are visible on the catchment scale and on the global scale. Especially in cold climates, temperature is an important factor in the development of hydrological drought.

#### *Deep running rivers*

Dr Bart Vermeulen graduated in 2014 on a thesis ‘Rivers running deep: Complex flow and morphology in the Mahakam River, Indonesia’.

Tropical rivers challenge our understanding of rivers. In this thesis, the Mahakam River on the island of Borneo is subject to study. Many meander bends in the Mahakam are sharp and reach depths exceeding sixty meters, more than four times the average depth. The scours in the Mahakam may have been the cause of a bridge collapse, resulting in several casualties, and failure of a coal mine harbour, with large economic damage. The occurrence of sharp bends and deep scours appears to be the result of non-conventional river meandering behaviour. While usually river bends erode on the outer side and aggrade on the inner side, sharp bends show a reversed pattern.

This extraordinary behaviour has large implications for our ability to predict the development of rivers with sharp bends. New methods have been developed to analyse the flow and morphology in rivers with sharp bends. Common assumptions made in turbulence closure schemes were proven invalid, whereas large eddy simulations successfully reproduced the complex flow behaviour.

#### *Modelling rainfall-runoff processes*

In 2014, Dr Claudia Brauer wrote a PhD thesis called “Modelling rainfall-runoff processes in lowland catchments”. Water managers worldwide use hydrological models to forecast river discharges for flood warnings or spatial development projects. Unfortunately, the models that are used in lowland catchments are often complex and computationally demanding, while simple models are usually developed for sloping catchments. In her thesis, Claudia analysed the most important processes which determine the response of a lowland catchment to rainfall. Measurements in the Hupsel Brook catchment (eastern part of The Netherlands) and Cabauw polder (western part) indicate that shallow groundwater causes moist top soils and little water stress for plants, that certain flow routes (for example through drainpipes or over the land surface) are only used when the catchment is wet enough and that high surface water levels limit groundwater drainage. These findings contributed to the development of the Wageningen Lowland Runoff Simulator (WALRUS), a new, efficient hydrological model which can be used by water managers and researchers in lowland catchments worldwide. Now, two years after its publication, WALRUS is increasingly being used by Dutch water boards and engineering firms.

#### **LAR: Landscape Architecture**

*Landscape infrastructure: urbanism beyond engineering*

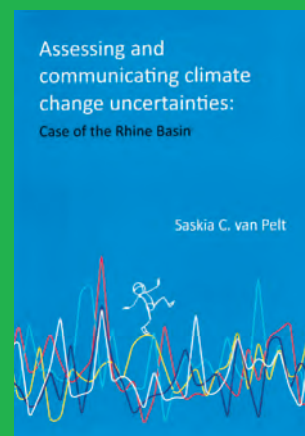
Dr P. (Pierre) Bélanger (LAR) graduated on 13-5-2013 - cum laude (with distinction) - on a thesis “landscape infrastructure: urbanism beyond engineering”.



18/12/2013 | **Oosterkamp, M.J.**  
Physiology and biochemistry of aromatic hydrocarbon-degrading bacteria that use chlorate and/or nitrate as electron acceptor



24/01/2014 | **Braakhekke, M.C.**  
Mechanistic modelling of the vertical soil organic matter profile



27/01/2014 | **Pelt, S.C. van**  
Assessing and communicating climate change uncertainties: case of the Rhine basin



27/01/2014 | **Biesbroek, G.R.**  
Challenging barriers in the governance of climate change adaptation

As ecology becomes the new engineering, the project of Landscape Infrastructure - a contemporary, synthetic alignment of the disciplines of landscape architecture, civil engineering and urban planning - is proposed here. Predominant challenges facing urban regions today are addressed, including changing climates, resource flows, and population mobility. Responding to the inertia of land use zoning and overexertion of technological systems at the end of 20th century, the thesis argues for the strategic design of "infrastructural ecologies", a synthetic landscape of living, biophysical systems that operate as urban infrastructures to shape and direct the future of urban economies into the 21st century.

### Regeneration of Athens' City Centre

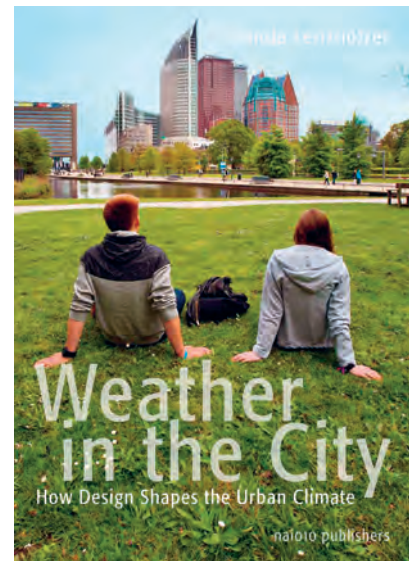
LAR PhD Wiebke Klemm wins international competition for regeneration of Athens' City Centre with OKRA team. On the 27 February 2013 it was announced that the plan "One step beyond" had won the first prize in the prestigious competition "ReThink Athens, towards a new city centre". This plan was developed by the OKRA team, consisting of OKRA Landschapsarchitecten, Mixst Urbanism, and Wageningen University (Wiebke Klemm, LAR in cooperation with Bert Heusinkveld, MAQ). The team was supported by Studio 75 Architects, Greece, and Werner Sobek Green Technologies, Germany. The project "One step beyond" aims to bring contemporary ideas on climate control in cities, ideas on changing transportation nodes and on activating public realm a step further than already realised in many European cities. The project starts from stating that public space is about creating space for people. It is where those masses meet the ground and interact with each other that is the binding element to a city. Therefore it is suggested to implement green public spaces linked to the urban network of public realm, and to retain and improve this space. "One step beyond" focuses on creating a resilient city, accessible city and vibrant city.

### Book publication 'Het weer in de stad / Weather in the city' (author: Sanda Lenzholzer)

In November 2013 Sanda Lenzholzer's book 'Het weer in de stad' was launched. The book explains the way people experience the urban climate and how that depends on physical and psychological factors dictated by our surroundings.

The book uses these factors to explain how the basic processes of the urban climate work and how they can be influenced by spatial planning and urban design. To make these abstract concepts tangible, it is richly illustrated with photographs, diagrams and practical examples.

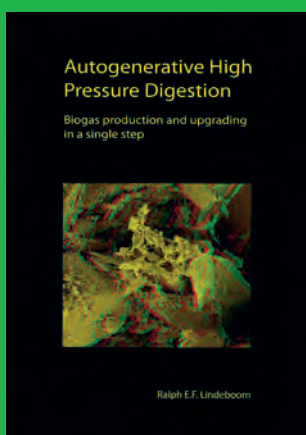
The book is a text book, a reference work and a source of inspiration for all those working to enhance the quality of city life: commissioners, policymakers, professionals and students in urban design, landscape architecture and planning. The book received great media attention in national newspapers and radio. Due to the success of the Dutch version an updated English version was launched soon after in March 2015. Also the English version was received with enthusiasm and received very good reviews.



### MAQ: Meteorology and Air Quality

ERC grant of 2.3 million for Wouter Peters' Amazon research

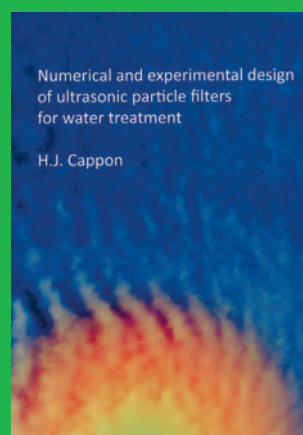
Dr. W. (Wouter) Peters received an ERC grant of 2.3 million in 2015 for his research programme "Airborne Stable Isotopes of CO2 from the Amazon".



27/02/2014 | **Lindeboom, R.E.F.**  
Autogenerative high pressure digestion: biogas production and upgrading in a single step



28/02/2014 | **Maat, H.W. ter**  
Regional atmospheric feedbacks over land and coastal areas



05/03/2014 | **Cappon, H.J.**  
Numerical and experimental design of ultrasonic particle filters for water treatment



12/03/2014 | **Petz, K.**  
Mapping and modelling the effects of land use and land management change on ecosystem services from local ecosystems and landscapes to global biomes



During the serious droughts in 2005 and 2010, the carbon balance in the Amazon region changed from being a carbon sink to a carbon source. It is expected that such droughts will become more frequent and more intense in the future. The question is therefore what the impact will be on the carbon balance and consequently on the climate. Wouter Peters: "The carbon-climate feedback is one of the largest uncertainties in climate predictions because both the extent of CO<sub>2</sub> uptake and the drought response is unknown for rainforests. The amount of carbon involved in these changes is large enough to have a significant impact on future fossil-fuel emissions."

Wouter Peters will be doing his research together with the universities of Groningen (where he is a part-time professor), Utrecht and Leeds, and the Instituto Nacional de Pesquisas Espaciais in Brazil. The research will focus on the question: 'How much CO<sub>2</sub> does vegetation in the Amazon region absorb and how does this uptake change as a result of drought?' The question is extremely relevant because the Amazon region has an enormous biomass, so its carbon balance is characterised by a very large CO<sub>2</sub> uptake due to photosynthesis. However, the CO<sub>2</sub> emission is almost as large because of decay or burning of biomass. The net CO<sub>2</sub> balance in the Amazon region will be an important factor in the global CO<sub>2</sub> balance over the next 50 years.

ASICA (Airborne Stable Isotopes of CO<sub>2</sub> from the Amazon) – the programme that has been awarded the grant – will involve gathering data on this balance by measuring CO<sub>2</sub> in the atmosphere above the rainforest. The levels of CO<sub>2</sub> and other greenhouse gases will be measured, as well as the ratio of stable isotopes. All measurements will then be integrated by using the 'CarbonTracker', which Wouter Peters has already developed ([www.carbontracker.eu](http://www.carbontracker.eu)).

**Urban heat island effect**

Dr. Gert-Jan Steeneveld published a paper<sup>10</sup> on the quantification of the urban heat island effect (UHI) and human



**Urban meteorological measurements by carrier tricycle**

thermal comfort for a wide range of small to large villages and cities in The Netherlands. Since the Netherlands has a relatively mild marine Cfb climate, this topic has so far received only little attention in the last 30 years. The paper surprisingly shows that the urban heat island intensity and adverse thermal comfort occur frequently, and large cities as Rotterdam and The Hague reach values analogue to other large cities in Europe. Moreover, the observations indicate that UHI and thermal comfort indices values above thresholds that directly affect human health and labour productivity during several days per year. As such the paper points towards a problem that was so far not considered as a problem.

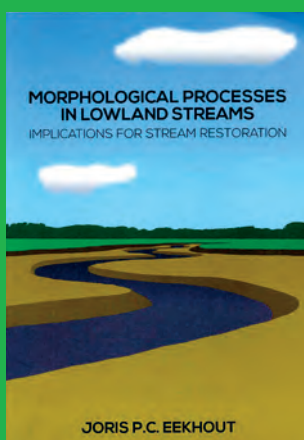
The paper also relates the UHI to urban morphological quantities, i.e. green vegetation, surface water cover and population intensity. It identifies a solid relation between the recorded maximum urban heat island and the amount of green vegetation and population density in the nearby surroundings of the observing stations. These robust relations can act as tools for urban planners to reduce the UHI and adverse thermal comfort in city and neighbourhood (re-)design.



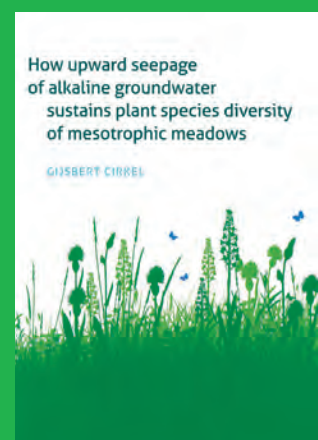
11/04/2014 | **Brauer, C.C.**  
Modelling rainfall-runoff processes in lowland catchments



25/04/2014 | **Rakovec, O.**  
Improving operational flood forecasting using data assimilation



09/05/2014 | **Eekhout, J.P.C.**  
Morphological processes in lowland streams: implications for stream restoration



16/05/2014 | **Cirkel, D.G.**  
How upward seepage of alkaline groundwater sustains plant species diversity of mesotrophic meadows

## MIB: Microbiology

### Exploring new anaerobic microbial conversions

Professors W.M. (Willem) de Vos and A.J.M. (Fons) Stams participate in Dutch Gravitation Programme, coordinated by Prof. Mike Jetten (Radboud University Nijmegen) which received a €22,900,000 grant for research on Microbes for health and environment.

The programme focusses on supporting a sustainable economy by discovering and even designing new microbial communities. This proposal, of a leading group of Dutch microbiologists, earned a Gravitation grant (*Zwaarte-krachtsubsidie*) from the Ministry of Education, Culture & Science. Among them WIMEK researchers prof. Fons Stams and prof. Willem de Vos (MIB).

Top Dutch microbiologists jointly want to tackle one of the grand challenges: the creation of a sustainable biobased economy. Microbes that can live without oxygen (complex anaerobic microbial communities) can play an important role in that. The aim of this project is to discover new anaerobic microbial conversions and even to design synthetic microbial communities that can subsequently be applied in novel sustainable technologies. This will include the efficient production of biogas, the conversion of organic waste into degradable bioplastics, and improved health by optimising the intestinal microbiota. Related to the latter microbes inside us, the WIMEK PhD student Nam Bui MSc published a recent paper in *Nature Communications* (2015)<sup>11</sup> on a novel gut anaerobe that has the capacity to convert lysine into butyrate.

### Novel anaerobes for a biobased economy

Fons Stams of the Laboratory of Microbiology received an ERC Advanced Grant in 2012 to investigate anaerobic microorganisms at Wageningen University and at the University of Minho (Braga, Portugal) where is visiting scientist since 2010 for 3 months a year. Anaerobic microorganisms (microorganisms that can grow without oxygen) are important in environmental

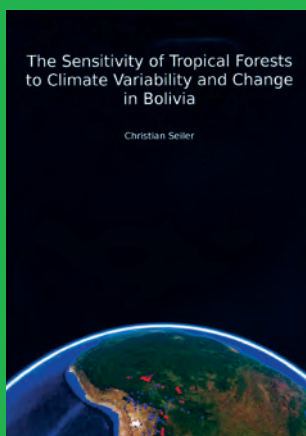
biotechnological processes such as bioremediation of water and soil. Anaerobic microorganisms are also able to convert organic compounds in agricultural side streams to useful products such as biofuels and organic acids. The research described in the ERC proposal Novel anaerobes for a biobased economy aims to isolate and characterise novel anaerobic microorganisms and to apply these novel anaerobes for the production of valuable products such as organic acids.

Molecular ecological research of the past decennia has revealed how little is known about microbial life on Earth. Typically, more than 95% of the microbial phylotypes that are detected with molecular techniques have never been isolated and characterised. The role of these uncultured microorganisms in biogeochemical processes is often unknown, and it also not known if such microorganisms can be applied in biotechnology.

Research of Fons Stams focusses on novel anaerobes that metabolise lignocellulose (Wageningen) and fats (Braga). A main challenge is to isolate from the huge microbial diversity of anaerobic environments those anaerobes that are phylogenetically novel and biotechnologically most interesting.

### Anaerobic methane oxidation by syntrophic communities

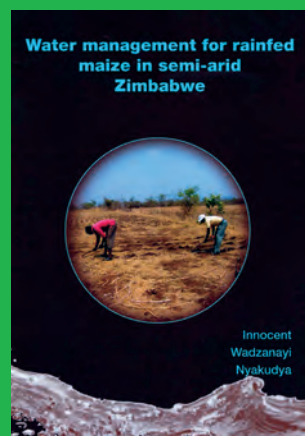
Dr P.H.A. (Peer) Timmers graduated in 2015 on the PhD thesis "Exploring the ecophysiology of anaerobic communities of methanotrophic archaea and sulphate-reducing bacteria". Anaerobic methane oxidation (AOM) is an important process controlling methane emission to the atmosphere. AOM coupled to sulphate reduction was already described for marine environments. In the thesis evidence is presented that AOM coupled to sulphate reduction also occurs in freshwater environments. In future geochemical studies on the methane cycle in freshwater environments besides AOM coupled to nitrate reduction AOM coupled to sulphate reduction needs to be considered as well.



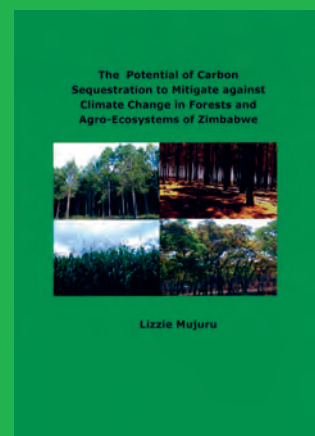
19/05/2014 | **Seiler, C.**  
The sensitivity of tropical forests to climate variability and change in Bolivia



19/05/2014 | **Rakowska, M.I.**  
Ex situ treatment of sediments with granular activated carbon: a novel remediation technology



20/05/2014 | **Nyakudya, I.W.**  
Water management for rainfed maize in semi-arid Zimbabwe



20/05/2014 | **Mujuru, L.**  
The potential of carbon sequestration to mitigate against climate change in forests and agro ecosystems of Zimbabwe

**PEN: Plant Ecology and Nature Conservation (formerly known as NCP)**

*Sensitivity of tundra ecosystems to climate change*  
 The Arctic is warming twice as fast as the global average, which has already resulted in increased shrub cover in Arctic tundra ecosystems. Dr. Monique Heijmans and PhD candidates Ake Nauta, Bingxi Li and Peng Wang have investigated at a Siberian tundra site how such shrub expansion would influence the summer thawing of permafrost. In a field experiment, the removal of the shrub part of the vegetation initiated thawing of permafrost, followed by an unexpected collapse of the originally elevated shrub patches into waterlogged depression within five years. This thaw pond development shifted the plots into a source of the strong greenhouse gas methane. These results demonstrate the importance of the vegetation cover for protection of the massive carbon reservoirs stored in the permafrost and illustrate the extreme sensitivity of tundra ecosystems to perturbations, which has been published in Nature Climate Change (Nauta et al., 2015)<sup>12</sup>.

*Immigrant's perceptions of nature*

Dr. M.E. (Marjolein) Kloek graduated in 2015 on a PhD thesis "Colourful green: immigrants' and non-immigrants' recreational use of greenspace and their perceptions of nature."  
 In various Western countries, such as in the Netherlands, both scholars and nature conservation organisations have described immigrants as under-participating in outdoor recreation. Because of the presumed positive effects of outdoor recreation on support for nature conservation, health and wellbeing, and social integration, low participation levels of immigrants have been perceived as a problem. As the number of immigrants in most Northwest European countries is growing, including in the Netherlands, it is important to gain a better understanding of their outdoor recreational behaviour.



**Kytalyk Nature reserve study site, Northeastern Siberia, Russian Federation**

In this dissertation immigrants' and non-immigrants' recreational use of greenspace and their perceptions of nature have been analysed by means of a qualitative empirical study and a quantitative empirical study among young adults from three different ethnic backgrounds in the Netherlands. The empirical studies were conducted among young adults of Turkish, Chinese and non-immigrant descent in the Netherlands. The dissertation ends with five practical recommendations for policy and management, namely to reflect on the motivations for reaching out to immigrant groups; to recognise diversity between immigrant groups; to look beyond ethnicity (but not to forget it); to acknowledge the multiplicity and contextuality of recreational behaviour; and to question Dutch/Western views on recreation and nature (conservation) as being 'the standard'.

**SLM: Soil Physics and Land Management**

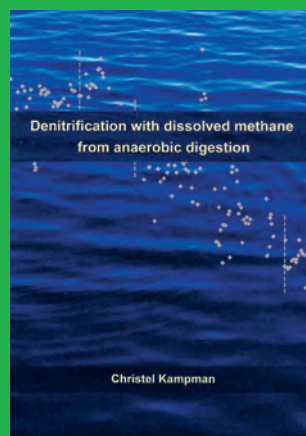
SLM staff has acquired multiple prestigious research grants, amongst others:  
 'Interactive soil quality assessment in Europe and China for agricultural productivity and environmental resilience (iSQAPER)'. This is a 5.8 million Euro project, bringing



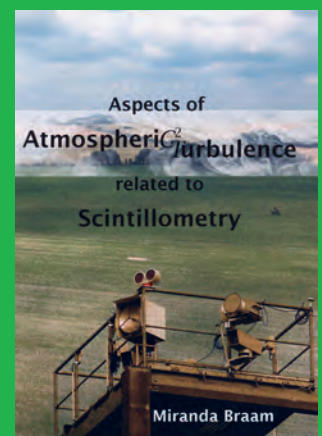
23/05/2014 | **Huijgevoort, M.H.J. van**  
 Hydrological drought: characterisation and representation in large-scale models



26/05/2014 | **Rico Artero, A.**  
 Environmental risk assessment of veterinary medicines used in Asian aquaculture



27/05/2014 | **Kampman, C.**  
 Denitrification with dissolved methane from anaerobic digestion



28/05/2014 | **Braam, M.**  
 Aspects of atmospheric turbulence related to scintillometry

together 27 partners from Europe and China. The project will be executed during 2015-2020. SLM is overall project coordinator. For more info, please, visit <http://www.isqaper-project.eu>

'Preventing and remediating degradation of soils in Europe through land care (RECARÉ)'. This is an 11.1 million Euro project, bringing together 28 partners from European countries. The project will be executed during 2014-2019. SLM is overall project coordinator. For more info, please, visit <http://www.recare-project.eu>

Connecting European Connectivity Research. This is a 1.0 million Euro Cost Action, bringing together 36 partners from Europe and associated countries. The project will be executed during 2014-2018. SLM is overall project coordinator. For more info, please, visit <http://www.connecteur.info>

#### Restoration of seepage dependent meadow ecosystems

Dr. D.G. (Gijsbert) Cirkel graduated in 2014 on a PhD thesis "How upward seepage of alkaline groundwater sustains plant species diversity of mesotrophic meadows". Wet mesotrophic meadows depending on upward seepage of fresh alkaline groundwater, regarded as the Dutch crown jewels of biodiversity, have declined dramatically in both surface area and botanical quality over the last century. Nowadays, these low productive meadows are only found in protected nature reserves, usually small ones, isolated in an intensively used agricultural landscape. The high biodiversity is explained by the supply of unpolluted, base rich groundwater, which ensures a relatively high and stable groundwater level and leads, in combination with a limited amount of infiltrating precipitation water, to small scale water quality gradients in the soil. Deep intensive drainage in the agricultural areas surrounding the reserves resulted in reduced seepage intensities, and increased influence of infiltrated precipitation water in the soil. To restore seepage dependent meadow ecosystems to their full floristic glory, water management

measures should aim at restoring seepage intensities and high groundwater levels, whilst at the same time preserving small scale abiotic gradients.

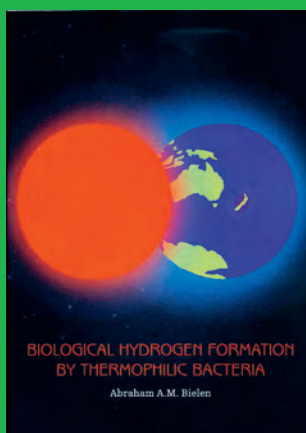
Cirkel's thesis provides integrating insights into the hydrological and biogeochemical relationships between upward seeping groundwater, infiltrating precipitation water and vegetation patterns. These insights contribute to sound management of seepage dependent meadows and to a better understanding of the eco-hydrological effects of changes in water management, changes in climatic conditions and contamination of inflowing groundwater.

#### Flood protection by coastal dunes in times of climate change

Dr. J.G.S. (Joep) Keijsers graduated in 2015 on a thesis "Modelling foredune dynamics in response to climate change".

Coastal dunes are prominent features along many of the world's sandy shorelines. They are valued for their contributions to flood protection, biodiversity, fresh water supply and recreation. The most seaward dune ridge or foredune is the most dynamic part, showing fluctuations in size and morphology in response to erosion by the sea and subsequent recovery by interactions between wind-blown sand and vegetation. Given their dependency on multiple natural processes, coastal dunes may be particularly sensitive to the effects of climate change, including sea-level rise (SLR) and changes in temperature and precipitation.

In this thesis Keijsers has examined the yearly to decadal scale foredune dynamics and the impacts of climate change and management options on these dynamics. Keijsers concludes that sand nourishments are effective to mitigate the effect of sea level rise on coastal dunes. On the long term, it is recommended to use a combination of sand nourishments and remobilisation efforts to preserve the coastline, promote landwards transport and make benefit of a dune's natural self-regenerating capacity.



10/062014 | **Bielen, A.A.M.**  
Biological hydrogen formation by thermophilic bacteria



18/062014 | **Velzeboer, I.**  
Implications of nanoparticles in the aquatic environment



04/07/2014 | **Sutton, N.B. dr.**  
Microbiological and geochemical dynamics of the subsurface: chemical oxidation and bioremediation of organic contaminants



19/09/2014 | **Eerten-Jansen, M.C.A.A. van**  
Bioelektrochemische methaanproductie uit CO<sub>2</sub>

Under the precondition that safety requirements are met, these natural processes enable long-term preservation of flood protection, biodiversity and dynamic landscapes.

**SOQ: Soil Chemistry and Chemical Soil Quality**

*The uptake of trace metals by rice grains*

Dr Yunyu Pan graduated in 2015 on a PhD thesis "Speciation of trace metals and their uptake by rice in paddy soils". Contamination of paddy soils with trace metals and the accumulation of trace metals in rice grains is a worldwide concern, because it can lead to yield reduction of rice, a decline in the nutritional quality of the rice, and accumulation of trace metal contents in rice grains. Moreover, the consumption of rice with high levels of trace metals can lead to unacceptable human health risks. This underlines the need for a thorough understanding of the processes determining the uptake of trace metals by rice plants. In this PhD thesis, Yunyu Pan used a combination of experimental research and mechanistic modelling to investigate the solubility of trace metals in paddy soils exposed to alternating flooding and drainage and to link trace metal solubility to the uptake by rice plants over time. This PhD study contributes to the understanding of trace metal solubility in flooded soil and sediment systems, the development of multi-surface modelling, the derivation of risk-based standards, and the production of safe rice on contaminated paddy soils.

**TOX: Toxicology**

*Persistent organic pollutants (POPs) in Antarctic marine ecosystem*

Although Antarctica is remote and considered pristine, unexpectedly high levels of more or less volatile persistent organic pollutants (POPs) have been detected in organisms from this region. This is related to the so-called global distillation effect. Recently, levels of POPs in the pelagic part of the marine system (the "floating" part) were shown to decrease in time, while concentrations in ben-

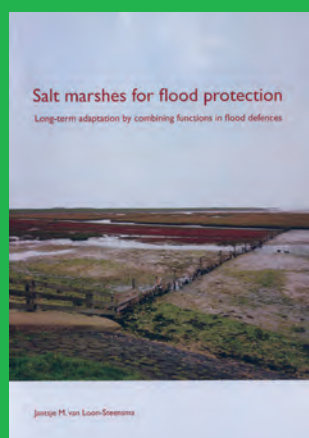


**FluxPOPs project, Antarctica**

thic organisms (at the sea floor) showed an increase in time. It is hypothesised that this discrepancy is closely related to sea ice dynamics and the related algal blooms. Considering the potential impacts of climate change on future sea ice dynamics, mechanistic understanding of the environmental fate of POPs in the Antarctic marine ecosystem is of eminent importance for predicting future trends. In order to study such environmental kinetics, PhD candidate Artem Krasnobaev, Dr. Nico van den Brink and MSc student Melvin Faber performed fieldwork for the NWO-funded (Netherlands Polar Programme) project FLUXPOPs at Rothera research station (British Antarctic Survey). Elucidating depth profiles and seasonal time trends of POPs will provide empirical inputs for modelling future trends of POPs in Antarctic ecosystems, which can be used to monitor their global background levels and as such the effectiveness of world-wide policies to minimise the environmental release of these harmful substances.

*Environmental effects of nanomaterials*

Dr. Merel van der Ploeg graduated in 2013 on a PhD-thesis "Unravelling hazards of nanoparticles to earthworms, from gene to population". Nanomaterials are used in more



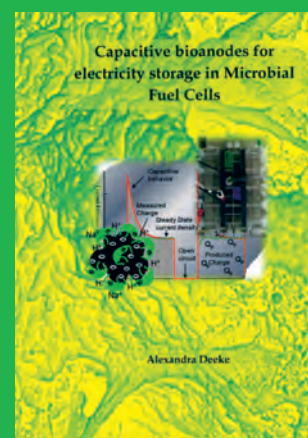
08/10/2014 | **Loon-Steensma, J.M. van**  
Salt marshes for flood protection. Long-term adaptation by combining functions in flood defences



10/10/2014 | **Tervahauta, T.H.**  
Phosphate and organic fertilizer recovery from black water



10/10/2014 | **Kuipers, J.**  
Distributed light sources for photocatalytic water treatment



10/10/2014 | **Deeke, A.**  
Capacitive bioanodes for electricity storage in Microbial Fuel Cells

and more (consumer) products, and it is expected that environmental release will increase. The small size of the nanomaterials provides them with very specific properties for which environmental fate and effects cannot be predicted, yet. In this study, van der Ploeg showed effects of nanoparticles on earthworms at different levels of biological integration, from gene to population.

The dissertation provides essential knowledge about the potential effects of nanoparticle exposure on earthworms and the mechanisms underlying these effects, but also showed the need for better characterisation and quantification of exposure conditions and levels. This is currently being studied by two PhD-students at the department, Sunday Makama (defence 15 September 2016) and Marta Baccaro (2015-2019).

### WRM: Water Resources and Management

*Climate change threatens already volatile Urmia Lake*  
Climate change is likely to worsen the situation of the largely drought-stricken hypersaline Urmia Lake in Iran. Even in the most optimistic climate change scenario and without any further human impact. This is shown by Wageningen University researchers in a study published by the Science of The Total Environment journal on 15 April 2016<sup>13</sup>.

The surface area of Urmia Lake has declined by 80% to the lowest recorded level over the last two decades. As a result, the salinity of the lake has sharply increased. This is disturbing the ecosystems, local agriculture and livelihoods, regional health, as well as tourism. The socio-environmental consequences are similar or even larger than those of the Aral Sea disaster. Thousands of people around the lake have already abandoned the area. The lake is drying out because of a combination of factors. Over the past decades, agricultural area has tripled. This resulted in a high irrigation water demand, surface flow diversions and groundwater extraction. Efficient water management stayed behind. During the same period, a significant decrease in precipitation and an increasing



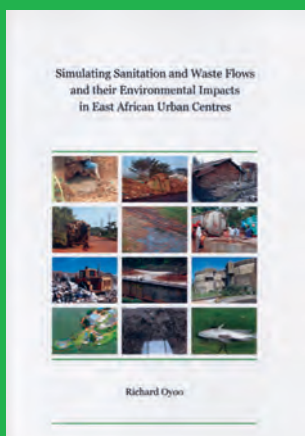
Urmia Lake

Photo: Mehran Biparva

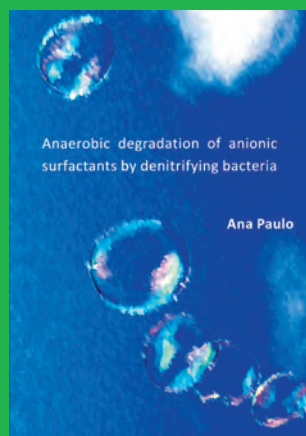
trend in average maximum temperature took place.

A new water management plan to rescue the lake has been proposed, entailing a rapid 40% decline in use of irrigation water. It replaces a former plan which intended to develop reservoirs and irrigation. However, none of these water management plans, which have large socio-economic impacts, have been assessed under future changes in climate and water availability, says Somayeh Shadkam, PhD at Wageningen University. Together with colleagues she explored the impacts of water resources management plans on the inflow into Urmia Lake during the 21st century as part of her PhD-research.

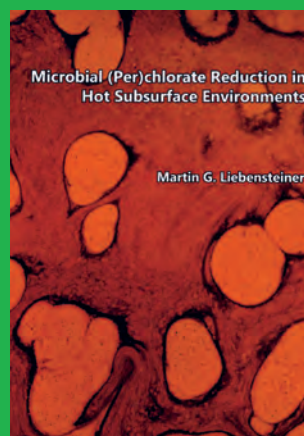
The results show that the proposed irrigation plan can help to preserve the lake only if the future climate change will be very limited. "This means that urgent actions are needed to save the lake. It involves both regional action to limit human water use, and global action to limit greenhouse-gas concentration." The results also indicate that for the whole range of climate change scenarios, the area will have less water available in the future. "This is an important message not only for Urmia basin, but also for the wider region. Water scarcity is increasing in this area and we need to adapt," Shadkam says.



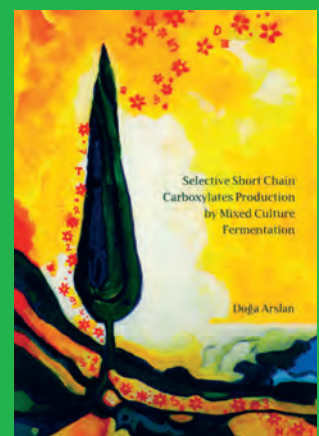
14/10/2014 | **Oyoo, R.**  
Simulating sanitation and waste flows and their environmental impacts in East African urban centres



15/10/2014 | **da Silva Paulo, A.M.**  
Anaerobic degradation of anionic surfactants by denitrifying bacteria



17/10/2014 | **Liebensteiner, M.**  
Microbial (per)chlorate reduction in hot subsurface environments



21/10/2014 | **Arslan, D.**  
Selective short chain carboxylates production by mixed culture fermentation

# Societal impact

WIMEK researchers play an important role in the scientific underpinning of national and international policy documents regarding climate change, reduction of biodiversity, the disturbance of ecosystems and a sustainable reform of production and consumption. They participate actively in advisory boards of governmental and non-governmental organisations and are frequently asked to comment on recent developments in newspapers, on radio and television. Moreover, new system concepts and technological and management solutions are being developed and disseminated to companies, governments and non-government institutions practising “the science for impact mission” of WIMEK and Wageningen University.

## Some highlights

### Smart Solutions for Sustainable Cities (AMS)

WIMEK researchers are strongly involved in the AMS initiative: the Amsterdam Institute for Advanced Metropolitan Solutions. AMS Institute is a new ambitious scientific institute located in Amsterdam. In this institute science, education, government, business partners and societal organisations are working closely together to create solutions for the complex challenges a metropolitan region like Amsterdam is facing now and in the future. The scientific partners are Wageningen UR, TU Delft, MIT and TNO. Moreover, WIMEK is the coordinator of the Wageningen UR wide Knowledge Investment Theme “Metropolitan Solutions” (MetSol), which will be connected closely to the AMS initiative.

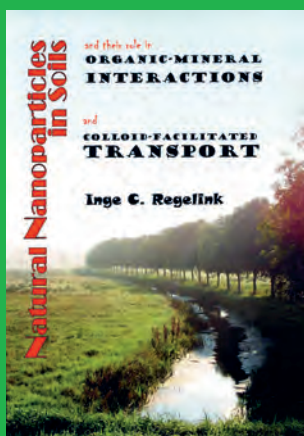
Examples of AMS projects with contributions of WIMEK researchers are:

*Rain Sense (TU Delft, Wageningen UR, IBM, Cisco, Waternet, Deltares, KPN)*

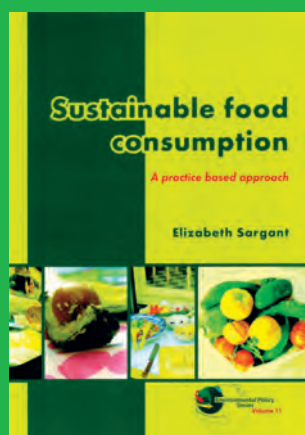
Rain Sense will make Amsterdam more resilient to flooding and to damage from severe weather conditions. Thanks to smart innovations such as monitoring stations umbrellas that double up as mobile rain gauges, and an app that residents can download onto their phones, the researchers can track the rainfall in Amsterdam right down to street level. People with the app will be able to report problems by uploading photos, noting the location of the rainfall, and remote-checking that their own home is dry. This will enable partners like Waternet to visualise potential problems in good time and take appropriate precautions to contain any damage from heavy downpours.

*Urban Pulse (Wageningen UR, TU Delft, Massachusetts Institute of Technology, City of Amsterdam, Waternet, AEB Amsterdam, Waag Society, Alliander and Port of Amsterdam)*

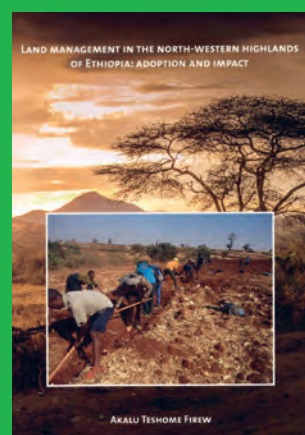
Urban Pulse generates the knowledge required to build sustainability strategies for energy, water, food, and natural resources in the city. A fresh approach to ‘urban metabolism’ can ensure that Amsterdam will be spared shortages of energy, water, food or natural resources in the future, and will reduce environmental pressure. This can only be achieved by acquiring a clear and precise understanding of the flow patterns of essential resources in the city. The researchers use a combination of methods and technologies informed by local residents, knowledge and industry partners. Data of different urban flows such as water, waste, food and energy must be integrated and made easily accessible to relevant stakeholders. Only then can it become possible to identify options for reuse, cascading and synergies between these different urban flows.



07/11/2014 | **Regelink, I.C.**  
Natural Nanoparticles in Soils and their role in organic-mineral interactions an colloid-facilitated transport



02/12/2014 | **Sargant, E.M.**  
Sustainable food consumption: A practise based approach



02/12/2014 | **Firew, A.T.**  
Land management in the north-western highlands of Ethiopia: adoption and impact



03/12/2014 | **Faust, L.**  
Bioflocculation of Wastewater Organic Matter at Short Retention Times



*Filling in the blind spots of urban air quality together with citizens (Wageningen UR, Ministry of Infrastructure and the Environment, LongFonds, KNMI, ECN, Waag Society, Smartsensors.me, GGD Amsterdam)*

The group will measure air quality on streets of Amsterdam with high NO<sub>2</sub> concentrations together with citizens, in multiple design and measuring sessions, and develop new techniques to combine official and alternative (crowdsourced) data.

*Green Junkie: Exploring added value of a new green innovation for an economical vital city (Wageningen UR, Corporation MyEarth, Amsterdam Engineering Bureau Sacha Stolp)*

Pilot project with a plant named 'Green Junkie' to reduce air pollution and absorb fine particles onsite at the Amsterdam "Zuid-as".

*Smart Wasting in Amsterdam (Wageningen UR, CREM, Waste department Municipality of Amsterdam)*

This stimulus project will contribute to the big waste challenge of the city by: gaining insight in the waste dynamics and practices, design of a conceptual model relating waste

production and separation practices with demographic characteristics of neighbourhoods in Amsterdam and finally the design, implementation and application of a spatially explicit model for the optimal location of waste containers.

*Climadaptool (Wageningen UR, start-up G.H. Sterenberg, Municipality Amsterdam, ANMEC)*

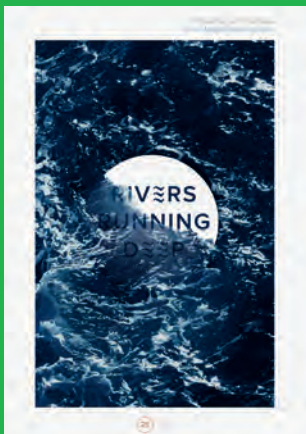
A data system and smartphone app which shows urban climate high resolution maps, indicating urban climate problems (such as heat stress) and potentials for improvement. Additionally, the CLIMADAPTOOL provides a recommendation map with location specific interventions for urban climate improvement.

*Industrial symbiosis in closing the chain of mineral building materials in the Amsterdam Metropolitan Region (Wageningen UR, ECN)*

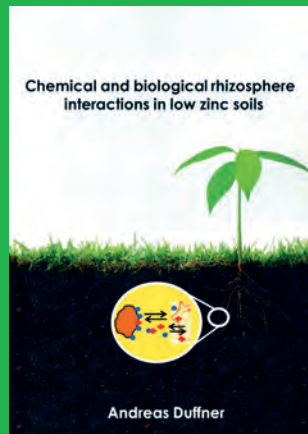
This project will provide an overview of mineral building materials flows and properties in the Amsterdam Metropolitan Region and the potential for industrial symbiosis for these materials.

### **Finalisation Knowledge for Climate Programme**

Knowledge for Climate (2007-2014) was a Dutch research programme that aimed to develop applied knowledge, through cooperation between the Dutch government, the business community and scientific research institutes, in order to ensure that long term decision making takes into account the impacts of climate change. Wageningen University and Research Centre, Utrecht University, VU University Amsterdam, KNMI, TNO and Deltares combined forces in this research programme to generate the applied knowledge, together with other academic institutes, the business community and the government (central government, provinces, municipalities and water authorities), necessary to assess investments in spatial planning, infrastructure and institutions in terms of their resistance to climate change and to make changes where necessary.



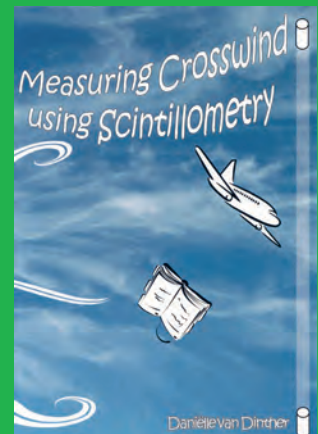
08/12/2014 | **Vermeulen, B.**  
Rivers running deep. Complex flow and morphology in the Mahakam River, Indonesia



15/12/2014 | **Duffner, A.**  
Chemical and biological rhizosphere interactions in low zinc soils



14/01/2015 | **Visser, M.**  
One-carbon metabolism in acetogenic and sulfate-reducing bacteria



16/01/2015 | **Dinther, D. van**  
Measuring crosswind using scintillometry



The national "Knowledge for Climate" programme has been rounded off with the International Conference "Deltas in Times of Climate Change II" (24 – 26 September 2014, Rotterdam, The Netherlands). The conference, with over 1300 participants from more than 50 countries was a great success. Professor Pier Vellinga, extraordinary professor of Climate Change and Adaptive Land and Water Management (ESS), was the chair of the conference.

Many WIMEK researchers have contributed to the results of the Knowledge for Climate research programme, for example as consortium leaders on Climate Adaptation for Rural Areas (prof. Adri van den Brink) and Decision Support Tools (prof. Ekko van Ierland).

### Citizen Science

On the occasion of the celebrations marking 750 years since Wageningen was granted city rights, Arnold van Vliet was honoured with the Gilded Wageningen Honorary Silver Medal by the Mayor of Wageningen Geert van Rumund on 12 June 2015, for "making essential, structural contributions over a lengthy period of time to a Wageningen-based institution of social importance, also benefiting the community of Wageningen itself." On top of that Van Vliet was ranked number 55 to the Sustainable Top 100 (2015), which the Dutch newspaper Trouw composes annually. Dr A.J.H. (Arnold) van Vliet (ESA) is specialised in the development and coordination of citizen science networks. The main network is the Dutch phenological network "Nature's Calendar", ([www.natuurkalender.nl](http://www.natuurkalender.nl)) that aims to monitor, analyse, predict and communicate the timing of life cycle events like e.g. the start of flowering, appearance of butterflies and the arrival of migratory birds. Nature's Calendar network aims to help society to adapt to climate change ecological impacts. Other examples of citizen science networks that are set up are the Mosquito Radar ([www.muggenradar.nl](http://www.muggenradar.nl)), Allergy Radar ([www.allergieradar.nl](http://www.allergieradar.nl)) and Tick Radar ([www.tekenradar.nl](http://www.tekenradar.nl)).

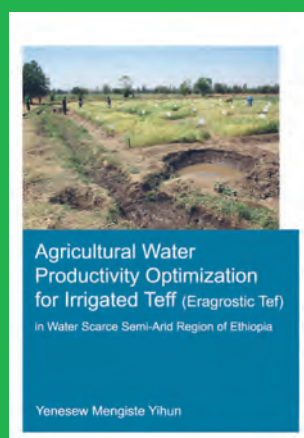


Dr Arnold van Vliet catching ticks

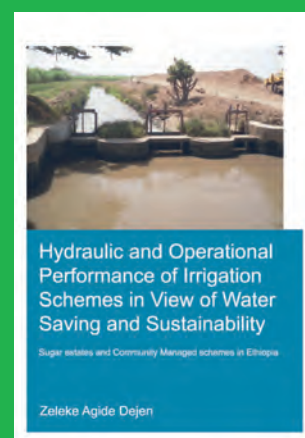
Furthermore, Van Vliet is specialised in communicating science to society. He is coordinating the nature news website Nature Today (<https://www.naturetoday.com/intl/nl/home>) where over twenty nature organisations publish two nature reports per day on current developments in nature in The Netherlands aiming to bring nature into the news domain and to increase the interest of society in nature. In the coming years they want to involve biologists from other countries to also publish their stories on Nature Today.



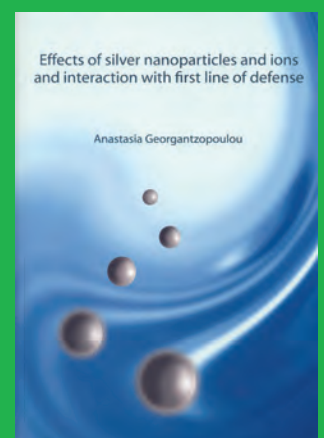
21/01/015 | **Oudenhoven, A.P.E. van**  
Quantifying the effects of management on ecosystem services



22/01/2015 | **Yihun, Y.M.**  
Agricultural water productivity optimization for irrigated teff (eragrostic tef) in a water scarce semi-arid region of Ethiopia



22/01/2015 | **Dejen, Z.A.**  
Hydraulic and operational performance of irrigation schemes in view of water saving and sustainability: sugar estates and community managed schemes In Ethiopia



06/02/2015 | **Georgantzopoulou, A.**  
Effects of silver nanoparticles and ions and interaction with first line of defense

## Sustainable Food Policy

ENP staff have been active in public policy debates. In 2014 Dr Peter Oosterveer was instrumental in guiding the analysis made for Scientific Advisory Board to the Dutch government entitled 'Towards a Food Policy' (Naar een voedselbeleid). He was also active in the review of the Sustainable Trade Initiative at the Ministry of Foreign Affairs in 2015.

## Sustainable sanitation in East Africa

Based on the successfully concluded INREF funded PROVIDE project, Dr Bas van Vliet (ENP) has developed an East Africa based alumni network of former Provide PhD-researchers. The goal of the network is to provide a structural basis for future collaboration in education and research on urban sanitation, water and waste.

## Water Nexus: Salt water where possible, Fresh water where necessary

Water Nexus is a new NWO-STW research programme of 6 Million Euro that will run from January 2015 to 2020, and is supported by 25 partners from multinational and small/middle sized companies, consultancy firms, research institutes, water boards, and the Ministry of Infrastructure and Environment. It is coordinated by Prof. Huub Rijnaarts of the Environmental Technology group.

In total 15 PhD and 2 postdoc researchers will work together to develop new solutions for water supply in fresh water scarce coastal regions in the Netherlands and abroad.

The project focuses on strategies to balance water supply and water demand between industrial and agricultural systems and contain both saline and fresh water options. The search project includes water technology and green technologies such as wetlands. The emphasis will be on industry and agri/horticulture where large volumes of water are produced and used.

Technologies and management strategies will be developed that enable climate change adaptation by exchange of water between industry, agriculture, urban and natural

systems, the use of brackish water as a resource, and the inclusion of green infrastructure for water storage and treatment.

## Innovation Technology Award for Kirsten Steinbusch

ETE post doc, MSc and PhD graduate Dr. Kirsten Steinbusch was awarded the Hoogewerff Stimulation Prize 2014 for innovation in the field of process technology research. Steinbusch was granted the prize because of her groundbreaking research activities in the field of conversion of organic waste into valuable components and building blocks for the chemical industry. She started her own company W2C (waste to chemical) to introduce this technology into the market.

## Marjolein Helder (CEO Plant-e) speaks at TEDx Binnenhof and switches on the lights powered by living plants

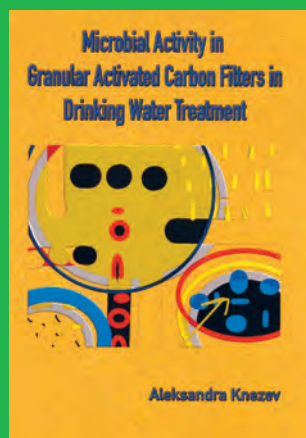
On March 31st 2014 ETE alumna Marjolein Helder, researcher at the Sub-Department of Environmental Technology and CEO of the company Plant-e, was one of the eleven speakers at TEDx Binnenhof. The theme of the day was "Global challenges, Dutch solutions". Helder spoke about generating electricity from living plants. The principle of this novel technology is that microorganisms degrade organic material excreted by the plant's roots, while releasing electrons. Calculations have shown that one hectare of plants generates enough energy for 80 households. Helder demonstrated the principle by charging her cell phone using plants. She finished her presentation with a song 'It's not easy being green' and received a standing ovation.

In addition, she presented the breakthrough technology behind Plant-e on Dutch Television in 2013 and at the World Economic Forum Davos in 2016.

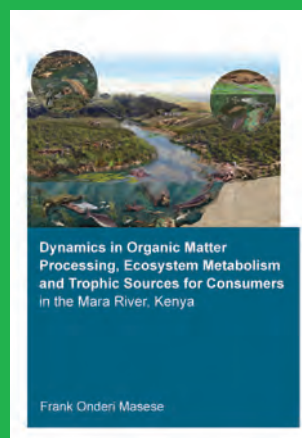
Moreover, on Wednesday November 5, 2014 the Netherlands was the first country in the world where lights were



06/02/2015 | **Boer, A. van de**  
Atmospheric turbulence over crops: Confronting theories with observations



27/02/2015 | **Knezev, A.**  
Microbial activity in granular activated carbon filters in drinking water treatment



11/03/2015 | **Masese, F.O.**  
Dynamics in organic matter processing, ecosystem metabolism and trophic sources for consumers in the Mara River, Kenya



19/03/2015 | **Haren, R. van**  
Assessment of uncertainties in simulated European precipitation



**Dr Marjolein Helder presenting at TEDx Binnenhof**

powered by living plants. The municipalities of Ede and Wageningen (home to the innovative young company Plant-e of WIMEK alumna Marjolein Helder) and the Central Government Real Estate Agency (owner of the old ammunition site Hembrug) are Plant-e's first customers and have switched on the lights that are powered by a modular plant-system, the first of its kind in the world.

### **Climate change and gas and oil exploration activities in the arctic**

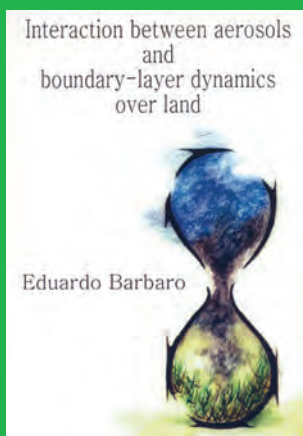
After the PEN publication in Nature Climate Change the research in Siberian tundra got quite some media attention, including a full-page article in De Volkskrant. Shortly after this publication, Dutch parliament members referred to the tundra research in the climate debate. They requested the government to plead for a ban on oil and gas exploration activities in the Arctic, based on the finding that even disturbance of part of the vegetation can trigger feedback loops that cause permafrost collapse and an ecosystem shifting from being a greenhouse gas sink to a source. The resolution was accepted by Dutch parliament in December 2014.

### **Rodenticides affect birds of prey and owls**

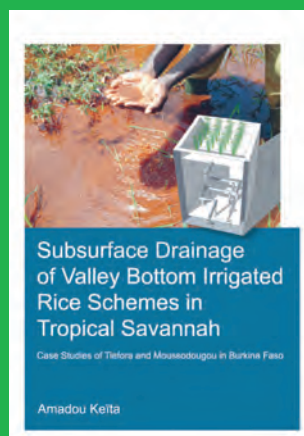
In 2014 Nico van den Brink finalised a first inventory of exposure of birds of prey and owls to anti-coagulant rodenticides (Alterra report). Based on a limited dataset it was shown that approximately 50% of the birds were exposed to these rodenticides, potentially impacting them, which is in line with other European research. This report got quite some media attention, including an interview in "Vroege vogels" (February 8th 2015). This report sparked discussions at the ministry of Infrastructure and Environment, also in relation to the development of an Integrated Pest Management approach. This was emphasised in a letter to the Tweede Kamer (2 July 2015) in which Staatssecretaris Mansveld (I&M) stressed the need for research on the effectiveness of adequate implementations of Integrated Pest Management (IPM).

### **WRM PhD Melle Nikkels wins prize for technique to reduce salinity of brackish water**

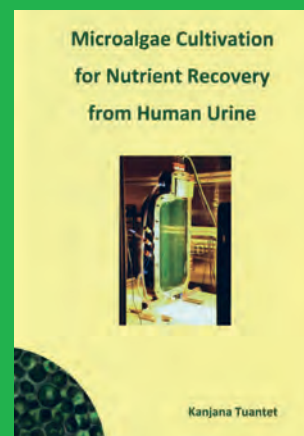
The Fource project created by Lodewijk Stuyt from Alterra and SENSE PhD candidate Melle Nikkels from Wageningen University has won first prize at Water Republic x SAIL 2015 Innovation Edition. Fource is a 'Standalone Farm Water Salinity Reducer', a technique used to make shallow, brackish water suitable for agricultural purposes by reducing the salinity. The aim is to make food production less vulnerable to salinization, a problem that is becoming increasingly serious throughout the world. Mild desalinisation is often enough to enable farming in areas that would otherwise be unsuitable or are in jeopardy of increased salinization. People assume that water for agriculture must be entirely fresh, but this isn't the case. A bit of salt is okay so in some areas, an instrument like Fource, which 'trims' the salinity, can make the difference between being able to produce food and not being able to produce food. The first prize will allow Stuyt and Nikkels to continue developing Fource beyond the current prototype stage.



20/03/2015 | **Wilde Barbaro, E.**  
Interaction between aerosols and convective boundary-layer dynamics over land



26/03/2015 | **Keita, A.**  
Subsurface drainage of valley bottom irrigated rice schemes in Tropical Savannah. Case studies of Tiéfora and Moussodougou in Burkina Faso



21/04/2015 | **Tuantet, K.**  
Microalgae cultivation for nutrient recovery from human urine



24/04/2015 | **Galama, A.H.**  
Ion exchange membranes in seawater applications Processes & Characteristics

# Our education

## The PhD education and training programme

All WIMEK PhD candidates participate in the SENSE PhD training programme. This training programme aims (i) to train PhD candidates to be able to conduct research in a systematic and productive way, (ii) to translate environmental problems into relevant and sound research proposals, (iii) to work effectively in an international arena, (iv) to contribute to an improved understanding of the causes and effects of environmental problems and of possible solutions, and (v) to increase the impact and relevance of their research for society.

In the end, we wish to help PhD candidates in performing their PhD study, in understanding the wider environmental and societal context of their study, and in preparing them for their future careers.

## Examples of specialised PhD courses

In the period 2013 - 2015, WIMEK has been involved in the coordination and organisation of several international PhD courses, for example:

Photo: Monique Gulickx



Exercise for transdisciplinary collaboration

## Grasping Sustainability (from 2015 yearly; 1.5 EC)

The PhD course Grasping Sustainability was offered for the first time in 2015. The course aims to explore and understand sustainability, the different concepts, objectives and methodologies to improve the sustainability goals of the PhD research. This on-site course enables the participants to grasp sustainability and to apply concepts and approaches to their own research in a collaborative and interdisciplinary learning environment. Our intention is to offer this course once a year.

## Human Induced Soil Degradation (14 - 18 July 2014; 3.0 EC)

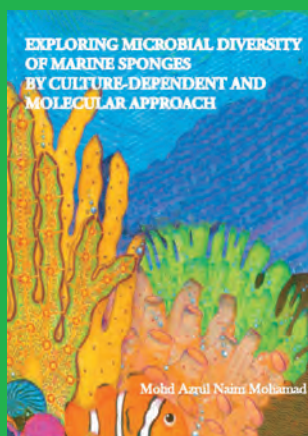
Soil degradation induced by humans is a very actual and increasing problem all over the world. Population growth, unsustainable management of natural resources, as well as increasing amount of harmful chemicals in the environment, lead to severe land and soil degradation. The phenomena of soil degradation have to be considered in a socio-ecological context with respect to economic, cultural and social conditions. In this course we use an interdisciplinary approach to teach about the different syndromes of soil degradation in different countries of the world and their consequences for people and the environment. Furthermore, the course focuses on finding solutions and sustainable management strategies.

## Modelling Critical Transitions in Nature and Society (17 - 21 February 2014; 2 EC)

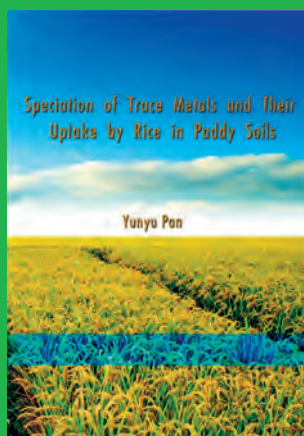
It has become clear that many systems may go through critical transitions or tipping points. Not only ecosystems, but also the climate, depressed patients and financial markets may suddenly undergo dramatic change. After a tipping point it may be difficult or impossible to restore



29/04/2015 | **Sterk, H.A.M.**  
Modelling Stable Atmospheric Boundary Layers over Snow



30/04/2015 | **Mohamad, M.A.N.**  
Exploring microbial diversity of marine sponges by culture-dependent and molecular approaches



12/05/2015 | **Pan, Y.**  
Speciation of trace metals and their uptake by rice in paddy soils



26/05/2015 | **Klok, J.B.M.**  
Modeling studies of biological gas desulfurization under haloalkaline conditions

the original situation. Therefore, there is a strong need to predict the occurrence of such transitions as early as possible. Recently researchers have made much progress by identifying generic indicators of the proximity to a tipping point, so-called early warning signals. This theory has been developed using mathematical models of various complexity. During this course the PhD candidates learn the theory of critical transitions and how to apply this in their own study. The course is divided in two parts. The first part involves the analysis of mathematical models and an introduction to early warning signals. The second part consists of (making a plan) how to apply modelling or tipping points in the PhD candidates own work. This course takes place about every two-three years, the next edition is planned early 2017.

*Principles of Ecological Genomics (8 – 10 April 2015; 2 EC)*

Ecological genomics is a new scientific discipline, which studies ecological complexity, nutrient cycles, life-history patterns and responses of organisms to environmental stress at the genomic level. Analysis of environmental genomes will improve our understanding of ecosystem functions and biodiversity and may help to define and measure environmental quality. This course is intended for those just embarking on genomics within an ecological setting and teaches the fundamentals of the discipline, while concentrating on ecological questions. The course focuses on three topics: (i) Comparative genomics; (ii) Metagenomics & systems biology and (iii) Functional genomics of environmental change.

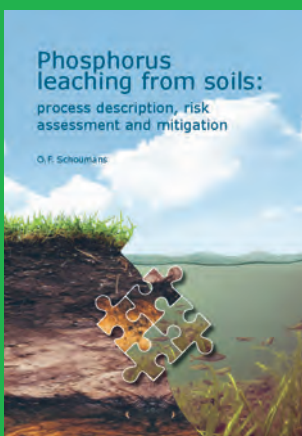
*General skills courses*

All PhD candidates need several skills for conducting their research that are independent of their research topic. We call these general skills, which includes competence assessment, scientific writing and presenting; English proficiency; project and time management; scientific integrity; networking; information literacy; career orientation and several more. WIMEK has joined forces with the other Wageningen University Graduate schools, including Experimental Plant Sciences (EPS), Production Ecology and Resource Conservation (PE&RC), Wageningen School of Social Science (WASS), Wageningen Institute of Animal Sciences (WIAS), and Food and Nutrition, Agro-Biobased technology and health (VLAG), and formed the Wageningen Graduate Schools (WGS) to organise these general skill courses together. WIMEK contributes to the organisation of these courses.

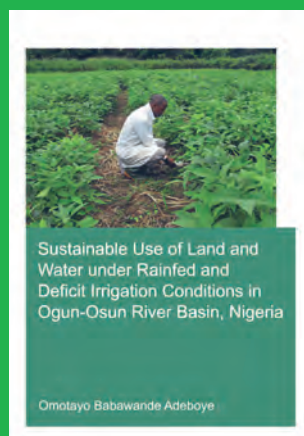
*Collaborations*

WIMEK collaborates with other Wageningen Graduate Schools, SENSE partner institutes, the Research School Ecology and Evolution (RSEE-RUG) and the Postgraduate Education programme on Toxicology (PET) to offer a broad spectrum of PhD courses, such as:

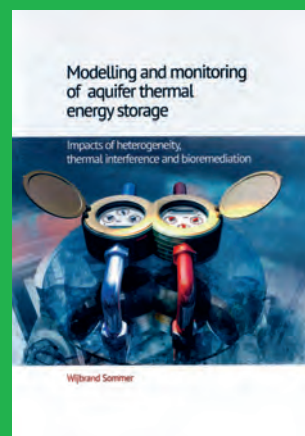
- Ecotoxicology and Risk Assessment (PET)
- Statistical courses (PE&RC)
- Advanced courses in ecology (together with PE&RC and RSEE)
- Advanced courses in social sciences (WASS).



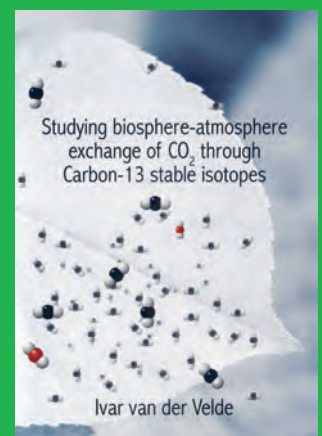
26/05/2015 | **Schoumans, O.F.**  
Phosphorus leaching from soils: process description, risk assessment and mitigation



28/05/2015 | **Adeboye, O.B.**  
Sustainable use of land and water under rainfed and deficit irrigation conditions in Ogun-Osun River Basin, Nigeria



04/06/2015 | **Sommer, W.T.**  
Modelling and monitoring of Aquifer Thermal Energy Storage. Impacts of heterogeneity, thermal interference and bioremediation



05/06/2015 | **Velde, I.R., van der**  
Studying biosphere-atmosphere exchange of CO2 through Carbon-13 stable isotopes

# WIMEK - SENSE Symposia

*NCGG7 Seventh International Symposium on Non-CO2 Greenhouse Gasses: Innovation for a Sustainable Future (5 – 7 November 2014, Amsterdam, The Netherlands)*

*Coordinator: professor C. (Carolien) Kroeze*  
Methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), fluorocarbons (CFCs, HFCs, SF<sub>6</sub>, etc.) black carbon, aerosols and tropospheric ozone (O<sub>3</sub>) contribute significantly to climate forcing. Reducing emissions of these non-CO<sub>2</sub> greenhouse gasses (NCGG) is often more cost-effective than reducing CO<sub>2</sub> emissions. This leads to an enhanced interest in, and need for significant NCGG-emission reductions. Roadmaps addressing NCGG-emission reduction measures from policy towards implementation are still missing or incomplete in many countries. Integrated studies at the science-policy interface that take into account international trends will support the development of efficient NCGG policies and measures.

The main objective of the NCGG7 was to address both the

role of non-CO<sub>2</sub> greenhouse gasses and aerosols in human-induced climate forcing, and provide options for their reduction by industry and society. The symposium focused also on removing the barriers between policy, industry and science and fostered the dialogue between scientists, engineers and officials in industry and government working in this field from different perspectives. The symposium, coordinated by professor C. (Carolien) Kroeze (ESA) was a big success. Over 260 people, from 40 different countries, have attended the conference.

*8th Annual International Symposium on "Carbon-Water-Energy balance and climate over boreal and arctic regions, with special emphasis on eastern Eurasia", 10 - 12 November 2014, Wageningen.*

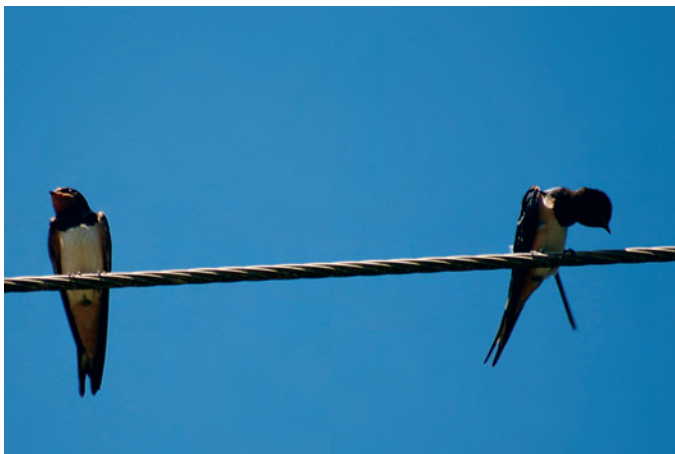
*Coordinator: Dr. Monique Heijmans (PEN)*  
Global warming will likely transform Siberian environments. Early evidence indicates that carbon and hydrologic cycles are undergoing rapid change. These changes in the C/H<sub>2</sub>O/Energy balance and climate over the vast permafrost regions of Siberia potentially have grave impacts on the global climate system as well on Siberian flora and fauna. Since 1998, intensive field observations on C/H<sub>2</sub>O/Energy cycles have been carried out in the permafrost regions of East-Siberia by Russian, Japanese and European researchers. During this 8th symposium the most recent research results were presented and discussed.

*SENSE Symposium Carbon-Climate Interactions: from Science to Policy*

*12 January 2015, Wageningen Coordinators: Marie Combe & Denica Bozhinova (MAQ PhDs)*

The carbon cycle and the climate system are interconnected and changes in one affect the other through multiple

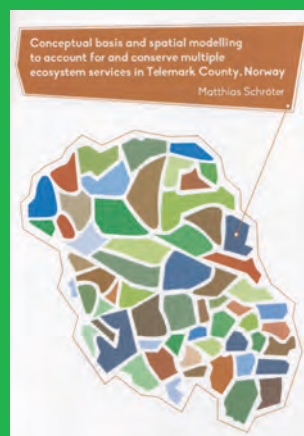
Photo: Dr. Arnold van Vliet



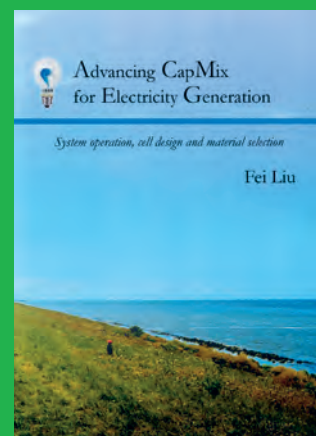
08/06/2015 | **Alvarez Fernandez, S.**  
Rhyme and Reason: Plankton changes in the North Sea Ecosystem



08/06/2015 | **Pauw, P.S.**  
Field and Model Investigations of Freshwater Lenses in Coastal Aquifers



10/06/2015 | **Schröter, M.**  
Conceptual basis and spatial modelling to account for and conserve multiple ecosystem services in Telemark County, Norway



10/06/2015 | **Liu, F.**  
Advancing CapMix for Electricity Generation - System operation, cell design and material selection

feedback processes. Until recently, the models describing the two systems were usually separated, with global annual mean CO<sub>2</sub> concentrations specified into the climate models, while only crucial atmospheric and oceanic processes were included in the carbon cycle ones. With the progress in the understanding in both compartments and the continuous development of better Earth System models, however, it was inevitable that they would eventually merge.

The new generation of carbon-climate models include the coupling of the two systems and the feedbacks between them. This development has led to significant changes in the predictions for the future climate change and will possibly lead to further changes to the mitigation and adaptation strategies worldwide, as recorded in the latest IPCC Assessment report.

In this symposium, the current knowledge and advances in the study about the carbon cycle and climate change were presented and how it affects policy making.

*Summer Academy on Economic Growth and Governance of Natural Resources;  
20 July – 1 August 2015, Lomonosov Moscow State University, Russia*

*Co-organiser: Dr Andries Richter (ENR)*

The Moscow Summer Academy on Economic Growth and Governance of Natural Resources focused on contemporary concepts of the management of natural resources and economic growth and discussed the methodological and applied challenges in this field. Among the considered tools were nonlinear dynamic systems, multi-criteria optimisation, evolutionary and dynamic games, and agent-based modelling.

*SENSE Symposium - Hazard, Risk and Sustainability in the Soil Environment (HRSSE)*

*14 October 2015, Wageningen. Coordinators: four PhD candidates (SLM)*

The symposium focused on sharing knowledge between PhD candidates and researchers, and to promote the discussion of new ideas, problems and challenges faced, and solutions encountered for the different soil-related topics covered by this symposium.

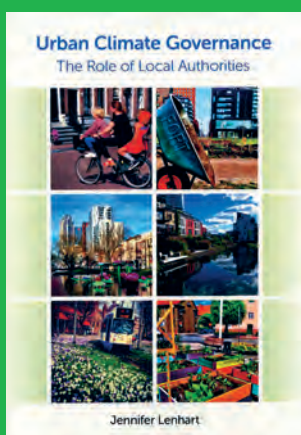
*WIMEK Climate Event, Thursday 10 December 2015, Wageningen*

*Coordinators: WIMEK PhD Council and WIMEK staff*

In the build-up of the 2015 United Nations Climate Change Conference, COP 21, in Paris, WIMEK organised a climate event, consisting of the Climate Negotiation Game in the morning and the Movie "Chasing Ice" in the evening.

*Farewell symposium Pier Vellinga, "More Sea or More Sun", 10 December 2015, Wageningen*

On the occasion of the retirement of professor Pier Vellinga, extraordinary professor of Climate Change and Adaptive Land and Water Management, the farewell symposium focused on the overwhelming evidence of human induced climate change and the required actions and challenges for governments, NGOs and industries to decrease the greenhouse gas emissions significantly within the coming decades.



02/07/2015 | **Lenhart, J.L.**  
Urban Climate Governance:  
The Role of Local Authorities



28/08/2015 | **Butkovskiy, A.**  
Removal of Micropollutants in  
Source Separated Sanitation



28/08/2015 | **Kloek, M.E.**  
Colourful green. Immigrants' and  
non-immigrants' recreational use  
of greenspace and their perceptions  
of nature



01/09/2015 | **Janssen, S.K.H.**  
Greening Flood Protection in  
the Netherlands. A knowledge  
arrangement approach

# Proofs of Esteem

## VENI and VIDI grants

**Dr. A. (Annemiek) ter Heijne (ETE)** received a VENI grant in 2014 for her research project "Fundamentals and kinetics of electrochemically active microorganisms on capacitive materials"

Bacteria can release electrons from wastewater and store these electrons in conducting granules. The researchers will be studying how the bacteria charge these granules and the factors that influence this process. In doing so, they aim to purify wastewater, while at the same time generating and storing as much electricity as possible for future use.

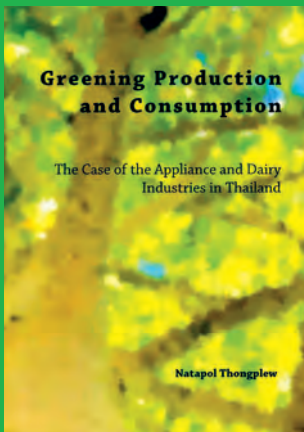
**Dr. M.T.H. (Michelle) van Vliet (ESS)** received a VENI grant in 2014 for her research project "Quality matters: including water quality in global water stress projections". Water stress is increasing worldwide due to a growing demand for high-quality water among a growing and prosperous global population, while water availability is changing as a result of climate change, among other developments. This research is aimed at developing an integral model to determine current and future water stress worldwide. The possibilities for improving water quality through technological solutions are also being evaluated.

**Dr. G.J. (Gert-Jan) Steeneveld (MAQ)** received a 2014 VIDI grant for his research programme "Wind in cities". Spatial variation in buildings, roads and parks lead to microclimates in urban areas. Wind affects thermal comfort, air quality, health and the energy demands of those living there. Advanced flow models allow meteorologists to determine the behaviour of wind, gusts and microclimates in urban areas.

Two years before, in 2013, Steeneveld already won the Young Scientist Award (YSA) from the European Meteorological Society (EMS). The EMS award is given to individuals in recognition of excellent performance in terms of scientific publications or presentations during the early stage of their scientific career.

## European Research Council (ERC) Grants

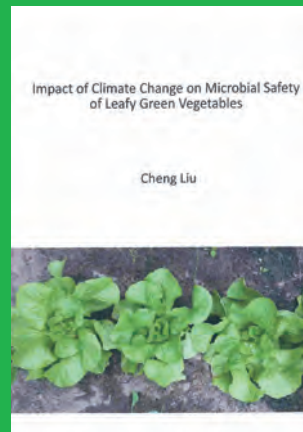
**Dr. W. (Wouter) Peters (MAQ)** received a prestigious ERC grant of 2.3 million in 2015 for the ASICA programme, focusing on the measurement of Airborne Stable Isotopes of CO<sub>2</sub> from the Amazon. The programme will involve gathering data on this balance by measuring CO<sub>2</sub> in the atmosphere above the rainforest. Small aeroplanes will make a number of flights every month from five different locations in order to collect air samples to a height of up to 6 km above the rainforest. This strategy is unique because the CO<sub>2</sub> uptake of millions of square kilometres of rainforest will be measured simultaneously in the atmosphere; signals from the surface always mix rapidly in the warm and humid atmosphere of the tropics. Taking samples from a network of ground measurements cannot be done on such a large scale because the vegetation of the area is so impenetrable and diverse. The levels of CO<sub>2</sub> and other greenhouse gases in the collected air samples will be measured, as well as the ratio of stable isotopes. All measurements will then be integrated by using the 'CarbonTracker', which Wouter Peters has already developed. Wouter Peters: *"We're going to measure things that have never been measured before in an area we know far too little about. I'm convinced we'll be taking a significant step forward in climate research. There is no doubt that this is the most important research I've been able to carry out in my career so far. I'm really enthusiastic about the freedom*



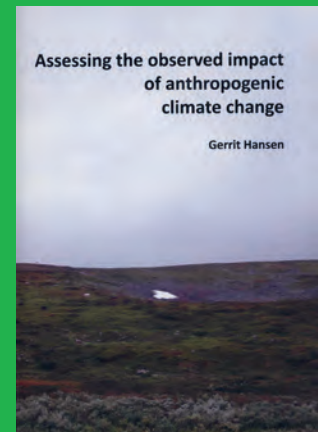
02/09/2015 | **Thongplew, N.**  
Greening production and consumption: The case of the appliance and dairy industries in Thailand



03/09/2015 | **Osman, I.S.E.**  
Impact of improved operation and maintenance on cohesive sediment transport in Gezira Scheme, Sudan



08/09/2015 | **Liu, C.**  
Impact of Climate Change on Microbial Safety of Leafy Green Vegetables



14/09/2015 | **Hansen, G.E.**  
Assessing the observed impact of anthropogenic climate change





and opportunities this ERC grant permits us, and especially about the science we're going to be able to do."

### PhD awards

**Dr. Darya Kupryianchyk (AEW alumna)** has won a prestigious prize for the best PhD thesis in the past 2.5 years, from the Royal Netherlands Chemical Society (KNCV in Dutch). She graduated on 1 February 2013 on a PhD thesis entitled "Activated carbon in sediment remediation: benefits, risks and perspectives". The PhD research was meant to increase our mechanistic understanding of the effects of activated carbon (AC) application on HOC exposure and toxicity reduction for benthic species and communities, and to bridge the gap between laboratory and field settings for AC remediation. This included the evaluation of alternative methods of AC deployment and application. The obtained knowledge may help in gaining regulatory acceptance of this emerging remediation technique and can be used to improve risk

assessment and decision support with respect to contaminated sediments, reduce risks caused by polluted sediment sites, and take away public resistance against contaminated sediments and sediment remediation.

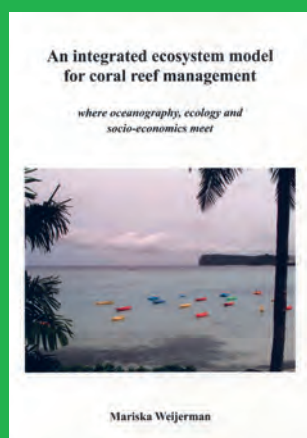
**Dr. M.T.H. (Michelle) van Vliet (ESS)** received the SENSE PhD award in 2013 for her thesis "Global Rivers Warming Up: Impacts on Cooling Water Use in the Energy Sector and Freshwater Ecosystems", which she defended successfully in December 2012.

**Wei-Shan Chen (PhD candidate at ETE & ESA)** won two prizes for his outstanding and novel research on valorising organic waste and other biomass residues in 2015. The first prize is from the Ministry of Education of the Taiwanese government. The second award is from Delta Electronics Foundations. Wei-Shan Chen's research is about Mixed Culture Chain Elongation (MCCE). MCCE is an emerging biotechnology that utilises microorganisms to convert organic waste into biochemicals that have diverse biochemical applications such as antimicrobial or food additives.

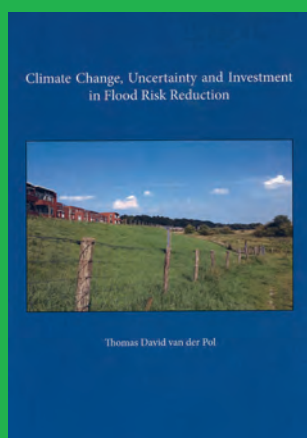
**Dr. Nora Sutton (ETE)** received the SENSE PhD award 2015 for her thesis: "Microbiological and geochemical dynamics of the subsurface: chemical oxidation and bioremediation of organic contaminants", which she defended successfully in July 2014.

### WIMEK's female PhD talents

On Thursday 18 April 2013, three stipends were awarded to talented female PhD candidates of Wageningen University on the occasion of the biannual awarding of the Storm-van der Chijs Stipends. All three prizes were grant-



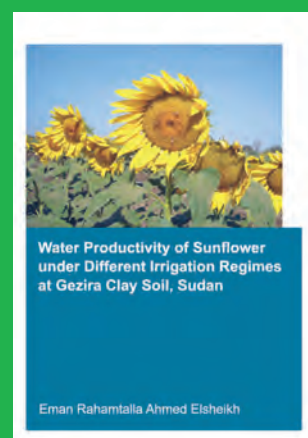
16/09/2015 | **Weijerman, M.**  
An integrated ecosystem model for coral reef management; where oceanography, ecology and socio-economics meet



02/10/2015 | **Pol, T.D. van der**  
Climate change, uncertainty and investment in flood risk reduction



06/10/2015 | **Pera, H.**  
Lipid bilayer stability in relation to oxide nanoparticles



08/10/2015 | **Elsheikh, E.R.A.**  
Water productivity of Sunflower under different irrigation regimes at Gezira Clay Soil, Sudan

ed to WIMEK PhD candidates: Nora Sutton (ETE), Natalie Theeuwes (MAQ) and Anne van Loon HWM) received a stipend and certificate. The 2015 Storm-van der Chijs Stipends were awarded to Ingrid van der Leemput (AEW) and Maryna Strokal (ESA).

## Other proofs of esteem

**Professor A.A.M. (Bert) Holtslag (chair holder MAQ)** has been appointed a Fellow of the American Meteorological Society (AMS). An appointment like this is only awarded to scientists who, over a period of many years, have made an exceptional contribution to meteorological or hydrological sciences or to practical applications in these disciplines. Every year, just 0.2% of the 14,000 AMS members are elected to a fellowship. In a reaction Bert Holtslag said: "I'm delighted with this American recognition of the exciting and varied work I've carried out with many colleagues over the years."

**Prof. J.P.M. (Jan) van Tatenhove (ENP)** has been appointed as Honorary Professor at the School of Planning, Architecture and Civil Engineering of Queen's University Belfast (from 25 March 2015 to 10 June 2018).

**Dr B.G. (Bert) Heusinkveld (MAQ)** has won the Tromp Award 2015 from the European Meteorological Society (EMS) for his outstanding achievement in biometeorology. He was nominated with the paper: Spatial variability of the Rotterdam urban heat island as influenced by urban land use, published in the Journal of Geophysical Research: Atmospheres, 2014.

**Dr M.J. (Martine) van der Ploeg (SLM)**, was awarded the SSSA Soil Physics Division Early Career Award in

2014. This award recognises scientists who have made outstanding contributions in soil physics within six years of completing their PhD degree.

Martine's research shows her originality and versatility as it covers a broad research area ranging from subpermafrost environments to monitoring systems. In her PhD, she successfully combined polymer chemistry, ceramic technology, and soil physics into a system that could measure beyond wilting point — a goal long seen as a holy grail in soil physics — and in subsequent research applied this technology in ecogenomics and plant physiology research.

In her teaching Martine mobilizes students to apply topical content to formulate sustainable solutions for future challenges (food, water, climate). She teaches in both the regular programme at Wageningen University and in the BSc Honours Programme.

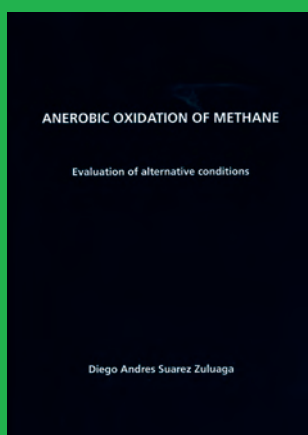
She has an impressive service record: she chairs the Vadose Zone subdivision of EGU, and has co-initiated the global network on Groundwater@Global Palaeoclimate Signals and is the European coordinator of this collaboration. In 2014 she became a Board member of the Dutch Scientific Hydrology Center Boussinesq. She co-founded a non-profit organisation to find innovative ways to communicate and interact with society.

**Prof. C.J. (Coen) Ritsema (SLM)**, received the prestigious Distinguished Researcher Award of the World Association of Soil and Water Conservation (2013).

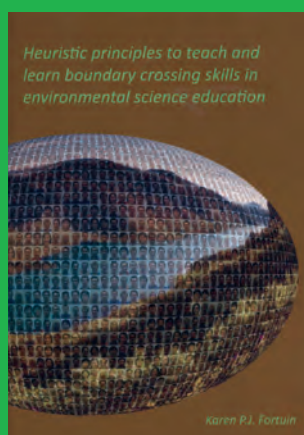
**Prof. S.E.A.T.M. (Sjoerd) van der Zee (SLM)** has been appointed as adjunct full professor (0.2 fte) at the School of Chemistry, Monash University, Melbourne, Australia (2015).



13/10/2015 | **Sumarga, E.**  
Spatial modelling and ecosystem accounting for land use planning: Addressing deforestation and oil palm expansion in Central Kalimantan, Indonesia



14/10/2015 | **Suarez Zuluaga, D.A.**  
Evaluation of different conditions in the anaerobic oxidation of methane



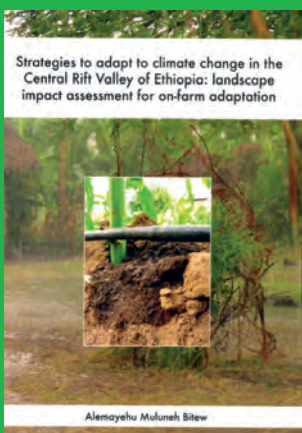
14/10/2015 | **Fortuin, K.P.J.**  
Heuristic principles to teach and learn boundary crossing skills in environmental science education



19/10/2015 | **Diepens, N.J.**  
Sediment toxicity testing and prospective risk assessment of organic chemicals

# The WIMEK PhD Council

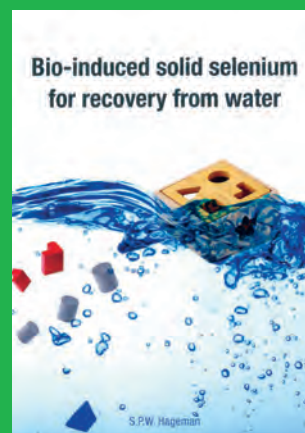
The WIMEK PhD Council represents all PhD candidates involved in the Graduate School WIMEK at Wageningen University. The main aims of the council are: (1) being a bridge between all PhD candidates and the WIMEK Board; (2) providing PhD candidates relevant information of new developments in WIMEK and asking their opinions; and (3) creating a strong work of PhD candidates to collaboratively find solutions for problems regarding education, supervision and planning that PhD candidates might face during their research project. The WIMEK PhD council has six members who meet every month. The council is closely involved with the WIMEK management and a representative of the council joins the WIMEK Board meetings.



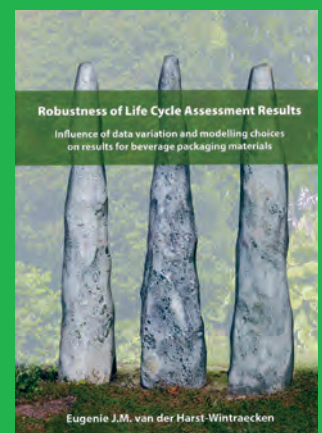
20/10/2015 | **Bitew, A.M.**  
Strategies to adapt to climate change in the Central Rift Valley of Ethiopia: landscape impact assessment for on-farm adaptation



21/10/2015 | **Bozhinova, D.N.**  
Interpreting plant-sampled  $\Delta^{14}\text{CO}_2$  to study regional anthropogenic  $\text{CO}_2$  signals in Europe



23/10/2015 | **Hageman, S.P.W.**  
Bio-induced solid selenium for recovery from water



28/10/2015 | **Harst-Wintraecken, E.J.M. van der**  
Robustness of Life Cycle Assessment Results. Influence of data variation and modelling choices on results for beverage packaging materials

# How to contact us

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WIMEK Board (per 01-01-2016):

Prof. A.A.M. (Bert) Holtslag (chair)

Prof. R. (Rik) Leemans

Prof. H. (Henk) Siepel

Prof. G. (Gert) Spaargaren

Prof. A.J.M. (Fons) Stams

Prof. S.E.A.T.M. (Sjoerd) van der Zee

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(Institute for Environmental Studies, VU)

Director of Education: Dr. A. (Ad) van Dommelen

(Institute for Environmental Studies, VU)

Director of Research: Prof. M.G. (Max) Rietkerk

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Coordinator SENSE Research School: Mr. J. (Johan)

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(Monique) Gulickx (Monique.Gulickx@sense.nl)

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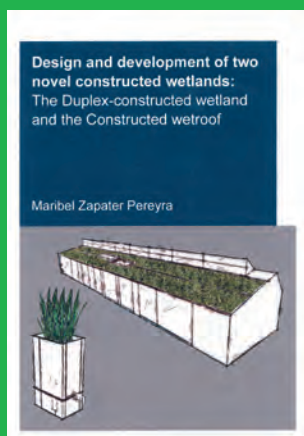
(Marjolijn) Dannenburg (Marjolijn.Dannenburg@wur.nl)

SENSE website: [www.sense.nl](http://www.sense.nl)

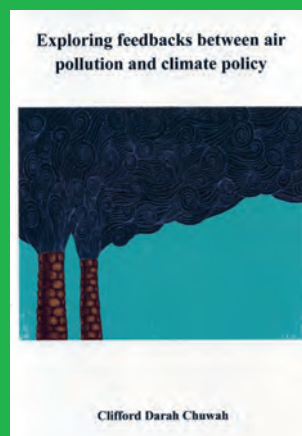
General SENSE email address: [info@sense.nl](mailto:info@sense.nl)



30/10/2015 | **Chung, J.W.**  
Pathogen removal using saturated sand columns supplemented with hydrochar



30/10/2015 | **Zapater Pereyra, M.**  
Design and development of two novel constructed wetlands: the Duplex-constructed wetland and the Constructed wetroof



03/11/2015 | **Chuwah, C.D.**  
Exploring feedbacks between air pollution and climate policy



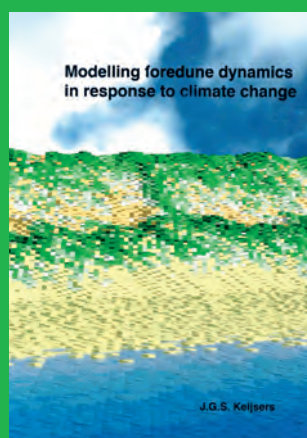
18/11/2015 | **Theeuwes, N.E.**  
Urban Heat. Natural and anthropogenic factors influencing urban air temperatures

# ANNEX 1: WIMEK Research Groups

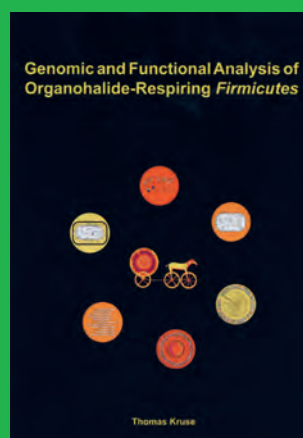
Code	Chair Group	WIMEK Research Group Leader(s)	%
AEW	Aquatic Ecology and Water Quality Management Group	Prof. M. (Marten) Scheffer & Prof. A.A. (Bart) Koelmans	100 %
BCT	Biobased Chemistry & Technology Group	Prof. J.H. (Harry) Bitter Dr. K. (Karel) Keesman	10%
ENP	Environmental Policy Group	Prof. A.P.J. (Arthur) Mol (until 28-05-2015) Prof. S.R. (Simon) Bush (from 01-06-2016) & Prof. G. (Gert) Spaargaren	50%
ENR	Environmental Economics and Natural Resources Group	Prof. E.C. (Ekko) van Ierland	35%
ESA	Environmental Systems Analysis Group	Prof. R. (Rik) Leemans	100%
ETE	Environmental Technology Group	Prof. H.H.M. (Huub) Rijnaarts & Prof. C.J.N. (Cees) Buisman	100%
HWM	Hydrology and Quantitative Water Management Group	Prof. R. (Remko) Uijlenhoet	100%
LAR	Landscape Architecture Group	Prof. A. (Adri) van den Brink	100%
MAQ	Meteorology and Air Quality Group	Prof. A.A.M. (Bert) Holtslag & Prof. M. (Maarten) Krol	100%
MIB	Microbiology Group (only Environmental Microbiology part)	Prof. W.M. (Willem) de Vos & Prof. A.J.M. (Fons) Stams Prof. H. (Hauke) Smidt	30%
PEN	Plant Ecology and Nature Conservation Group	Prof. F. (Frank) Berendse (until 01-07-2015) Prof. D. (David) Kleijn (from 01-07-2015)	20%
SLM	Soil Physics en land Management Group	Prof. C.J. (Coen) Ritsema Prof. S.E.A.T.M. (Sjoerd) van der Zee	70%
SOQ	Soil Chemistry and Chemical Soil Quality Group	Prof. R.N.J. (Rob) Comans	100%
TOX	Toxicology Group	Prof. I.M.C.M. (Ivonne) Rietjens & Dr. N.W. (Nico) van den Brink	20%
WGC	Water Systems and Global Change Group	Prof. C. (Carolien) Kroeze (from 01-04-2016)	100%
WRM	Water Resources and Management Group	Prof. P.J.G.J. (Petra) Hellegers	20%



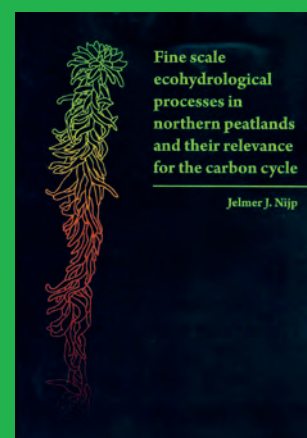
20/11/2015 | **Leopold, M.F.**  
Eat or be eaten: porpoise diet studies



30/11/2015 | **Keijsers, J.G.S.**  
Modelling foredune dynamics in response to climate change



30/11/2015 | **Kruse, T.**  
Genomic and Functional Analysis of Organohalide-Respiring Firmicutes



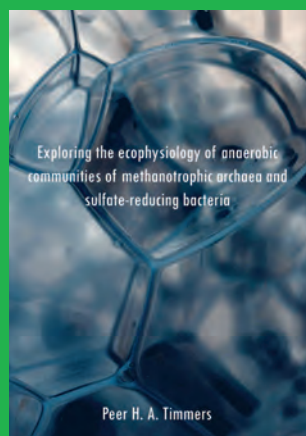
01/12/2015 | **Nijp, J.J.**  
Fine scale ecohydrological processes in northern peatlands and their relevance for the carbon cycle

# (Endnotes)

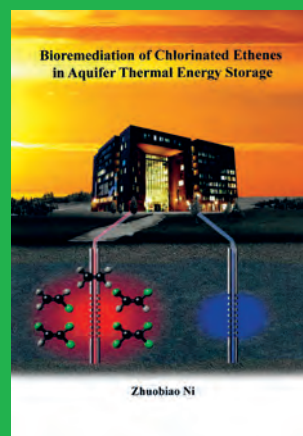
- 1 Creating a safe operating space for iconic ecosystems; Scheffer, M.; Barrett, S.; Carpenter, S.R.; Folke, C.; Green, A.J.; Holmgren, M.; Hughes, T.P.; Kosten, S.; Leemput, I.A. van de; Nepstad, D.C.; Nes, E.H. van; Peeters, E.T.H.M.; Walker, B. (2015); *Science* 347 (6228). - p. 1317 - 1319.
- 2 Resource Magazine, March 26, 2015
- 3 Spatially explicit fate modelling of nanomaterials in natural waters by Joris T. K. Quika, Jeroen J.M. de Klein, & Albert A. Koelmans. *Water Research* Volume 80, 1 September 2015, Pages 200–208 doi:10.1016/j.watres.2015.05.025
- 4 Secure sustainable seafood from developing countries. Require improvements as conditions for market access; Sampson, G.S.; Sanchirico, J.N.; Roheim, C.A.; Bush, S.R.; Taylor, J.E.; Allison, E.A.; Anderson, J.L.; Ban, N.C.; Fujita, R.; Jupiter, S.; Wilson, J.R. (2015); *Science* 348 (6234). - p. 504 - 506
- 5 Certify Sustainable Aquaculture? Bush, S.R.; Belton, B.; Hall, D.; Vandergeest, P.; Murray, F.J.; Ponte, S.; Oosterveer, P.J.M.; Islam, M.S.; Mol, A.P.J.; Hatanaka, M.; Kruijssen, F.; Ha, T.T.T.; Little, D.C.; Kusumawati, R. (2013); *Science* 341 (6150). - p. 1067 - 1068.
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- 12 Permafrost collapse after shrub removal shifts tundra ecosystem to a methane source Nauta, A.L.; Heijmans, M.M.P.D.; Blok, D.; Limpens, J.; Elberling, B.; Gallagher, A.; Li, B.; Petrov, R.E.; Maximov, T.C.; Huissteden, J. van; Berendse, F. (2015); *Nature Climate Change* 5. - p. 67 - 70
- 13 Preserving the world second largest hypersaline lake under future irrigation and climate change, *Science of The Total Environment*, Vol. 559, 15 July 2016, p317–325. doi:10.1016/j.scitotenv.2016.03.190



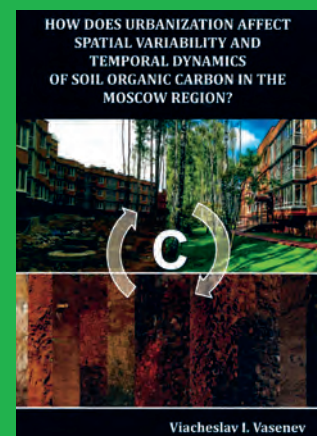
04/12/2015 | **Jacobs, P.**  
The impact of pelagic mussel collectors on plankton in the western Wadden Sea, the Netherlands



04/12/2015 | **Timmers, P.H.A.**  
Exploring the ecophysiology of anaerobic communities of methanotrophic archaea and sulfate-reducing bacteria



08/12/2015 | **Ni, Z.**  
Bioremediation of Chlorinated Ethenes in Aquifer Thermal Energy Storage



08/12/2015 | **Vasenev, V.I.**  
How does urbanization affect spatial variability and temporal dynamics of soil organic carbon in the Moscow region?

# Colophon

## Text editor

WIMEK | Mr. Johan Feenstra

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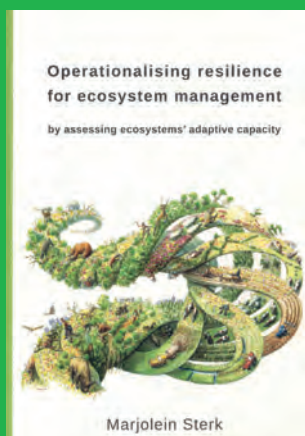
Front cover: Dr Nico van den Brink, FluxPOPs project, Antarctica

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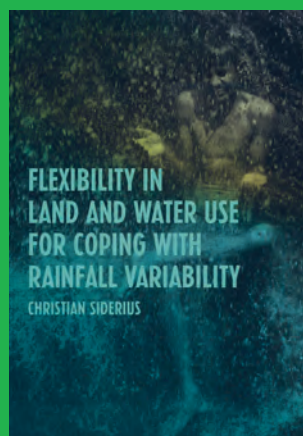
GAW ontwerp+communicatie



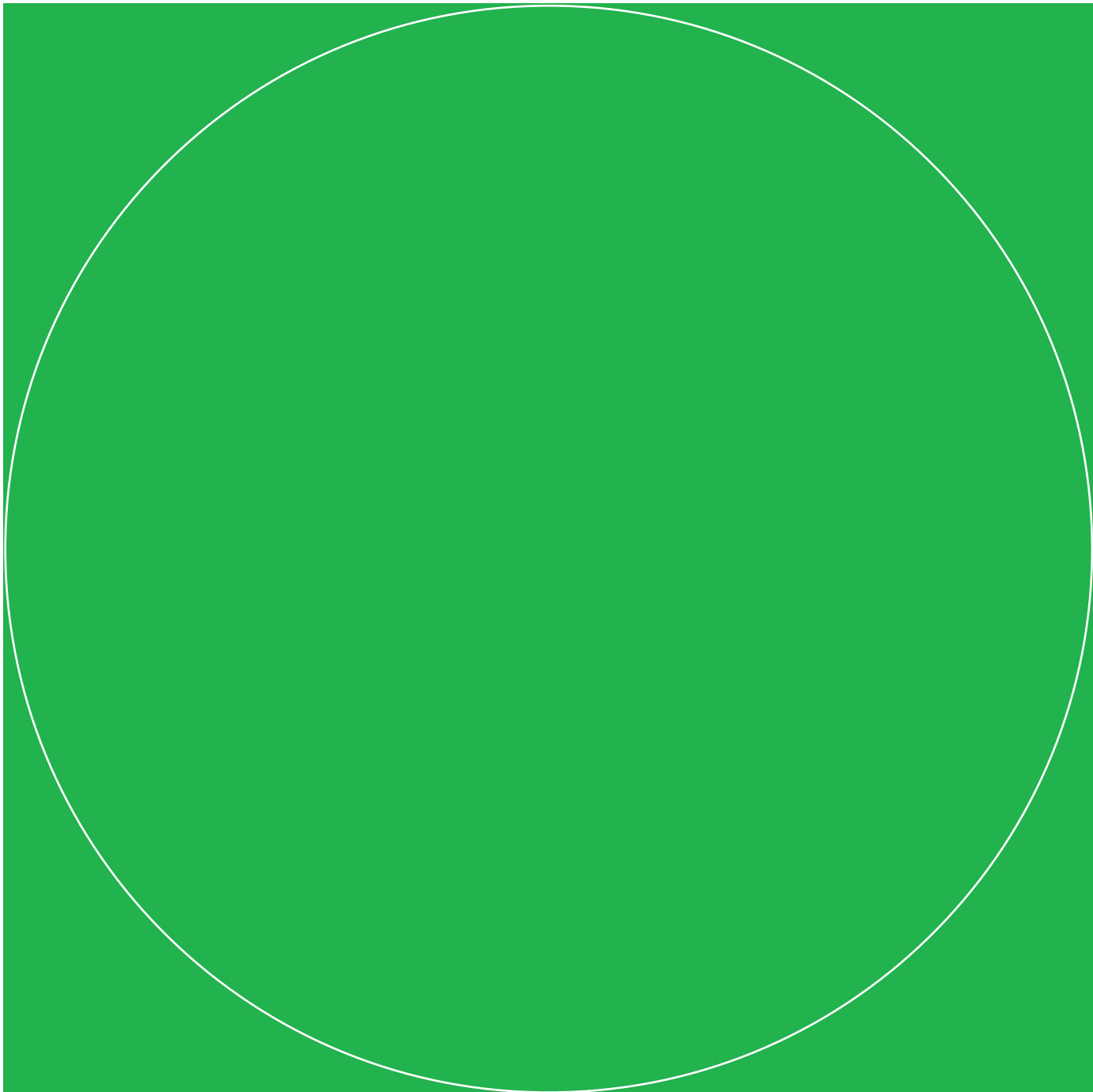
14/12/2015 | **Alvarado Quesada, I.**  
International cooperation for biodiversity conservation: an economic analysis



15/12/2015 | **Sterk, M.**  
Operationalising resilience for ecosystem management by assessing ecosystems' adaptive capacity



18/12/2015 | **Siderius, C.**  
Flexibility in land and water use for coping with rainfall variability



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