



Universiteit Leiden

ANNUAL REPORT 2012



Leiden University
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1 Executive summary

1.1 General introduction

During 2012 the director of CML, prof.dr. Geert R. de Snoo, was appointed as Dean of the Faculty of Science. To bridge the period between his departure and the appointment of a new scientific director, prof.dr. Eddy van der Meijden accepted the position of interim director.

Diverse highlights occurred in the fields of education and research. These highlights can be found in the paragraphs following this one.

Prof.dr. Eddy van der Meijden interim director at CML



As of 1 September 2012, prof.dr. Eddy van der Meijden was appointed as interim director at CML.

From origin the research fields of Eddy van der Meijden are ecology, plant defence systems and plant secondary metabolites. For many years he was Scientific Director of the Institute of Biology Leiden. After reaching the retirement age, Eddy van der Meijden continued several tasks, such as member of the board of the Centre of Expertise of Plant Substances, which is involved in stimulating projects on the valorisation of green agricultural waste. The appointment of prof.dr. Eddy van der Meijden follows from the appointment of prof.dr. G.R. de Snoo as Dean of the Faculty of Science.

Mission of CML

The mission of the Institute of Environmental Sciences (CML) will be to carry out strategic interdisciplinary research and education in relation to the sustainable management and governance of natural resources, including environmental quality and biodiversity. The aim is to combine research and education at the highest level with a good balance between fundamental and applied science.

1.2 Education Highlights

Stans Prize

During the CML New Year meeting on January 23, 2012 the 'Stans Prize 2011' was awarded to Ingrid Odegard for her research on The Future of Food - Scenarios and the Effects on Resource Use in Agriculture. Ingrid wrote her report for her master study (Industrial Ecology).

The aim of the study was to design four global food scenarios for the year 2050 and to evaluate these quantitatively with respect to their use of the natural resources land, water and fertilizers in agriculture. Resource use and food are popular topics in the current sustainability debate, because of population growth and the change seen in diet composition, related to increased welfare levels, with increased demand for animal products in developing countries. To evaluate resource use for a complete diet in different food scenarios, the study integrated three sub-studies:

1. Four scenarios were designed, which include different trends related to population, economic development, policy, technological development and diet and are specified to the year 2050.
 2. A methodology was developed – Virtual Resource Content – with which the use of resources in agriculture can be calculated.
 3. A model was created, with which the scenarios are quantified with respect to their resource use.
- The four scenarios were all evaluated on a global scale, two of which were also evaluated on a regional scale.



The results show that an assessment of resource use is only valuable when a complete picture is given. Trade-offs between land-use, fertilizer use and water use are very relevant. Therefore, the present study provides valuable input for assessing problem areas, but also for identifying opportunities in our agricultural system

Diploma Ceremony Industrial Ecology 2012

On Thursday 20 September, Jan Bergen, Thijs Kamperman, Merel Segers, Katinka Wijsman, and Wei Han Wu received their diploma for the Msc Study programme Industrial Ecology. The ceremony took place in the Academy Building of Leiden University.



ERASMUS MUNDUS Master's programme in Industrial Ecology

The MIND programme (ERASMUS MUNDUS Master's programme in **Industrial Ecology**) is a new two-year programme with 120 ECTS, offering a unique Industrial Ecology education for up to 15 Third-country and up to 10 EU students per edition. Those maximal 25 students can study at two or three universities of the MIND consortium, representing seven universities. The program intends to issue a joint degree as soon as this is possible. For the moment, a double degree is awarded to students that have successfully completed the program.

The objective of the MIND programme is to train students:

- to conduct industrial ecology analyses of complex sustainability problems,
- to design industrial ecology solutions for these problems and
- to develop implementation strategies for those solutions identified.

MIND is in the heart of the EU needs of the "Europe 2020 strategy", because due to the current sustainability problems and imminent EU and global transitions in energy systems, food systems etc. there is a great need for Industrial Ecology trained persons that have a grasp of the complexities of the field of sustainable development.



The MIND programme combines the expertise and experience of prominent groups in the area of Industrial Ecology research, within and outside the EU. MIND is the first international master programme in Industrial Ecology worldwide.

Four European universities participate: Leiden University, Delft University of Technology, Chalmers University of Technology and University of Graz. In addition, one American and two Asian universities are part of the program: Waseda (Japan), the Asian Institute of Technology (Thailand), and Rochester Institute of Technology (United States of America).

A highlight of the MIND-programme is the annual summerschool. This summerschool combines the introduction week for new arrivals coming from all over the world, the summer project for students that have completed their first year, and the graduation ceremony for students who have finished their studies. The introduction program was designed with the help of a grant from Leiden University and is very successful. The new students work together to compose a Material Flow Account of an island, and to present the result to the island municipality. Theory and field work are combined and applied to derive policy relevant messages, all in one week time. Moreover, this exercise allows the new students to get to know each other and the new culture they will be encountering for the next two years.



Record amount of students starts Industrial Ecology

At the start of the Master programme Industrial Ecology (IE) in 2004 12 students enrolled for this study. In 2012 the number of students has increased up to 90, coming from 20 different countries.

IE is an interdisciplinary science that educates students to contribute to a sustainable society now and in the future. The programme combines three different topics: analysis, design and implementation. This interdisciplinary approach is essential to solve the complex problems of sustainability, but also attracts students from different disciplines, making the IE student population a mixture of knowledge and cultures.



educates students to contribute to a future. The programme combines three implementation. This interdisciplinary complex problems of sustainability, but also disciplines, making the IE student and cultures.

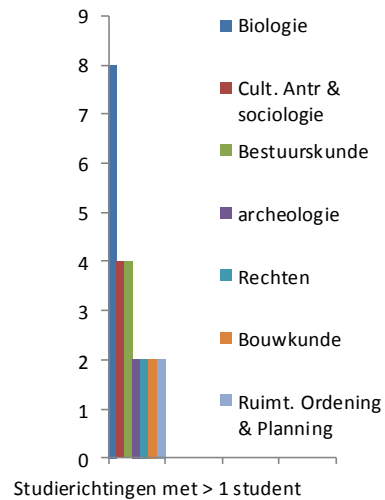
René Kleijn new Director of Education of the MSc program Industrial Ecology

As of 1 September 2012 René Kleijn is Director of Education of the MSc program Industrial Ecology, a joint master program of Delft University of Technology and Leiden University. He is the successor of Gijsbert Korevaar.

From the start in 2004 Gijsbert has played an essential role in the success of the program, first as a coordinator and later as director of education. In this period the program has seen a steady growth in the number of students. The staff, students and alumni of the program are all very grateful to Gijsbert for his energy and efforts that helped make this program to the success it is today.

Diversity new minor students

This year, a total of 34 students registered for the Minor Sustainable Development. The composition of the group was quite diverse. Students came from: Biology, Anthropology, Public Administration, Archeology, Law, Architecture, Spatial Planning, China Studies, Life Science & Technology, Physics, Communication, Biopharmaceutical science, World religions, Politics and History. We were quite keen to work with this group, considering the diversity in knowledge and disciplines.



Grand opening Minor Sustainable Development by Councillor Baldewsingh

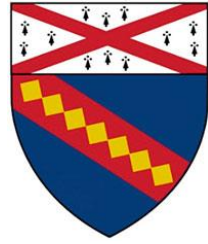
On Monday, 3 September 2012, the minor sustainability started its fourth edition. The opening speech was held by Mr. Rabin Baldewsingh (PvdA), Councilor for Health, Sustainability, Media and Organization in The Hague. Enthusiastically he welcomed the students and encouraged them to learn and use as much as possible from the minor, stating "You are the future". Passionately he informed the audience on the sustainability initiatives that are undertaken in the city of The Hague. He expressed his hope that the cooperation between the Universities of Leiden, Delft and Erasmus Rotterdam (LDE) would lead to a move of CML to The Hague. At the closure of his opening speech, he invited the students for a fieldtrip to The Hague. It was a grand opening of the Minor 2012-2013.



MSc student has obtained a PhD-position at the Yale School of Public Health

We are very proud that Elise Elliott, one of our graduated MSc-students of the ECB-track, got a PhD-position at the Yale School of Public Health.

Elise received a fully paid scholarship. Her focus of research will be on the environmental and genetic factors that have influence on the development of testicle cancer.



Sarah Herms wins university-wide award for best master thesis

The "Leidse Universitaire Scriptieprijs 2010-2011" for the best master thesis of Leiden University has been awarded to Sarah Herms. Sarah studied the Leiden-Delft MSc programme Industrial Ecology.



The subject of her thesis research was on combining exergy analysis and life cycle assessment, with a theoretical component and a case study on paper for cardboard production. She was supervised by Reinout Heijungs from CML, Leiden University, and Gijsbert Korevaar from TU Delft. Sarah's thesis report is entitled: "Exergy Flows in Product Life Cycles. Analyzing thermodynamic improvement potential of cardboard life cycles".

The award consisted of a certificate and € 3.000. It was handed over by Professor P.F. van der Heijden (Rector Magnificus and President of Leiden University) at the occasion of the 437th anniversary of the university. The award has been created through the Leiden University Fund by alumni students from Leiden University.

1.3 PhD student Graduations

Wenjie Liao

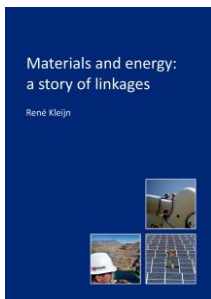
“A thermodynamic perspective on technologies in the Anthropocene: Analyzing environmental sustainability”

Technologies and sustainable development are interrelated from a thermodynamic perspective, with industrial ecology (IE) as a major point of access for studying the relationship in the Anthropocene. To offer insights into the potential offered by thermodynamics in the environmental sustainability analysis of technologies, this thesis develops a hierarchical framework which defines techno-systems at four levels, viz. the ecosphere, the anthroposphere, and individual technologies, the latter being further subdivided into a foreground system and a supply chain. The role and applications of thermodynamic analysis in IE and broader human-environment systems is reviewed. The production of US bioethanol, global biofuels, and Chinese titania is studied by applying a series of thermodynamic sustainability indicators, combining thermodynamic analysis with material flow analysis (MFA), and combining thermodynamic analysis with life cycle assessment (LCA), respectively, in the framework. The outcomes of the review and case studies show that taking account of thermodynamics is a necessity when analyzing the environmental sustainability of technologies, and integrating energy analysis, exergy analysis, and emergy analysis with LCA and MFA is both feasible and useful. The thesis then discusses the limitations and challenges of the developed framework and ends with three recommendations for the further development of thermodynamic analysis for sustainability.



Rene Kleijn

“Materials and energy: a story of linkages”



Human society has always depended on a substantial input of materials. At the moment our energy supply is almost completely based on fossil fuels with minor contributions of biomass and uranium based nuclear. Climate science tells us that, in order to avoid catastrophic impacts, we need a transition to a low-carbon energy system in the next few decades. This means we will need to build a new energy system almost from scratch including wind turbines, solar cells, carbon capture and storage and a smart supergrid. In this work the material requirements of such a transition are analysed. It is concluded that a substantial upscaling of current mining activities is needed very quickly in order to be able to supply the metals needed for this energy transition.

Haman Unusa

“The New pastoralism, Absentee owners, new technologies, economic change and natural resource management in the Sahelian region of Far North Cameroon”

This research study on ‘The new technologies, economic change Sahelian Region of Far North to call into question the purported pastoralists in a non-equilibrium ecological, economic, and socio-traditional pastoralism and how enhance pastoral modernization. was observed in this study to be a intensification, in which feed stabling, water provision through



pastoralism: Absentee owners, new and natural resource management in the Cameroon’ has as its principal objective endless mobility and flexibility of landscape by investigating the cultural causes of the decline in these induce technology change that The process of pastoral modernization form of sustainable indigenous pastoral supplements, farm residues, cattle boreholes and water pump machines,

and healthcare facilities, etc. are used in livestock raising. The lessons learned from failed State-sponsored pastoral modernization projects in the form of ranches designed for commercial production in a non-equilibrium landscape paved the way for indigenous pastoral modernization. Pastoralism attained ecological sustainability and economic viability through modernisation; a way out of the dilemma for traditional pastoralism. In addition, there are two entry points to pastoral modernization: from poverty and from wealth. Impoverished herders that have suffered from pastoral decline modernize their activities to ensure survival and livelihood perpetuation. For the rich, pastoral modernization is a form of investment and diversification of income source.

Pricelia Tumenta

“A Lion Population under Threat, Understanding lion (Panthera leo Linnaeus, 1758) ecology and human-lion interactions related to livestock predation in Waza National Park, Cameroon”

Lions in Waza National Park Cameroon were studied with focus on lion ecology and the human-lion conflicts due to livestock predation. The number of adult lions has declined from 40-60 in 2002 to 14-21 in 2008, which represents a reduction of about 65% in 6 years. The human-livestock pressure on the park is enormous, 31% of photographs captured by camera traps in 2008, were of humans and livestock in the park. Retaliatory killing of lions by herders is high, as lions increasingly predate on cattle due to the strong decline of their natural prey. Lion home ranges have increased from a mean of 630 km² in 2000 to 1015 km² in 2008, extending to areas outside the park. Livestock constitutes as much as 21.6% of the diet. Characteristics of the diet and movements of the lion reflect a survival strategy of lions under highly disturbed conditions. Although the Waza lion population now seems to be most threatened, concerted conservation efforts could save this population from local extinction. The government must greatly improve park protection through the park management authority and law enforcement, as well as providing financial and human resources for the park. Furthermore, local communities living close to the park must receive direct benefits from park revenues.



1.4 Research Highlights

'Faas'-prize for CML researchers

CML-researchers working on pesticides research in the Netherlands received the prestigious prize for mapping the pesticides concentrations in the surface water on a special public accessible website: www.bestrijdingsmiddelenatlas.nl.

This prize is to honor people or institutes that execute prestigious activities around the topic of water quality and/or pesticides. CML received the prize for the pesticides-website and the book called *Bestrijdingsmiddelen en Water* published in 2012.



Publication: Pesticides and Water Quality (*Bestrijdingsmiddelen en Waterkwaliteit*)

In the Dutch surface water, the concentration of pesticides is notably lower than some decades ago. However, the latest positive results date for 2001 and earlier, while during the past ten years hardly any improvement was established. Improvement can be made though. According to the book "Pesticides and water quality", edited by Geert de Snoo and Martina Vijver, at the moment 1 to 2 percent of all agricultural areas cause the biggest problems. The book, in Dutch, answers questions like:



- Where and when are pesticides found in water and are values exceeded?
- What causes the presence of pesticides in the water?
- What are the consequences for the ecological system?
- What are possible solutions to reduce the environmental burden?

Environmental Sciences Research Prize awarded to David Font

The Environmental Sciences Research Prize 2012 of the Environmental Scientists Association of Catalonia, has been awarded to CML researcher David Font Vivanco .

The Environmental Sciences Prize was created to celebrate the 20th anniversary of the creation of the Environmental Sciences the Autonomous Barcelona (UAB). Of the which the prize is divided, awards the best research the field of Environmental during the year 2011. The ceremony held in the 18th .



Degree in Spain by University of four categories in the research prize project carried out in Sciences in Catalonia prizes were given in a UAB on October the

Memory of Understanding (MOU) with the Mulawarman university in Indonesia



On 7 December an MOU was signed in Leiden by the rector of the Mulawarman university, prof. Sjamsudin and the Dean of the Faculty of Science, prof.dr. Geert de Snoo. The MOU builds on previous collaboration on natural resources management and sustainable forestry.

It is the intention during the coming 5 years to exchange staff, PhD students and MSc students

Disappearance African savannah disastrous for lions

The surface area of savannah in West and Central Africa is rapidly shrinking, with disastrous consequences for the lion populations living there. Without protective measures, within ten years, there will be no more lions in this part of Africa. (*Journal of Biodiversity and Conservation*, 4 December 2012.)



A group of researchers from different universities in a number of countries, including prof.dr. Hans de longh from the Institute of Environmental Sciences of Leiden University (CML), have carried out a meta-analysis on the basis of Google Earth satellite images of the savannah landscape in Africa. The researchers have concluded that the surface area of savannah (a landscape type with 300 to 1500 mm of rainfall per year) has shrunk from 11.9 million km² in 1960 to 9.7 million km² in 2000, a decrease of 20%. The study was funded by the National Geographic Big Cat Initiative.

1.5 Symposia and Lectures

Top Lecture: Evolutionary ecology of host-parasite interactions: ticks and hole-nesting songbirds

On Friday 27 January, 2012 prof. dr. Erik Matthyssen of the University of Antwerp provided for a top lecture entitled "Evolutionary ecology of host-parasite interactions: ticks and hole-nesting songbirds".



In this lecture he reported on ongoing research on interactions between great and blue tits as hosts, and several tick species (Ixodidae) as parasites. Ticks have a number of features that make them particularly interesting for studies of host-parasite interactions, including their amenability to experimental infestations in both lab and field conditions. Great and blue tits are regularly infested with two tick species with highly contrasting ecologies: the generalist field-dwelling sheep tick (*Ixodes ricinus*) and the generalist tree-hole tick (*Ixodes arboricola*), a specialist of hole-nesting forest birds.

Lecture Prof. dr. Noboyuki Yamaguchi

Prof. Dr. Yamaguchi is a professor in evolutionary ecology at the department of Biological and Environmental Sciences, Faculty of Arts and Sciences, Qatar University. He gave a lecture about '**Lion genetics and evolution**' on Monday 27 August 2012. Prof. Yamaguchi has been associated with Oxford University (WILDCRU) for a long time.

Prof. Yamaguchi has done extensive research on the evolution of large cats and on the phylo genetics of the of the modern lion. He has worked with the research group of WILDCRU, Oxford university until 2010, when he joined Qatar University as a professor in evolutionary ecology. He has been involved in a study on the genetics of the Barbary lion and in the preparation of the rehabilitation programme of the Barbary lion in Maroc. Prof Yamaguchi gave a guest lecture at CML on the evolution of the lion in which he covered the evolution of large cats 2 million years ago until recent times, the impact of genetic bottleneck during the Pleistocene and the threats to modern lions in Africa and Asia.

Lecture by Prof. Dr T. Graedel

On Tuesday 4 September 2012, professor Tom Graedel of Yale University gave a guest lecture on three topics:

- Industrial ecology in general
- The analyses of global and regional flows of metals through modern society
- The criticality of metals

The work of prof. Graedel resulted in dozens of scientific publications one of which was recently published in Science. Tom Graedel is one of the founding fathers of the Scientific field of Industrial Ecology.

1.6 CML in society

Radio interview Hans de longh about the white rhino's in Kenya

On Thursday 29 September Hans de longh was interviewed by Menno Bentvelt on Radio 1 (programme De Gids) on the breeding programme of Northern white rhino's in Kenya.

The Northern white rhino (*Ceratotherium simum cottoni*) has recently been declared extinct in its last stronghold, Garamba National park in the Democratic Republic of Congo. Some 8 individuals still remain in captivity in Zoos in the Czech republic and in California, USA, where they do not reproduce. In December 2009 four individuals (two females and two males) were transported from the Czech republic to a Conservancy in Kenya to start a captive breeding programme, in the hope that local conditions in Kenya may stimulate reproduction. Hans de longh suggested that this breeding population is probably too small to produce a viable population and that the breeders consider first to hybridize the Northern white rhinos with Southern white rhinos. The first generation of hybrids may then be cross bred again with Northern white rhinos, in order to rescue a large part of the original gene pool.



CML in collaboration with IBL has particular experience with research on the genetics of African lions, which has demonstrated distinct genetic lines in West and Central Africa. Similar to the white rhino breeding programme this genetic research is important to back up captive breeding programmes of zoos and conservancies with the ultimate aim to save species from extinction and restore natural populations.

PR Book “Bestrijdingsmiddelen en waterkwaliteit”

We had many outreach on the topic of possible solutions to reduce pesticides drift towards ditches. Mid 2012 our book was published on Bestrijdingsmiddelen en Waterkwaliteit. This book shows where and what pesticides residues exceed the environmental quality standards. What impact that has on ecological risks, what sources of emissions there are and some case studies on what techniques, tools and actor-based actions can be taken to reduce these pesticides emissions towards the surface waters. In the months July, August, September we had many interviews for professional journals, radio and newspapers.

Popular journals:

- Bionieuws
- Boederij vandaag
- LTO - 3-7-2012 Waterkwaliteit over algemeen goed, in enkele regio's moet het beter
- Bloemisterij, Martina Vijver, milieuo onderzoeker Universiteit Leiden: Bloementelers doen het niet goed genoeg, p4 21-7-2012
- H2O
- BloembolVisie, Waterkwaliteit best goed maar het kan nog beter p12-13. 5-10-2012
- Milieu, Pleidooi voor verder terugdringen bestrijdingsmiddelen p38-39.
- Vrij Nederland, Gif op de bloemen. Dode bij, stille lente p36-39, 1-12-2012

News paper articles

- Trouw, Verbod op landbouw gif nodig p3 2-7-2012
- Trouw, De sloot kan best nog schoner p8-9 2-7-2012
- Trouw, Gifverbod slaat de plank mis 6-7-2012
- Haarlems dagblad, Pleidooi voor verbod gif in bollenteelt 4-7-2012
- Sleutelstad.nl,, Leidse onderzoekers schrijven over water 3-7-2012
- Leidsch dagblad, Pleidooi voor verbod gif in bollenteelt 3-7-2012
- AGDmedia Onderzoek: tijdelijk verbod bestrijdingsmiddelen nodig 3-7-2012

Radio interviews

- NOS Radio 1 interview met Martina Vijver 2-7-2012
- Hoe?Zo! Radio 5 interview met Martina Vijver 2-7-2012
- Vroege Vogels, interview Geert de Snoo 8-7-2012

2 Organization and Staff

2.1 Governing bodies in 2012

Board of Directors (01-01-2012 to 01-09-2012)

Prof.dr. G.R. de Snoo (Director CML)

Prof.dr. S.M. Verduyn Lunel (Dean Faculty of Sciences)

Drs. G.J. van Helden (Managing Director Faculty of Sciences)

Board of Directors (as of 01-09-2012)

Prof.dr. E. van der Meijden (Interim Director CML)

Prof.dr. G.R. de Snoo (Dean Faculty of Sciences)

Drs. G.J. van Helden (Managing Director Faculty of Sciences)

Managementteam

Prof.dr. G.R. de Snoo (director, head of department of Conservation Biology, chair); until 01-09-2012)

Prof.dr. E. van der Meijden (interim director, chair; as of 01-09-2012)

Dr. E. van der Voet (head of department of Industrial Ecology)

Prof. dr. H.H. de longh (vice-head of department of Conservation Biology)

Drs. L.M. Zondervan (institute manager)

Institute Council

Dr. R. Heijungs (chair)

Prof.dr.ir. W.T. de Groot

Ing. M. van 't Zelfde

L.D. Bertola, MSc

2.2 Finances and Staff

2.2.1 Financial report

The financial year 2012 was concluded with a turnover of K€ 2.483

The following table shows a breakdown of the turnover in 2012 compared with the preceding year 2011:

	Turnover (in K€) 2011	Turnover (in K€) 2012
Direct government funding (1 st flow of funds; 1 ^e geldstroom)	1.069	1.283
Indirect government funding (2 nd flow of funds; 2 ^e geldstroom)	221	173
External funding (3 rd flow of funds; 3 ^e geldstroom)	879	1.027
Total	2.169	2.483

2.2.2 Staff

The table below gives an overview of the numbers of CML staff in 2012, expressed in fte:

Departments	Scientific staff	PhD students	Supporting staff	Totals
CML-Central unit	0,42	0,00	3,28	3,70
Industrial Ecology	7,16	4,00	0,00	11,16
Conservation Biology	6,13	4,45	0,00	10,58
Total 2012	13,71	8,45	3,28	25,44
Cf: totals 2011	14.1	8.8	4.7	27.6

Scientific staff

Name	Department of	Position
Dam-Mieras prof.dr. M.C.E.	Central Unit	Professor
Eckstein, C. MSc	Conservation Biology	Long term fellow
Ehret, J. Msc	Conservation Biology	Short term fellow
Groot, prof.dr. W.T. de	Conservation Biology	Associate professor
Guinée, dr.ir. J.B.	Industrial Ecology	Researcher
Heijungs, dr. R.	Industrial Ecology	Assistant professor
Hu, dr. M.	Industrial Ecology	Researcher
Huele, drs. R.	Industrial Ecology	Assistant professor
Huppés, dr. G.	Industrial Ecology	Associate professor
longh, prof.dr.ir. H.H. de	Conservation Biology	Associate professor
Kleijn, drs.ing. E.G.M.	Industrial Ecology	Assistant professor
Koning, ir. A. de	Industrial Ecology	Researcher
Meijden, prof.dr. E. van der	Central Unit	Professor
Musters, dr. C.J.M.	Conservation Biology	Assistant professor
Oers, drs. L.F.C.M. van	Industrial Ecology	Researcher
Sahoo, dr. A.	Industrial Ecology	Researcher
Snelder, dr. D.J.R.M.	Conservation Biology	Associate professor
Snoo, prof.dr. G.R. de	Conservation Biology; Central Unit	Professor
Tamis, dr. W.L.M.	Conservation Biology	Assistant professor
Vijver, dr.ing. M.G.	Conservation Biology	Assistant professor
Voet, dr. E. van der	Industrial Ecology	Associate professor
Weerd, drs. M. van	Conservation Biology	Researcher

PhD students

Name	Department
Adhitya, A.	Conservation Biology
Admiraal, J.F.	Conservation Biology
Bertola, L.	Conservation Biology
Cucurachi, S.	Industrial Ecology
Font Vivanco	Industrial Ecology
Giesen, C.C. van der	Industrial Ecology
Grebenstein, C.	Conservation Biology
Henriksson, P.	Industrial Ecology
Ieromina, S.	Conservation Biology
Song, L.	Conservation Biology
Trimbos, K.B.	Conservation Biology
Verschoor, ir A.J.	Conservation Biology

Guest PhD students

Name	Department
Afidchao, M.	Conservation Biology
Buij, R.	Conservation Biology
Evans, T.	Conservation Biology
Fang, K.	Industrial Ecology
Hua, J.	Conservation Biology
Hsu, R.	Conservation Biology
Huqa, T.J.	Conservation Biology
Kosamu, I.B.M.	Conservation Biology
Liao, W.	Industrial Ecology
Liu, Y.	Conservation Biology
Mabhachi, O.	Conservation Biology
Osinga, N.	Conservation Biology
Qiu, H.	Conservation Biology

Guest PhD students (continued)

Rui, J.	Industrial Ecology
Saliling, W.	Conservation Biology
Sprecher, B.	Industrial Ecology
Suba, R.	Conservation Biology
Tankou, C.	Conservation Biology
Tumenta, P.	Conservation Biology
Unusa, H.	Conservation Biology
Villegas, K.	Conservation Biology
Wiloso, E.	Industrial Ecology
Ziebe, R.	Conservation Biology

Administrative and supporting staff

Name	Department of	Position
Bree, R.E. de, MSc	Central Unit	Coordinator Minor
Brittijn J.G.H.C.	Central Unit	Secretary
Oever, S. van den	Central Unit	Secretary
Oosthoek, dr. P.W.	Faculty of Science	Coordinator MSc IE
Philips-Volriet, E.M.	Central Unit	Policy officer
Sjardijn-Sinteur, J.M.	Central Unit	Secretary
Zelfde, ing. M. van 't	Conservation Biology	Research assistant
Zondervan, drs. L.M.	Central Unit	Institute Manager

Year round guests

Name	Department of	Position
Boersema, prof.dr. J.J.	Central Unit	Associate professor
Gertenaar, E.R.	Conservation Biology	Research assistant
Kramer, prof.dr. G.J.	Industrial Ecology	Professor
Peijnenburg, prof. dr. ir. W.J.G.M.	Conservation Biology	Professor
Udo de Haes, prof.dr. H.A.	Central Unit	Emeritus professor

3 Research

3.1 PhD Student Research

Department of Industrial Ecology

Cucurachi, Stefano: Noise impacts in environmental life assessment (promotor: prof.dr. G.R. de Snoo, co-promotor: dr. R. Heijungs).

Fang, Kai: Evaluation of Energy Systems for Sustainable Development Based on Ecological Footprint Analysis (promotor: prof.dr. G.R. de Snoo, co-promotor: dr. R. Heijungs).

Font Vivanco, David: Environmental assessment of eco-innovation in transport systems (promotor: prof.dr. G.R. de Snoo, co-promotors: dr. E. van der Voet, prof.dr. R. Kemp)

Giesen, Coen van der: Constraints on large-scale implementation of BioSolar Cells; Early-stage Assessment of Environmental Value Propositions (promotor: prof.dr. G.J. Kramer, co-promotor: drs.ir. E.G.M. Kleijn).

Henriksson, Patrik: Life Cycle Assessment of Asian Aquaculture. Evaluating the environmental impacts of Pangasius, Tilapia, shrimp and prawn imports from Bangladesh, Thailand, Vietnam and China using Life Cycle Assessment. (promotor prof.dr. G.R. de Snoo, co-promotors: dr. ir. J.B. Guinée & drs ir E.G.M. Kleijn).

Rui, Jiali: The operational Mechanism of Industrial Ecosystems and Its Implementation in China (promoter: prof. dr. G.R. de Snoo, co-promotor dr. R. Heijungs).

Simoões, Sofia: (Portugal): Combining energy and environmental policy objectives: adequacy of using integrated policy approaches to electricity (promoter: prof. dr. G.J. Kramer, co-promotor dr. G. Huppes).

Sprecher, Benjamin: Extraction of raw materials from waste streams (promotor: prof.dr. G.J. Kramer, co-promotor: drs ir E.G.M. Kleijn).

Wiloso, Edi: Life Cycle Assessment of bioethanol from lignocellulosic waste in Indonesia (promotor: prof.dr. G.R. de Snoo, co-promotor: dr R. Heijungs).

Department of Conservation Biology

Adithya, Achmad: The role of hydrodynamics for ecosystem functioning in East Kalimantan, Indonesia (promotor: prof. dr. P. Herman, KUN, co-promotor: dr. T. Bouma, NJIOO & prof.dr. H.H. de longh).

Admiraal, Jeroen: Motivation for Biodiversity (promotor: prof.dr. G.R. de Snoo, co-promotor: dr. D.J.R.M. Snelder).

Afidchao, Miladis: The Ecological Impact of Bt Corn on Agro-ecosystem's Health, Its Societal Acceptance and Effects on the Socioeconomic Status of Farmers in Isabela Province, Philippines (promotor: prof. dr. G.R. de Snoo, co-promotor: dr. C.M. Musters).

Arbainsyah, Insyah: Indicators for sustainable forest management (promotor: prof.dr. G.R. de Snoo, co-promotor: prof.dr. H.H. de longh)

Bertola, Laura: Phylogeography of the lion in West and Central Africa based on mitochondrial and nuclear autosomal genes, Y genes and SNPs: Pleistocene bottleneck and population expansion of a West African subspecies? (promotor: prof. dr. G.R. de Snoo, co-promoters: prof. dr. ir. H.H. de longh & dr. K. Vrieling).

Buij, Ralph: Impact of land use changes on raptor communities in North Cameroon (promotor: prof. dr. G.R. de Snoo, prof. J. Komdeur, co-promotor: prof.dr. H.H. de longh).

Evans, Tracy: Agricultural Practices that Improve Biodiversity (promotor: prof.dr. G.R. de Snoo, co-promotor: dr. C.M. Musters)

Grebenstein, Cilia: Opportunities for and evidences of introgression between wild and cultivated carrots in the Netherlands (promoter: prof. dr. G.R. de Snoo, co-promoters: dr. W.L.M. Tamis & dr. T. de Jong).

Hua, Jing: Assessment of the dosimetry of metal-based nanoparticles (promotor: prof.dr.ir. W.J.G.M. Peijnenburg, co-promotor: dr M.G. Vijver).

Huga, Tuga Jirno: Lions (*Panthera leo*) Ecology: Lions – Livestock conflict around Amboseli National Park Kenya (promotor: prof.dr. G.R. de Snoo, co-promotor: prof.dr. H.H. de longh).

Hsu, Rebecca: Plant diversity of epiphytes in Taiwan related to Climate change (co-operation with UvA). (1st promotor: J.H.D. Wolf (UvA), 2nd promotor: prof. dr. G.R. de Snoo, co-promotor: dr. J.G.B. Oostermeijer (UvA) & dr. W.L.M.Tamis).

Ieromina, Oleksandra: Assessing effects of pesticide mixtures in aquatic environment (promotor: prof. dr. W. Peijnenburg, prof. dr. G.R. de Snoo, co-promotor: dr. M.G. Vijver).

Kosamu, Ishmael: Rainfall variability and its impact on communities' livelihoods in Ng'abu catchment, Shire River Basin, Malawi (promotor: prof.dr. W.T. de Groot).

Liu, Yang: Determining the mixture effects of metals (promotor: prof.dr.ir. W.J.G.M. Peijnenburg, co-promotor: dr. M.G. Vijver)

Mabhachi, Osiman: Just how practical and effective is community-based conservation outside protected areas? The case of integrated crane and wetland conservation projects in Kenya, Uganda and Zimbabwe (promotor: prof.dr. W.T. de Groot, 2nd promotor: prof.dr. G.R. de Snoo).

Osinga, Nynke: The use of genetic research to study the population biology and anthropogenic influences on seals in The Netherlands (promotor: prof. dr. H.A. Udo de Haes).

Qiu, Hao: Development of predictive models to evaluate individual and mixture toxicity of metals for soil organisms (promotor: prof. dr. W. Peijnenburg, co-promotor: dr. M.G. Vijver).

Saliling, Willie: Water resource and nutrient dynamics in upland agricultural systems in the Philippines. (promotor: prof. dr. W.T. de Groot, co-promotor: dr. D.J.R.M. Snelder).

Song, Lan: Smart Nanotoxicity testing for biodiversity conservation (promotor: prof. dr. W. Peijnenburg, prof. dr. G.R. de Snoo, co-promotor: dr. M.G. Vijver).

Suba, Rachmat: Ecology and phylo genetics of the Bornean forest elephant (promotor: prof.dr. G.R. de Snoo, co-promotor: prof.dr H.H. de longh).

Tapia, Maricel: Governance of biospheres: combining biodiversity conservation and local food and water security (promotor: prof.dr. G.R. de Snoo, co-promotor dr. D. Snelder)

Tankou, Christopher: Impact of human mobility and land use on farming systems and biodiversity in the Savannah of Cameroon (promoters: prof. dr. G.R. de Snoo and prof. dr. G. A. Persoon (FSW), co-promoter prof.dr. H.H. de longh)

Trimbos, Krijin: α , β , γ , genetic diversity; a new tool for conservation biodiversity (promotor: prof. dr. G.R. de Snoo, co-promotor dr. C.J.M. Musters).

Verschoor, Anja: Elaboration and operationalisation Biotic Ligand Models. (promotor: prof. dr. G.R. de Snoo, co-promotor: dr. M.G. Vijver).

Villegas, Karl: Biodiversity conservation: integration of communities' perceptions and needs with global visions on nature conservation (promotor: prof. dr. W.T. de Groot, co-promotor: dr. D.J. Snelder).

Weerd, Merlijn van: Trees in agricultural landscapes: farmers' adoption of trees in farming systems in Northeast Luzon, Philippines (promotor: prof. dr. H.A. Udo de Haes, co-promotor: dr. D.J. Snelder).

Ziebe, Roland: Floodplain fisheries around Amboseli N.P. (promoter: prof. dr. G.A. Persoon (FSW), co-promotor: prof.dr. H.H. de longh).

PhD student research finished

Kleijn, René: Materials and energy: a story of linkages. (promotor prof.dr. G.J. Kramer, co-promotor: dr. E. van der Voet)

Liao, Wenjie: Environmental Extensions to Input-Output Tables for Integrated Sustainability Assessment. Estimation of environmental impacts and external costs of economic activities, such as resource consumption. Environmentally extended input-output framework for sustainability assessment at both the micro, meso and macro level (promotor: prof. dr. S.M. Verduyn Lunel, co-promotor: dr. G. Huppes).

Tumenta, Pricelia: The interactions between nomadic livestock and wild herbivores in the Waza-Logone complex, Cameroon (promotor: prof. dr. H.A. Udo de Haes, co-promotores: prof.dr. H.H. de longh and dr. D.J. Snelder).

Unusa, Haman: The new pastoralism: absentee owners, new technologies, economic change and natural resource management in the Sahelian region of Far North Cameroon (promotor: H. van Dijk, co-promotores: prof.dr. H.H. de longh, prof. dr. G.A. Persoon).

4 Research projects 2012

Department of Industrial Ecology

Risk based management of chemicals and products in a circular economy at a global scale (RiskCycle)

Period: 2009-2012
Commissioner: European Commission
Contact: dr. E. van der Voet

Resource Efficient Europe

Period: 2012-2014
Commissioner: European Commission, DG Environment
Contact: dr. E. van der Voet

Environmental Macro Indicators of Innovation (EmInInn)

Period: 2011-2013
Commissioner: European Commission
Contact: dr. E. van der Voet

Sustaining Ethical Aquatic Trade (SEAT)

Period: 2009-2013
Commissioner: European Commission
Contact: dr.ir. J.B. Guinée

Critical review of Life Cycle Assessments of current practice and of comparative evaluation of new MDS technology for the purpose of the collaborative project Magnetic Sorting and Ultrasound Sensor technologies for Production of High Purity Secondary Polyolefins from Waste

Period: 2011-2013
Commissioner: Technical University of Denmark
Contact: dr.ir. J.B. Guinée

Increasing Industrial Resource Efficiency in European Mariculture (IDREEM)

Period: 2012-2016
Commissioner: European Commission
Contact: dr.ir. J.B. Guinée

Development and application of environmental Life Cycle Impact assessment Methods for improved sustainability Characterisation of Technologies (LC-Impact)

Period: 2010-2013
Commissioner: European Commission
Contact: dr. R. Heijungs

EU Compiling and Refining Environmental and Economic Accounts (CREEA)

Period: 2011-2014
Commissioner: European Commission
Contact: dr. R. Heijungs

Meetbaar Duurzaam

Period: 2012-2015
Commissioner: RIVM
Contact: dr. R. Heijungs

DataCentre Lot 2, Services on environmental statistics and accounts – Assistance to the Environmental Data Centres on Natural Resources and Products

Period: 2009-2012
Commissioner: Eurostat
Contact: dr. R. Kleijn

Constraints on large-scale implementation of biosolar cells; early-stage assessment of environmental value propositions

Period: 2011-2015
Commissioner: Biosolar Cells
Contact: dr. R. Kleijn

EU Advanced Technologies for the Production of Cement and Clean Aggregates from Construction and Demolition Waste (C2CA)

Period: 2011-2013
Commissioner: European Commission
Contact: dr. R. Kleijn

Development of a System of Indicators for a Resource efficient Europe (Desire)

Period: 2012-2016
Commissioner: EU DG Environment
Contact: dr. R. Kleijn

Cecilia2050

Period: 2012 - 2015
Commissioner: European Commission, FP7
Contact: dr. R. Kleijn

European research agenda for Eco-Innova

Period: 2010 - 2012
Commissioner: Ministry of Infrastructure and the Environment
Contact: dr. G. Huppes

LCA Training & Coaching

Period: 2012
Commissioner: Royal Haskoning
Contact: dr. R. Heijungs

Department of Conservation Biology

Quantifying introgression risks of transgenes with hazard rates, using carrot as a model species

Period: 2007 - 2012
Commissioner: NWO/ERGO
Contact: prof. dr. G. R. de Snoo

Biologische kenmerken en rode lijsten in Nederland

Period: 2010-2012
Commissioner: Min. E., L. & I.
Contact: dr. C.J.M. Musters

Biodiversity indicators from the GLOBIO database

Period: 2010- 2012
Commissioner: PBL
Contact: dr. C.J.M. Musters

NUFFIC PhD fellowship programme (Tuqa Jirimo Huqa, Kenya)

Period: 2009 - 2012
Commissioners: NUFFIC
Contact: prof.dr H.H. de longh

Amboseli Lion Research Project

Period: 2007 - 2012
Commissioners: WWF/Prins Bernhard Natuur fonds
Contact: prof.dr. H.H. de longh

Lycaon research project

Period: 2008 - 2012
Commissioner: WWF
Contact: prof.dr. H.H. de longh

Phylogeography of the lion in West and Central Africa based on mitochondrial and nuclear autosomal genes, Y genes and SNPs: Pleistocene bottleneck and population expansion of a West African subspecies?

Period: 2010 - 2014
Commissioner: NWO-ALW
Contact: prof.dr. H.H. de longh

ESPRIT (Environmental Sustainability: Priority research and education in the tropics)

Period: 2008 - 2012
Commissioner: EU (EDULINK)
Contact: prof. dr. W.T. de Groot

Bestrijdingsmiddelen en Water (book publication)

Period: 2011-2012
Commissioner: Waterschappen
Contact: Prof.dr. G.R. de Snoo en Dr. M.G. Vijver

Quantifying and managing metal induced ecological effects in the field

Period: 2008 - 2013
Commissioner: NWO
Contact: dr. M.G. Vijver

Pesticides Atlas, update with measurements

Period: 2012
Commissioner: Waterdienst
Contact: dr. M.G. Vijver

Development and implementation of effect models for single metals, Biotic Ligand Models

Period: 2008-2013
Commissioner: Deltaris
Contact: dr. M.G. Vijver

Evaluation Policy for Plant Protection Products

Period: 2010-2012
Commissioner: PBL/RIVM
Contact: dr. M.G. Vijver

Electromagnetic fields, impact on bees

Period: 2011-2012
Commissioner: PRI - ZonMW
Contact: Dr. M.G. Vijver

Electromagnetic fields / review on nature, extent and ecological effects

Period: 2011-2012
Commissioner: RIVM
Contact: Dr. M.G. Vijver

Zuiver water in de Bommelerwaard

Period: 2011-2012
Commissioner: Waterlaboratorium
Contact: Dr. M.G. Vijver

Environmental Chemoinformatics

Period: 2009 - 2013
Commissioner: European Commission
Contact: prof.dr.ir. W.J.G.M. Peijnenburg and dr. M.G. Vijver

Ecotoxicity of metal and metal oxide nanoparticles: experimental studies and modeling

Period: 2012-2015
Commissioner: NATO
Contact: prof.dr. W. Peijnenburg

Motivational strength of ecosystem services and alternative ways to express the value of biodiversity (BIOMOT)

Period: 2011-2015
Commissioner: European Commission
Contact: prof.dr. G.R. de Snoo

Mainstreaming climate change in biodiversity planning and conservation in the Philippines

Period: 2011-2012
Commissioner: International Centre for Research in Agroforestry (ICRAF)
Contact: dr. D. Snelder

Interpretation of monitoring results

Period: 2008-2012
Commissioner: PPO/WUR
Contact: dr. W.L.M.Tamis

5 Publications

In 2011, CML staff produced a total number of 76 academic publications.

The following table shows the number and status of publications as seen over the past five years.

Table: Publications of CML 2006-2010 by type

	2008	2009	2010	2011	2012
1. Academic publications	77	66	58	76	50
a. refereed	63	56	52	71	43
b. non-refereed	14	10	6	5	7
2. PhD theses (CML only)	1	3.5	5	1	3,5
3. Professional publications	26	39	30	13	20
4. Membership editorial boards*	8	10	8	7	8
5. Popular publications*	8	3	-	4	9
6. Total 1-5	120	118	101	101	90,5

* Before 2008 membership of editorial boards and popular publications were not registered separately

PhD theses

Kleijn, R. (2012, september 05). *Materials and energy: a story of linkages*. Universiteit Leiden (173 pag.) (Leiden: Leiden University). Prom./coprom.: Prof. dr. G.J. Kramer & dr. E. van der Voet.

Liao, M.E.W. (2012, juli 03). *A thermodynamic perspective on technologies in the Anthropocene: Analyzing environmental sustainability*. Universiteit Leiden (134 pag.) (Leiden: Leiden University). Prom./coprom.: prof.dr. S.M. Verduyn Lunel, dr. G. Huppés & dr. R. Heijungs.

Tumenta, P.N. (2012, december 11). *A lion population under threat : understanding lion (Panthera leo Linnaeus, 1758) ecology and human-lion interactions related to livestock predation in Waza National Park, Cameroon*. LEI Universiteit Leiden (113 pag.) (Leiden: Leiden University). Prom./coprom.: prof. dr. H.A. Udo de Haes & prof. dr. ir. H.H. de longh.

Unusa, H. (2012, september 20). *The new pastoralism. Absentee owners, new technologies, economic change and natural resource management in the Sahelian region of Far North Cameroon*. LEI Universiteit Leiden (291 pag.). Prom./coprom.: prof. dr. G.A. Persoon, prof.dr. J.W.M. van Dijk & prof. dr. ir. H.H. de longh.

Yen Le, T.T (2012, december 20). *Modelling bioaccumulation and toxicity of metal mixtures*. Radboud University Nijmegen (179 pag.) (Enschede: Radboud University). Prom./coprom.: A.J. Hendriks, prof.dr. W.J.G.M. Peijnenburg, dr. R.S.E.W. Leuven & dr. ing. M.G. Vijver.

Academic publications refereed

Department of Industrial Ecology

Cucurachi, S., Heijungs, R. & Ohlau, K. (2012). Towards a general framework for including noise impacts in LCA. *International Journal of Life Cycle Assessment*, 17(4), 471-487.

Font Vivanco, D., Puig Ventosa, I. & Gabarrell Durany, X. (2012). Building waste management core indicators through Spatial Material Flow Analysis: Net recovery and transport intensity indexes. *Waste Management*, 32(2), 2496-2510.

Heijungs, R. (2012). Spatial differentiation, GIS-based regionalization, hyperregionalization, and the boundaries of LCA. In G. Ioppolo (Ed.), *Environment and Energy* (Editorial series of Italian Commodity Science Academy and Engineering Association of Messina, 1) (pp. 165-176). Milano, Italy: FrancoAngeli.

Henriksson, P.J.G., Guinée, J.B., Kleijn, R. & Snoo, G.R. de (2012). Life cycle assessment of aquaculture systems - a review. *International Journal of Life Cycle Assessment*, 17(3), 304-313.

Huppés, G., Oers, L. van, Pretato, U. & Pennington, D.W. (2012). Weighting environmental effects: Analytic survey with operational evaluation methods and a meta-method. *International Journal of Life Cycle Assessment*, 17(7), 876-891.

Liao, M.E.W., Heijungs, R. & Huppés, G. (2012). Natural resource demand of global biofuels in the Anthropocene: A review. *Renewable and Sustainable Energy Reviews*, 16(1), 996-1003.

Liao, M.E.W., Heijungs, R. & Huppés, G. (2012). Thermodynamic analysis of human–environment systems: A review focused on industrial ecology. *Ecological Modelling*, 228, 76-88.

Liao, M.E.W., Heijungs, R. & Huppés, G. (2012). Thermodynamic resource indicators in LCA: a case study on the titania produced in Panzhihua city, southwest China. *International Journal of Life Cycle Assessment*, 17(8), 951-961.

Oers, L. van, Voet, E. van der & Grundmann, V. (2012). Additives in the Plastic Industry. In B. Bilitewski, R.M. Darbra & D. Barceló (Eds.), *Global Risk-Based Management of Chemical Additives I: Production, Usage and Environmental Occurrence* (The Handbook of Environmental Chemistry, 18) (pp. 133-149). Heidelberg: Springer.

Sahoo, A & Raa, T ten (2012). Wage–productivity differentials and Indian economic efficiency. *Economic Modelling*, 29(2), 341-348.

Wardenaar, T., Ruijven, T. van, Beltran, A.M., Vad, K., Guinée, J.B. & Heijungs, R. (2012). Differences between LCA for analysis and LCA for policy: a case study on the consequences of allocation choices in bio-energy policies. *International Journal of Life Cycle Assessment*, 17(8), 1059-1067.

Wiloso, E.I., Heijungs, R. & Snoo, G.R. de (2012). LCA of second generation bioethanol: A review and some issues to be resolved for good LCA practice. *Renewable and Sustainable Energy Reviews*, 16(7), 5295-5308.

Zamagni, A., Guinée, J.B., Heijungs, R., Masoni, P. & Raggi, A. (2012). Lights and shadows in consequential LCA. *International Journal of Life Cycle Assessment*, 17(7), 904-918.

Department of Conservation Biology

Buij, R., Goes, D. van der, Iongh, H.H. de, Gagare, S., Haccou, P., Komdeur, J. & Snoo, G.R. de (2012). Interspecific and intraspecific differences in habitat use and their conservation implications for Palearctic harriers on Sahelian wintering grounds. *Ibis*, 154(1), 96-110.

Ding, G., Wouterse, M., Baerselman, R. & Peijnenburg, W.J.G.M. (2012). Toxicity of poly- and perfluorinated compounds to lettuce (*Lactuca sativa*) and green algae (*Pseudokirchneriella*). *Archives of Environmental Contamination and Toxicology*, 62, 49-55.

Ding, G.H., Frömel, T., Brandhof, E.J van den, Baerselman, R. & Peijnenburg, W.J.G.M. (2012). Acute toxicity of poly- and perfluorinated compounds to two cladocerans, *Daphnia magna* and *Chydorus sphaericus*. *Environmental Toxicology and Chemistry*, 31(3), 605-610.

Fedotov, P.S., Kordel, W., Miro, M., Peijnenburg, W.J.G.M., Wennrich, R. & Huang, P.M. (2012). Extraction and Fractionation Methods for Exposure Assessment of Trace Metals, Metalloids and Hazardous Organic Compounds in Terrestrial Environments. *Critical Reviews in Environmental Science and Technology*, 42, 1117-1171.

Grebenstein, C., Kos, S.P., Jong, T.J. de, Tamis, W.L.M. & Snoo, G.R. de (2012). Morphological markers for the detection of introgression from cultivated into wild carrot (*Daucus carota* L.) reveal dominant domestication traits. *Plant Biology*.

Guerrero, I., Morales, M.B., Oñate, J.J., Geiger, F., Berendse, F., Snoo, G.R. de, Eggers, S., Pärt, T., Bengtsson, J., Clement, L.W., Weisser, W.W., Olszewski, A., Ceryngier, P., Hawro, V., Liira, J., Fischer, A., Florhre, A., Thies, C. & Tschamtke, T. (2012). Response of ground-nesting farmland birds to agricultural intensification across Europe: landscape and field level management factors. *Biological Conservation*, 152(8), 74-80.

Hsu, C.C., Tamis, W.L.M., Raes, N., Snoo, G.R. de, Wolf, J.H.D, Oostermeijer, G. & Lin, S.H. (2012). Simulating climate change impacts on forests and associated vascular epiphytes in a subtropical island of East Asia. *Diversity and Distributions*, 18, 334-347.

Jonker, R.M.V. & Tamis, W.L.M. (2012). Introduction, breeding and poaching of Scarlet Macaws (*Ara macao* L.) in a temperate country: a case study from the Netherlands. *The Open Ornithology Journal*, 5, 1-4.

Kosamu, I.B.M., Groot, W.T. de, Kambewa, P.S. & Snoo, G.R. de (2012). Institutions and Ecosystem-Based Development Potentials of the Elephant Marsh, Malawi. *Sustainability*, 4(12), 3326-3345.

Laurance, W.F., Weerd, M. van & et., al. (2012). Averting biodiversity collapse in tropical forest protected areas. *Nature*, 489, 290-294.

Li, F., Wu, H., Li, L., Li, X., Zhao, J. & Peijnenburg, W.J.G.M. (2012). Docking and QSAR study on the binding interactions between polycyclic aromatic hydrocarbons and estrogen receptor. *Ecotoxicology and Environmental Safety*, 80, 273-279.

Li, L., Liu, X., Peijnenburg, W.J.G.M., Zhao, J., Chen, X., Yu, Y. & Wu, H. (2012). Pathways of cadmium fluxes in the root of the halophyte *Suaeda salsa*. *Ecotoxicology and Environmental Safety*, 75, 1-7.

Moermond, C., Janssen, M.P., Knecht, J.A. de, Montforts, M.H.M.M., Peijnenburg, W.J.G.M., Zweers, P.G. & Sijm, D.T.H.M. (2012). PBT assessment using the revised annex XIII of REACH: a comparison with other regulatory frameworks. *Integrated Environmental Assessment and Management*, 8(2), 359-371.

Osinga, N., Shahi Ferdous, M.M., Morick, D., García Hartman, M., Ulloa, J., Vedder, L., Udo de Haes, H.A., Brakefield, P.M., Osterhaus, A.D.M.E. & Kuiken, T. (2012). Patterns of Stranding and Mortality in Common Seals (*Phoca vitulina*) and Grey Seals (*Halichoerus grypus*) in The Netherlands between 1979 and 2008. *Journal of Comparative Pathology*, 147(4), 550-565.

Osinga, N., Nussbaum, S.B., Brakefield, P.M. & Udo de Haes, H.A. (2012). Response of common seals (*Phoca vitulina*) to human disturbances in the Dollard estuary of the Wadden Sea. *Mammalian Biology*, 77(4), 281-287.

Peijnenburg, W.J.G.M., Capri, E., Kula, C., Liess, M., Luttik, R., Montforts, M., Nienstedt, K., Römbke, J., Paulo Sousa, J. & Jensen, J. (2012). Evaluation of exposure metrics for effect assessment of soil invertebrates. *Environmental Science and Technology*, 42, 1862-1893.

Quik, J.T.K., Cohen Stuart, M., Wouterse, M., Peijnenburg, W.J.G.M., Hendriks, A.J. & Meent, D. van de (2012). Natural colloids are the dominant factor in the sedimentation of nanoparticles. *Environmental Toxicology and Chemistry*, 31, 1019-1022.

Rahman, S.A., Imam, M.H., Snelder, D.J.R.M. & Sunderland, T. (2012). Agroforestry for Livelihood Security in Agrarian Landscapes of the Padma Floodplain in Bangladesh. *Small-scale Forestry*, 1-10.

Riggio, J., Jacobson, A., Dollar, L., Bauer, H., Becker, M., Dickman, A., Funston, P., Groom, R., Henschel, P., Iongh, H.H. de, Lichtenfeld, L. & Pimm, S. (2012). The size of savannah Africa: a lion's (*Panthera leo*) view. *Biodiversity and Conservation*, 12(3), 1-19.

Snoo, G.R. de, Naus, N., Verhulst, J., Ruijven, J. van & Schaffers, A.P. (2012). Long-term changes in plant diversity of grasslands under agricultural and conservation management. *Applied Vegetation Science*, 15(3), 299-306.

Tabora, J.A.G., Hinlo, M.A.R.P., Bailey, C.A., Lei, R., Pomares, C.C, Rebono, G., Weerd, M. van, Engberg, S.E., Brenneman, R.A. & Louis, Jr., E.E. (2012). Detection of *Crocodylus mindorensis* x *Crocodylus porosus* (Crocodylidae) hybrids in a Philippine crocodile systematics analysis. *Zootaxa*, 3560, 1-31.

Verschoor, A.J., Hendriks, A.J., Vink, J.P.M., Snoo, G.R. de & Vijver, M.G. (2012). Multimetal accumulation in crustaceans in surface water related to body size and water chemistry. *Environmental Toxicology and Chemistry*, 31(10), 2269-2280.

Verschoor, A.J., Vink, J.P.M. & Vijver, M.G. (2012). Simplification of Biotic Ligand Models of Cu, Ni, and Zn by 1-, 2-, and 3-Parameter Transfer Functions. *Integrated Environmental Assessment and Management*, 8, 738-748.

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6 Education

6.1 Introduction

CML's education programme aims at training (under)graduate and graduate students for integrated and multidisciplinary sustainability research and for better decision making in managing the world's natural resources, environmental quality and biodiversity. CML acts as a centre for sustainability expertise in education programmes of Leiden University.

The educational program of CML consists of the following:

- An MSc program Industrial Ecology, together with TU Delft
- A specialization track Evolution, Biodiversity and Conservation in the MSc Biology, together with IBL and NHN
- An Erasmus Mundus international Master program in Industrial Ecology, MIND, together with the University of Graz (Austria) and Chalmers University of Technology (Göteborg, Sweden)
- A university wide minor Sustainable Development for Bachelor students
- Several courses in the Sustainability track of the Leiden University College Bachelor in Liberal Arts and Sciences
- Several courses in the BSc Biology
- MSc and BSc thesis research projects not just in CML's own Master programmes but also in other educational programmes.

CML is currently engaged in expanding the educational program with initiatives between the universities of Leiden, Delft and Rotterdam, among others in creating a joint sustainability specialization and in developing online courses.

Below, some key statistics are presented for CML's educational program.



6.2 Course attendance

COURSE TITLE:	PART OF	2011/2012 students	2012/2013 students
Introduction to Environmental Science (propaedeutic module)*	BSc Biology	119	n/a
Ecologie, Gedrag en Milieu (propaedeutic module)	BSc Biology	113	96
Ecologie en Milieu	BSc Biology	43	44
Biodiversiteit 1: Taxa in Ruimte en Tijd	BSc Biology	64	42
Environmental Processes and Biodiversity 9 ECTS	BSc Biology	14	37
Milieubiologie	BSc Biology	53	42
Minor Sustainable Development	Minor		
- Grote Vragen Nieuwe Antwoorden (GVNA)		39	31
- Project group European Research		24	28
- Region study Philippines		7	9
- Region study North Sea		28	n/a
- Themastudie Weg met Afval		n/a	21
EBC Book Exam	MSc Biology	n/a	24
Biodiversity and Conservation (Seminar)	MSc Biology	20	6
Trends in Conservation Biology	MSc Biology	20	15
Fundamentals in Evolution, Biodiversity and Conservation*	MSc Biology	43	36
<i>Courses of MSc IE (Data are derived from uSis, so guest students from TU Delft are not included)</i>			
Environmental Science	MSc IE	2	n/a
IE Capita Selecta Module (2EC)	MSc IE	3	-
IE Capita Selecta Module (3EC)	MSc IE	-	-
IE Capita Selecta Module (4EC)	MSc IE	1	-
IE Capita Selecta Module (5EC)	MSc IE	-	-
IE Capita Selecta Module (6EC)	MSc IE	1	3
Design of Sustainable Technological Systems	MSc IE	n/a	10
Thesis Preparation Module	MSc IE	15	22
Interdisciplinary Project Groups	MSc IE	8	21
Thesis Research Project	MSc IE	13	18
Advanced Course on LCA	MSc IE	4	29
General Introduction to Industrial Ecology 6 EC	MSc IE	36	35
Fundamentals of Systems, Data, Models and Computational Thinking	MSc IE	29	36
Social Systems – Policy and Management	MSc IE	30	36
Analytical Methodologies and Tools	MSc IE	33	34
Renewable Energy Systems	MSc IE	37	42
Sustainable Innovation and Social Change	MSc IE	28	17
System Earth	MSc IE	40	22
Urban Environments and Infrastructures	MSc IE	35	15
	TOTAL	902	771

* in collaboration with IBL and NHN

The following gives a more detailed overview of CML's educational output in 2012.

A. Propaedeutic education

BSc Biology:

Ecologie, Gedrag en Milieu, 29 April -17 May 2012, 4EC

96 participants

B. Bachelor education

BSc in Biology:

Ecologie en Milieu, Start 8 April 2013, 6EC

44 participants

Biodiversiteit 1: Taxa in Ruimte en Tijd, Start 1 October 2012, 6EC

42 participants

Environmental Processes and Biodiversity, September 5 – October 4 2012

37 participants

Milieubiologie, Start 12 November 2012, 3ECTS

42 participants

Minor Sustainable Development:

The Minor Sustainable Development consists of 3 courses, together 30 ECTS:

Duurzame ontwikkeling Grote Vragen Nieuwe Antwoorden, September – December 2012

31 participants.

Project group European Research, September – December 2012

28 participants

Region & theme studies, December 2012 – February 2013

- Philippines: 9 participants
- Weg met Afval: 21 participants

26 students came from Leiden University.

2 students came from Delft University of Technology, 1 came from Erasmus University Rotterdam, another 1 from the University of Amsterdam and 2 students came from the International Higher Educational institution of Breda.

C. Master education

MSc in Biology:

EBC Book Exam:

24 participants

Fundamentals of Evolution, Biodiversity and Conservation: 5 September – 28 October 2012

36 participants

Biodiversity and Conservation Seminar: 28 March – 27 June 2012

6 participants

Trends in Conservation Biology, 28 November – 21 December 2012

15 participants

MSc in Industrial Ecology:

Total enrolled at 1-9-2009: 28

Total enrolled at 1-9-2010: 47

Total enrolled at 1-9-2011: 60

Total enrolled at 1-9-2012: 64

Diploma's in 2009: 9

Diploma's in 2010: 7

Diploma's in 2011 (exam date): 21

Diploma's in 2012: 15

6.3 Internships at CML

Table: Overview of Internships in the Netherlands in 2012

Family name	Type of internship	Title of report
Bergen	Master	On the Role of Government in Transition Management
Chalkias	Master	Putting Industrial Ecology to the Test: An Operationalization of the 'Biological Analogy' Using Agent-Based Modeling.
Feldmar	Master	Towards a Sustainable Livelihood: Small-scale biomass briquette production for a Roma community in Hungary.
Galgani	Master	Compost, biogas and biochar in Northern Ghana: Climate impact and economic feasibility in the context of voluntary carbon markets.
Houwelingen, van	Master	Possible causes for wood ant decline
Huizer	Bachelor	Vogels, vleermuizen, de baas? Interacties tussen vleermuizen en vogels.
Jimenez	Contract	Environmental fate of organic and inorganics
Jong, de	Master	Morphometric parameters to identify AWD tracks.
Jong, de	Master	Resource competition for tree cavities between the ring-necked parakeet & 2 native tree dwelling bat species. (1).
Kamperman	Master	The Emergence of the Sustainable Development Maturity Model.
Klugt, van der	Master	Conservation biological control of Black Cherry (<i>Prunus serotina</i>).
Korpelshoek	Master	Harbour porpoises in the Oosterschelde and the southern North Sea.
Ochssée, von	Bachelor	Vogels en vleermuizen slachtoffers van windmolens.
Putman Cramer	Master	Shaping sustainable normality: Evaluating a practice-oriented design method for Industrial Ecology and Philips Design.
Roelse	Master	Strategic niche management of biogas technologies in the Netherlands.
Roest	Bachelor	De invloed van natuurvriendelijke oevers op soortenrijkdom.
Schiebel	Master	Yellow Nutsedge in the Netherlands: The effects of changing policies on distribution and abundance.
Segers	Master	Designing a Sustainability Support System for Product Designers: An explorative study to identify Design Criteria.
Smit	Bachelor	The toxic effects of copper nanoparticles on <i>Daphnie magna</i> in natural water.
Treurniet	Bachelor	Verandert de relatie tussen oppervlak en soorten-aantal onder invloed van een hogere mobiliteit van de mens?
Vlieg	Master	Tendering the 'Street of the future': A research into sustainable procurement.
Wijsman	Master	Making Sense of Cityscapes – Ecosystem and Metabolism Metaphors in Grasping the City.
Wilson	Master	Resource competition between ringnecked parakeets and two native bat species. (2).
Wu	Master	Integrate the environmental concern into new chemical synthesis design - Case of new bioplastic (PEF).

Table: Overview of Internships Abroad in 2012

Family name	Study	Country	Title of report
Baaten	Biology	Kenya	Impact of trophy hunting on lion population.
Beveridge	Biology	Kenya	Lion-human conflicts around Nairobi NP, Kenya.
Buiks	Biology	Philippines	Modeling head start programme of Philippine crocodile
Costanzi	Biology	Kenya	Home range and movement of lions in Amboseli national park.
Davina	Sustainable development (RU)	Phillipines	A predictive model for the distribution of (endemic) bird species in relation to forest types.
Drenth	Biology	Kenya	The impact of extreme draught on the diet of lion in Amboseli National Park, Kenya.
Drost	Biology	Kenya	Lion-livestock conflicts around Amboseli NP, Kenya
Hoogen, van den	Biology	Kenya	Lion diet, their prey distribution and density in Amboseli National Park, Kenya.
Laatum, van	Biology	Zimbabwe	Comparing time lapse cameras with line transects to monitor wildlife in Zimbabwe.
Lattuada	Biology Antwerp	Kenya	Lion-human conflicts around Nairobi NP, Kenya.
Robeys	Biology Antwerp	Kenya	Lion-livestock conflicts around Amboseli NP, Kenya
Vooft	Biology	Philippines	Modeling growth of the Philippine crocodile