



**REQUEST FOR RENEWAL OF  
ACCREDITATION  
SENSE RESEARCH SCHOOL 2008 – 2013**

**December 2007**



# REQUEST FOR RENEWAL OF ACCREDITATION SENSE RESEARCH SCHOOL

## CONTENTS

1.	<b>Mission</b> .....	4
2.	<b>SENSE's PhD education, PhD training and Research Programme</b> .....	4
2a	<i>PhD training and supervision programme</i> .....	4
2b	<i>Research Programme</i> .....	7
3.	<b>Bachelor and Master programmes</b> .....	9
4.	<b>Management and Organisation</b> .....	9
5.	<b>Cooperation</b> .....	9
6.	<b>SENSE Research Leaders</b> .....	10
7.	<b>National position SENSE Research School</b> .....	10
8.	<b>International position SENSE Research School</b> .....	10
9.	<b>Financial resources</b> .....	11
10.	<b>Guaranteed input (financial and personnel resources)</b> .....	12
11.	<b>Duration PhD studies</b> .....	13
12.	<b>Career perspectives</b> .....	13
13.	<b>Actions resulting from comments ECOS-KNAW at re-accreditation in 2002</b> .....	13
14.	<b>Actions resulting from results external peer review in 2007</b> .....	14
15.	<b>Male / Female ratios per staff category</b> .....	14
Annex 1:	<b>Summary General Requirements SENSE ITSP</b> .....	15
Annex 2:	<b>Overview SENSE PhD Courses (Tables 1, 2 and 3)</b> .....	16
Annex 3:	<b>SENSE Research Programme 2008 - 2013</b> .....	20
Annex 4:	<b>Overview of scores SENSE research groups</b> .....	23
Annex 5:	<b>Key Publications SENSE Research Leaders (added as separate file)</b>	
Annex 6:	<b>Gemeenschappelijke Regeling betreffende de Onderzoeksschool SENSE 2008 – 2013 (added as separate file)</b>	



## REQUEST FOR RENEWAL OF ACCREDITATION SENSE RESEARCH SCHOOL

**Date:**

20 December 2007

**Previous accreditations:**

The SENSE Research School was formally accredited by the Royal Netherlands Academy of Arts and Sciences (KNAW) in 1997 for the period 1997 – 2001.

In 2002 the KNAW responded positively to the request for renewal of accreditation of the SENSE Research School for the period 2002 – 2006.

In 2002, NWO, KNAW and VSNU decided to define a new evaluation system for publicly funded research organisations in the Netherlands, known as the Standard Evaluation Protocol (SEP). In this renewed evaluation system, which came into force in 2003, all publicly funded research programmes are evaluated once every six years. Therefore the SENSE Research School asked the ECOS-KNAW to prolong the current accreditation of the SENSE Research School with one year (2002 – 2007) and to agree with the submission of the request for renewal of accreditation in December 2007. The ECOS-KNAW agreed with the latter part of our request, but stipulated that the SENSE Research School would have no formally accredited status in the year 2007.

The present request for renewal of accreditation concerns the next six-year period: 2008 – 2013.

**Name:**

The Netherlands Research School for the **Socio-Economic and Natural Sciences of the Environment**.

**Acronym:**

SENSE Research School or SENSE

**Contact person SENSE Research School:**

Dr. Ad van Dommelen,  
Deputy Director SENSE  
Institute for Environmental Studies (IVM-VU)  
De Boelelaan 1087,  
1081 HV Amsterdam, The Netherlands  
Phone: 020 – 598 9532  
E-mail: [Ad.van.Dommelen@ivm.vu.nl](mailto:Ad.van.Dommelen@ivm.vu.nl)

**SENSE Commissioners:**

The Vrije Universiteit and Wageningen University cooperate as the commissioners of the SENSE Research School. Contact address:

Professor Dr. Bauke Oudega,  
Dean Faculty Earth and Life Sciences VU,  
De Boelelaan 1085  
1081 HV Amsterdam, The Netherlands  
Phone: 020 – 598 2880  
E-mail: [Bauke.Oudega@falw.vu.nl](mailto:Bauke.Oudega@falw.vu.nl)

**Participating Institutes:**

- Wageningen University: Wageningen Institute for Environment and Climate Research (WIMEK-WU): 11 chair groups (full or major part of their research capacity); 7 chair groups (minor part of their research capacity)
- Vrije Universiteit: Institute for Environmental Studies (IVM-VU): 4 Departments
- Vrije Universiteit: Institute of Ecological Sciences (IES-VU): 3 chair groups
- Vrije Universiteit: Theoretical Biology Group
- Utrecht University: Copernicus Institute for Sustainable Development and Innovation (3 out of 4 research groups)
- University of Amsterdam: Institute for Biodiversity and Ecosystem Dynamics (IBED-UvA): 3 chair groups
- Leiden University: Institute of Environmental Sciences (CML): 2 research groups



- Radboud University Nijmegen: Institute for Wetland and Water Research (IWWR-RU): 2 chair groups
- Groningen University: Center for Energy and Environmental Studies (IVEM)
- Maastricht University: International Centre for Integrated Assessment & Sustainable Development (ICIS)
- UNESCO-IHE: Institute for Water Education (UNESCO-IHE, Delft)

**Agreements with other research institutes:**

No official agreements.

**Changes in SENSE partnership:**

Research groups that ended their SENSE partnership in the period 2002-2007:

- Geo-environmental Science Group (Prof. A.J. Dolman, VU) in 2003
- Nature Conservation and Plant Ecology Group (Prof. F. Berendse, WU) in 2007

Research groups and institutes that joined the SENSE partnership in the period 2002-2007:

- Environmental Studies and Policy Group (Prof. P. Glasbergen, Copernicus Institute, UU) in 2002
- Environmental Sciences / Land Use, Biodiversity and Ecosystem functioning Group (Prof. P.C. de Ruiter / Prof. M.J. Wassen; Copernicus Institute, UU) in 2002
- International Centre for Integrated Assessment and Sustainable Development (Prof. P. Martens, ICIS-UM) in the course of 2002
- Meteorology and Air Quality Group (Prof. A.A.M. Holtslag and Prof. M. Krol, WIMEK-WU) in 2007
- Institute for Water Education, UNESCO-IHE, starting 1 January 2007.

**Joint Agreement Universities and UNESCO-IHE regarding the SENSE Research School**

The universities participating in SENSE and UNESCO-IHE have laid down the regulations regarding the SENSE Research School in the "Gemeenschappelijke Regeling betreffende de Onderzoekschool SENSE 2008 – 2013" (Annex 6; added as separate file).



## 1. Mission

The SENSE Research School aims to provide an excellent and supportive scientific network for junior and senior researchers in The Netherlands in order to conduct high quality disciplinary and multidisciplinary research in the socio-economic and natural sciences of the environment, as well as to train and educate highly qualified environmental researchers and professionals. The research programme is directed to an integrated understanding of environmental change in terms of mechanisms that cause it and the consequences that result from it. The scientific results are actively disseminated both among peers and among stakeholders to support environmental management, environmental governance and decision making.

To realize this ambition, the SENSE Research School is dedicated to fulfilling three main functions:

- SENSE as a *School for Environmental Researchers and Professionals*
- SENSE as a *National Network for Researchers in Disciplinary and Multidisciplinary Environmental Sciences*
- SENSE as a *Bridge to Society and Environmental Governance*

These three functions correspond to the following three practical goals:

- To provide a high quality training programme for young researchers in the field of environmental sciences and policy, especially through the education and training of PhD students;
- To foster world-class environmental research by stimulating and supporting a national network of environmental research institutes at an academic level;
- To disseminate the results of scientific research actively to relevant stakeholders on a national and international level.

## 2. SENSE's PhD education, PhD training and Research Programme

### 2a PhD training and supervision programme

All SENSE PhD students participate in a PhD education and training programme. The SENSE educational programme aims to train PhD students to be able (i) to conduct research in a systematic and productive way, (ii) to work effectively in an international arena, (iii) to contribute to an improved understanding of the causes and effects of environmental problems and of possible solutions, (iv) to position their own research in a multidisciplinary context and to translate environmental problems into relevant sound research proposals. SENSE aims to support PhD students in performing their PhD research, in understanding the wider environmental context of their research, and in preparing them for their future careers.

Each PhD student participating in SENSE formulates a tailor-made *Individual Training and Supervision Plan* (ITSP), in close consultation with his or her supervisors.

The SENSE PhD training programme consists of (1) PhD courses and (2) other PhD education and training components. Most elements are optional, but some are mandatory (see the summary of SENSE ITSP requirements in [Annex 1](#)). The PhD courses include an introductory course *Environmental Research in Context*, a number of specialised and broadening PhD courses, and general skills courses. In addition, selected MSc courses may be included in ITSPs. The other PhD education and training components include research skills training, management skills training, presentations and publications. Each PhD candidate who has fulfilled the SENSE training requirements (equivalent to 30 ECTS; where 1 ECTS = 28 hours workload), and finalized the PhD dissertation, receives the SENSE Certificate issued by the General Board of the Research School. SENSE now also offers the possibility to publish PhD dissertations in a SENSE Series.

Since 2001, the number of courses offered through SENSE has increased considerably. In total, the SENSE website now lists approximately 80 different PhD courses, of which about half are (co)-organised by SENSE. Course coordinators are encouraged to organise their PhD courses on a biannual basis. [Annex 2](#) gives an overview of selected SENSE courses organised since 2001. The SENSE Research School encourages course coordinators to organise international courses, both in terms of the course programme and the course participants. To this end, SENSE (partly) covers



additional costs of inviting top lecturers from abroad. In addition, SENSE actively raises funds for international PhD exchange and PhD summer schools. For example, SENSE received external funding [from... specify external funding?] to organise a series of Summer Schools on global change. In May 2007 the first two were held (courses S340 and S460), focusing on natural and social science aspects of global change. This course approach was very successful and the programme attracted many course registrations: the 70 most suitable candidates were selected from over 300 international applications. Both courses have been evaluated overwhelmingly positively by the participants, highlighting the high quality of the lecturers, the useful course material, the stimulating environment and the very good atmosphere within the group.

For more information on the SENSE PhD training and education programme, please see:

- SENSE self-evaluation report 2001 – 2006, Sections 4.1 and 11.1

### *Assessment SENSE PhD training programme*

The General Review Committee of the review Environmental Sciences 2007 considers the PhD programme one of the great successes of SENSE: “Through its PhD programme, SENSE is making a major contribution to the training of the next generation of environmental researchers and professionals in the Netherlands and internationally. The organization and enthusiasm in the PhD programme is outstanding” (page 2 review report). The review committee particularly observes that (i) the PhD training programme is well-organised and comprehensive, involving in-dept disciplinary, multidisciplinary and skills courses; (ii) the programme promotes effective networking and (iii) the programme encourages students to be “entrepreneurial” in a positive sense by supporting self-organized student activities. Nevertheless, the committee has proposed several stimulating recommendations for improvement. These specific suggestions are listed below, together with the actions that SENSE will undertake to put these suggestions into practice.

### *Postdoc policy*

SENSE offers postdocs a national network for environmental and climate research. As all SENSE researchers, SENSE postdocs are informed about national and international workshops, congresses, symposia and PhD courses, by our electronic newsletter SENSE e-News. The new SENSE policy to develop flexible Research Clusters on research topics will further stimulate the active participation of postdocs in the SENSE network. Moreover, postdocs are involved in the (co)organisation of SENSE workshops, symposia and PhD courses. They may also participate in all (international) SENSE PhD courses at a reduced course fee. In addition SENSE will set up an alumni network for PhD graduates, in which postdocs can play an important role.

### *New initiatives in the period 2008 – 2013:*

Recommendations and actions resulting from the outcome of the external peer review in 2007

- i. Review recommendation: Take steps to stimulate and ensure that all institutes fully participate in the procedures and the guidelines of the SENSE’s PhD programme

Actions:

- ⇒ Create privileges for SENSE PhD students with an approved ITSP, for instance by reducing the course fee for SENSE PhD courses and restricting the yearly SENSE PhD Dissertation Award to PhD graduates who have earned the SENSE Certificate.
- ⇒ The requirements for the PhD training and supervision plan will be harmonized between the SENSE research school and all participating SENSE institutes, in order to stimulate that in principle all PhD students supervised by a SENSE professor (as promotor or co-promotor), whose PhD research fit in the SENSE research programme, will have an approved SENSE ITSP in the future and will finish their PhD education and training programme with a completed SENSE Certificate.
- ⇒ SENSE will suggest the Executive Boards of the participating faculties or universities to differentiate the graduation bonus granted to the research groups between PhD graduates with and without a PhD education and training certificate of the concerned research or graduate school (learning from experiences with the successful policy of Wageningen University).
- ⇒ More site visits to SENSE universities by the SENSE management to promote and explain the SENSE PhD training programme to both staff members and PhD students.



- ii. Review recommendation: Raising the visibility of the SENSE Certificate  
Actions: making it
  - ⇒ More worthwhile, by establishing specified final qualifications and competencies for the PhD training and education, upgrading the SENSE Certificate and relaunching it as SENSE Diploma
  - ⇒ More visible, by advertising it more openly and assertively at the SENSE website
  - ⇒ Better known, by informing prospective employers about the significance and value of the SENSE Diploma, for instance by publishing informative articles in relevant professional journals, such as “Milieu”
  - ⇒ More appreciated, by stimulating promoters to hand over the SENSE Diploma during the official graduation ceremony at all participating universities.
  
- iii. Review recommendation: Preparing for non-academic careers  
Actions:
  - ⇒ SENSE will continue the focus of the PhD education and training programme on the improvement of the so called T-shaped skills: combining scientific excellence in the PhD student’s own disciplinary field with well-developed capacities to communicate effectively with researchers from different relevant disciplines and with stakeholders.
  - ⇒ SENSE will further stimulate the participation in skills courses, such as “Scientific presentation”, “Time planning and project management”, “Career orientation” and “Career assessment”, for instance by establishing a minimum requirement for this category PhD courses (in ECTS).
  - ⇒ SENSE will organise more workshops, conferences and symposia in close cooperation with the Netherlands Ministry of Environment (VROM) and the Netherlands Environment Assessment Agency (Milieu en Natuur Planbureau – MNP) to stimulate the exchange of knowledge between scientists, policy makers, non-governmental organisations and industry.
  - ⇒ SENSE will invite SENSE alumni as speakers in PhD courses.
  - ⇒ SENSE will think about the organisation of a PhD course focused on the effective and sound presentation of scientific results for policy makers and other stakeholders.
  - ⇒ SENSE will encourage internships at non-academic institutes, if this research experience fits good in their PhD research.
  
- iv. Review recommendation: Achieving a reduction of the real PhD period  
Actions:
  - ⇒ SENSE will publish a guide for PhD supervisors, which will focus on the success and fail factors for PhD research / PhD students.
  - ⇒ SENSE will continue to offer courses for supervisors of PhD students. Besides we will make an inventory of other relevant staff courses regarding communication and supervision and publish an overview on the SENSE website.
  - ⇒ The SENSE partner institutes will be stimulated to monitor the individual PhD progress yearly and ask explicitly for all specific measures taken to avoid or minimise a delay
  - ⇒ SENSE will carry out a PhD inquiry on the assessment of supervision and PhD training every two years; the results will be presented to the management of the participating institutes and research groups.
  
- v. Review recommendation: Quality assurance of so-called sandwich PhDs  
Actions:
  - ⇒ Before the start of the PhD trajectory: SENSE will urge the participating universities and supervisors to make a written agreement with sound arrangements on available time for PhD research; supervision; library and research facilities
  - ⇒ SENSE will encourage sandwich PhDs to co-organise mini-symposia in the first and last period of their PhD research for a broad public.
  - ⇒ SENSE will encourage a yearly return period of the sandwich PhDs to the supervising SENSE research group (following the good practice of UNESCO-IHE)
  - ⇒ SENSE will stimulate the organisation of workshops and conferences in the home country / region of groups of sandwich PhD students
  - ⇒ SENSE will encourage visits of supervisors to the PhDs in their home countries
  - ⇒ SENSE will support the development and organisation of e-learning / distance learning courses, e-workshops and e-conferences in which sandwich PhD students can participate



- ⇒ Yearly monitoring of the PhD progress (see actions at item iv)
- vi. Review recommendation: Targeting core courses mandatory for particular groups of PhD students  
Actions:
  - ⇒ SENSE will support the organisation of international PhD courses with specific relevance to a research cluster. We prefer not to make these courses mandatory for groups of PhD students because of the unsatisfactory experiences with mandatory PhD courses in the past. It is our challenge to offer excellent and inspiring PhD courses for 20 – 40 participants. PhD students ideally choose to participate in a PhD course because they really like it and not because it is mandatory.
- Other recommendations and actions
- vii. Linking PhD and MSc programmes
  - ⇒ Enhancing the SENSE role as a clearing-house, through listing all relevant MSc programmes of the SENSE partners on the website
  - ⇒ SENSE will invite MSc thesis students, who are supervised by SENSE PhD students, to participate in SENSE meetings.
- viii. Institutionalising a SENSE Alumni Network
  - ⇒ Setting up (i) a network for SENSE alumni working in the Dutch environmental context and (ii) a network for SENSE alumni operating in a global environmental context.
  - ⇒ Encouraging the involvement of alumni in the yearly SENSE Symposia
  - ⇒ Organizing meetings or symposia on subjects suggested by the alumni with a frequency of once every two years for instance.
- ix. Development of e-learning PhD courses
  - ⇒ SENSE will explore the options and start a pilot to organise an e-learning PhD course on a topic related to “Environment and Development” in the near future.
  - ⇒ With UNESCO-IHE as a new SENSE member, the e-learning experience of SENSE has increased considerably. The SENSE management will encourage the SENSE partners to take benefit from this experience

## **2b Research Programme**

In the previous accreditation period 2001-2006 the SENSE Research Programme was structured as a matrix with disciplinary clusters (i.e. research fields) forming the rows and core themes forming the columns (see SENSE self-evaluation report, Section 4.2). The subdivision into four Core Themes has strongly contributed to a more balanced and coherent presentation of the SENSE research programme. As a result of the growth in participating research groups and the scientific developments in the past 6 years, a restructuring of the SENSE Core Themes is now timely and important. Besides, the SENSE Core Themes do not necessarily function as the most useful discussion platforms for SENSE researchers, because of the relatively broad scope of the larger research themes and the heterogeneity among the research projects. Therefore the SENSE Research School has decided to adjust the SENSE Research Programme as follows:

- The titles and description of the four Core Themes have been actualised, aiming at a representative and adequate presentation of the current SENSE research ([Annex 3](#)). The SENSE Core Themes are the overarching organizational networks for groups and clusters of researchers, dealing with particular (sets of) research questions similar to the subdivision of large international research programmes, such as IGBP, IHDP, EU FP7 Environment Programme, etc. Each Core Theme has a “Core Chair”, whose main tasks are (i) to advise the SENSE Board on strategic research issues; (ii) to represent the SENSE research theme externally (NWO, KNAW, EU, VROM, NMP, ..) and (iii) to stimulate SENSE workshops, conferences and PhD training and education within the scope of the core theme.
- As the Core Themes are in general too broad and diverse to organise sufficiently focused and inspiring internal meetings for the SENSE community, SENSE has decided to determine a number of so called Research Clusters around actual research topics. Limiting conditions for these smaller and more focused Research Clusters are: (i) more than 10 interested SENSE PhD students and postdocs involved coming from at least two universities and (ii) at least two inspiring coordinators



has been installed to lead the cluster. The relevant subjects of the separate research clusters were identified by a bottom-up approach. Each research cluster has at least two coordinators from two different universities who are responsible for the organisation of activities, such as PhD meetings, discussion groups, workshops, expert meetings, etc. An overview of SENSE research clusters can be found in [Annex 3](#).

The SENSE Core Themes 2008 – 2013 are:

- *Core Theme 1:* Environmental nutrients and micropollutants: behaviour, exposure, effects, removal and reuse; Core Chair: Dr. J. (Juliette) Legler (VU)
- *Core Theme 2:* Environmental processes and ecosystem dynamics; Core Chair: Professor J.A.(Jan) Hendriks (RU Nijmegen)
- *Core Theme 3:* Global Environmental Change; Core Chair: Professor P. (Pier) Vellinga (WU / VU)
- *Core Theme 4:* Sustainable change: methodologies and governance; Core Chair: Professor A.P.J. (Arthur) Mol (WU)

*New initiatives in the period 2008 – 2013:*

Recommendations and actions resulting from the outcome of the external peer review in 2007

x. Review recommendation: Incentives to encourage tighter cooperation within the SENSE community

Actions:

- ⇒ SENSE will facilitate and support the organisation of PhD meetings, research cluster meetings, SENSE workshops, SENSE symposia, etc. directed to participants from several SENSE partner institutes.
- ⇒ The development of flexible inter-university research clusters, following a bottom-up approach

xi. Review recommendation: Incentives to encourage multidisciplinary research

Actions:

- ⇒ SENSE will keep the focus of its own meetings on multidisciplinary subjects: SENSE symposia; SENSE – VROM – MNP meetings (SENSE Questions: policy-relevant research questions for a sustainable future);
- ⇒ Supporting multidisciplinary PhD initiatives, for example the SENSE Context Symposium as it was organized on 20 November 2007 by SENSE PhD students on the subjects of “ethics in environmental sciences” and “resilience in environmental and social systems”, organised by SENSE PhD students

xii. Review recommendation: Monitor the development of interdisciplinary research

Action:

- ⇒ SENSE will specifically register all PhD projects supervised by professors of two different disciplines and distinguish interdisciplinarity (i) within natural sciences, (ii) within social sciences and (iii) in exchange between natural and social sciences.

xiii. Review recommendation: Transparent procedure for the establishment of new Research Clusters

- ⇒ All SENSE members can take the initiative to set up a new research cluster under the following conditions: (i) at least 10 SENSE PhD students involved and (ii) at least two SENSE staff members from different universities are willing to act as coordinator of the research cluster. The proposed research cluster should be sent to the SENSE Director of Research for approval and will be announced on the SENSE website after approval.

Other actions:

xiv. Strengthening systems of quality control by

- ⇒ Listing all accepted SENSE staff members at the SENSE website.
- ⇒ Listing of best publishing and best cited researchers at the SENSE website

xv. Improving the visibility of the national and international leading position of SENSE research by

- ⇒ Publishing the prominent role of SENSE researchers in international research programmes at the SENSE website
- ⇒ Stimulating more co-ordination of Dutch efforts through SENSE
- ⇒ Starting a SENSE e-newsletter for external researchers, organisations and stakeholders



- Publishing an annual SENSE book on important policy issues with contributions from different SENSE groups.

### **3. Bachelor and Master programmes**

Most SENSE staff members have been appointed professor, associate professor (UHD) or assistant professor (UD). Staff members in these staff categories usually spend on average 40% of their time on research, 40% on education (especially BSc and MSc courses) and 20% on management. In the coming years SENSE will also work closely together with university-based “Graduate Schools”, covering the environmental sciences, which are or will become partly responsible for the research masters (MSc) and doctoral (PhD) programmes. SENSE aims to fulfil a supporting and facilitating role in these cooperations for the benefit of excellent education and training programmes.

### **4. Management and Organisation**

The management and organisation structure has not been changed and consists of (i) General Board; (ii) Board of Directors; (iii) Research Committee and (iv) Education Committee (see paragraph 3 self-evaluation report).

### **5. Cooperation**

The cooperation between the SENSE participants can be distinguished in different forms and intensity:

- One level of quite intense cooperation may be found in the involvement of the SENSE participants in the management of SENSE itself. All SENSE partners are represented in the General Board of SENSE, which meets about 3 times each year and which has strongly contributed to the dynamic development of SENSE in the past few years. The same goes for the cooperation between the SENSE partners in the SENSE Board of Directors, which meets every month. Also, a good representation of the SENSE participants is actively involved in the SENSE Research Committee and the SENSE Education Committee. The full overview of management cooperation may be found at: <http://www.sense.nl/management>. These cooperation would not exist in the same intensity without the strong commitment of the SENSE participants to the research school.
- A recent feat of cooperation between the SENSE participants is the joint effort to organize the research review Environmental Sciences 2007 together. It is difficult to imagine that this complex project would have been realized so fruitfully and constructively without the solid basis for cooperation that was already present in SENSE.
- An ongoing and continuously developing form of cooperation between the SENSE participants is the collective development of the SENSE website ([www.sense.nl](http://www.sense.nl)) and the regular newsletter SENSE e-News.
- Furthermore the participants in the SENSE network regularly join forces for the organization of workshops, meetings and conferences on emerging issues and trends in the environmental sciences. Recent examples are a two-day meeting organized by SENSE PhD students on “Sensible water technology” (12-13 April 2007, Leeuwarden) and a one-day meeting organized by the SENSE Core 2 Chair on “Is Nederland schoon genoeg?” (30 November 2007, Den Haag).
- Perhaps most primary is the extensive cooperation between SENSE participants for the organization of excellent and international PhD courses (see also Section 2a). It should be noted here that the SENSE network also actively stimulates the cooperation with other relevant research and graduate schools, to ensure the excellence of PhD courses and summer schools. The cooperation between SENSE participants for the development of PhD education and training is presently also directed to the joint development of online courses and e-learning possibilities.
- Another highly important form of cooperation between SENSE participants may be found in the active promotion of opportunities for SENSE PhD students to meet each other and interact with different environmentally relevant scientific disciplines. This strongly contributes to our ambition to promote the so-called T-shaped qualities of junior (and senior) researchers (see also Section 2a). Examples of these opportunities are the four-day and compulsory SENSE A1 Course – which takes place every nine months with about 40 PhD students from the partner universities participating in SENSE and the so-called SENSE Context Symposium, which was first organized by SENSE PhD students on 20 November 2007 (for details, see: <http://www.sense.nl/contextsymposium>).
- Finally, it should be noted that participants in SENSE also have many collaborations which are not typically part of SENSE – however, we believe that the good relationships developed within SENSE also have a stimulating effect on these cooperation beyond the context of SENSE.



## **6. SENSE Research Leaders**

### *Research Group level*

All research projects are carried out by the basic units of the participating universities: the research groups, chair groups or departments. Each group consists at least of a full professor, tenured staff, non-tenured staff (postdocs in most cases) and PhD students. For an overview of all research group leaders, including their key publications see [Annex 5](#) (added as separate pdf-file). The development of innovative fundamental and strategic research requires a stimulating academic environment in which researchers have ample freedom to develop and pursue their original ideas. The SENSE research groups are therefore rather autonomous in choosing the research topics which fit best with their own capacities and ambitions. In this regard the SENSE Research School functions mainly as a bottom-up scientific network organisation, where the SENSE management tries to create optimal conditions for high quality innovative scientific research and a good support for young researchers by offering a structured training and education programme. The SENSE management has a stimulating and facilitating role, in part by actively responding to emerging issues and trends in the environmental sciences.

### *SENSE Core Themes*

At SENSE level the SENSE research programme has been subdivided in four Core Themes. The names of the Core Chairs are mentioned in Section 2b.

### *SENSE Research Clusters*

The PhD research projects are embedded in (flexible) Research Clusters, which focus on current research topics. In all research clusters PhD researchers of different universities participate. The coordinators of these Research Clusters are mentioned in [Annex 3](#).

## **7. National position SENSE Research School**

The SENSE Research School has a unique position in the Dutch research infrastructure, covering a significant part of the disciplinary and multi-disciplinary academic research in the field of environmental and climate change research. As SENSE covers a broad range of disciplines there are many interfaces with more disciplinary oriented research schools in the field of ecology, earth sciences, economics, social & policy sciences. The SENSE Research School works closely together with a number of other research schools to offer excellent PhD courses with top-lecturers from all over the world and with an international audience of PhD students.

In the past six years (2001 – 2006) more than 300 PhD students defended their dissertation successfully, this means on average 51 SENSE PhD graduations a year!

SENSE is also recognized as the prior academic partner in environmental research by national governance bodies. The Dutch Ministry of the Environment (VROM), for instance, has invited the SENSE Research School to contribute to its strategic knowledge agenda by setting up a process to identify the 50 most pressing and relevant research questions on environmental change and sustainable development for the coming years.

Besides this, SENSE research leaders are regularly involved in drawing up policy documents and participating in national or regional advisory committees on environmental issues (see also paragraph 7 self-evaluation report).

## **8. International position SENSE Research School**

### *External peer review*

The scientific quality of 9 of 32 SENSE research groups was judged as excellent (score = 5, on a scale of 1 to 5). This indicates that these groups operate at the forefront internationally and have an important and substantial impact in their field and may be considered as international research leaders.

16 of 32 SENSE research groups were judged as very good (score = 4), which means that their work is internationally competitive and nationally at the forefront in their field. These research groups are considered as an international player and national research leader. An overview of the scores of all SENSE groups is presented in [Annex 4](#).



Moreover, SENSE has a rather high scientific output with about 650 refereed publications (articles and book chapters) a year, with frequent publications in top journals covering all sciences, such as Nature, Science and PNAS as well as high impact journals in specific fields. SENSE researchers published on average 240 refereed scientific articles (i.e. more than 50%) in A rated journals (top 33% journals per ISI domain). In the review period 2001 – 2006 SENSE published 16 articles in Nature, 10 in Science and 3 in PNAS.

A bibliometric analysis over the past ten years (1996 – 2005) showed that some 474 publications belonged to the top 10% most frequently cited publications in their field. This is about 19 % of the total publication output. Of these publications 60 belonged to the select group of the 1% most cited publications in their field (i.e. 2.4% of the total publication output). The Relative Impact of all SENSE publications fluctuated between 1.54 for publications in 2000 and 1.79 for publications in 2005; this means 1.5 – 1.8 times the world average.

A selection of current SENSE research leaders belong to the world top of scientists in their research field (Relative Impact publications at least 2 times world average and h-factor over 20), such as Professor W.M. (Willem) de Vos (MIB-WU); Professor W.H. (Willem) van Riemsdijk (SOQ-WU); Professor J. (Jacob) de Boer (C&B-IVM-VU); Professor G.A. Kowalchuk (SE-IES-VU/NIOO) and Professor P.M.J. Herman (ES-RU).

Furthermore, SENSE researchers received many scientific awards and prizes (see Section 6.4 and Annex 4 of the Self-evaluation report) and they participate actively in editorial boards of high impact scientific journals (see Section 6.5 self-evaluation report)

Besides this, SENSE researchers play an important role in the scientific underpinning of international policy documents on climate change, resilience of ecosystems, biodiversity, environmental pollution, sustainable production and use of energy and materials, ecological reform of industrial production, etc. SENSE researchers contributed actively to integrated assessments, such as IPCC, Millennium Ecosystem Assessment (MEA), World Energy Assessment (WEA) and Global Environmental Outlook (GEO) and presented the summary of these assessments to Dutch parliament and ministries. (See also paragraph 7 self-evaluation report “External validation and relevance for society”).

Please note that the General Review Committee has also evaluated the SENSE Research School following the ECOS criteria (Appendix A, Report of General Review Committee). The Committee concludes “In the opinion of the committee, SENSE fulfils the criteria for re-accreditation of the research school. The considerations for this conclusion are described in the following paragraphs” (appendix A of the review report).

## 9. Financial resources

### *Funding of the SENSE research projects*

Table 1 shows the research input at SENSE level subdivided in funding categories. As IBED-UvA has not registered the funding at research group level, part of the research input funding is undefined.

*Table 1: Funding at SENSE level in fte*

<b>Funding</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>6 year average</b>	<b>%</b>	<b>% def</b>
University funded	54,8	57,4	59,7	57,7	53,0	50,5	55,5	30%	33%
NWO funded	36,1	43,5	46,0	43,7	44,9	41,4	42,6	23%	26%
Contract funded	55,7	57,5	61,0	64,9	80,9	90,9	68,5	37%	41%
Undefined	21,4	21,7	20,9	17,2	17,8	13,8	18,8	10%	n.a.
<b>Total</b>	<b>167,9</b>	<b>180,0</b>	<b>187,6</b>	<b>183,5</b>	<b>196,7</b>	<b>196,7</b>	<b>185,4</b>	<b>100%</b>	<b>100%</b>

About one third of the (registered) research input is funded by the university; the other two third is externally funded. The most important external funds are from NWO (26%), EU, national government, other research institutes and industry.

### *Funding of the SENSE organisation*

The overhead costs of the SENSE organisation (management, administration and central SENSE activities) are paid by the partner institutes on the basis of shared responsibility and comparative staff and PhD input. Besides these contributions, Vrije Universiteit and Wageningen University pay an extra



budget as joint commissioners of the SENSE Research School. As a network organisation SENSE tries to keep the overhead costs as low as possible.

In the past few years SENSE has earmarked part of the budget to stimulate internationalisation of PhD courses and to support scientific events initiated by SENSE PhD students.

Moreover, SENSE received a significant subsidy from the Dutch Ministry of Environment for the years 2007, 2008 and 2009, for the specific purpose of organizing a process of knowledge exchange, which is dedicated to the determination of the 50 most pressing policy-relevant research questions related to environmental and climate change issues in the coming years.

Furthermore, SENSE was granted a donation of a private foundation in 2006, for the further development of its bridge function to society, especially for the improvement of the SENSE website for external visitors. In the coming years the same foundation will subsidize a research project on "Protection of ground and surface water from pesticides used in greenhouse horticulture".

#### 10. Guaranteed input (financial and personnel resources)

University	Institute	Tenured staff		PhD students			Financial contribution (k€)
		RI 2008	RI-G 50%	N	RI 2008	RI-G 50%	
Wageningen University	WIMEK	22.7	11.4	229	73.8	36.9	100*
Vrije Universiteit (VU)	IVM	8.2	4.1	28	15.0	7.5	
	IES	4.0	2.0	41	14.9	7.5	
	TB	1.8	0.9	7	4.9	2.5	
	VU-TOTAL		7.0			17.4	70*
Utrecht University	Copernicus Institute	5.2	2.6	29	11.7	5.9	10
University of Amsterdam (UvA)	IBED	2.8	1.4	9	4.9	2.5	5
Leiden University	CML	2.7	1.4	6	3.2	1.6	5
Radboud University	ES & EB	4.7	2.4	26	15.0	7.5	10
Maastricht University	ICIS	2.0	1.0	15	2.6	1.3	5
Groningen University	IVEM	2.7	1.4	5	3.3	1.7	5
UNESCO-IHE	Institute for Water Education	PM		28	7.0	3.5	5
<b>TOTAL</b>		<b>56.8</b>	<b>28.4</b>	<b>423</b>	<b>156.3</b>	<b>78.2</b>	<b>215</b>

Explanation:

- **RI:** Research Input: tenured staff on average 0.4 fte per full time staff member; PhD students: 0.8 fte for PhD students full time working at the university; 0.25 fte for sandwich PhDs and 0.0 fte for external PhD students.
- **RI-G:** Guaranteed Research Input: 50% of the research input in 2008 is guaranteed for the coming years (2008 – 2013). In practice the real research input will be substantially more.
- **Financial contribution:** Contribution to the budget of the SENSE research school (i) to compensate management tasks, (ii) to finance supporting policy and administration tasks and (iii) to support the organisation of international PhD courses, PhD research cluster days, SENSE symposia, etc.
- \* = the contributions of Wageningen University and Vrije Universiteit include an additional commissioners' contribution of 45k€ each.



## 11. Duration PhD studies

PhD cohort analysis 1999 – 2007:

Cohort	N	< 4 years		< 5 years		< 6 years		< 7 years		> 7 years		Not Fin.		Stop	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
2004	75	3	4.0									68	90.7	4	5.3
2003	48	3	6.3	13	27.1							32	66.7	3	6.3
2002	60	2	3.3	17	28.3	30	50.0					27	45.0	3	5.0
2001	67	7	10.4	17	25.4	40	59.7	46	68.7			14	20.9	7	10.4
2000	62	4	6.5	20	32.3	33	53.2	39	62.9	43	69.4	12	19.4	7	11.3
1999	59	7	11.9	17	28.8	27	45.8	39	66.1	47	79.7	6	10.2	6	10.2
Total	371														

The figures in the table should be interpreted very carefully. The table shows the results for a mixed population PhD students (AIOs, guest PhDs, sandwich PhDs, external PhDs and staff) and include also PhD students with a part-time appointment. For external PhD students, many sandwich PhDs and staff members the PhD period is often rather long, because they have to carry out their PhD research in combination with their regular research tasks. For more information on the delay of PhD projects and drop-outs, see the results of the SENSE PhD Inquiry 2007.

PhD progress analysis 1996 – 2006:

628 PhD students started their PhD research since 1996, of which 354 before 2003. Of this last group, 62% graduated, 29% are still working on their dissertation and 9% stopped without graduation.

The median promotion duration of SENSE PhD students is 5.2 years (time between start of the project and the graduation date). This 5.2 years period is longer than the typical appointment of most PhD students, but close to the average for Dutch PhD students. It should be noted that 5.2 years would be fast for students working on a part-time basis on their PhD dissertation. Nevertheless, the majority of SENSE PhD students are regular AIO/OIOs, with a 4 year appointment, implying a graduation date within 4.5 years after start. The results of the analysis therefore indicate that many SENSE PhD students graduate with a delay.

A wide variety of reasons to stop without graduating were indicated by the chair groups: acceptance of another job (20%), lack of motivation (15%), lack of knowledge (11%), lack of progress (9%) and several others. It should be noted that this is the perception of the chair groups, which may differ from the perception of the PhD students.

## 12. Career perspectives

The vast majority of graduates (79%) find their first job in research, of which 18% as a postdoc. About 12% get a first job as policy officer, policy advisor or consultant and about 5% as IT specialist. Almost 50% find their first job at a university, 22% at another research institute and 8% at consultancy agencies. 11% start their first job with the government. (See for more details Annex 11, table A11-3, SENSE self-evaluation report).

## 13. Actions resulting from comments ECOS-KNAW at re-accreditation in 2002

We have extracted five main points of concern from the ECOS letter of re-accreditation (26 June 2002):

### Scientific mission and coherence of the research programme

ECOS-1: Improve the internal coherence and focus of the research programme rather than broaden the scope of the school by extension of the work field.

- In the past accreditation period (2002 – 2007) SENSE has continued its research focus on the four Core Themes. The research programmes of the research groups and institutes that joined SENSE



in the past period fit all very well in the current research programme and have led to a strengthening of the research programme, especially in environmental policy (ESP-Copernicus UU), land use, biodiversity and ecosystem functioning (ES Copernicus-UU), integrated assessment (ICIS) and water related subjects (UNESCO-IHE).

- It should be noted here also that the SENSE research school is primarily a network organisation. The research programme has been established following a bottom-up approach. SENSE stimulates and facilitates the research cooperation between the SENSE partners, but SENSE cannot direct or manage the research programmes of its partners in a top-down manner.

ECOS-2: Create more links between the Core Programmes.

- The subdivision in Core Themes has strongly contributed to a more sound and coherent presentation of the SENSE research programme. In practice there are no rigid divides between the core themes and most SENSE activities are not limited to a specific core theme. Examples of inter-core activities are the SENSE symposia (see SENSE self-evaluation report, page 5); joint core meetings of Core 1 and Core 2; PhD context activities, such as the SENSE Context Symposium on ethics and resilience.
- The internal coherence and cooperation within the renewed research programme will be further realised at research cluster level. Research clusters are often linked to more than one Core Theme.

ECOS-3: Stimulate the cooperation with other research schools, especially with research schools that are involved in the global change research (for instance ICG, NSG and CLIVAR).

- The inter-university cooperation on global change research has mainly been realised by the development of the Bsik research programmes “Climate changes, spatial planning”; “Carbon dioxide capture, transport and storage” and “Living with water”.
- On the field of ecology, the research schools SENSE, PE&RC and FE work closely together to develop and organise attractive international PhD courses
- The inter-university cooperation on the field of hydrology has led to the establishment of the Boussinesq Centre for Hydrology, which coordinates some high quality PhD courses.
- SENSE and Mansholt Graduate School work closely together for the organisation of PhD courses on research methodology and governance.

#### PhD training and education programme

ECOS-4: Earmark part of the budget for the enhancement of the opportunities for PhD students to participate in “top courses” and international conferences.

- SENSE has earmarked a budget (€ 20.000 a year) to support the development and organisation of international PhD courses and PhD activities. This has resulted in the financial support of 3 – 4 international PhD courses each year since 2005.

ECOS-5: Take effective measures to reduce the average PhD duration to 4 years.

- See Section 2a, issue iv.

### **14. Actions resulting from results external peer review in 2007**

See the actions mentioned in Section 2a and 2b of this report.

### **15. Male / Female ratios per staff category**

Category	Number	Male (%)	Female (%)
Tenured staff	170	87.6 %	12.4 %
Postdocs	30	63.3 %	36.7 %
PhD students	419	56.1 %	43.9 %

The table shows an unbalanced gender ratio, especially in the higher qualified scientific positions. The SENSE institutes stimulate and support talented female researchers to send in applications for specific grants, like NWO-ASPASIA, NWO Meervoud and the NWO Veni-Vidi-Vici programme. In the past six years several applications have been awarded by NWO.



**Annex 1: Summary General Requirements SENSE ITSP**

<b>PhD courses</b>			
Code	Activity	Mandatory / Optional	ECTS
A1-SENSE	Introductory SENSE course "Environmental Research in Context"	Mandatory	2
A2-SENSE	Research in Context Activity, to be approved by the A2 coordinator	Mandatory	3 – 6
Sxxx:	SENSE PhD courses: Specialised and widening SENSE PhD courses	Mandatory: 6 ECTS, including at least one SENSE PhD course	≥ 6
ORSxxx	Specialised and widening PhD courses offered by Other Research Schools (ORS)		
MSc courses	Advanced and specialised MSc courses to be approved of by the SENSE Director of Education		
Gxxx	General Skills Courses for PhD students	Optional	≥ 0
<b>Other PhD education and training components</b>			
Component	Activity	Mandatory / Optional	ECTS
Research Skills Training	Detailed elaboration of the research set-up, work plan and time schedule of your PhD project within a year after the start of your PhD to be approved of by your supervisor	Mandatory	1
	Writing your own PhD research proposal, reviewed and approved of by SENSE (send it to <a href="mailto:Johan.Feenstra@wur.nl">Johan.Feenstra@wur.nl</a> )	Mandatory for most sandwich and some other PhD students	0 or 6
	Writing a follow-up research proposal, reviewed by SENSE (send it to <a href="mailto:Johan.Feenstra@wur.nl">Johan.Feenstra@wur.nl</a> )	Optional	0 or 6
	Site-specific training, for example in the use of specific equipment	Optional	0 - 6
	External training period at a scientific (foreign) research institute	Optional	0 - 6
	Extended literature study, supervised by a SENSE research leader (NOT the standard literature review every PhD student should do at the start of his/her PhD)	Optional	0 - 6
	Management Skills Training	Organisation of a scientific workshop, SENSE symposium or SENSE Core meeting	Optional; 1 ECTS for a half day activity (if more, please explain)
Membership of a PhD Council, General Board Research Institute, SENSE Research and Education Committee		Optional	0 - 6
Co-organisation of a SENSE PhD course		Optional	0 - 6
Presentations	Attending at least 2 SENSE meetings and presenting your own PhD research once	Mandatory	1
	Presenting PhD research at a international symposium	Mandatory: once 1 ECTS per presentation	1 - 3
Publications	Articles in refereed scientific journals (first author)	Optional; 2 ECTS per accepted publication	0 - 8
TOTAL			≥ 30

1 ECTS (European Credit Transfer System) is roughly equivalent to 28 study hours.



Annex 2: Overview SENSE PhD Courses (Tables 1, 2 and 3)

**Table 1: Overview of PhD courses organised by SENSE (SENSE A and S courses)**

Code	Course Title and coordinators <sup>1</sup>	Organised in 2002-2007 <sup>2,3</sup>
A1	Environmental Research in Context (Tromp-Meesters, VU; Leemans, WU)	X
A2	Research context activity (van Dommelen, VU)	X
S010B	Basic Statistics (PE&RC/SENSE; Gort WU & v/d Vijver PE&RC)	X
S010A	Advanced Statistics (PE&RC/SENSE; Gort WU & v/d Vijver PE&RC)	X
S020	Uncertainty Analysis (SENSE/PE&RC/MLAG; Keesman WU)	X
S030	Physical Modelling (MSc course; van Loon, WU)	X
S031	The Art of Modelling (PE&RC/SENSE; v/d Vijver, PE&RC)	X
S050	Research Methodology: designing and conducting a PhD research project (MGS/SENSE; Verschuren, WU)	X
S100	Environmental Risk Assessment of Micropollutants (van Gestel VU)	X
S101	Speciation and Bioavailability (van Leeuwen, WU)	X
S110	Soil Analysis and Data Handling (Temminghoff, WU)	X
S121	Euro Summer School Topics in Environmental Biotechnology (Lens WU): <ul style="list-style-type: none"> <li>o Trends in bioremediation of soils and sediments</li> <li>o Closing water and resources cycles: options for gas treatment</li> </ul>	X
S123	Biological Processes in Environmental Technology (Lens, WU)	X
S130	Ecotoxicology (van Gestel, VU and Murk, WU)	X
S131	Topics in Ecotoxicology (Murk, WU and van Gestel VU): <ul style="list-style-type: none"> <li>o Community Ecotoxicology</li> <li>o Bioassays and Bioindication</li> </ul>	X
S140	Risk Assessment (Blaauboer, WU)	X
S150	Principles of Ecological Genomics (SENSE/FE/PE&RC; van Straalen VU)	X
S200	Interaction between element cycles and ecosystems (Roijackers, WU)	X
S210	Soil Ecology: Interactions between Soil and Plant Communities (PE&RC/FE/SENSE; Brussaard, WU)	X
S211	Community Ecology: processes, models and applications (SENSE/PE&RC/FE; Verhoef, VU)	X
S212	Restoration Ecology of low-productive ecosystems	X
S213	Consumer – resource interactions (FE/PE&RC/SENSE; Mooij RUG)	X
S214	Innovative approaches in sustainable management of biodiversity (PE&RC/WIAS/SENSE; v/d Vijver, PE&RC)	To be organised
S221	Dynamic Energy Budgets (Kooijman, VU)	X
S222	Dynamic Energy Budgets in Ecotoxicology (Kooijman, VU)	X
S230	Integrative Research for Sustainable Landscapes (Gunther and Bärbel Tress Alterra-WUR)	X
S235	Spatial Ecology (FE, PE&RC, SENSE)	To be organised
	Catchment Science – Problems and opportunities in relating soil and vegetation with water, sediment and solute transport on hillslope and catchment scale (Bogaart, HWM-WU)	To be organised in 2008
S260	Complex dynamics in and between ecosystems (CERES/PE&RC/SENSE; Roquas e.a., WU)	To be organised
S300	Integrated Assessment of Global Environmental Change (old title; replaced by S310) (de Groot, WU)	X
S310	Understanding Global Environmental Change: Processes, Compartments, Interactions (Leemans, Kabat, Kroeze, Metzger, WU)	X



S330	Soil Organic Matter (Buurman, WU)	To be organised
S340	Integrated Assessment of Global Environmental Change: Causes and Responses (Leemans & van Ierland, WU)	To be organised in 2008
S350	Climate and the Hydrological Cycle (ICG/SENSE; Bierkens UU)	X
	Coping with Climate Change in Integrated Watershed Management (Hutjes, ESS-WU)	To be organised in 2008
S400	Energy, Materials and Waste: issues in quantitative analysis and modelling (Bellekom & Moll; RUG)	X
S410	Life Cycle Assessment (LCA) (Heijungs, LU)	X
S412	Industrial Ecology: Theory and Concepts	To be organised
S420 old	Introduction to Environmental Economics and Resource Economics for Non-Economists (Verbruggen, VU)	X
S420 new	The Economic Approach to Environmental Policy (v/d Bergh, VU)	X
S421	Intertemporal Allocation of Natural Resources and Intergenerational Justice (MGS/SENSE; Weikard, WU)	X
S422	Theories and Models in Environmental Economics (Dellink, WU)	X
S430	Policy Evaluation Methodology (MGS/SENSE; van Tatenhove, WU)	X
S431	Environmental Policy Analysis (v/d Kerkhof & Hisschemöller, VU)	X
S434	Summer Course American Environmental Politics (Mol, WU)	X
S435	Superpowers in global environmental politics: China and the USA (van Leeuwen, WU)	X
S440	Social Theory and the Environment: Introduction into Ecological Modernisation Theory (MGS/SENSE; Oosterveer WU)	X
S460	Earth System Governance (Biermann, VU & Martens MU)	X

<sup>1</sup>Note: WU = Wageningen University, VU = VU University Amsterdam, UL = University Leiden, RUG = Groningen University, PE&RC, MGS, and FE: Other Research Schools.

<sup>2</sup> X means: organised at least once in the period 2001-2006

<sup>3</sup> excluding EU summer schools "Closed Industrial Cycles" and "The Sulphur Cycle in Environmental Biotechnology" organised in 2001 and 2002, respectively.

**Table 2: General Skills Courses offered by Wageningen Graduate Schools (WGS); open for all SENSE PhD students**

Code	Course Title	
G050	PhD Competence Assessment	X
G060	Personal Efficacy	X
G100	The Art of Writing	X
G200	Time Planning and Project Management	X
G300	English for PhD students (various courses): ▪ Scientific Writing for PhD students (WU language centre)	X
G400	Techniques for Writing and Presenting a Scientific Paper (Grossman)	X
G410	PhD Presentation skills (WU language centre)	X
G420	Media and mediators; messages and means: a training in media skills for scientific researchers	X
G422	Creating your scientific network	X
G430	Scientific Publishing: Introductory workshop for PhD students	X
G431	Information Literacy Course	X
G440	Interpersonal communication for PhD students	X
G450	Teaching and Supervising MSc thesis students	X
G480	Ethical Dilemmas for Life Scientists	X
G481	Ethical Dilemmas for Social Scientists	X
G500	Writing a grant proposal	X
G600	Career Orientation	X
G620	Career Perspectives	X
G900	PhD Debating Course	X
		X
Gxxx	Professional in PhD Supervision (course for PhD supervisors)	X



**Table 3. External PhD Courses accepted by SENSE as Specialised PhD courses in the field of Socio-Economic and Natural Sciences of the Environment**

Code	Title
<b>PE&amp;RC: The C.T. de Wit Graduate School for Production Ecology and Resource Conservation</b>	
S014E	Survival Analysis (FE/PE&RC; Haccou, FE-UL; Hemerik, PE&RC-WU)
S250E	Tropical forest ecology and management
S232E	Land Science: bringing concepts and theory into practice
<b>FE: Functional Ecology (<a href="http://www.rug.nl/biol/fe">www.rug.nl/biol/fe</a>)</b>	
S012E	Generalized Linear Models for Ecologists (Van Dooren, FE-UL)
S013E	Multivariate Statistics – Repeated Measures (Molenberghs, Verbeke, Van Dooren, FE-UL)
S014E	Survival Analysis (FE/PE&RC; Haccou, FE-UL; Hemerik, PE&RC-WU)
S220E	Theoretical Ecology (FE; Metz, UL)
S223E	Adaptive Dynamics (FE; Egas, IBED-UvA)
S240E	Ecophysiology of Plants (FE; Elzenga, Vousenek, De Kroon)
S241E	Estuarine Ecology (FE; Stal, NIOO Yerseke)
S242E	Life History Theory (FE; Van Alphen, UL; Tinbergen, RUG)
S243E	Microbial Ecology (FE; Van Veen, NIOO Heteren)
S244E	Population Genetics (FE; Bijlsma, RUG)
S245E	Introduction to the Marine Sciences <a href="http://www.rug.nl/biol/fe">www.rug.nl/biol/fe</a> PhD courses - Topical Courses
<b>MGS: Mansholt Graduate School (<a href="http://www.sls.wau.nl/mi/mgs/courses/index.htm">http://www.sls.wau.nl/mi/mgs/courses/index.htm</a>)</b>	
S051E	Qualitative Research Methods (MGS/CERES; Assche; Devlieger)
S052E	Quantitative Research Methodology (MGS; Van den Lans)
S053E	Socio-cultural Field Research Methods (MGS/CERES; Price; Casimir)
S054E	Bayesian Methods in Theory and Practice (MGS; Geweke)
S231E	Multifunctional Land Use Planning: Integrating Socio-cultural and Bio-physical Principles; Theory, Analysis and Tools
S450E	Multi-agents systems for natural resources management (MGS/PE&RC; François Bousquet, CIRAD Green, Montpellier, France)
S461E	Governance crossing borders (MGS; Gremmen, Hagelaar)
<b>TI: Tinbergen Institute (<a href="http://www.tinbergen.nl/home.html">http://www.tinbergen.nl/home.html</a>)</b>	
S423E	T1652 Environmental Economics; Withagen (VU)
S424E	T1651 Spatial and Transport Economics; De Groot and Verhoef (VU)
<b>ICG: Centre for Geo-ecological Research (<a href="http://www.science.uva.nl/ibed/icg/">http://www.science.uva.nl/ibed/icg/</a>)</b>	
	Spatio-environmental modelling in GIS (PC-Raster) ; distance learning course over the internet; this course consists of three different modules (S032E; S033E and S034E, see below) <a href="http://pcraster.geog.uu.nl/courses/courses.html">http://pcraster.geog.uu.nl/courses/courses.html</a>
S032E	An Introduction to Map Algebra and Cartographic Modelling
S033E	An Introduction to Dynamic Modelling
S034E	An Introduction to Python Programming
<b>NSG: Netherlands Research School of Sedimentary Geology; <a href="http://www.geo.vu.nl/users/nsq/">http://www.geo.vu.nl/users/nsq/</a></b>	
S320E	Advanced Organic Biogeochemistry (ECOLMAS/NEBROC); Schouten, Damsté, NIOZ, Texel
S321E	Ocean carbonates and their budgets
<b>CTG: Centre for Technical Geoscience (<a href="http://www.ctg.tudelft.nl/">http://www.ctg.tudelft.nl/</a>)</b>	
S260E	TG033: Stochastic modelling and geostatistics for flow and transport in porous media; Schuttelaars
S261E	TG431: Advanced environmental geohydrology; Bruining/Hassanizadeh
<b>VLAG: Research School of food technology, nutrition and health</b>	
S128E	Bioreactor Design and Operation (VLAG/BSDL; Eggink, VLAG and Van 't Riet, BSDL) <a href="http://www.vlaggraduateschool.nl/courses/reactor-design.htm">http://www.vlaggraduateschool.nl/courses/reactor-design.htm</a>
<b>BSDL: Graduate School for Biotechnology Studies Delft Leiden (<a href="http://www.bodl.bt.tudelft.nl/ac.html">http://www.bodl.bt.tudelft.nl/ac.html</a>)</b>	



S120E	Advanced Course on Environmental Biotechnology (BSDL; Heijnen; Kuenen)
S124E	Advanced Course on Microbial Physiology and Fermentation Technology (BSDL; Heijnen; Pronk)
S125E	Advanced Course on Biocatalysis (BSDL; Sheldon, De Bont)
S126E	Advanced Course on Downstream Processing (BSDL; Van Wielen, Van Dedem)
S127E	Advanced Course on Applied Genomics of Industrial Fermentation (BSDL; De Winde)
<b><i>Boussinesq Center for Hydrology (<a href="http://www.boussinesqcenter.nl/">http://www.boussinesqcenter.nl/</a>)</i></b>	
S360E	Upscaling and modelling of coupled transport processes in the subsurface (S.M. Hassanizadeh; Professor of Hydrogeology, Utrecht University) <a href="http://hydroforum.com/phpbbforo/viewtopic.php?t=546">http://hydroforum.com/phpbbforo/viewtopic.php?t=546</a>
<b><i>UNESCO-IHE Institute for Water Education (<a href="http://www.unesco-ihe.org/education/phd.htm">http://www.unesco-ihe.org/education/phd.htm</a>)</i></b>	
	European SWAT Summer School (Uhlenbrook, Griensven c.s.)
	Advanced Techniques in Experimental Hydrology (Luxembourg; IHE in co-operation with TU-Delft)
<b><i>Postgraduate School of Industrial Ecology (<a href="http://www.indecol.ntnu.no/psie.php">http://www.indecol.ntnu.no/psie.php</a>)</i></b>	
S413E	Life Cycle Assessment
S414E	Value Chain Modelling
S415E	Ecological Design
S416E	Resource and Recycling Systems
S417E	Sustainable Production
S418E	Sustainable Consumption
<b><i>Other Specialised PhD courses</i></b>	
BBOS	<a href="http://www.phys.uu.nl/~wwwimau/education/bbos/">http://www.phys.uu.nl/~wwwimau/education/bbos/</a>
	BBOS Spring symposium
	BBOS Autumn symposium
	Workshop boundary-layer meteorology
<b><i>Other General Skills Courses</i></b>	
G411E	Presentation Skills (FE; Van Gunsteren; RUG) <a href="http://www.rug.nl/biol/fe">www.rug.nl/biol/fe</a>
G501E	Writing a grant proposal (FE) <a href="http://www.rug.nl/biol/fe">www.rug.nl/biol/fe</a>

**Annex 3: SENSE Research Programme 2008 - 2013****Core 1:****Environmental nutrients and micropollutants: behaviour, exposure, effects, removal and reuse**

Core 1 Chair: Dr. J. (Juliette) Legler (IVM-VU)

**Aim**

The strategic aim of the Core 1 research programme is to study the exposure and effects of micropollutants in the environment, as well as their removal or remediation in soil and (waste)water. Core 1 covers research varying from ecology and toxicology to analytical chemistry and environmental technology. Exposure and effect research form the basis of the risk assessment of micropollutants. Exposure studies encompass the occurrence, behaviour, fate and bioavailability of micropollutants in terrestrial and aquatic systems. Studies on the effects of micropollutants assess the biological responses to toxicant stress at the molecular (ecological genomics), organism and population level (ecotoxicology, biodiversity). The development of new analytical or biological-based methods to measure exposure and effects of micropollutants is an important goal of exposure and effect studies. Integrative models are also developed by Core 1 researchers to predict micropollutant behaviour in complex environmental settings. Environmental technology research in Core 1 aims to develop sustainable solutions for the removal of micropollutants from (waste) water and soil, and for the restoration of renewable cycles of matter and energy.

**Research Clusters / Research Topics:**

- I. Behaviour, exposure and effects of nutrients and micropollutants in soil and water** (chemical speciation, bioavailability, mobility, uptake and eco(toxico)logical risk assessment of nutrients and micropollutants; developing and testing of new analytical and measurement techniques; risk-based toxicity profiling of new pollutants, organic compounds and heavy metals (from molecular level to the thermodynamic macroscopic scale and field scale)  
**Co-ordinators:** Dr. P.E.G. (Pim) Leonards (VU-IVM-C&B); Dr. E.J.M. (Erwin) Temminghoff (WU-SOQ)
- II. Ecological genomics** (ecological complexity, nutrient cycles, life-history patterns and responses of organisms to environmental stress at the genomic level. Analysis of environmental genomes to improve our understanding of ecosystem functions and biodiversity and to contribute to define and measure environmental quality)  
**Co-ordinators:** Dr. D. (Dick) Roelofs (VU-IES-CEE); Dr. H. (Hauke) Smidt (WU-MIB)
- III. Biotechnological and physico-chemical processes for sustainable use and reuse of water, energy, materials and minerals** (treatment of waste, wastewater and off-gases; removal of pollutants; reuse and recycling of energy and minerals; self-purification; biomass & bio-energy; bio-conversion; eco-technology)  
**Co-ordinators:** Prof. P. (Piet) Lens (UNESCO-IHE); Prof. J.B. (Jules) van Lier (WU-ETE)

**Core 2:****Environmental processes and ecosystem dynamics**

Core 2 Chair: Professor J.A.(Jan) Hendriks (RU Nijmegen)

**Aim**

The aim of Core 2 is to understand processes and patterns in ecosystems that are important to solve environmental problems. We study the fluxes of energy, water, carbon, nutrients and toxicants through these systems as well as the dynamics of populations, communities, landscapes and biomes. Physical-chemical pressures are linked to ecological and human health, covering important interrelated environmental issues, in particular global change, biodiversity loss, eutrophication, acidification, pollution, droughts and flooding. While we focus on natural sciences, interaction with social sciences is sought. In addition, we cooperate with governmental agencies, non-governmental organizations and private companies at various scales to facilitate implementation in society.

Research involves integrated lab, field and modelling studies, especially at regional scales.



#### Research Clusters / Research Topics:

- IV. Ecosystem dynamics** (temperature; nutrient, carbon and salt cycling in ecosystems; multiple stress; food webs; feedback mechanisms; disturbance and resilience; biodiversity processes, modelling at landscape, watershed and ecosystem scales)  
**Co-ordinators:** Dr. K. (Klaas) Metselaar (WU-SEG); vacancy
- V. Adaptation to environmental change** (variation in the response of organisms to global warming, urbanization, pollution, drought and other stresses, with emphasis on the consequences for species interactions, community diversity and community composition)  
**Co-ordinators:** vacancy
- VI. Landscape ecology, restoration ecology and nature conservation** (*key processes; causes for decline:* effects of fragmentation; stable states & catastrophic events; *strategies for restoration:* nutrient impoverishment; restoring faunal communities; reintroduction of species; modelling)  
**Co-ordinators:** activities could be combined with research cluster XIV
- VII. Processes in soil, water and atmosphere** (soil dynamics, subsurface hydrology, groundwater hydrology; water flow; transport of nutrients, micropollutants and bacteria in soil and water; soil degradation, erosion and landscape evolution; geophysics; atmospheric boundary layer dynamics, circulation and distribution of air pollutants; carbon and nutrient fluxes, the hydrological cycle; extreme weather events, the effects of climate change on floods and droughts; integrated soil and water management; scale issues; modelling)  
**Co-ordinators:** Dr. G.H. (Ger) de Rooij (WU-SEG); Prof. S. (Stefan) Uhlenbrook (UNESCO-IHE)

#### Core 3:

##### Global Environmental Change

Core 3 Chair: Professor P. (Pier) Vellinga (WU / VU)

#### Aim

The aim of Core 3 is to analyse the causes and effects of, and possible solutions to global change with emphasis on changes in climate, land use, biodiversity and biogeochemical cycles. Global change is the ultimate result of expanding economic activities based on wide spread practices and technologies that result into global scale changes in the functioning of the biosphere. The effect per capita is a major determinant in this equation. It is still growing in industrialised countries while in emerging economies the environmental use per capita is rapidly growing. At the global level major changes are now taking place in climate, land use, biodiversity and biogeochemical cycles. The early effects on environmental quality and ecosystem services are becoming increasingly visible. Existing local stresses related to intensive human use of ecosystem services are exacerbated by global changes

The ultimate aim of the various foci of this core programme 3 is to understand global change and its driving mechanisms, explore socio-economic and technological development trajectories that have a lower impact and to develop integrated models for simulation, projection and scenario development, and assess management implications and policy strategies under different plausible futures and at various scales.

#### Research Clusters / Research Topics:

- VIII. Global environmental change: pressure, state and impact** (interacting biogeochemical cycles; global change observations and trends; earth system compartment interactions; complex systems and resilience; effects on ecosystems and biodiversity; scenarios and modelling potential impacts; uncertainty and communication)  
**Co-ordinators:** Dr. L.N. (Laurens) Ganzeveld (WU-ESS); Dr. S.C. (Stefan) Dekker (UU-COP-ES); Prof. B.J.M. (Bert) de Vries (UU-COP-STs)
- IX. Managing global and climate change** (the role of technological change on mitigation strategies; the development of long-term mitigation and adaptation policies in an international context; assessment of climate adaptation strategies for the Netherlands and internationally; risk management of vulnerable areas like river basins, river delta's and coastal areas; the use of spatial analysis, economic analysis and policy instruments in water management; global change and human health)  
**Co-ordinators:** vacancy

#### Core 4:



## **Sustainable change: methodologies and governance**

Core 4 Chair: Professor A.P.J. (Arthur) Mol (WU)

### **Aim**

To bring about a more sustainable development important changes in production and consumption systems will be required. A basic question is how to produce and consume energy and materials in a more sustainable way and how to realize such transformations. Core 4 seeks to understand the complex society-environment interactions, to identify driving forces for change, to explore the feasibility of development trajectories, and to evaluate and design new societal arrangements for sustainable development. Evaluation and design criteria encompass the efficacy, efficiency, responsiveness, openness, legitimacy and justice of change strategies and arrangements.

### **Research Clusters / Research Topics:**

**X. Governance for Sustainable Development** (understanding the limits to growth regarding inputs with inelastic supply, like energy resources, materials, land and water and outputs in terms of emissions to be constrained to what the system earth can manage; transforming these boundary conditions in requirements for sustainable development; international relations; international and national instruments and multilateral agreements; sustainability partnerships; public-private partnerships; EU and regional frameworks for environmental governance; sovereignty; governance at local, national and international level)

**Co-ordinators:** Dr. R. (Ron) Corvers (MU-ICIS); Dr. P.H. (Phillipp) Pattberg (VU-IVM-EPA); Dr. A. (Aarti) Gupta (WU-ENP).

**XI. Industrial transformation / Sustainable production and consumption / Transitions to Sustainability** (analysing the metabolism of society as involved in production and consumption; understanding of social and technological change in processes of long-run transitions towards sustainability; effective policies and decision making for sustainable technological development and for sustainable production and consumption).

**Co-ordinators:** Prof. H.C. (Henk) Moll (RUG-IVEM); Dr. B.J.M. (Bas) van Vliet (WU-ENP); Dr. R.P.M. (Rene) Kemp (MU-ICIS); Prof. M.P. (Marko) Hekkert (UU-COP-ISG)

---

### **Cross cutting Research Clusters / Research Topics:**

**Co-ordinators:** Dr. G. (Gjalt) Huppes (LU-CML);

### **Core 1 & 4:**

#### **Research Cluster / Research Topic:**

**XII. Sustainable use and reuse of energy, material and resources / Cradle to Cradle approach** (technological innovations; closing industrial production cycles, LCA, MFA, food-feed-fuel interactions)

**Co-ordinators:** Dr. G. (Gjalt) Huppes (LU-CML); Prof. H.C. (Henk) Moll (RUG-IVEM); Dr. W.G.J.H.M. (Wilfried) van Sark (UU-COP-STs)

### **All Cores:**

#### **Research Clusters / Research Topics:**

**XIII. Land use, spatial analysis and modelling / Ecosystem and Landscape Services**

(development of tools for analysing, understanding and visualising patterns and dynamics of environmental functions and values; competing claims for land use, development of decision support systems for spatial planning and management; quantifying, evaluating and developing effective financial mechanisms regarding ecosystem and landscape services and implementation of this knowledge in integrated local planning, landscape design and management; governance of natural resources, biodiversity, ecosystem and landscape services)

**Co-ordinators:** Dr. R.S. (Dolf) de Groot (WU-ESA); Prof.Dr. P.F.M. (Paul) Opdam (WU-LUP/Alterra)

**XIV. Integrated Assessment of Global Environmental Change** (sustainability science; integrated modelling; participatory methods; uncertainty analysis; decision support systems for integrated pollution and/or ecosystem management)

**Co-ordinators:** Dr. P.J. (Pieter) Valkering (MU-ICIS); Dr. S.B. (Bas) Amelung (MU-ICIS)



## Annex 4

### Annex 4: Overview of scores SENSE research groups

#### Assessment of Research Quality Environmental Sciences (2007) (See for explanation / meaning of the scores next page)

<b>WU</b>	<b>code</b>	<b>WIMEK</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	ESA	Environmental Systems Analysis Group	5	5	5	5
	ENP	Environmental Policy Group	5	4	5	4
	AEW	Aquatic Ecology and Water Quality Management group	5	4	5	5
	SOQ	Soil Chemistry and Chemical Soil Quality Group	5	4	5	3,5
	MIB	Microbiology Group (only Environmental Microbiology part)	5	4	4	3,5
	NCP	Nature Conservation and Plant Ecology Group	4	5	5	4
	ETE	Environmental Technology Group	4	5	5	4
	ESS	Earth System Science Group	4	4	4,5	4,5
	SEG	Soil Physics, Ecohydrology and Ground Water Quality Group	4	4	4	4
	HWM	Hydrology and Quantitative Water Management Group	3,5	3	3	4,5
	ENR	Environmental Economics and Natural Resources Group	3	3	4	3
<b>UU</b>	<b>code</b>	<b>Copernicus</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	STS	Science, Technology and Society Group	5	4	5	5
	ES	Environmental Sciences Group	4	3	4	4
	ISG	Innovation Studies Group (Not SENSE)	3	3	4	4
	ESP	Environmental Studies and Policy Group	3	3	3	2
<b>VU</b>	<b>code</b>	<b>IVM</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	EPA	Environmental Policy Analysis Group (EPA)	5	4	4	5
	C&B	Chemistry and Biology Group (C&B)	5	4	4	4
	E&T	Economics and Technology Group (E&T)	4	5	4	3
	SPACE	Spatial Analysis and Decision Support Group (SPACE)	4	4	4	4
<b>VU</b>	<b>code</b>	<b>IES</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	SE	Systems Ecology Group	5	5	4	5
	AE2	Animal Ecology Group 2: Ecotoxicology and Ecogenomics	4	5	4	5
	AE1	Animal Ecology Group 1: Community and Evolutionary Ecology	4	3	4	4
	TB	Theoretical Biology Group	4	3	3	3
<b>MU</b>	<b>code</b>	<b>ICIS</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	ICIS	International Centre for Integrated Assessment and Sustainable Development	3	4	4	3
<b>RUG</b>	<b>code</b>	<b>IVEM</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	IVEM	Center for Energy and Environmental Studies	3	4	4	3
<b>RU</b>	<b>code</b>	<b>Radboud</b>	<b>Q</b>	<b>P</b>	<b>R</b>	<b>V</b>
	EB	Environmental Biology Group	4	3	4	4
	ES	Environmental Sciences Group	3	3	4	4



#### Assessment of Research Quality PE&RC (2004)

WU	code	WIMEK	Q	P	R	V
	MAQ	Meteorology and Air Quality Group	4,5	4	4,5	4,5

#### Assessment of Research Quality CML (2006)

LU	code	CML	Q	P	R	V
	IE	Industrial Ecology Group	4	5	5	4
	EB	Environmental Biology Group	4	3,5	4	4

#### Assessment of Research Quality IBED (2006)

UvA	code	IBED	Q	P	R	V
	EC	Environmental Geo-ecology research programme, in which the Environmental Chemistry Group (EC) participates as part of CBPG (research groups: CBPG, ESPM, P&L and ES)	4	4	4,5	3,5
	AMB & AEE	Community Dynamics research programme, in which the Aquatic Microbiology Group (AMB) and the Aquatic Ecology and Ecotoxicology Group (AEE) participate (research groups PB, TE, AMB and AEE)	4,5	4,5	4,5	4

#### Explanation of the scores on a five point scale

5	<b>Excellent</b>	Work is at the <b>forefront internationally</b> and will most likely have an <b>important and substantial impact</b> in the field. Institute is considered an <b>international leader</b> .
4	<b>Very Good</b>	Work is <b>internationally competitive</b> and is expected to make a <b>significant contribution</b> ; nationally speaking at the forefront in the field. Institute is considered <b>international player, national leader</b> .
3	<b>Good</b>	Work is <b>competitive at the national level</b> and will probably make a <b>valuable contribution</b> in the international field. Institute is considered <b>internationally visible and a national player</b> .
2	<b>Satisfactory</b>	Work that is <b>solid but not exciting</b> , will add to our understanding and is in principle worthy of support. It is considered of less priority than work in the above categories. Institute is <b>nationally visible</b> .
1	<b>Unsatisfactory</b>	Work that is neither solid nor exciting, flawed in the scientific and or technical approach, repetitions of other work, etc. <b>Work not worthy of pursuing</b> .