

**Environmental Sciences 2007
Research Evaluation,
including SENSE Research School**

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FOREWORD

This report is part of the periodic quality assessment of all publicly financed research in the Netherlands, using the Standard Evaluation Protocol 2003-2009 for Public Research Organisations (SEP) that was developed by VSNU, KNAW and NWO. The purpose of this report is to present a reliable picture of the results of the research submitted for this review and to give feedback to the internal quality assurance of the organisations concerned.

The review covers the research in the period 2001-2006 in the research programmes and institutes that participate in the research school for Socio-Economic and Natural Sciences of the Environment (SENSE), plus the activities of the research school as such.

The review was commissioned jointly by the Boards of the universities that participate in SENSE and by the Board of SENSE. The review committees were supported by QANU (Quality Assurance Netherlands Universities). QANU cooperated with SENSE to ensure compliance with SEP in all aspects and to produce independent assessment reports with peer review committees of international experts in the academic fields involved.

This report consists of two parts.

The first part, the Report of the General Committee, builds on the programme reviews and deals with:

- a) the research school SENSE, with three general functions:
 - School for Environmental Researchers and Professionals
 - Network for Environmental Sciences
 - Bridge to Society and Environmental Governance.
- b) the research institutes (WIMEK-WU, IVM-VU, IES-VU, Copernicus-UU, IVEM-RUG, ICIS-UM).

The second part of this report contains the findings of the five programme review committees, regarding the twenty-two research programmes submitted for review.

QANU wishes to thank the chairpersons and members of the Review Committees for their participation in this assessment and for the dedication with which they carried out this task. We also thank the staff of the research school and institutes concerned for their carefully prepared documentation and for their co-operation during the assessment.

Quality Assurance Netherlands Universities

Mr. Chris J. Peels
Director

Dr. Jan G.F. Veldhuis
Chairman of the Board

PART I: REPORT OF THE GENERAL COMMITTEE

SUMMARY OF EVALUATION OF SENSE SCHOOL

SENSE as an organization has two main *de facto* functions: the training of young environmental scientists and the advancement of environmental research through networking. It has been very successful in pursuing these goals. As a practical matter, it would be worthwhile to revise the SENSE mission statement to reflect these *de facto* functions. Besides this, SENSE is further developing its function as a bridge between the environmental sciences on one hand and society and environmental governance on the other.

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. Nevertheless, not all member institutes fully participate in the School's PhD programme. Since the training of young scientists is one of the central tasks of SENSE, we recommend that steps be taken to increase the participation of all institutes in the procedures and guidelines of the School's PhD programme.

Through the achievements of its scientists and research groups, SENSE has become well recognized as a major player in the fields of environmental sciences and global change. It was noted that SENSE has not achieved this reputation by being a "top down" research organization. In fact, the School has neither the funds, organizational structure, nor (apparently) the ambition to be a top down research organization. Instead, the School contributes to research mainly through its networking activities – i.e. building, strengthening and supporting a powerful network of environmental research institutes in NL. This approach exploits the talents of member institutes and does not challenge their autonomy.

While the level of networking and collaboration is high between and within many SENSE institutes, it is not uniformly high. This is unfortunate because one of the main values of SENSE is to support synergistic relationships between research groups. Hence, high priority should be given to providing incentives for increasing the level of collaboration within the SENSE community and for strengthening the School's multi-disciplinary approach to environmental research.

Acknowledgments

The Review Committee wishes to express its thanks to the staff of SENSE and QANU for their goodwill and helpfulness during the review. We found the arrangements for the review to be well-organized and smooth-running.

1. Introduction

1.1. Scope of the Review

This report is part of the external review of the activities in the research school for Socio-Economic and Natural Sciences of the Environment (SENSE). The review covers the research in the period 2001-2006 in the research programmes and institutes that participate in the research school, plus the activities of the research school as such. This means that the entire review is on three levels:

- the research school SENSE.
- the research institutes (WIMEK-WU, IVM-VU, IES-VU, Copernicus-UU, IVEM-RUG, ICIS-UM)
- the research programmes

This review was commissioned jointly by the Boards of the universities that participate in SENSE and by the Board of SENSE. The review committees were supported by QANU (Quality Assurance Netherlands Universities). QANU cooperated with SENSE to ensure compliance with SEP in all aspects and to produce independent assessment reports with peer review committees of international experts in the academic fields involved.

For the review of the 22 research programmes, five review committees were installed. The findings of the programme review committees are laid down in separate reports. For the review of the institutes and the research school, a sixth committee was installed. This General Committee consisted of the chairpersons of the five programme review committees plus an independent chairman:

- Prof. Joseph Alcamo, Chairman, University of Kassel
- Prof. Aviel Verbruggen, University of Antwerp
- Prof. Janne Bengtsson, Swedish University of Agricultural Sciences
- Prof. Andrea Rinaldo, University of Padova
- Prof. Willy Verstraete, Ghent University
- Prof. Lea Kauppi, Finnish Environment Institute (SYKE).

Secretary of this committee was Roel Bennink, QANU.

The findings of the General Committee are presented in this report.

This report deals with

- the research school SENSE, with three general functions:
 - *School for Environmental Researchers and Professionals*
 - *Network for Environmental Sciences*
 - *Bridge to Society and Environmental Governance.*
- the research institutes (WIMEK-WU, IVM-VU, IES-VU, Copernicus-UU, IVEM-RUG, ICIS-UM)

1.2. Data Provided

The Committee has received detailed documentation consisting of the following parts:

1. Self evaluation reports per institute
2. Self evaluation report SENSE
3. Report on the SENSE PhD Inquiry 2007
4. Guidelines for Course Coordinators; Information booklet for PhD students
5. CD with all evaluation documents for the 2007 review.

1.3. Procedures of Review

The review process was set up in such way that the programme review committees interviewed the management of the institutes and the management, staff and board of the research school. (See Appendix D). A summary of the findings of the General Committee was presented to representatives of the institutes and SENSE in the afternoon of June 22, 2007.

The review of the research programmes and institutes follows the guidelines of the Standard Evaluation Protocol 2003-2009 for Public Research Organisations (SEP), published by KNAW, NWO and VSNU. Therefore, this element of the review serves the purpose of the external quality assessment of the university research, as outlined in SEP.

The review of the research school follows the guidelines of the protocol for the accreditation of research schools, developed by the Research School Accreditation Committee (ECOS) of the KNAW. This element of the review (together with the results of the research reviews) is intended to serve in the process of re-accreditation of the research school by the KNAW.

1.4. Limitations of Review

While the self-evaluations provided to the Committee were comprehensive and informative, it is necessary for a Committee of this type to construct its own picture of the evaluated organizations through direct discussions and questioning of the organizations being evaluated. Nevertheless, the Committee only had a **half-day** for discussions with SENSE School officials, and **only one day** for meeting with representatives from six separate SENSE institutes. Although the members of the Committee had spent much of the week meeting with the research programmes, their evaluations had been organized *by discipline and group* rather than by *institute*. In the future, if evaluations of more depth are needed of the School and the coordinating role of its Institutes, we recommend that more time be allowed for interviews with School and institute representatives. At the same time we recommend that reviews be held less frequently (similar reviews were held in 2000 and 2004).

2. Evaluation of the Sense Research School

2.1. Basis for the Review

To evaluate the SENSE Research School we considered not only the material we received about the School but also took into account information we could glean from our evaluation of its constituent institutes and research groups.

First of all, we considered the mission statement of the School, which is:

To promote an integrated understanding of environmental change in terms of mechanisms that cause it and the consequences that result from it. Research and education in SENSE are dedicated to developing high quality scientific results that may be applied to practically and critically inform sustainable environmental governance and decision-making.

To fulfil this mission, the combined programmes of research and education within SENSE are aimed at the development and further improvement of scientific concepts and methods that are required for an effective disciplinary and multi-disciplinary understanding of environmental change.

Although this is certainly a valuable mission statement, it does not make clear the relative importance of the words “research” versus “education”. In reality, the Committee noted that the Board and management of SENSE have neither the funds nor institutional instruments to coordinate the research of or between its member institutes. Indeed, the institutes are autonomous when it comes to the details of their own research plans. With regards to research, SENSE has the role of facilitating research cooperation, of maintaining quality, and sometimes catalyzing new research themes.

Indeed, after examining the SENSE Research School at all levels (research groups, member institutes, and the school administration itself) the Committee concludes that the School’s *de facto* functions are two-fold:

- To provide training for young scientists in the many fields of environmental science and policy, especially through the education of PhD students.
- To foster world-class environmental research by supporting a national network of environmental research institutes.

These are very worthwhile and admirable functions, and we recommend the School make it more clear in a revised mission statement that its activities are guided by them. We have evaluated the School with reference to these twin functions.

2.2. The PhD Training Programme

Introduction

As noted above, we consider the PhD Training Programme to be one of the two core functions of the School. Our opinion is that this programme is the “glue” that binds the SENSE community together.

Particular Strengths

The Committee considers the PhD programme one of the great successes of SENSE. Through this programme SENSE makes a major contribution to the training of the next generation of environmental researchers and professionals in the Netherlands and internationally.

The Committee notes the high motivation and enthusiasm of the PhD students. A very positive aspect of the PhD Program is the engaged managerial style of the programme coordinators who are open to feedback and improvements.

The Committee approves of current efforts to improve the supervision of students and better communicate the “T-approach” of the programme.

We also find that:

1. The program is well-organized and comprehensive in that it involves in-depth disciplinary and multi-disciplinary courses, as well as general skill courses.
2. The organizational structure of the programme promotes effective networking within and outside of the SENSE community (See next section).
3. The programme encourages students to be “entrepreneurial” in a positive sense, because SENSE supports self-organized student activities.

The committee applauds the efforts to increase the number of international and summer courses & workshops which will make the PhD course program even more valuable.

Suggested Improvements

Achieving Full Participation

While the School has adopted excellent guidelines and procedures for PhD study, these guidelines are unfortunately not followed or recognized by all the member institutes of the School. For example, not all member institutes require their doctoral students to follow a SENSE-authorized “Individual Training and Supervision Plan” (ITSP). **The Committee believes that member institutes should be required to cooperate and comply with the School’s PhD programme or at least with a designated set of core objectives and courses.** (It may be desirable to make the selection of mandatory courses somewhat different for particular member institutes or academic disciplines.) We recommend that steps be taken to ensure that all institutes fully participate in the procedures and guidelines of the School’s PhD programme unless there are factors that make this impossible.

Improving PhD Supervision

Because of the key role of supervision in the success of PhD students, we are happy to see that SENSE is taking steps to improve this supervision by organizing workshops on conducting and supervising PhD studies, and by developing administrative guidelines for supervisors.

Raising the Visibility of the S-Certificate

Despite the quality of the PhD program, the students felt that the S-Certificate was still not a very valuable asset for their careers because it is relatively unknown among potential employers. To make the S-Certificate more valuable to PhD graduates, SENSE should try to raise the certificate’s visibility among the professional environmental community (e.g. government agencies, environmental firms).

Preparing for Non-Academic Careers

It is well-known that a very high percentage of SENSE-PhDs go into non-academic careers (perhaps 80%). On one hand, the School takes this into account by making its scientific research and training as relevant as possible to sustainable development issues. The “T-shaped” model of training (depth of analysis as well as on width of understanding and communication) is indeed very relevant both for scientific careers and for careers outside scientific research. On the other hand, Committee believes that the PhD training program could better prepare its students for non-academic careers. We recommend that various actions be taken to broaden the training program. In particular, the School should provide more opportunities for interaction between PhD students and professionals. For example, students should be encouraged to take courses to develop “soft” but important skills such as project management, project planning, and public speaking. The School should also organize special “work fairs” where students can meet with potential employers.

Achieving a Four-Year Target

Based on international experience the Review Committee believes that under normal circumstances four years is an adequate time for achieving a PhD in NL. The committee believes that the following steps should be taken to achieve the four year target:

- (i) continuing a strict “Go - No Go” decision after one year,
- (ii) providing incentives for publications and for finishing within four years;
- (iii) continuing to provide time management courses for students;
- (iv) urging supervisors to develop a four year plan for their doctoral students.

Maintaining the Quality of Sandwich PhD's

The international “sandwich PhD” programme is a commendable effort at capacity building and bridging to developing countries. However, SENSE should take steps to ensure the high research standards set by the School are maintained in this program. SENSE should ensure that the numbers of sandwich PhD students accepted by chair research groups do not exceed the capacity of these groups to provide adequate supervision.

Targeting core courses to particular audiences

The committee believes that the mandatory core courses offered by the PhD programme are the core of SENSE research training programme. Because of the multi-disciplinary nature of the research in SENSE and because the PhD students have a very diverse academic background, the number of mandatory courses cannot be very large, and for that reason the optional elements in the programme also perform a very important role in the quality and coherence of the training. Therefore it is important to SENSE that its PhD students fully participate in both its mandatory and optional courses. However, the reality is that the participation of PhD students in optional courses is disappointingly small because they are a diverse group and often select optional courses from outside of SENSE. As noted above, a solution would be for SENSE to make the selection of mandatory courses somewhat different for particular member institutes or academic disciplines.

2.3. Research Activities

Introduction

Here we evaluate the research-related activities of the SENSE Research School. An important point to make at the outset is that SENSE has neither the funds, organizational structure,

nor (apparently) the ambition to be a “top down” research organization. During many interviews it became clear that virtually all members of the SENSE community were satisfied with its “bottom up” approach to setting research priorities and coordinating research activities. Indeed, it is the view of the Committee that the research activities of the School are (and should be) concentrated on networking activities – i.e. building, strengthening and supporting a powerful network of environmental research institutes in NL. (See Section 2.1 of this report). Conversely, the goal of the SENSE Research School is not (primarily) the coordination of a fully “optimized” research programme.

Our acceptance of SENSE as primarily a networking organization differs to some degree from former evaluations¹. We recommend that future evaluations also judge the effectiveness of SENSE as a research organization based primarily on its networking activities. With regards to the coherence of its research programme – we believe that future evaluations should consider the difficulties in achieving research coherence among a network of autonomous institutes. Conclusions regarding the quality of research in the various research programmes of SENSE are presented in a separate report. Therefore this section is fairly brief and only covers the main points having to do with the School’s involvement in research.

Particular Strengths

The information presented to the committee clearly shows that SENSE has become well recognized as a major international player in environmental science and in identifying emerging research needs in the fields of environmental sciences and global change.

The Committee finds that the overall research goals of the School are highly relevant, namely, “To excel in scientific research of environmental changes, both with regard to disciplinary understanding of the relevant issues and with regard to multi-disciplinary understanding in the context of society.”

The committee notes that SENSE recognises the need for bridging the gap between scientific knowledge on the one hand, and society and environmental governance on the other. With these ambitious aims, SENSE transgresses the boundaries of regular university research. Such aims are beyond the reach of individual research programmes, because they require a high degree of exchange, integration and translation of knowledge, and a high degree of interaction between science and society in order to find the right focus of the research and to create adequate conditions for the interpretation of the findings at different levels. SENSE has created a unique platform for these interactions by incorporating a broad range of scientists in a dedicated network.

The Committee approves of the current SENSE core themes (see Appendix C) and also the development of new themes. The structure and management of the four core themes are the responsibility of the SENSE Board of Directors and General Board. For each core, a manager is appointed who fosters collaboration and exchange of expertise, insights and new ideas within the theme but also between the themes. This is achieved through workshops, core meetings and discussion groups. The committee finds the currently discussed ideas for new

¹ e.g. “Research schools such as SENSE seem to play a positive role in increasing the coherence of the research programmes of the participating universities ...” (Evaluation, 2000). “... the coherence of the research ... is not very strong” (Evaluation, 2004), “Important weaknesses are lack of discretionary research funds and lack of top-down influence on the research programme.” (Evaluation, 2004)

themes to be promising and they should be developed further. We suggest, however, that the core themes can be better communicated within SENSE, and to the outside world, if they are re-formulated as challenging “research questions.”

Because of its many public outreach activities, SENSE also plays a valuable role in communicating findings from ecology and environmental sciences to a broad audience.

Suggested Improvement

Fostering More Collaboration

Networks as organizational structures have limits, and these should be recognized in the case of SENSE. A network needs an effective hierarchy or a shared bottom-up coherent perspective in order to achieve a high level of coherence in its research programme, and in the present situation the autonomy and competitive force of the participating universities do not foster this. In a multidisciplinary domain, a network can deliver more coherence than any form of disciplinary hierarchy. Since SENSE harbours both disciplinary and multidisciplinary groups, this is yet another reason why a very coherent research programme may not be possible nor desirable in SENSE. Indeed, some amount of overlap and perhaps gaps in research areas are inevitable.

Nevertheless, the Committee believes that it is possible to continue to improve the collaboration between its research institutes. This collaboration would encourage research synergies not otherwise possible. A reward system is now needed to encourage tighter cooperation within the SENSE community. For example, the allocation of resources within the SENSE family could be at least partly tied to the level of cooperation between institutes.

Strengthening Multi-Disciplinary Research

As noted in Section 2.1, one of the key aims of the School is to further “multi-disciplinary understanding” of environmental changes by encouraging and initiating more multi-disciplinary research between natural and social sciences (including economics). Therefore collaboration between institutes (see previous point) should especially focus on multi-disciplinary research. The Committee recommends that progress in developing multi-disciplinary research should be monitored and measured. The SENSE Self Evaluation Report did not sufficiently document which groups and institutes were involved in joint and in multi-disciplinary projects. Financial and other incentives should also be offered to encourage this type of research.

Making the Procedure for Selecting Themes More Transparent

While approving of the School’s core themes, the procedure for selecting these themes is unclear. It is recommended that SENSE examines and evaluates this process to ensure that important emerging issues are covered and that all members of the SENSE community are involved.

3. Evaluation of SENSE Research Institutes

3.1. The Institutes

Four of the seven institutes in this review have produced self assessment reports according to the Standard Evaluation Protocol (SEP), providing all the information that SEP requires. The institutes ICIS-UM, IVEM-RUG and the Radboud University department of Environmental Sciences (RU/ES) and the Environmental Biology group (RU/EB) that are part of the RU Institute of Water and Wetland Research (IWWR) did not produce a separate self assessment report on the level of the institute. (It has been argued that the self-evaluations of the research groups of ICIS and IVEM should be taken as the self-evaluations of the research institutes since the level of the research group is the same as the level of the institutes. Regarding IWWR of Radboud University, it was noted that only 2 out of 8 of its institutes participate in SENSE. Therefore, the organizers of the review did not request a self-evaluation from IWWR. Finally, it was noted that two other institutes participate in SENSE – IBED of the University of Amsterdam and CML of Leiden University. Both institutes were reported to receive a very positive assessment in 2006.)

The evaluation of the institute-level according to SEP should cover:

1. *Leadership, strategy and policy*
 - What is the quality of the leadership, management, strategy and policy of the institute, and how can they be improved?
 - To what extent has the institute achieved its mission and goals formulated for the period under review?
 - Are the overall mission and goals of the institute/research programme well chosen and phrased in view of the actual developments in the relevant research field(s)?
 - What are the scientific qualities and relevance of the institute's research plans and to what extent are these plans in line with the overall mission of the institute; i.e. is there sufficient coherence in the research portfolio of the institute?
2. *Resources, funding policies and facilities*

What is the quality of the (human) resources, organisation and infrastructure and how can they be improved?
3. *Academic reputation and societal relevance*
4. *Reflection on the strengths and weaknesses the institute has formulated.*

The committee held interviews with the management of the institutes on Wednesday, June 20, 2007, in the same week in which the programme review committees had held their interviews with the programme directors. In the case of WIMEK-WUR, RU/ES and RU/EB, IVM-VU and IES-VU the programme committees visited the institutes and made a tour of the facilities.

The size of the institutes in terms of research input in 2006 is as follows:

Institute	Tenured staff	Non-tenured staff	PhD-students	Total research input (fte)
WIMEK-WU	18,9	16,6	64,7	100,2
Copernicus-UU	10,3	7,9	28,3	46,4
IVM-VU	10,6	3,3	16,8	30,7
IES-VU	3,8	4,6	13,1	21,5
ICIS-UM	1	5,3	3,9	10,3
IVEM-RUG	2	0,4	3,3	5,6
RU/ES	2,5	0,1	9,3	11,9
RU/EB	1,5	3,4	5,2	10,1
<i>Total</i>	<i>50,5</i>	<i>41,6</i>	<i>144,6</i>	<i>236,6</i>

3.2. Wageningen Institute for Environment and Climate Research (WIMEK, Wageningen University)

Leadership, strategy and policy

The Wageningen Institute for Environment and Climate Research (WIMEK) aims to develop an integrated understanding of environmental change and its impact on the quality of life and sustainability, by

- (i) conducting innovative scientific research,
- (ii) offering PhD training and education and
- (iii) dissemination of emerging insights and recent research results.

WIMEK has a director, a secretary and one technical staff member. In the interview with the committee, the director described WIMEK as a 'programming unit', a virtual organisation (no bricks), and a graduate school. WIMEK was founded in 1993 and executes a broad multi-disciplinary fundamental and strategic environmental research programme at Wageningen University, which encompasses about 100 fte staff, including the PhD's.

WIMEK's research is carried out by 'chair groups'. The self assessment report shows a list of 20 chair groups that participate in WIMEK. In each chair group a full Professor, tenured staff, post-docs and PhD students work together in well-defined research projects, within the overall scope of WIMEK's research programme. MSc students are stimulated to participate in these research projects by doing research for their MSc thesis. They are regarded as part of the scientific community and actively involved in colloquium series at chair group level. The WU chair groups that participate in WIMEK are hierarchically embedded in one of the WU Departments and participate in one or more Graduate Schools. The chair groups contribute teaching capacity to a number of bachelor and master programmes. The Environmental Sciences cluster, for instance, consists of 5 bachelor and 11 master programmes.

The mandate of WIMEK is:

- quality assessment of research proposals of PhD's (with external reviewers)
- quality assessment of groups
- organisational reviews

- advice on appointment of professors
- allocating research grants (300 K€ per year).

The committee remarks that WIMEK's bottom-up approach to research planning is creative but makes it difficult to develop a comprehensive research strategy and has the risk that critical research questions are overlooked. However, given the limited resources of WIMEK and the autonomy of the chair groups, the committee agrees that bottom-up research planning is perhaps the most feasible approach for WIMEK. In fact the approach has resulted in very relevant and important results. In general WIMEK has successfully consolidated expertise at WUR in the environmental research area, and has engaged in innovative research both within particular disciplines and across the disciplines.

Resources, funding policy and facilities

In the Wageningen-UR Strategic Plan 2007 – 2010, the WUR Executive Board has defined research priorities for the coming years in consultation with the graduate schools and the science groups. These priorities aim at:

- strengthening the knowledge base of the specialized research institutes by allocation of strategic research funds financed by the national government (especially Min. LNV) and enhancing the synergy between the specialized research institutes and the university
- identifying upcoming and fast developing research themes, which need extra financial investments in the coming years.

For WIMEK, the following high priority research themes are of particular importance:

- Sustainable development and adaptation of ecosystems and landscapes in a metropolitan context (co-ordinator: Prof. Opdam, WIMEK)
- Climate change (co-ordinator: Prof. Kabat, WIMEK)
- Bio-based economy
- Climate resistant coastal zones
- Integration of scale levels and governance.

WIMEK receives a yearly budget of approximately 350 k€ from the WUR Executive Board to support strategic research developments by financing or co-financing PhD and post-doc projects. This budget is used to support and stimulate:

- the interdisciplinary co-operation between WIMEK chair groups;
- the synergy with Wageningen-UR strategic research priorities and
- the participation of WIMEK chair groups in national and international collaborative research programmes within the WIMEK domain.

With this budget, WIMEK can fund 2 PhD's per year. According to the WIMEK director this limits the number of new curiosity driven research programmes.

The percentage of university money for the research in WIMEK is 20%, the percentage of EU and other funds is 80%. The teams are flexible; group leaders obtain their own money to do the research. The combination of natural sciences and social sciences allows the integration of research contributions, which is considered essential to analyze complex environmental issues and to develop appropriate solutions.

In the opinion of the Committee, the strategic priorities set by the WUR Executive Board for the coming years are an excellent complement to the bottom-up research strategy of the chair groups. It is appreciated that a budget of 2 M€ per year is available for promoting the synergy between natural science and social science. The themes identified by the university rightly place much emphasis on model-based opportunities to strengthen the link between knowledge and policy (on scales ranging from local to global).

Regarding the PhD policy, the committee notes positively that WIMEK has a well thought-out PhD programme which tracks students from arrival to graduation and contributes to a high success rate for Dutch and foreign students. It is noteworthy that all WU PhD students with an approved TSP get a budget of € 2.500 to (partly) cover the costs of PhD courses (course fees) and participation in international symposia and congresses. The committee was informed that this financial policy is unique for universities in the Netherlands.

Academic reputation and societal relevance

The committee finds that WIMEK has made great progress in combining fundamental and applied research, with participatory elements and strategic perspective. The institute has made a major contribution to raising the awareness of the general public and policymakers about the importance of global change.

The WIMEK-programmes that were evaluated in this review and their scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V) are as follows:

Nr.	Programme	Q	P	R	V
23	Environmental Systems Analysis Group	5	5	5	5
7	Aquatic Ecology and Water Quality Management group	5	4	5	5
1	Environmental Policy Group	5	4	5	4
20	Soil Chemistry and Chemical Soil Quality Group	5	4	5	3,5
18	Microbiology Group (only Environmental Microbiology part)	5	4	4	3,5
8	Nature Conservation and Plant Ecology Group	4	5	5	4
19	Environmental Technology Group	4	5	5	4
15	Earth System Science Group	4	4	4,5	4,5
17	Soil Physics, Ecohydrology and Ground Water Quality Group	4	4	4	4
16	Hydrology and Quantitative Water Management Group	3,5	3	3	4,5
2	Environmental Economics and Natural Resources Group	3	3	4	3

The programme reviews show that the quality, productivity, relevance and viability of the work is good to excellent. The research covers a wide range of disciplines and shows various degrees of multi-disciplinarity. Most groups also translate their findings into policy and practice. Some groups have excellent connections with industry.

The stage of development differs strongly between the groups; some groups were recently reorganised, some show an uneven profile, understaffing or an overload of commitments. Overall excellent scores are rewarded to the Environmental Systems Analysis group (ESA). The Environmental Policy Group (ENP) also received very high grades, and has potential for more collaborative research in fields related to natural science.

In the case of the hydrology research it was not clear to the programme review committee why the research was organised in three separate groups. On the national level of hydrology

research it was not clear to the programme review committee what determines collaboration in SENSE and/or in the Boussinesq Centre².

A general recommendation of the committee is to organise structural interactions with graduates from the PhD training to assess their experience after a number of years.

Reflection on the strengths and weaknesses

The SWOT analysis in the self assessment report gives a good comprehensive analysis. The committee agrees that WIMEK has a unique research niche by combining fundamental, applied and participatory research in natural and social sciences. This combination enables WIMEK researchers to integrate contributions from natural and social science research, which is considered essential to analyze complex environmental issues and develop appropriate solutions. The programme reviews confirm that WIMEK has a strong scientific basis, both in disciplinary research and in interdisciplinary research. The scientific quality, productivity and relative impact of the WIMEK chair groups is good to excellent.

Within the organizational structure of WUR, with relatively autonomous chair groups and with strategic planning initiatives from the university level, WIMEK has significantly contributed to the development of an integrative approach to environmental research (combining fundamental and applied research) and to prospective and assessment studies of environmental & global change.

3.3. Copernicus Institute for Sustainable Development and Innovation (Utrecht University)

Leadership, strategy and policy

The Copernicus Institute for Sustainable Development and Innovation was established in March 2001, based on a joint decision of the Governing Board of Utrecht University, the faculty of Geographical Sciences (now integrated in the faculty of Geosciences) and the faculty of Chemistry (now integrated in the faculty of Science). The mission of the institute is to investigate and develop processes and opportunities for innovative change towards sustainability. The institute seeks to contribute to the development of knowledge and techniques as well as methods and instruments in the field of sustainable development, taking note of related social debates and policy processes.

The institute is a multi-disciplinary natural science – social science (β - γ) institute with a very broad range of expertise:

- sustainable energy
- land use, the environment and biodiversity

² The Boussinesq Center for Hydrology is a scientific centre dedicated to focussing and strengthening hydrological research in The Netherlands. It will also strive to create favourable conditions for an efficient multi-disciplinary research environment. The Boussinesq Center will be the umbrella of the university hydrology groups of Delft University of Technology (Water Resources Section), Utrecht University (Earth Surface Hydrology Group and Hydrogeology Group), Vrije Universiteit (Department of Hydrology and Geo-environmental Sciences), Wageningen University (Soil Physics, Ecohydrology and Groundwater Management Group and Hydrology and Quantitative Water Management Group) and the hydrology groups of the technological institutes UNESCO-IHE (Institute for Water Education, Delft) and ITC-Enschede.

- science, technology and society
- innovation processes and systems
- governance towards sustainable development.

Four groups participate in the institute:

- Science, Technology and Society (STS), Faculty of Science
- Environmental Sciences (ESc), Faculty of Geosciences
- Innovation Studies (IS), Faculty of Geosciences
- Environmental Studies and Policy (ESP), Faculty of Geosciences.

The board of the institute consists of the leaders of these groups and a representative of the Ph.D. students. The board is responsible for the annual budget and for the preparation of the five-year research programme in line with the focal areas of Utrecht University and the faculties involved. The chair of the board is also the scientific director of the institute, charged with the daily leadership of the institute. A managing director, who in turn is assisted by a management assistant, assists the scientific director. The institute has installed a committee of coordinators of the research topics. The institute is involved in four MSc programmes that are strongly linked to the research.

The committee regards the organizational structure and context of the institute as very complex. Major decisions involve several faculties, departments and groups. It is commendable that Copernicus has developed a communication plan in 2002 to strengthen the internal and external communication processes. This has led to a series of activities, such as the yearly Copernicus symposium. Locating the institute in a single building in 2004 was also an important move.

In 2006, Utrecht University formulated focal research areas. The Copernicus Institute participates in the focal research area “Earth and Sustainability”. The committee appreciates that strategic planning at the institute has led to an especially coherent set of research themes that promote the study of critical questions regarding sustainability. The committee is happy to see that the university is encouraging and supporting this strategic planning.

The committee supports the conclusion of the mid-term review 2004 that the institute lives up to its mission and has achieved the goals set for the past years.

Resources, funding policy and facilities

The total funding for the research in the institute increased from 24.40 fte in 2001 to 46.09 fte in 2006. The external funding increased from 39% in 2001 to 61% in 2006. In the period under review, on average 48% came from the university, 38% from research funds and 14% from contracts.

The percentages of external funds for the sub-programmes in the period 2001-2006 are:

- 64.5% for Energy for Sustainable Development
- 61% for Governance for Sustainable Development
- 47% for Land use, Biodiversity and Ecosystem functioning
- 37.5% for Dynamics and Governance of Innovation systems.

The committee recognizes the successful acquisition of new funds, allowing the appointment of a large number of new PhD students. Since April 2004 all groups are located in the same building of Utrecht University which we believe will enhance to collaboration between groups. In the interviews, the PhD students have indicated that the restructuring and relocation of the institute have created a stimulating academic environment.

The introduction of a new allocation model within the Faculty of Science of Utrecht University, based on funds from internal and external sources, will probably create new opportunities for tenured staff positions.

Academic reputation and societal relevance

The research programme of the institute is called 'Exploring a Sustainable World'. The starting point of the research programme is the link between economic activities and ecological qualities. The institute believes that high quality disciplinary research is needed to understand problems and issues in the field of sustainable development and to formulate potential answers to these issues. The self assessment report contains an impressive list of projects in which different groups or sub-programmes of the institute cooperated in the period under review (p. 8).

The Review Committee recognizes that the institute has recently greatly improved its record of publishing scientific articles in key journals. The number of academic publications in journals and book chapters has doubled between 2001 and 2006, and the number of publications in scientific journals included in the citation index has almost tripled, reflecting the policy of the institute to focus especially on scientific journals. The committee applauds the institute's intention to maintain this level by attracting high quality new professors, employees and visiting guests and by making the publications more easily downloadable from the websites.

The Copernicus-programmes that were evaluated in this review and their scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V) are as follows:

Nr.	Programme	Q	P	R	V
25	Science, Technology and Society Group	5	4	5	5
14	Environmental Sciences Group	4	3	4	4
6	Innovation Studies Group (Not SENSE)	3	3	4	4
5	Environmental Studies and Policy Group	3	3	3	2

The programme reviews show that the quality, productivity and relevance of the work is good to excellent. The viability is very good to excellent, with one exception. The groups are, or have the potential to become, international leaders. A particular strength is the building of partnerships and collaborating with researchers from other institutes and private and public sectors in developing knowledge and strategies on relevant issues. The combination of natural sciences and social sciences, both in teaching and in research, has high potential but also needs a degree of intellectual consolidation to counteract fragmenting forces.

Reflection on the strengths and weaknesses the institute has formulated

The committee regards the SWOT-analysis provided in the self assessment report a very good overview of the institute's development and responses. The institute has made good use of the 2000 and 2004 reviews. Developments in society, in research and in education have been favorable to the multi-disciplinary approach and the institute has not only greatly profited from this trend, but has also made the right policy decisions in a pro-active and responsive way.

A very important aspect for the further development of the institute is that there are three vacant chairs to be filled. The vacant chairs are for Environmental Sciences, Dynamics of Innovation Systems, and Energy, Materials and the Environment.

The favorable climate for multi-disciplinary environmental research and education, with its wide range of subjects and disciplines, has presented great opportunities for Copernicus, and it will be a continuous challenge to maintain critical mass, avoid fragmentation and increase coherence.

The overriding conclusion of the committee is that the institute's integration of natural and social sciences with technological research (spanning fundamental, strategic, and participatory approaches) makes a unique contribution to international global change and energy research.

The committee agrees with the strategic statement in the SWOT analysis (p. 29) that the cooperation between local Graduate Schools and national Research Schools should be strengthened further in order to improve the quality of the PhD education and training programme.

3.4. Institute for Environmental Studies (IVM, Vrije Universiteit Amsterdam)

Leadership, strategy and policy

The Institute for Environmental Studies was established in 1971 as the first academic institute for multi-disciplinary research of environmental problems in the Netherlands, originally as an independent institute within the VU. In 2001 IVM was integrated into the newly-created Faculty of Earth and Life Sciences (FALW). As part of this merger process, IVM was reorganized into four departments, each with 20-25 researchers:

- Chemistry and Biology (C&B)
- Environmental Policy Analysis (EPA)
- Economics and Technology (E&T)
- Spatial Analysis and Decision Support (SPACE).

The departments have developed around a set of core disciplines, methods and datasets. The departments play a critical role in management and research coordination within the institute. Each IVM researcher is also a member of one or more research clusters, each led by a coordinator. These clusters were created in 2005 as fora to discuss scientific issues, to generate new ideas for research and publication, and to develop new competences. The clusters are designed to encourage cross-departmental interaction. Currently there are 12 clusters; an evaluation is planned every 2 years. The research strategy of IVM as a whole emerges in large part out of the research clusters.

Merger into the faculty has encouraged a greater focus on scientific quality and provided a basis for a growth in graduate teaching. In 2005 a Graduate Studies Programme was created at IVM as part of a new Graduate School for Earth, Environment and Ecology (Triple E) in the Faculty. IVM runs a one-year Masters programme - *Environment and Resource Management* (ERM, launched in 2003) – which attracts 55-60 students, over half of them from outside the Netherlands and about a third from outside the EU. The institute also teaches on a number of bachelors courses.

The management team of IVM consists of the director and the heads of the four departments. The director's role is to encourage a stimulating intellectual climate in the institute, to lead the management team, to represent the institute to the faculty board and to act as an ambassador for the institute nationally and internationally.

The mission of the Institute for Environment Studies is *to contribute to sustainable development and management of the environment through scientific research and teaching*. IVM aims to do excellent science that is problem-oriented and is useful to a wide range of audiences in science, government, industry and civil society, within the Netherlands and internationally. IVM believes that curiosity-driven research is stimulated by confrontation with real-world problems, and that complex environmental and sustainability problems are best addressed through appropriate combinations of disciplinary expertise. A feature of IVM's research is the capacity to conduct environmental studies in their societal and economic context. IVM aims to reinforce its position as a major European centre for environmental research, measured in terms of scientific and societal impact. IVM's policy is to strengthen a research culture that stimulates interchange between researchers and stakeholders from diverse backgrounds, within the institute and outside it.

In the interview with the committee, IVM stated that the research strategy develops as a result of strengths, objectives, competences and demands. Projects need to be scientifically worthwhile and contribute to sustainable development. There are bi-weekly management team meetings and discussions in the departments and clusters. Projects are often cooperative between teams. The instrument to substantiate the collaboration is usually a book.

IVM is project-based organization. In 2006 19% of the research was university funded, 8% NWO, 73% external funds.

The Review Committee recognizes that IVM is adjusting its activities so as to place a greater emphasis on theoretical research and post-graduate teaching and development. The Review Committee supports this transition because it will allow IVM to make a larger contribution to the training of young researchers and enable the institute to develop a longer-term strategic plan for research.

The committee concludes that IVM fulfils its mission well because it makes a significant contribution to applied research in support of strategy development and identifying emerging issues. It continues to be a pioneer in multi-disciplinary approaches, especially regarding the human dimensions of global change.

Resources, funding policy and facilities

At any one time, IVM researchers are engaged in over 100 projects. Each project has a leader who is responsible for the scientific and financial management of the project. Projects have separate budgets; the coordination of the workflow at the institute is handled by departmental project leader meetings. Most projects are large, but IVM regards small projects as useful for the flow of knowledge to scientific and other audiences. The committee believes that the tactic of using flexible research clusters helps the institute to effectively respond to new research opportunities.

The proportion of direct funding rose from 11% in 2000 to 19% in 2006. The strategy of the institute is to increase the proportion of direct funding to about 30%, primarily by increas-

ing its teaching activities. The aim is to move towards a position where about one-third of the income is core funding. The committee agrees that this will provide for a better balance between fundamental and applied research, enable synergies between research and teaching, and make the institute less vulnerable to changes in research priorities set by outside funding organizations.

Academic reputation and societal relevance

IVM's research projects are typically carried out in teams, frequently in collaboration with researchers in other institutions, within and outside the Netherlands. The committee applauds the efforts of IVM to recruit talented scientists from outside the Netherlands.

Teamwork, collaboration, multi-disciplinarity and problem-orientation leading to interactive research design are all key aspects of research practice at IVM.

In the area of socio-ecological interactions, the focus of the research is on chemical contaminants and water quality. In the area of the analysis of human responses, the research covers a broader range of economic valuation and incentive structures, analysis of environmental governance and policy in several domains, and the study of social behaviors in response to environmental change.

The committee considers it a wise decision that IVM works on a number of *integrating research themes* in which the institute regards itself as leading at the national and international level, and where the institute expects to make major contributions. For the coming period the integrating research themes are:

- *Managing climate and adaptation* (the role of technological change on mitigation strategies; the development of long-term mitigation and adaptation policies in the international context; the assessment of climate adaptation strategies for the Netherlands and internationally)
- *Governing water resources* (the application of spatial analysis to support decisions on water resources; the use of economic analysis and policy instruments in water management; the evolution of new approaches for adaptive water governance taking account of uncertainty)
- *Assessing emerging pollutants* (the development and testing of new measurement and analytical techniques, on risk-based toxicity profiling of new pollutants, and on developing alternatives to animal testing)
- *Shaping sustainability transitions* (understanding of social and technological change in processes of long-run transitions towards sustainability; policies towards sustainable system innovations).

Another wise choice is that IVM aims to develop specific and integrated methods for analyzing environmental problems. These methods are deployed across the full portfolio of research carried out at IVM. A focus for methodological development in the coming years will be:

- *Environmental measurement and assessment techniques*
- *Decision-making processes and tools*
- *Models and approaches for valuing environmental change and management options*
- *Methods for analyzing policies and strategies to govern environmental resources and services.*

The committee regards the mission and goals of the institute as well chosen in view of the developments in the field. This is also evidenced by the bibliometric analysis which shows that IVM's four departments all achieve high scores.

The IVM-programmes that were evaluated in this review and their scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V) are as follows:

Nr.	Programme	Q	P	R	V
4	Environmental Policy Analysis Group (EPA)	5	4	4	5
21	Chemistry and Biology Group (C&B)	5	4	4	4
3	Economics and Technology Group (E&T)	4	5	4	3
24	Spatial Analysis and Decision Support Group (SPACE)	4	4	4	4

The programme reviews show that the quality, productivity and relevance of the work is very good to excellent. The viability is good to excellent. The work is relevant to the scientific community and to civil society organizations, and national and international environmental policy. In the area of chemical and biological exposure and effects measurement, the research is considered to be among the best internationally. The work on spatial analysis and decision support places a strong emphasis on natural systems modeling and hydrology/climate, and the programme review committee recommends placing more emphasis on risk analysis in order to better support the mission of science and policy integration.

Reflection on the strengths and weaknesses the institute has formulated

The SWOT-analysis in the IVM self evaluation report shows an ambitious attitude and a clear appreciation of opportunities and threats. The adjusted strategy towards a better balance between fundamental and applied research, and towards greater synergy between research and teaching, is fully supported. The structure and leadership of IVM are in excellent shape for the challenges that the transition poses. The institute makes a significant contribution to applied research in support of strategy development and identifying emerging issues. It continues to be a pioneer in multi-disciplinary approaches, especially regarding the human dimensions of global change.

In line with the multi-disciplinary objectives of IVM, the Department of Chemistry and Biology should work more closely with the IVM departments concerned with the human dimensions of global change. An alternative would be to concentrate natural science expertise in the field of environmental sciences in the Institute of Ecological Science (IES-VU).

3.5. Institute of Ecological Science (IES, Vrije Universiteit Amsterdam)

Leadership, strategy and policy

The Institute of Ecological Science of the Faculty of Earth and Life Sciences was established in 2001. At that time it consisted of four departments: Animal Ecology, Systems Ecology, Ecology and Physiology of Plants, and Theoretical Biology, which cooperated in a very loose structure. After re-organization in 2003, only two groups are now present within the IES: Animal Ecology and Systems Ecology. The research is organized along four lines, in which members of both departments are involved:

- climate change
- plant-soil interactions
- stress ecology
- ecological genomics.

These themes are tackled at levels ranging from the molecular- to ecosystem-. The mission of the institute is to achieve and maintain an internationally recognized position in these four fields. The fundamental ecological questions that the institute tackles are further specified in three categories:

- the relationship between biodiversity and the structure of ecological communities, paying special attention to *evolutionary adaptation* to environmental change;
- the ecological effects of *stress factors* in the environment and the mechanisms by which animals respond and adapt to these factors;
- how global change factors affect biodiversity and ecosystem functioning and making projections of *future ecosystem behavior* based on the results obtained today and from the past both by experimentation and modeling.

IES employs 52 persons, 25 fte research input. The tenured staff is 8.8 fte, of which is 3.4 research fte (their other task is teaching). The output per tenured staff is 19 publications per year.

The organizational structure of IES is relatively light. The organization within the faculty is such that the institute directors do not control the allocation of budgets to the departments. The heads of the departments have a relatively high level of autonomy. Both departments in IES have a similar organizational structure with a head of department and weekly meetings of the department and of the staff. The responsibility for the quality and innovation of the research themes of the institute lies primarily with the programme leaders. According to the self evaluation report this has proven to be a successful approach. The main task of the institute is to identify common themes and possibilities for funding.

During the evaluation period, the research strategy of the institute has considerably changed in order to increase the strength and the viability of the institute. The committee finds the recent re-organization and developments at IES to be very positive.

The committee notes that IES has an excellent PhD policy, providing intensive personal supervision and a stimulating academic atmosphere. The policy involves regular meetings, intensive personal supervision by the daily supervisor and regular feed-back by the head of department. Since 1985 all PhD students finished their studies with a PhD degree, except in two cases. In most cases the manuscript for the thesis is delivered by the end of the four-year contract and the defense is scheduled in the fifth year after the beginning of the project. The PhD students follow the SENSE training program and often take additional courses from Functional Ecology or from the VU. For practical and statistical skills they are further trained by lab technicians and staff.

Resources, funding policy and facilities

On average 43% of the IES research staff is funded by NWO and 33% by the university. The remainder is financed by contract research. The institute aims to maintain this high level of external financing by focusing on NWO funds.

The institute has well-equipped laboratories, but the self assessment report states that finances from the university are under such pressure that in the long-term IES might not be able to replace existing equipment or invest in new types of equipment. At present the facilities and equipment are of the highest quality. The molecular laboratories are equipped for DNA fingerprinting, quantitative PCR and access to a shared genetic analyzer for sequencing. Equipment for chemical analysis includes an Atomic Absorption Spectrophotometer for trace metal determination, a high performance liquid chromatography system for hydrocarbon analysis and equipment for substance-specific isotope ratio analysis. For the experimental work IES has greenhouses, climate rooms and an experimental garden. Field work is performed in Lapland, Spitsbergen, Antarctica, and the Netherlands.

The committee believes that the university should provide more support for IES, especially more space and funds to maintain an adequate infrastructure.

Academic reputation and societal relevance

The scientific publication output of the institute per unit tenured staff is high in terms of quality and quantity. The number of PhD theses from 2001 has increased significantly.

The societal relevance of the work was highlighted by intense discussions with orthodox Islamic students in the course on Human Evolution, followed by media contributions on evolution and Intelligent Design in 2005. IES also organized meetings with nature management organizations to present the results of the biodiversity research and to show the implications are for their management activities.

The IES-programmes that were evaluated in this review and their scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V) are as follows:

Nr.	Programme	Q	P	R	V
10	Systems Ecology Group	5	5	4	5
22	Animal Ecology Group 2: Ecotoxicology and Ecogenomics	4	5	4	5
9	Animal Ecology Group 1: Community and Evolutionary Ecology	4	3	4	4
11	Theoretical Biology Group	4	3	3	3

The programme reviews show that the quality, productivity, relevance and viability of the work is good to excellent. Some interesting combinations of scientific approaches offer excellent perspectives for the future. In the view of the evaluators, the potential towards policy and management has not been fully realized, but developments are moving in the right direction. The potential of some of the theoretical work for a wider academic audience would merit an extra effort.

Reflection on the strengths and weaknesses the institute has formulated

The committee observes that the institute has shown considerable innovation over the last six years. New staff have been appointed and large research grants have been attracted from prestigious funds. The investments in molecular facilities and in mass spectrometry have proven to be fruitful. The choice of themes and the strategic adjustments are very good and the international reputation has increased as a result of participation in international research networks and visiting guest researchers. The research programme reviews show that IES is making important contributions to a number of fields of ecological science including ground-breaking work in environmental genomics.

While IES has achieved much, the committee recommends that IES increase its contributions to SENSE. In particular IES should contribute its expertise in fundamental ecological science to joint multi-disciplinary projects within SENSE.

3.6. Centre for Energy and Environmental Studies (IVEM, Rijksuniversiteit Groningen)

Leadership, strategy and policy

The general committee did not interview the IVEM management. A separate self assessment on the institute level along the lines of SEP was not provided.

The Centre for Energy and Environmental Studies IVEM is an independent research and education centre within the Faculty of Mathematics and Natural Sciences (FMNS) of the University of Groningen. IVEM originates from two predecessor groups working on energy and environmental issues since 1973. IVEM aims to analyze, design, and assess transition routes towards a more sustainable and environmentally compatible societal use of the earth's natural resources. The IVEM research is interdisciplinary and rooted in natural sciences and to a lesser extent in social sciences.

The Centre has a three member directorate (elected semi-annually) under the chairmanship of the professor of environmental sciences. The directorate meets on a regular basis. The full Centre board meets four times a year. The Centre conducts regular staff meetings in which relevant research and education issues are discussed and appropriate plans and strategy are proposed or adjusted. Decisions on scientific strategy, educational programmes and budget plans are made by the directorate in close consultation with the staff members concerned. Formal appointments of personnel financed by the University of Groningen are made by the Board of FMNS upon proposals for appointment by the IVEM directorate. Decisions on specific projects are made by the staff members concerned and in case of PhD projects by the co-promoter in close cooperation with the promoter. The compact size of IVEM is reflected in its informal style of management aimed at facilitating and stimulating research and education.

IVEM and the RUG Centre for Isotope Research (CIO) jointly offer a two year English-language based MSc degree programme in Energy and Environmental Sciences. IVEM is a key participant in the Energy Delta Research Centre (EDReC) of the University of Groningen.

Since 2000 IVEM manages the university-wide sustainability project and it is increasingly involved in sustainability-relevant teaching and research activities both within and outside the university.

Resources, funding policy and facilities

The institute is very small, but relative to its size it has a considerable number of PhD students. The institute is strongly supported by university funding.

Academic reputation and societal relevance

The transition process towards an equitable and sustainable world is at the core of the IVEM research programme entitled: 'Transition towards sustainability and environmental quality'.

The programme is mainly directed at the development of basic scientific methodologies such as life cycle analysis, energy-based input-output analysis, process analysis, computer modeling, integrated assessment, scenario building and gaming. Applied studies explore specific issues such as food and energy consumption in households. The focus is on basic research; secondary attention is given to more applied research issues that aim to achieve both scientific credibility and transfer of knowledge to societal groups. The number of publications in A-category journals has increased considerably in the last year.

In the programme review the IVEM-programme received the following scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V):

Nr.	Programme	Q	P	R	V
26	IVEM: Center for Energy and Environmental Studies	3	4	4	3

The programme review shows that the quality, productivity, relevance and viability of the work is good to very good. The strategic choice of this group to focus on the role of customers is regarded as original and innovative. The societal relevance of the group is demonstrated by its regional function in commenting on current developments.

Reflection on the strengths and weaknesses the institute has formulated

The SWOT analysis states that IVEM is a compact and vital centre with a coherent and strong sense of mission. IVEM produced a substantial number of good quality PhD theses and peer reviewed papers and has the ambition to continue along these lines. IVEM is strongly supported by its faculty and the University of Groningen as well as by its membership of the Energy Research Center (EDReC) and the Centre for Development Studies (CDS). A strong point is also that IVEM and the Centre for Isotope Studies offer the international MSc programme Energy and Environmental Sciences.

The non-central geographic location in the Netherlands gives the institute a particular societal and scientific position in the SENSE School. The programme review committee remarked that the group seems somewhat isolated and could benefit from more national cooperation.

3.7. International Centre for Integrated Assessment and Sustainable Development (ICIS, Universiteit Maastricht)

Leadership, strategy and policy

The International Centre for Integrated Assessment and Sustainable Development ICIS is a research institute within Maastricht University. It is a self-supporting business unit reporting to the Dean of the Faculty of Humanities and Sciences.

The general committee did not have an interview with the ICIS management. A separate self assessment on the institute level along the lines of SEP was not provided.

ICIS started in 1998 and developed into an international expertise centre for the integrated assessment of sustainable development. ICIS started with a team of 5 people, and expanded to 35 fte around 2001. The current size of the research staff is about 21 people. Since 2004 the institute has focused on developing integrated assessment methods and tools to address key

sustainability issues. From its inception, ICIS has also contributed to educational programmes in a number of faculties of Maastricht University.

The mission of ICIS is to stimulate integration in sustainable thinking and practice at different levels of society by research, education and the informing of policy. In order to achieve this, ICIS develops and applies innovative integrated decision support and research tools that address and enhance understanding of issues of sustainability.

ICIS identifies its strength as its concrete focus on sustainability problems. Core activities are the development and improvement of integrated assessment (IA) methods, tools and procedures in support of sustainable development practice. Current methodologies are participatory methods, scenarios, indicator analysis and IA modeling techniques. The selection of topics reflects the priorities and research agendas of national and international research programmes, but the focus of the research group is wide and lacks some coherence. The number of priority themes listed is high for such a small group.

ICIS has a flat organizational structure with a core group of 11 multi-disciplinary researchers/PhDs and 10 affiliated staff-researchers. Emphasis is placed on personal responsibility, a strong commitment, a transparent management and monitoring structure.

ICIS collaborates closely with other research groups in the university. Strong collaboration also exists with other SENSE-partners in the field of integrated assessment and sustainable development. The institute generates around 20 research proposals annually.

Resources, funding policy and facilities

The six-year average percentage of university funded fte in research was 13%, NWO-funds 24%, contracts 63%. The institute follows a strategy of increasing the proportion of university funding, primarily by increasing its teaching activities and by developing their own master Sustainable Development in 2007. This will provide a better balance between fundamental and applied research, and enable the institute to exploit synergies between research and teaching, while making it less vulnerable to the cyclic behavior of research funding.

Academic reputation and societal relevance

The self assessment report states that the scientific and societal value of ICIS research is reflected in frequently requested advice by policymakers and professional organizations, reports to ministries and NGOs, and interviews for newspapers, radio and television.

In the programme review the ICIS-programme received the following scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V):

Nr.	Programme	Q	P	R	V
27	ICIS: International Centre for Integrated Assessment and Sustainable Development	3	4	4	3

The programme review shows that the quality, productivity, relevance and viability of the research is good to very good.

Reflection on the strengths and weaknesses the institute has formulated

The SWOT analysis mentions as a potential weakness the danger that its research program could become too broad or vague. ICIS tries to overcome this by focusing on specific problems, tools and methodologies, but regards the current institutional support as insufficient to deal adequately with the rapidly changing field of integrated assessment of sustainable development.

Although ICIS has good contacts with other research groups within SENSE, the programme review committee strongly recommends that this cooperation be further intensified.

3.8. Radboud University: Environmental Sciences and Environmental Biology

The two research groups evaluated in this review, are sub-groups in the Institute for Water and Wetland Research (IWWR), which is one of the five research institutes in the Faculty of Science of Radboud University, Nijmegen.

On the institute level, no self assessment report was provided. The general committee did not have an interview with the institute or group management.

The Department of Environmental Sciences (RU/ES) participates since 2004 in IWWR. Currently, RU/ES employs 5 fte tenured and 12.6 fte temporary staff, including PhDs. The tenured staff spends about half of its time on teaching, i.e. 6 courses in the BSc-Biology and 8 courses in the MSc-Environmental Sciences. The MSc programme is coordinated by RU/ES.

The research group Environmental Biology (RU/EB) is an integral part of the Institute for Wetland and Water Research (IWWR). The group has 1.5 fte research input from tenured staff, 3.38 fte non-tenured and 5.17 fte PhD students. According to the self evaluation, since February 2007 the number of PhD students has increased to 17, and the number of MSc students to 15.

In the programme review the RU/ES and RU/EB groups received the following scores for Quality (Q), Productivity (P), Relevance (R) and Viability (V):

Nr.	Programme	Q	P	R	V
13	Environmental Biology Group	4	3	4	4
12	Environmental Sciences Group	3	3	4	4

The programme review shows that the quality, productivity, relevance and viability of the research is good to very good.

Because no information on the level of the research institute IWWR was provided, no separate assessment of the institute was made. For the assessments of the programmes, we refer to the report of the programme review committee on Environmental Biology and Ecology (EBE).

3.9. Overview of programme scores per review committee

cee	nr.	code	programme	institute	Q	P	R	V
ESEP	1	WU-ENP	Environmental Policy Group	WIMEK	5	4	5	4
	2	WU-ENR	Environmental Economics and Natural Resources Group	WIMEK	3	3	4	3
	3	VU-E&T	Economics and Technology Group	IVM	4	5	4	3
	4	VU-EPA	Environmental Policy Analysis Group	IVM	5	4	4	5
	5	UU-ESP	Environmental Studies and Policy Group	COPERNICUS	3	3	3	2
	6	UU-ISG	Innovation Studies Group (Not SENSE)	COPERNICUS	3	3	4	4
EBE	7	WU-AEW	Aquatic Ecology and Water Quality Management group	WIMEK	5	4	5	5
	8	WU-NCP	Nature Conservation and Plant Ecology Group	WIMEK	4	5	5	4
	9	VU-AE1	Animal Ecology Group 1: Community and Evolutionary Ecology	IES	4	3	4	4
	10	VU-SE	Systems Ecology Group	IES	5	5	4	5
	11	VU-TB	Theoretical Biology Group	IES	4	3	3	3
	12	RU-ES	Environmental Sciences Group	RU	3	3	4	4
	13	RU-EB	Environmental Biology Group	RU	4	3	4	4
	14	UU-ES	Environmental Sciences Group	COPERNICUS	4	3	4	4
EES	15	WU-ESS	Earth System Science Group	WIMEK	4	4	4,5	4,5
	16	WU-HWM	Hydrology and Quantitative Water Management Group	WIMEK	3,5	3	3	4,5
	17	WU-SEG	Soil Physics, Ecohydrology and Ground Water Quality Group	WIMEK	4	4	4	4
ECMEB	18	WU-MIB	Microbiology Group (only Environmental Microbiology part)	WIMEK	5	4	4	3,5
	19	WU-ETE	Environmental Technology Group	WIMEK	4	5	5	4
	20	WU-SOQ	Soil Chemistry and Chemical Soil Quality Group	WIMEK	5	4	5	3,5
	21	VU-C&B	Chemistry and Biology Group	IVM	5	4	4	4
	22	VU-AE2	Animal Ecology Group 2: Ecotoxicology and Ecogenomics	IES	4	5	4	5
ISS	23	WU-ESA	Environmental Systems Analysis Group	WIMEK	5	5	5	5
	24	VU-SPACE	Spatial Analysis and Decision Support Group	IVM	4	4	4	4
	25	UU-STC	Science, Technology and Society Group	COPERNICUS	5	4	5	5
	26	RUG-IVEM	IVEM: Center for Energy and Environmental Studies	IVEM	3	4	4	3
	27	MU-ICIS	ICIS: International Centre for Integrated Assessment and Sustainable Development	ICIS	3	4	4	3

Q = Quality
P = Productivity
R = Relevance
V = Viability

ESEP = Environmental Sociology, Economics and Policy Studies
EBE = Environmental Biology and Ecology
EES = Environmental Earth Sciences
ECMEB = Env. Chemistry, Microbiology, Ecotoxicology and Biotechnology
ISS = Integrated Assessment, Sustainable Systems Analysis and Spatial Management

3.10. Overview of scores per institute

nr.	code	WIMEK	Q	P	R	V
23	ESA	Environmental Systems Analysis Group	5	5	5	5
1	ENP	Environmental Policy Group	5	4	5	4
7	AEW	Aquatic Ecology and Water Quality Management group	5	4	5	5
20	SOQ	Soil Chemistry and Chemical Soil Quality Group	5	4	5	3,5
18	MIB	Microbiology Group (only Environmental Microbiology part)	5	4	4	3,5
8	NCP	Nature Conservation and Plant Ecology Group	4	5	5	4
19	ETE	Environmental Technology Group	4	5	5	4
15	ESS	Earth System Science Group	4	4	4,5	4,5
17	SEG	Soil Physics, Ecohydrology and Ground Water Quality Group	4	4	4	4
16	HWM	Hydrology and Quantitative Water Management Group	3,5	3	3	4,5
2	ENR	Environmental Economics and Natural Resources Group	3	3	4	3
nr.	code	Copernicus	Q	P	R	V
25	STS	Science, Technology and Society Group	5	4	5	5
14	ES	Environmental Sciences Group	4	3	4	4
6	ISG	Innovation Studies Group (Not SENSE)	3	3	4	4
5	ESP	Environmental Studies and Policy Group	3	3	3	2
nr.	code	IVM	Q	P	R	V
4	EPA	Environmental Policy Analysis Group (EPA)	5	4	4	5
21	C&B	Chemistry and Biology Group (C&B)	5	4	4	4
3	E&T	Economics and Technology Group (E&T)	4	5	4	3
24	SPACE	Spatial Analysis and Decision Support Group (SPACE)	4	4	4	4
nr.	code	IES	Q	P	R	V
10	SE	Systems Ecology Group	5	5	4	5
22	AE2	Animal Ecology Group 2: Ecotoxicology and Ecogenomics	4	5	4	5
9	AE1	Animal Ecology Group 1: Community and Evolutionary Ecology	4	3	4	4
11	TB	Theoretical Biology Group	4	3	3	3
nr.	code	ICIS	Q	P	R	V
27	ICIS	International Centre for Integrated Assessment and Sustainable Development	3	4	4	3
nr.	code	IVEM	Q	P	R	V
26	IVEM	Center for Energy and Environmental Studies	3	4	4	3
nr.	code	Radboud	Q	P	R	V
13	EB	Environmental Biology Group	4	3	4	4
12	ES	Environmental Sciences Group	3	3	4	4

APPENDICES

Appendix A: Evaluation of the SENSE Research School According to ECOS Criteria

This report presents an evaluation of the SENSE School based on interviews with the management of SENSE and its constituent institutes, as well as self-evaluations and other information provided to the committee, and reviews of the research programmes within SENSE.

The SENSE Research School for *Socio-Economic and Natural Sciences of the Environment* was established in 1994 and accredited by the KNAW in 1997 for the first time for a 5-year period 1997-2001. In 2002, the SENSE Research School was accredited for another five-year period on the basis of a positive assessment. The results of the Midterm Review 2004 and the present peer review evaluation of *Environmental Sciences 2007* will accompany the request for renewal of accreditation that SENSE will submit to the KNAW in December 2007.

General conclusion regarding re-accreditation

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.

ECOS 1: Structured Training

The committee has determined that SENSE provides its PhD students with a thorough training for becoming independent researchers (in close cooperation with its institutes). All SENSE PhD students participate in a SENSE-organized educational programme which enables students to:

- conduct research in a systematic and productive way,
- work effectively in an international arena,
- contribute to an improved understanding of the causes and effects of environmental problems and of possible solutions,
- position their own research in a multi-disciplinary context and
- translate environmental problems into relevant sound research proposals.

During their training the rights and obligations of the PhD students and SENSE staff are clear. Each PhD student participating in SENSE formulates a tailor-made “Individual Training and Supervision Plan” (ITSP), in close consultation with his or her supervisor. The ITSP is in effect an agreement on education and supervision reached by the PhD student and SENSE, stipulating the tasks of the PhD student and the accompanying supervision.

The PhD courses include an introductory course Environmental Research in Context, a number of specialized and broadening PhD courses, and general skills courses. Most elements are optional, but some are mandatory. Each PhD candidate who has fulfilled the SENSE training requirements (equivalent to 30 ECTS; where 1 ECTS = 28 hours work load), including the PhD-thesis, receives the *SENSE Certificate* issued by the Board of the Research School. SENSE now also offers the possibility to publish PhD theses in a SENSE Series. The percentage of PhD students graduating with a SENSE Certificate (indicating that they followed the full educational programme), has more than doubled to 34% of the PhD students who started in 2001 or later.

The committee has seen a list of 34 titles of courses currently organized by SENSE (often in cooperation with other research schools). The background CD contained the information flyers of three of these courses. A specification of the learning objectives of the courses was not

provided. A second list showed the titles of about 50 external courses accepted by SENSE as specialized PhD courses. These external courses are offered by other research schools, graduate schools and institutes.

The committee notes that it would be in the interest of the students and of SENSE to give wider publicity to the opportunities that the training program provides.

ECOS 2: Scientific Mission

The committee believes that SENSE has a clear *de facto* scientific mission, namely to train young environmental scientists and to advance environmental research through networking. SENSE incorporates several high quality research groups who are active participants in many national and international networks, and is successful in acquiring outside funding. (see paragraph on Research Component)

ECOS 3: Independent Organization

This criterion concerns the formal/legal structure of the Research School. These aspects were not evaluated by the committee.

ECOS 4: Cooperation within NL

The committee has ascertained that SENSE is active in developing cooperation with key organizations in the Netherlands and abroad. The research groups contribute to implementation of knowledge in society by cooperating with partners in governmental, non-governmental and industrial organizations, ranging from local water boards to global panels. They are active in policy consultancy and public debates. There are numerous memberships of advisory committees and management boards on environmental and sustainable development issues.

In terms of inter- and intra-university cooperation, SENSE organizes symposia and meetings to exchange information on new research activities and research lines in order to stimulate mutual contacts and cooperation between the SENSE researchers and to avoid unnecessary overlap in research. The cooperation between the groups is characterized as informal and self-organizing. SENSE stimulates cooperation between socio-economic and natural sciences, investing in a new generation of young scientists capable of bridging the disciplinary approaches and of interacting effectively with societal bodies.

ECOS 5: Critical Mass

The committee regards the training capacity as adequate for its mission and size. The SENSE Research School is now host to more than 300 PhD students and almost 200 senior researchers. The funding of the courses is partly based on student fees and partly on course subsidies from the universities.

ECOS 6: Project Portfolio

SENSE has delegated the responsibility for the admission of PhD candidates to the partner institutes. For example, to be accepted as a WIMEK PhD student at the SENSE research school requires the following steps:

- Formal admission of the PhD candidate to the WU PhD programme, based on (i) previous academic training (at least MSc level); (ii) proficiency in English language and (iii) sufficient financial support;
- Submission of a full PhD proposal to the WIMEK desk for approval, at least 6 months after the start date of the PhD student;
- Assessment of the full PhD project proposal by two independent external experts on (i) scientific quality, (ii) scientific and societal relevance and (iii) feasibility;
- Drawing up an Individual Training and Supervision Plan (ITSP) and submission to the SENSE education desk for approval, within six months after the start of the PhD student.

The committee considers the procedure used by the School and its constituent institutes for selecting PhD students and their projects to be very good.

ECOS 7: Collective Training

The School provides training programmes with both collective and individual elements. To obtain the required 30 ECTS, PhD students follow their own tailor-made programme, with a minimum of 14 ECTS of compulsory elements.

Many (international) guest researchers/lecturers are involved in the SENSE courses and summer schools.

The quality assurance for membership, training and supervision in SENSE is high. The committee especially appreciates the policy decision to pay attention to improving supervision.

ECOS 8: Post Doc Policy

The committee has not separately assessed this element.

ECOS 9: Links with Graduate Programmes

The committee has seen positive examples of links with the graduate programmes in the participating universities, but the situation was not fully documented for the entire school. The increasingly close relations between local graduate programmes (especially research masters) and the local PhD training will offer new opportunities and challenges for SENSE. Strong cooperation on the issues of multi-disciplinarity and the environmental perspective are expected to remain an added value of the SENSE network.

ECOS 10: Accountability

The committee has ascertained that SENSE produces annual accounts of policy and results. The very adequate information provided for the current 6-year evaluation, shows that the SENSE network is capable of self-critical evaluations on the basis of good internal quality assurance and improvement procedures.

Appendix B: ECOS-criteria for (re)accreditation of research schools

The following elements are derived from the protocol for the accreditation of research schools, developed by the Research School Accreditation Committee (ECOS) of the Royal Academy of Arts and Sciences (KNAW).

1. Structured training

The research school provides a thorough and institutionalized training for independent researchers, with clearly defined rights and obligations.

- b. Is the training and the coaching clearly structured, both in the collective and in the individual components?
- c. Are the objectives of the training and coaching clearly defined?
- d. Is the objective of the training programme described in terms of the professional areas in which the trainees will be employed?
- e. Are the rights and obligations of trainers and trainees clearly described?

2. Scientific mission

The research school has a clear scientific mission. The research domain is well defined and contains one or more specific central research questions.

The school accommodates one or more research groups of proven high quality at national and international level. The school cooperates actively with research groups in the country and abroad.

- b. Is the scientific mission clearly defined and convincingly explained?
- c. Does the school hold a sufficiently strong position in the relevant research domain in terms of the national and international scientific community?
- d. Is the research portfolio coherent and does it demonstrate adequate planning, implementation and concrete scientific production?
- e. Does the school actively cooperate with research groups in the country and abroad, as evidenced by joint publications or projects?
- f. Does the school accommodate research groups with a high performance level in terms of international quality standards, as evidenced by publications of the participating staff in the preceding five years? Do these staff members spend an adequate proportion of their appointment on their participation in the training and research of the school?
- g. In the preceding four years, to what extent have the research groups succeeded in obtaining funds from national funding councils, international funding organizations, other external funds and from contract research?

3. Independent organization

The research school functions as an independent organizational unit with budget and management responsibilities, and the university or universities concerned guarantee sufficient funding for the planned capacity for a period of at least four years.

The research school is established in accordance with the relevant legal articles (WHW 9.20, 9.21, 9.22, or 9.23).

The tasks and responsibilities within the School are clearly delegated to bodies of the School.

- a. Does the School fulfill the legal requirements of the WHW regarding the research school of one or more faculties or universities?
- b. Have the faculty dean or deans defined a research programme for at least four years and does the board of the research school have the responsibility to define the annual research programme?
- c. Have sufficient responsibilities for personnel and material management been transferred to the board of the research school?
- d. Have the university or universities concerned guaranteed sufficient funding for the planned capacity for a period of at least four years?
- e. Are management and organization of the school well established?

4. Intra- and interuniversity cooperation

Research groups with similar or complementary missions within the same university or from several universities can cooperate in a research school. The school can also make multi-annual agreements for cooperation with research institutes from NWO, TNO, DLO, KNAW, large-scale technological institutes (GTI's), and other research institutes.

The governmental and financial responsibilities of the school are borne by one university or several universities; in the latter case the primary responsibility for the school is borne by one of the participating universities.

- b. Have the possibilities for intra- and interuniversity cooperation been sufficiently explored?
- c. In the case of participation from several universities, are the responsibilities of the commissioning university adequately described?
- d. Has sufficient attention been paid to opportunities for cooperation with para-university or non-university institutes?

5. Critical mass

The optimal size of the research school is determined by programmatic considerations, personnel, organizational structure, funding sources, the potential supply of PhD students, the labor market for PhD graduates. A guideline for the minimum size of a school is a research and training capacity for at least 40 research trainees, which is equivalent to an annual intake of 10 persons. In exceptional cases a smaller size is permissible, if proper motivation is provided.

- b. Is the funding guaranteed for training the required number of persons?
- c. Has evidence been presented that there is adequate capacity for the teaching and supervision of the trainees?
- d. Has sufficient attention been paid to the labor market perspectives of the PhD graduates of the school?

6. Project portfolio

The research school has a progressive multi-annual project portfolio, based on careful selection, prioritization and approval of research projects, with an established procedure for selecting PhD students.

- b. Is there a proper procedure for selecting, prioritizing and approving project proposals for PhD students?

- c. Do the procedures and criteria for selecting PhD students ensure a good quality of the research trainees?

7. Collective and individual training

The research school provides both collective and individual training programmes and supervision, within the framework of four years.

- a. Does the selection of senior-researchers charged with training and research supervision, ensure high quality performance?
- b. Does the school have sufficient funding for attracting guest researchers and guest lecturers and have such persons actually been employed in the preceding four years?
- c. Is there an adequate internal quality assurance for the training and supervision?

8. Post doc policy

The school has sufficient possibilities for appointing national and international researchers in the post doctorate phase.

Does the school have an adequate policy and sufficient financial means for appointing national and international post-docs and is there an adequate balance between the teaching and research tasks of the post-docs?

9. Links with graduate programmes

The academic staff of the research school also performs tasks in the university graduate programmes.

- a. Is evidence presented of interaction between the research school and the graduate programmes?

10. Accountability

The research school provides an annual account of the policy and the results. The school provides adequate information for evaluating its performance after six years.

Appendix C: SENSE Disciplinary fields and Core Themes

The SENSE Research Programme 2001 – 2006 is structured with disciplinary fields and core themes. The disciplines provide the long-term research basis, the core themes reflect the shorter term scientific collaborations.

The three *disciplinary fields* in SENSE are:

1. Natural sciences at the smaller scales (molecular and microscopic processes, and single organism in well defined soil or water samples)

Disciplines in this field include environmental chemistry, physics, microbiology, biotechnology, physiology, ecogenomics, ecotoxicology and soil chemistry. The research conducted in this field often involves several of these disciplines. Also, relatively well-defined systems are studied. The research leads to, for example, new pathways for soil remediation, innovative waste-water treatment plants and setting environmental standards.

2. Natural sciences at larger scales (from species, communities, plot and fields, landscape, ecosystem, watershed to the whole biosphere)

Disciplines include terrestrial, aquatic and systems ecology, hydrology, soil science, geology and atmospheric sciences. Processes at the local to regional level are studied and often integrated across different environmental compartments, such as soils, slopes and rivers or species interacting with their environment.

3. Regional and global change, especially climate change

These disciplines focus at integrating the human activities and behavior into environmental science. The disciplines include earth system science, systems analysis, economics, sociology, political and decision sciences. In view of their integrative nature, also methodological approaches such as geographic information systems, spatial environmental modeling and participatory integrated assessments are developed and applied in this field.

The four *core themes* in SENSE are:

1. Micropollutants

Studies on the effects of micropollutants increasingly focus on 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 new goal. Integrative models are now also developed to predict micropollutant behavior in complex environmental settings. All this should contribute to the development of better environmental technologies and the restoration of renewable cycles of matter and energy. Emerging and future foci of research include polar organic compounds, ecological genomics, integrative modeling and sustainable land and water use.

2. Environmental Change and Ecosystem Dynamics

The research focuses on fluxes of energy, water, carbon, nutrients and toxicants as well as changes in populations, ecosystems, landscape and biomes. The issues are studied by laboratory experiments, field observations and modeling. The balance between ecology, hydrology and atmospheric sciences will shift towards more aquatic systems. In the field of hydrology, there is an increasing awareness that specific functions, especially irrigation,

have to be considered in the context of water resource management. The sequestration of CO₂ requires enhanced understanding of carbon flows and dynamics. This all relates to water storage, biomass production and bio-geochemical cycling research in this theme but also to research groups in other Core themes.

3. Global Change: Climate, Land Use and Biogeochemical Cycles

The multi- and transdisciplinary research aims to address the needs of managers of ecosystem services, local, regional and national governments and international bodies and the international assessment processes. Major tools will be integrated assessment models, combined with GIS and the emerging large databases of spatial patterns and temporal trends. The focus will shift away from just understanding the causes and consequences of climate change towards the sustainable management of global and regional environmental change. New regional adaptation studies will focus on water management and nature. Extreme events, such as excessive precipitation, droughts and their consequences will be addressed.

4. Industrial Transformation: Towards Sustainable Use of Energy and Materials

The research emphasis is more and more on strategies that can help in developing and adopting sustainable ways of production and consumption. The theme will include social change and sustainable development, methodological development and integration, and new governance arrangements for sustainable development. A challenge is to combine rigorous scientific research with other stakeholders' tacit knowledge, perceptions, and values.

The self-evaluation states that initiatives are mounting to add a new core theme "*spatial analysis and modeling*". Its emphasis will be to measure properties and relationships, taking into account the spatial localization of the phenomenon and use this to improve understanding of the systemic dynamics of the studied systems. Spatially explicit phenomena are key features of many environmental issues and sustainable development (multi-scale, multi-domain, intergenerational) and this makes it a real challenge to model. It requires a way of modeling that takes the essential roles of spatial and temporal distribution into account. This theme is currently expanding rapidly and several SENSE research groups have engaged in developing innovative tools and methods. This is also the first core theme that focuses on tools that are useful for all disciplinary and interdisciplinary fields. The underlying statistics, large databases and their exploration, and specific modeling approaches are unique enough to prompt a dedicated core manager and activities. This theme may probably become operational late 2007.

Another methodological theme that could emerge in the near future is *stakeholder involvement and participatory integrated assessment*. These approaches have recently become more practical and are urgently required in applying environmental knowledge because of the pressing policy needs.

The structure and management of the four core themes are the responsibility of the SENSE Board of Directors and General Board. For each core, a manager is appointed who fosters collaboration and exchange of expertise, insights and new ideas within the theme but also between the themes. This is achieved through workshops, core meetings and discussion groups.

Appendix D: Schedule of the General Review Committee (actual program varied from what is shown)

WUR	28. Wageningen Institute for Environment and Climate Research (WIMEK)
VU	29. Institute for Environmental Studies (IVM)
VU	30. Institute of Ecological Sciences (IES)
UU	31. Copernicus Institute for Sustainable Development and Innovation
All	32. SENSE Research School

SUNDAY 17-06-2007	Utrecht
20.00 – 22.00	Meeting chairs
WEDNESDAY 20-06-2007	Utrecht
09.00 – 10.00	Meeting chairs (without Bengtsson)
10.00 – 11.00	Presentation CvB-WU + Wageningen Institute for Environment and Climate Research (WIMEK/WU)
11.00 – 12.00	Presentation CvB/FB-UU + Copernicus Institute for Sustainable Development and Innovation (Copernicus/UU) nr. 31
12.00 – 13.00	Lunch break
13.00 – 14.00	Meeting chairs
14.00 – 15.00	Presentation FB-ALW +Institute for Environmental Studies (IVM-VU) nr. 29
15.00 – 16.00	Presentation (Institute of Ecological Sciences (IES-VU) nr. 30
16.00 – 17.00	Presentations Institute of Environmental Sciences (CML-LU) and Institute for Biodiversity and Ecosystems Dynamics (IBED-UvA)
17.00 – 18.00	Meeting chairs
18.00 – 20.00	Dinner
THURSDAY 21-06-2007	Utrecht
09.00 – 10.00	Meeting Chairs
10.30 – 12.00	Presentation and discussion SENSE Research School, including Core Themes
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation PhD education and training programme
14.00 – 15.00	Meeting with SENSE PhD council
15.00 – 17.30	Meeting chairs
18.00 – 20.00	Diner
FRIDAY 22-06-2007	Utrecht
09.00 – 10.30	Meeting with SENSE Directors and Board
10.30 – 12.00	Meeting chairs
12.00 – 13.00	Lunch
13.00 – 15.00	Presentation preliminary conclusions per chair group
15.00 – 15.15	Coffee & Tea break
15.15 – 16.15	Presentation preliminary conclusions on SENSE institutes and SENSE Research School
16.15 – 17.30	Drinks and closure
18.00 – 20.00	Diner

Programme review committees:

1. Environmental Sociology, Economics and Policy

(Prof. Aviel Verbruggen, Prof. Ken Green, Prof. Michael Redclift)

2. Environmental Biology and Ecology

(Prof. Janne Bengtsson, Prof. Luc de Meester, Prof. Steve Ormerod)

3. Environmental Earth Sciences

(Prof. Andrea Rinaldo, Prof. Hannes Flüher, Prof. Roland Schulze)

4. Environmental Chemistry, Microbiology, Ecotoxicology and Technology

(Prof. Willy Verstraete, Prof. Colin Janssen, Prof. Laurent Charlet)

5. Integrated Assessment, Sustainable Systems Analysis & Spatial Management

(Prof. Lea Kauppi, Prof. Thomas Johansson, Prof. William Lafferty)

PART II: REPORTS OF THE PROGRAMME REVIEW COMMITTEES

General remarks about the programme review procedures

Harmonisation of scores

During the site visits and during the finalisation of the reports, the programme review committees have paid specific attention to the criteria used for the scores for scientific quality, productivity, relevance and viability, and to the possibility of an unwanted degree of variability in the scores between the reviewers or the committees. All committees have used the criteria of the SEP-scale and in all cases the scores were settled by the committee as a whole. During the site visit, a list of all scores was provided to the chairpersons of the committees with the specific purpose of checking whether there were any indications for an unwanted degree of variability in the scores. It was decided that there were no obvious signs of unfounded diversity. Also in the course of finalising the general report, the committee chairs have paid attention to the scores for all programmes in order to safeguard as much as possible that the meaning of the scores of one committee did not diverge from those of another committee in this review.

However, assessing the quality of research is not an exact science. The assessments of the research programmes are expressed in text and in scores. The scores by themselves are not a good basis for policy decisions; they must be interpreted in relation with the text and in the context of the review.

Criteria used for the scores on Quality and Productivity

The committees have used the criteria specified in SEP:

Quality is to be seen as a measure of excellence and excitement. It refers to the eminence of a group's research activities, its abilities to perform at the highest level and its achievements in the international scientific community. It rests on the proficiency and rigour of research concepts and conduct; it shows in the success of the group at the forefront of scientific development.

Productivity refers to the total output of the group; that is, the variegated ways in which results of research and knowledge development are publicised. The output needs to be reviewed in relation to the input in terms of human resources."

Indicators for Quality specified by SEP are the originality of the approach and ideas, significance of the contribution to the field, coherence of the programme, publication strategy, prominence of the programme director, prominence of the other members of the research group, quality of scientific publications (scientific impact), quality of other results.

Indicators for Productivity specified in SEP are the number of staff, number of PhD-theses, number of scientific publications, number of professional publications, other results (if applicable), distribution of published output within the group.

The weight assigned to each criterion is not a fixed entity, and the productivity scores are not based on a purely numerical calculation of the number of publications per f.t.e. in research or on the relative impact of the journal articles. Factors taken into account are the prominence of the publication medium, the international recognition and innovative potential. Ultimately, the assessments are based on the expertise and experience of the reviewers and the committee as a whole, within the context of this review.

Variability in the groups

The committees have considered variability in output among the staff members as one of the aspects in the assessment of quality and productivity, in accordance with SEP. The committees are aware that some staff members will be more involved in research and others in education, management or acquisition. A good division of tasks contributes to the quality of teaching and research. It is inevitable, however, that there can be quality differences between groups in which several excellent researchers succeed in producing high output and groups with more variability.

Stage of development of a group

The committees agree that it is important to take into account if a group was recently established or has been operative for many years. Generally speaking, the committees have attached more importance to the recent performance of a group and to their potential for the future, than to the 'average' performance over the whole period under review.

External reviewers

The committees have received advice from a number of external reviewers that were contacted by SENSE to complement the expertise in the committees. The committees have taken their advice into account. Within the context of the review, the final responsibility for the assessments rests with the review committees. Specific remarks are included in the response of the committees.

The chairpersons of the programme review committees,

Prof. Aviel Verbruggen
Environmental Sociology, Economics and Policy (ESEP)

Prof. Jan Bengtsson
Environmental Biology and Ecology (EBE)

Prof. Andrea Rinaldo
Environmental Earth Sciences (EES)

Prof. Willy Verstraete
Environmental Chemistry, Microbiology, Ecotoxicology and Biotechnology (ECMEB)

Prof. Lea Kauppi
Integrated Assessment, Sustainable Systems Analysis & Spatial Management (ISS)

**Committee Environmental Sociology, Economics and Policy
Studies (ESEP)**

1. The review committee and the review procedures

Scope of the assessment and structure of this report

The Review Committee was asked to perform an assessment of six research programmes in Environmental Sociology, Economics and Policy Studies. This assessment covers the activities and the research in the period 2001-2006. The assessment is part of the 2007 review of the Netherlands Research School for Socio-Economic and Natural Sciences of the Environment (SENSE).

Institute	Programme
WIMEK-WUR	1. Environmental Policy Group (ENP) 2. Environmental Economics and Natural Resources Group (ENR)
IVM-VU	3. Department of Economics and Technology (E&T) 4. Department of Environmental Policy Analysis (EPA)
Copernicus-UU	5. Environmental Studies and Policy Group (ESP) 6. Innovation Studies Group (ISG; not in SENSE)

The Committee's tasks were to assess the quality of the research programmes on the basis of the information provided by the Institutes and through interviews with the research leaders, and to advise how this quality might be improved.

Part I, chapter 1 describes the composition of the Committee, its activities and the procedures followed by the Committee.

Part I, chapter 2 contains general remarks about the state of the art in Environmental Sociology, Economics and Policy Studies.

Part II contains the assessment of the programmes.

Composition of the Committee

The composition of the Committee was as follows:

- Prof. Aviel Verbruggen, University of Antwerp, chair of the committee
- Prof. Kenneth Green, Manchester Business School
- Prof. Michael Redclift, King's College London.

Roel Bennink of the Bureau of QANU (Quality Assurance Netherlands Universities) was appointed secretary to the Committee.

A short curriculum vitae of the Committee members is included in Appendix 1.

Independence

All members of the Committee signed a statement of independence to safeguard that they would assess the quality of the Institute and research programmes in an unbiased and independent way. Any existing personal or professional relationships between committee members and programmes under review were reported and discussed in the committee meeting. The Committee concluded that there were no close relations or dependencies and that there was no risk in terms of bias or undue influence.

Data provided to the Committee

The Committee has received detailed documentation consisting of the following parts:

6. Self evaluation reports per institute and per programme
7. Copies of three key publications per programme
8. Bibliometric study SENSE 1996-2005
9. Self-evaluation and background material about SENSE, including a CD with all evaluation documents for the 2007 review.

The documentation included all the information required by the Standard Evaluation Protocol (SEP).

Procedures followed by the Committee

The Committee proceeded according to the standard Evaluation Protocol (SEP). Prior to the Committee meeting, each programme was assigned to a first and a second reviewer, who formulated a preliminary assessment. The final assessments are based on the documentation provided by the Institutes, the key publications, the interviews with the programme leaders and the PhD poster sessions. The interviews took place on June 17, 18 and 19, 2007 (see the schedule in Appendix 3).

Preceding the interviews, the Committee was briefed by QANU about research assessment according to SEP. The SENSE management gave a presentation about the School. On the same day, June 17, 2007, the Committee discussed the preliminary assessments. For each programme a number of comments and questions were decided upon. The Committee also agreed upon procedural matters and aspects of the assessment.

Site visits were not held. All interviews took place in Utrecht.

After the interviews the Committee discussed the scores and comments and made draft texts. The texts were finalised through email exchanges. The final version was presented to the Institutes and SENSE on August 1, 2007. The comments of the Institutes and SENSE were discussed in the Committee and led to changes in the report on a number of points. The final report was presented to Boards of the participating universities and was printed after their formal acceptance of the report.

The Committee used the rating system of the Standard Evaluation Protocol (SEP). The meaning of the scores is described in Appendix 2. The Committee adhered strictly to the assessment elements prescribed in SEP with reference to the scores.

2. General remarks

The mission of SENSE is to promote an integrated understanding of environmental change in terms of mechanisms that cause it and the consequences that result from it. From the SENSE perspective, the common denominator of the research programmes in this review is that they are aimed at the development and further improvement of scientific concepts and methods that are required for such an integrated understanding.

In SENSE terms, the disciplinary field for these programmes is 'Regional and global change, especially climate change'. These disciplines focus at integrating the human activities and behaviour into environmental science. The Core theme to which the programmes relate most is 'Industrial Transformation Towards Sustainable Use of Energy and Materials'. The research emphasis in this theme is on strategies that can help in developing and adopting sustainable ways of production and consumption. This includes social change and sustainable development, methodological development and integration, and new governance arrangements for sustainable development. According to SENSE, a challenge in this field is to combine rigorous scientific research with other stakeholders' tacit knowledge, perceptions, and values.

In the six programmes in Environmental Sociology, Economics and Policy Studies evaluated by this committee, the scientific concepts and methods include ecological modernisation, applied economics, governance and policy analysis, new societal arrangements and the analysis of (technological) innovation.

The committee has assessed the research programmes on their own individual mission and merit, not only because that is what the Standard Evaluation Protocol (SEP) requires, but also because the information provided to the committee did not provide a basis for a higher level assessment of the (potential) contribution of these programmes to an integrated understanding of the causes and results of environmental change. The programmes are not 'just' part of SENSE, but in the first instance they are university research programmes with close links to a diversity of university teaching programmes. In spite of the diverse contexts and the autonomy of the groups, the committee believes that it is a very good initiative of SENSE to organise a simultaneous review of all the research in the School.

The committee found the quality of the research in Environmental Sociology, Economics and Policy Studies to be good to excellent by international academic standards. The groups perform at a high level of productivity and the academic community in the Netherlands clearly punches more than its weight in this field.

Cooperation and collaboration does exist, but is not more important as an organising principle than debate and competition. SENSE provides a useful network for all these functions.

The groups differ in the balance between fundamental research and more applied (contract-based) research, and in their degree of participation in the international academic or policy debates. In most cases the tendency is to strengthen the academic quality by increasing the number of articles in high impact international journals, but not all groups have shown an equally feasible strategy in that respect.

3. Wageningen University, Institute WIMEK

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Environmental Policy Group	Excellent	Very good	Excellent	Very good
Environmental Economics and Natural Resources Group	Good	Good	Very good	Good

Programme 1: Environmental Policy Group (WIMEK-ENP)

Programme director:	Prof. dr. ir. A.P.J. Mol
Research staff 2006:	tenured 2.70 fte, total 11.24
Assessments:	Quality: Excellent
	Productivity: Very good
	Relevance: Excellent
	Viability: Very good

This is a fairly young group comprising twelve tenured staff, four untenured staff plus research students. The ENP Group is unusual in that it is part of a relatively small number of social scientists within a large agricultural university, with strong affiliations in the Life Sciences and an excellent international reputation. The ENP Group, led by Mol and Spaargaren is very well known in international social science circles, and well represented in international bodies such as the International Sociological Association (where they have been leaders of RC 24 on the Environment). Although most of the established staff are Dutch, the list of research students, visitors and others attached to the group is very international, as well as being youthful. The impression we gained was of a motivated, enthusiastic group led by two international 'stars'. This impression of vitality was borne out by conversations with the research students during the 'posters' sessions.

The ENP has developed its research around a premise – that environmental considerations can (to different degrees) be incorporated in modernisation and globalisation processes. They pioneered the investigation of Ecological Modernisation as a concept which could be analysed empirically as well as theoretically, and have taken the approach into some interesting and new areas – indeed making it a comprehensive, rather than partial, type of analysis. They have had significant success in recent years, notably since the last assessment in 2001, particularly in fostering connections with Asia, where they see notable examples of ecological 'modernity', and have entered into substantial links with Asian research bodies, often via 'sandwich' PhD students. Their work demonstrates how demanding analytical approaches can, if properly employed, help to give intellectual cohesion, and to direct the kind of empirical evidence that social science (and universities) rightly expect to obtain.

The group faces two kinds of organisational problem. On the one hand they currently have a rather 'flat' management profile, in that there is little hierarchy. Staff are given considerable freedom to develop their own research interests and new research is assessed on its merits, rather than with the explicit intention of enlarging the group or gaining additional funding (most is provided from the University, and little though increasing through NWO). Under the very capable leadership of Mol and Spaargaren this does not seem, as yet, to have provoked too many problems, but it might do so if one of them was to leave and not be replaced. As the group grows in size it will need to consider alternative strategies for managing what is becoming a substantial body of people and research projects.

The second kind of problem is related to the links with Wageningen. We had the impression that, although links with the natural sciences in Wageningen are reasonably good, more might be done to actively develop research in related fields. The group provided a list of possible areas of collaboration in its self-assessment report. It is noted that collaborations with natural scientists in Asia and elsewhere, in field situations, are carried out with natural science colleagues Wageningen. The committee considers such collaborations as very valuable.

The publication policy of the group has been to concentrate on big monographs with excellent (heavily refereed) international presses, such as MIT. This has helped them secure their inter-

national reputation, particularly within environmental sociology, but will be more difficult for younger, emerging, staff to undertake. In fact they themselves discerned a 'generational' dimension to this: younger staff often favouring journals over books and mid-career staff coming somewhere in between. There is a need to expand their already creditable showing in good academic journals. It is indicative of the ENP group that they have discussed journal rankings within the group and are keen to develop a strategy on this front.

The challenge for the ENP group is how to manage their 'vitality', and it does present some difficult (if not impossible) choices: if they expand they will probably need to develop in a more streamlined, less 'collegial' direction, with more devolution beyond the top strata. They might then be seen as "the cuckoo in the nest" at Wageningen, and a possible threat to other research teams which, although not social-science based, have strong presence in developing countries. To remain as they are, however, will be difficult, if they are to continue to act entrepreneurially and successfully drive up their international collaborations and highly regarded outputs.

Overall this is a group whose work is at the forefront internationally in most respects, and can be considered an international leader in several areas, and an international player in others. They are definitely a research group to watch.

Programme 2: Environmental Economics and Natural Resources Group (WIMEK-ENR)

Programme director:	Prof. dr. E.C. van Ierland
Research staff 2006:	tenured 1.94 fte, total 6.18 fte
Assessments:	Quality: Good
	Productivity: Good
	Relevance: Very good
	Viability: Good

The submitted Self Evaluation Report provided the basic information within the prescribed template. While the information was useful, the report does not fully transmit the spirit of a research group confronted by new challenges and horizons. On some occasions (e.g. the concluding section on “Adjusted strategy”, p. 8) the text is so succinct that the reader cannot fully understand what is really meant. At the meeting, ENR was represented by the group leader only, while it became obvious that in the near future more responsibility will be carried by the two associate professors of the group, *inter alia* because the group leader will take up a 40% director position at the WU Mansholt Graduate School, from July 2007. These various elements together induced doubt in the review committee as to whether the group was giving sufficient attention to its future development.

The RC appreciated the qualitatively and quantitatively robust work that the group has carried out, specialized as it is in the thorough study of important environmental issues, applying economic concepts and models. Themes covered include climate change, energy, pollution and waste, resources and biodiversity, water management and biotechnology. The five themes are led by five professors, one full, two associate and two assistant. The group observes that “the range of topics seems to be wide for a middle sized research group” (p. 2) and that “we need to succeed in obtaining larger programme funding which allows (us) to implement a more coherent research strategy ...” (p. 8).

From this, the RC concludes that the group is well aware of the advantages of reducing the range of topics covered; indeed this may be a prerequisite for strengthening the group’s performance in selected fields so as to attain higher scores on the standard academic criteria. The main barrier to moving forwards would seem to be, on the one hand, the attitude of the group in taking a “serving attitude” towards the needs and requests of other (natural sciences) groups and of societal clients asking for assistance in economic analysis and modeling. On the other hand, there are barriers related to policies for personnel recruitment: there is a choice to be made between candidates with a profile that complements and strengthens the existing themes and candidates with a better academic and scientific record but who are interested in other themes; the group has a preference for the latter, but this weakens the group’s focus. It is recommended that the group reflects on devising an explicit strategy for its future development, and does this in consultation with colleagues in SENSE. Depending on the outcome of these reflections, the future evaluation of the research group’s performance on particular criteria could be scaled accordingly.

External validation and relevance for society are strong points of the research group and extensively documented in the self evaluation report (p. 4). As such, the group realizes its goal of being “involved and linked to real life policy issues in the Netherlands” (p. 2). The 2001 VSNU review stated that “the connection with the policy community is not clear” (p. 4; p. 7; annex 4); the present review committee wanted a more explicit description of the interaction between the group and policy makers, although detailed examples of such interactions are

supplied in the self evaluation report (p.4). In the review period, the group has provided proof of an active involvement in capacity-building in developing countries, and of supplying PhD training.

The number of PhD students is commensurate to the available tenured staff of the group (perhaps at the high end) when the many other responsibilities and engagements are considered.

Because the group's bibliometric score is not outstanding, it is planned to put "stronger focus on more fundamental research" (p. 8) to realize more category A publications. This plan has to be weighed against the strengths of the group in applications and involvement in real life policy-making [see above].

The group, in particular the group leader, have played a key role in the development of the functions of SENSE as a school, a network and a bridge to society. The main part of the group's work is multidisciplinary in nature and directed to societal relevance for advancing the transition to a more sustainable society, but a review of its strategy is urgent if it is to improve its international profile.

4. Vrije Universiteit Amsterdam, Institute IVM

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Department of Economics and Technology	Very good	Excellent	Very good	Good
Department of Environmental Policy Analysis	Excellent	Very good	Very good	Excellent

Programme 3: Department of Economics and Technology (VU-E&T)

Programme director:	Prof. dr. M.W. Hofkes	
Research staff 2006:	tenured 2.64 fte, total 6.84 fte	
Assessments:	Quality:	Very good
	Productivity:	Excellent
	Relevance:	Very good
	Viability:	Good

The Self Evaluation Report provides good insight into the mission, fields of work and outputs of E&T, but there is not as much information and detail on how the department is organized and how the work is produced. When the SER of the E&T research group is read with the SER of the IVM Institute, more questions could be answered (in particular the role of the 'clusters').

The E&T research group excels in acquiring external funding (89% of its total income) while obtaining high scores in its publication record: 48% of the journal articles are in A journals; the relative impact amounts to 1.60 in the 2001-2006 period (well above world average). This is a very good result given that the group is specialized in applied economics research. The work is internationally competitive and leading at the national level.

The very high dependency on external funding is characteristic of IVM as an institute. On the one hand, it is seen as a proprietary attribute, as part of IVM's mission. On the other hand, changing criteria for assessing the group's academic performance push towards a more standard academic position, including the acquisition of resources for staffing and research (i.e. being less reliant on external funding). This may lead to some loss in administrative autonomy, but given the large degree of academic autonomy that research groups enjoy in the SENSE network, academic agenda-setting is likely to stay almost exclusively with the group. Adding more theoretical research to the portfolio may follow in seeking international research leadership. However, this may come at a price, by a reduction in the group's short and medium-term relevance for Dutch society and policy makers.

The productivity of the group is high according to the statistics provided in the SER. It is however not always evident for the RC what the impact is of the part-time and newly-engaged staff members on the productivity data. The interview with the group's professors on Tuesday 19th June revealed a very dedicated staff that processed many large projects of high relevance, leading to many publications in journals and in other media.

An almost natural corollary of the high rate of external research contracts is a high external validation / relevance for society. The Committee would have liked to see more specific information about this to complement the mainly quantitative meta indices provided in the SER.

The SWOT-analysis in the SER is rather brief and general, but does bring out some interesting things with respect to staffing, i.e. that the IVM group may not have a critical mass in some key areas and that it is very difficult to attract highly qualified personnel (because the academic and career pay-off for academics in mono-disciplinary research can be higher).

On the one hand, E&T faces some problems in keeping outstanding academics in-house; on the other hand, E&T and IVM have attracted outstanding academics from the international

academic labour market. It is difficult to assess the balance of this competition on the performance and future of E&T.

Because analogous discussions arose in the WIMEK-ENR group (which works in a rather similar way to E&T, but is more embedded in and funded by the university itself), it may help to deliberate in SENSE on how this issue should be addressed. Assigning high priority to the personnel issue, and finding creative solutions for it, is very important for E&T's future. It is also why the RC was reluctant in scoring the Viability criteria higher than Good (3), even though the dynamism and engagement of the group are great and new themes such as poverty and environment are being developed with enthusiasm.

Regarding the strategy for the future, the Committee recommends not to refrain from considering adjustments in strategy that are necessary and feasible.

Programme 4: Department of Environmental Policy Analysis (VU-EPA)

Programme director:	Prof. dr. F. Biermann
Research staff 2006:	tenured 2.37 fte, total 12.49 fte
Assessments:	Quality: Excellent
	Productivity: Very good
	Relevance: Very good
	Viability: Excellent

This group consists of three full professors and twelve other tenured staff, as well as fourteen untenured staff. Almost half their funding for research is from open, competitive contracts and most of the rest is earned competitively from the NWO. For such a large and important group of researchers, within a premier Dutch institution, this kind of profile depends heavily on a high degree of vitality and very effective management. Since 2003 they have grown from fifteen staff (total) to thirty five, a very large increase in a short space of time. We were particularly impressed by the senior management which includes some outstanding young scholars, notably Biermann and Gupta. This is a young group, whose leaders are barely in their forties and which is growing very rapidly.

The group have used 'governance' as an overarching concept, which enables them to distinguish between their various thematic areas, underpinned by an emphasis on politics, public management and international relations. Their work is interdisciplinary, as befits a group working on international environmental problems and integrated environmental assessment. Their funding profile has forced them to look outwards, but this is a feasible strategy given the strong contextual presence of IVM, with a solid international reputation, and their particular 'niche' in international studies and politics. They obtain just over 10% of their income from the university. Although they depend heavily on generating external research income, most of this is not 'soft' money, but in the form of EU project funds and NWO funding. It is to their credit that they have debated, and continue to debate, the merits of different strategies for managing and financing their research activities. There is the suggestion that younger staff, in particular, might be recruited on the back of consultancy, but that an emphasis on more core funding and greater attention to long-duration funded projects, while it has advantages in terms of academic quality, can only be pursued within a longer time-frame. The group gave every indication of being aware of these constraints and able to calculate within them, a considerable feat for such a young and evolving team.

We gained the impression that the publication strategy, like the funding strategy, is well informed. At the moment they are seeking a 'mix' of ISI publications, in good international journals, as well as book chapters – the normal medium for much work in international relations and politics.

The supervision of PhD students in the main appears to be successful; the Committee appreciates that the supervision is partly undertaken with colleagues elsewhere in IVM. Money needs to be raised for PhDs, and the group is always on the look-out for new projects.

Their publications strategy targets the policy community as much as academics in the field, and this means that they are heavily involved in 'grey' literature, writing reports and 'in-house' documents for international negotiations, as well as in the more 'public' literature represented by policy journals. One example is the Science Plan that members of EPA have been invited to develop for the International Human Dimensions Programme on Global Environmental Change (IHDP) around their key organising principle of 'governance'.

They have a clear and unremitting policy profile, which is consistent with their mission and their strengths. Their work is relevant to the scientific community, but even more markedly to the civil society organisations and government interests involved in international environmental policy.

We concluded that this was a young, dynamic group, which had still to reach its full potential, but which should certainly be viewed as at the forefront internationally in most areas, and making a significant contribution internationally where it was not at the leading edge of research.

5. Utrecht University, Copernicus Institute

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Environmental Studies and Policy Group	Good	Good	Good	Satisfactory
Innovation Studies Group (Not in SENSE)	Good	Good	Very good	Very good

Programme 5: Environmental Studies and Policy Group (UU-ESP)

Programme director:	Prof. dr. P. Glasbergen	
Research staff 2006:	tenured 1,81 fte, total 7.32 fte	
Assessments:	Quality:	Good
	Productivity:	Good
	Relevance:	Good
	Viability:	Satisfactory

This is a relatively small group consisting of six tenured staff, with varying commitments of time to the group, and a sizable number of affiliated research students. The group's mission statement, like that of others we reviewed, demonstrates a particular 'position' on environmental issues: in this case, the idea is that sustainable development can be 'induced' in societies, notably through 'new societal arrangements' which influence its development. The group have a 'model' representing an abstract way of looking at society (in terms of the sectors State, Market and Civil society and their interrelationships) in connection with the physical system. They have concluded from many of their studies, that governments often play a reactive role, while innovative ways of governance for sustainable development particularly develop in inter-sectoral arrangements.

There are a number of reasons why this conceptual approach is much weaker than some of the other groups with a similar, if not identical, disciplinary composition. First it is never clear whether 'societal arrangements' are responsible for achieving sustainable development, or *vice versa*. Indeed, the relationship between the two looks suspiciously like a tautology, since societies are often looked upon as more 'sustainable' the more they incorporate civil society groups into their deliberations. The team claim to have developed this 'model' fifteen years ago, but the scope and involvement in deliberative democracy and similar approaches seems to have outdistanced them. When asked where they had sought to develop their theoretical ideas, within the academic literature, they replied clearly that they saw these ideas as informing what they did. They did not appear to think that the development of these ideas might itself (like ecological modernisation, or governance) benefit from a robust discussion within the pages of academic journals. Their approach is axiomatic rather than analytical.

Similarly, given their involvement in Dutch civil life, and the great majority of their funds come from the University and the NWO, it is reasonable to ask how they might demonstrate that their interaction with policymaking works. In fact they argue that they are not principally concerned with policymaking as such, but rather with the application of their ideas (or coda) to specific policy areas. They have reviewed various aspects of Dutch policy, and the outputs although not published in the very best academic journals, have nevertheless been published internationally, and not simply in the Netherlands. However, from close questioning it was difficult to appreciate how this case material might inform larger international debates, rather than simply represent interesting Dutch evidence. They acknowledge that methodologies for policy analysis need to be given more attention, but are unclear as to what this might imply for their academic work in future. They did not seem to have a strategy for conveying their ideas within the social sciences internationally, or within high-level policy circles. They insist that this approach is viable and conclude their self-assessment by saying that they are "well prepared to continue their mission".

In a sense, if this group is to remain small and focused largely (although not exclusively) on Dutch policy areas, then its small and informal management is not a problem. If it were to

expand, or had its sights on higher international profile, then this might be an issue in the future. Clearly at the moment the validation it gains is from within the Netherlands, and although this is acknowledged as a potential problem, the group do not seem altogether clear how to address it. It is suggested that close links with the Dutch governmental structure can bring in a certain amount of 'commissioned' research – which at least keeps the group alive. This is a 'business as usual' scenario, and one that, although understandable given the difficulty in securing competitive funding internationally, demonstrates that the group is not of an international calibre. The previous evaluation had mentioned that this group probably 'under-represented' its work internationally. The problem, however, is rather more complex – how can work that is national, not analytically rigorous, and at the margins of the most innovative social sciences, be communicated internationally in good journal outputs and with leading publishers?

The group have organised the 'International Sustainable Development Research Conference' in the Netherlands. It is indicative of their current position that in an attempt to raise their profile internationally they have chosen journals focused on environmental issues, rather than putting their ideas to the test in more testing international fora of mainstream social science. This is a research group that has undertaken some worthy, if unexact, research with a clear nationally useful aim, but has thus far failed to initiate or contribute significantly to international debates at a high level in the social sciences. Much of the output is *nationally visible (2) and solid*. In some respects the outputs are *making a valuable contribution at the international level (3)* and are *competitive at the national level*. There is thus a 'mixed' picture of personal commitment to the idea of sustainable development but, as yet, a lack of clear international purpose.

Programme 6: Innovation Studies Group (UU-ISG, not in SENSE)

Programme director	Prof. dr. ir. R.E.H.M. Smits
Research staff 2006	3.52 fte, 14.32 fte
Assessments:	Quality: Good
	Productivity: Good
	Relevance: Very good
	Viability: Very good

The Innovation Studies Group (ISG), which pursues a research programme on “Dynamics and Governance of Innovation Systems”, is one of the four groups that make up Utrecht University’s Copernicus Institute. The ISG is not a member of the SENSE Network. However, whilst its principal intellectual focus is on the social, political and economic analysis of innovation and technological change in its broadest sense, it has inevitably become concerned with the environmental/sustainability aspects of innovation, though by a focus on energy/materials/ nano/bio/transport technologies. In this respect, it is similar to a set of research centres on innovation studies active in other European countries (such as PREST and SPRU in the UK, Chalmers in Sweden), a set which the group has set its sights on rivalling.

The group is a relatively new one, established in 2002; it has spent the last five years building up its capacity and developing its research themes and doctoral programme. By 2006, it had gathered together 12 tenured and 11 non-tenured staff to contribute to its research activities, with 13 PhD students and 5 Postdocs. The external funding for PhD’s and Postdocs has shot up from 2002 to 2006 (Bsik and NWO) and they expect to appoint 6 new externally funded PhD’s and Postdocs in the next six months.

The intellectual frameworks which underpin the group’s research are typical of almost all innovation studies research centres in Europe – namely *innovation systems* and *path-dependency/co-evolutionary economics*. However, because of its position within Copernicus (the group is a part of Utrecht’s Faculty of Geosciences), the group has a special connection to the natural sciences. Its claim to multi-disciplinarity is thus based on the links it has with the natural sciences that are behind the technological innovations it is analysing and socio-economically assessing.

There is no doubt that the group has made considerable progress over the last 5 years in both the output and quality of its papers and reports. The citation analyses that the Panel was presented with show evidence of some international quality, and in the discussions we had with the group we were assured that more publications would be appearing in 2007, with a focus on more prestigious international journals. The group was taking seriously the advice it had been receiving regarding improving its publications profile by reviewing the journals it was targeting; it expected that this would be clear within a couple of years. Prof. Smits described the current strategy of the group as “creative consolidation”; the Panel’ view was that the group was definitely on an upward trajectory, but that whilst the publications output was rising, it was still in the ‘Good’ category, with the group being “internationally visible and a national player”. The PhD programme is clearly developing apace – the Panel was impressed by the PhD presentations. However, as of the end of 2006, few doctoral students had completed their thesis, though it is clear that 2007 and 2008 will see a rapid rise in completions. Once again, an upward trajectory.

The research programme has made much use of in the teaching that the group takes part in – through a ‘Science and Innovation Management’ programme attracting 100 Bachelor and

40 Master students; this strong connection between research and (especially) postgraduate teaching is to be commended. As mentioned above, the group has active links with natural scientists, both as 'subjects' of their research and in collaborations. The group considers this natural science-social science combination to be their "unique niche". If this is the case, then the group needs to think about how it can give the 'combination' some intellectual force, by seeking to *theorise* how such combinations can be more than just part of the methodology of innovation researchers (i.e. close connections to actual innovators and their scientific associates). They need to show that the combination makes a difference to the innovation process itself.

The Panel was impressed by the vitality (intellectual liveliness) of the tenured/post-doc staff and PhD students. The plans for the next phase of the group's development – on research topics, publication strategy and staff/doctoral student development – are well expressed and credible. The group definitely shows signs of being a significant research group on innovation studies internationally; though it needs to develop its international connections as a deliberate tactic. But most importantly, it needs to reflect further on what its *main* intellectual contribution will be (probably in exposition of importance of social science – natural science research collaboration); i.e. needs to clarify how it can be "unique". The group – is on the 'cusp' of being internationally significant; continued strong support from Copernicus/UU will bear fruit.

Appendix 1: Curricula Vitae of committee members

Prof. Aviel Verbruggen, Dept. Milieu & Technologiemanagement, Universiteit Antwerpen. Trained in engineering and applied economics at Louvain, Antwerp and Stanford University, his present research covers electricity economics (cogeneration, planning, costing and pricing in power systems, distributed generation and grid access) and energy efficiency. He is co-founder of research and consultant units (STEM, CENERGIE and FINES). He conceived, supervised and edited the State of the Environment Reports in Flanders (1993-98) and was the first president of the Environmental Advisory Council (1991-95) and principal advisor to the Minister of the Environment (1999-01). He contributes to the IPCC Third and Fourth Assessment Reports (WGIII: Mitigation and Adaptation).

Prof. Ken Green, Manchester Business School, University of Manchester. Professor Green's current research interests are in the socio-economic analysis of technological development, especially with regard to environmental influences on innovation, and strategies for development of biotechnology. Current research contracts are with the Tyndall Centre, on the influence of long-term technological change on greenhouse gas emissions, and the ESRC, on sustainability in Food Systems. A recently completed research contract was an EU-funded five-country study on 'Strategies for Sustainable Households'. He has also undertaken consultancies on environmental purchasing management, the links between environmental strategies and R&D activities and the future of biotechnology in the UK.

Prof. Michael Redclift, Professor of International Environmental Policy in the Department of Geography at King's College, London. Research interests include sustainable development, global environmental change, environmental security and the modern food system. He has undertaken research in Spain, Ecuador, Peru, Mexico and the United Kingdom. His research on the production and consumption relations under the ESRC/AHRC Programme 'Cultures of Consumption', was published in 2004 by Taylor and Francis in New York as *Chewing Gum: the fortunes of taste*. He has just completed (2006) a major comparative study of frontier societies and their relations with the natural environment for MIT Press: *Frontiers: histories of civil societies and nature*. He was the first Director of the Global Environmental Change programme of the ESRC between 1990 and 1995. Between 1973 and 1997 he was at Imperial College at Wye, ultimately as Professor of Environmental Sociology. He has coordinated research grants for the European Commission (FM IV and V) and helped initiate the TERM programme of the European Science Foundation. In addition he has evaluated the research programmes of the Norwegian Research Council (RCN), the Netherlands Research Council (NRP), and other European research initiatives, including the Tyndall Centre in the UK. In 2006 he was the first recipient of the 'Frederick Buttel Award', from the International Sociological Association, for "an outstanding contribution to international scholarship in environmental sociology".

Appendix 2: Overview of Scores

Table 1: Overview of scores

	Quality	Productivity	Relevance	Viability
WIMEK: Environmental Policy Group	Excellent	Very good	Excellent	Very good
WIMEK: Environmental Economics and Natural Resources Group	Good	Good	Very good	Good
IVM: Department of Economics and Technology	Very good	Excellent	Very good	Good
IVM: Department of Environmental Policy Analysis	Excellent	Very good	Very good	Excellent
Copernicus: Environmental Studies and Policy Group	Good	Good	Good	Satisfactory
Copernicus: Innovation Studies Group (Not in SENSE)	Good	Good	Very good	Very good

Table 2: SEP-scale; the meaning of the scores

Work that is at the forefront internationally, and which most likely will have an important and substantial impact in the field. Institute is considered an international leader.	Excellent (5)
Work that is internationally competitive and is expected to make a significant contribution; nationally speaking at the forefront in the field. Institute is considered international player, national leader.	Very good (4)
Work that is competitive at the national level and will probably make a valuable contribution in the international field. Institute is considered internationally visible and a national player.	Good (3)
Work that is solid but not exciting, 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 nationally visible.	Satisfactory (2)
Work that is neither solid nor exciting flawed in the scientific and or technical approach, repetitions of other work, etc. Work not worthy of pursuing.	Unsatisfactory (1)

Appendix 3: Schedule

Research Assessment SENSE, ESEP

SUNDAY 17-06-2007	
15.00 – 15.30	WELCOME
15.30 – 16.00	QANU: General introduction on the assessment and the review programme
16.00 – 16.30	SENSE: General introduction SENSE, with emphasis on the 3 different assessment levels: research groups; SENSE institutes and SENSE Research School
16.45 – 18.30	Internal RC meeting
19.00 – 21.00	Dinner
21.00 – 22.00	(meeting chairs)
MONDAY 18-06-2007	
09.00 – 10.30	Internal RC meeting
10.30 – 11.30	Presentation and discussion Environmental Policy Group (ENP-WIMEK/WU) nr. 1
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Department of Environmental Policy Analysis (EPA-IVM/VU) nr. 4
14.00 – 15.00	Presentation and discussion Environmental Economics and Natural Resources Group (ENR-WIMEK/WU) nr. 2
15.15 – 16.45	PhD poster presentations (ENP, EPA and ENR) and discussion
17.00 – 18.00	Internal RC meeting
18.00 – 20.00	Dinner
TUESDAY 19-06-2007	
09.00 – 10.30	Internal RC meeting
10.30 – 11.30	Presentation and discussion Innovation Studies Group (ISG-Copernicus/UU) nr. 6
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Department of Economics and Technology (E&T-IVM/VU) nr. 3
14.00 – 15.00	Presentation and discussion Environmental Studies and Policy Group (ESP-Copernicus/UU) nr. 5
15.15 – 16.45	PhD poster presentations ISG, E&T and ESP and discussion
17.00 – 18.00	Internal RC meeting
	(chairs meet in General Committee, Wednesday 9:00 hrs)

Committee Environmental Biology and Ecology (EBE)

1. The review committee and the review procedures

Scope of the assessment

The committee was asked to assess the Environmental Biology and Ecology research at IES-VU (Amsterdam), WIMEK-WU (Wageningen), RU (Nijmegen) and COPERNICUS (Utrecht). The assessment covers activities over the whole period 2001-2006, and is part of the 2007 review of the SENSE research school.

Composition of the committee

The committee members were:

- Prof. Jan Bengtsson, professor in ecology and environmental sciences at the department of ecology, Swedish University of Agricultural Sciences, Uppsala, Sweden (chairman).
- Prof. Steve Ormerod, professor in ecology in the Cardiff School of Biosciences, Cardiff University, Wales, UK.
- Prof. Luc de Meester, professor in ecology and evolutionary biology, Katholieke Universiteit Leuven, Leuven, Belgium.

Three external reviewers assessed individual departments, and their views were taken into account in the final assessment of the programs.

Sietze Looijenga of the Bureau of QANU (Quality Assurance Netherlands Universities) was appointed secretary to the Committee.

A short curriculum vitae of the committee members is included in Appendix 1.

Independence

All members of the Committee signed a statement to indicate that they would assess the quality of the Institute and research programmes in an unbiased and independent way. Any existing personal or professional relationships between committee members and programmes under review were reported and discussed in the committee meeting. The Committee concluded that there were no close relations or dependencies and that there was no risk in terms of bias or undue influence.

One of the external reviewers of the individual programs had recently published with the group he was reviewing, but the committee decided his report could be used in the assessment.

Data provided to the Committee

The Committee received the following detailed documentation:

1. Self evaluations at the level of the programmes, the institutes and the research school
2. Copies of three key publications per programme
3. Bibliometric study 1996-2004
4. A CD-ROM with all SENSE background material.

The documentation included all the information required by the Standard Evaluation Protocol (SEP).

The Standard Evaluation Protocol (SEP) provides guidelines to evaluate university research institutes and their research programmes. The self-evaluations provided by SENSE were ade-

quately documented and transparent. In combination with the site visits, consisting of interviews with group leaders and senior staff, and meetings with PhD students, they allowed objective evaluations of the groups.

Procedures followed by the Committee

The Committee proceeded according to the SEP. Prior to the Committee meeting, each programme was assigned to a first reviewer, who formulated a preliminary assessment. The final assessments are based on the documentation provided by the Institutes, the key publications and the interviews with the management and with the leaders of the programmes, as well as meetings with Ph D students. Site visits and interviews took place over the period June 17, 2007- June 20, 2007 (see the schedule in Appendix 3).

Preceding the interviews, the Committee was briefed by QANU about research assessment according to SEP. On the same day, June 17, 2007, the Committee planned the interviews and procedural matters and aspects of the assessment.

After the interviews the Committee discussed the scores and comments and made draft texts. The texts were finalised through email exchanges.

The final version was presented to the Institutes and SENSE on August 1, 2007. The comments of the Institutes and SENSE were discussed in the Committee and led to changes in the report on a number of points. The final report was presented to Boards of the participating universities and was printed after their formal acceptance of the report.

The Committee used the rating system of the Standard Evaluation Protocol (SEP). The meaning of the scores is described in Appendix 2.

2. General remarks

The committee found the quality of the research in Environmental Biology and Ecology within SENSE to be generally high. Several groups show outstanding international leadership in their respective areas. The high standards set by the research school for groups and individual researchers has resulted in the fact that all groups are performing at levels clearly better than “satisfactory” (compared to international standards), viz. good or better in all aspects.

Hence, the restructuring of research in association with formation of research schools in the Netherlands has been successful. The quality of Dutch research in the areas assessed is clearly internationally competitive, and the groups in SENSE play important roles in maintaining and further enhancing this reputation.

The committee notes that the degree of collaboration within and between disciplines differs between the groups assessed. We acknowledge the necessity to maintain the highest disciplinary standards in research, but we also want to emphasise the possibilities of SENSE in that it provides an arena for developing innovative multi-disciplinary work in the field of environmental sciences. There are differences between the groups in the extent to which they have been able to use SENSE to do this. Collaboration depends not only on the groups themselves but also on whether the respective universities provide adequate facilities and incentives to increase cooperation with, for example, other natural or social sciences.

Another general observation is that several groups clearly need more support from their universities in terms of tenure-funded staff, infrastructure, space or other kinds of support. Some universities have been more successful than others in locating the groups in environmental biology and ecology in ways that increase their potential to perform cross-cutting research to the highest international level. It is notable that despite several groups having gone through a period of restructuring and decreases in university funding, the groups have to a large extent been able to increase external funding and both research productivity and quality. This indicates the strong capacity of the groups and should not be interpreted as a sign that funds can further be reduced, as there is a limit to the workload and stress research groups and individuals can cope with. With the environment now rising rapidly on the political, legal and social agenda worldwide, we urge universities in the Netherlands to better support ecology and environmental biology.

The groups in environmental biology and ecology have overall been successful in implementation and communicating their research to society. Nonetheless, we find that there is potential for improvement in this area. Some examples are communicating scientific knowledge on global change and ecology to the public, and influencing policy nationally and internationally.

3. Wageningen University, Institute WIMEK

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Aquatic Ecology and Water Quality Management Group	Excellent	Very good	Excellent	Excellent
Nature Conservation and Plant Ecology Group	Very good	Excellent	Excellent	Very good

Programme 7: Aquatic Ecology and Water Quality Management Group (WU-AEW)

Programme director	Prof. dr. M. Scheffer
Research staff 2006	6.9 fte
Assessments:	Quality: 5
	Productivity: 4
	Relevance: 5
	Viability: 5

This research group, headed by M. Scheffer and A. Koelmans, takes a broad multidisciplinary approach to generate novel insights in the functioning of ecosystems and to develop effective strategies for managing and restoring aquatic ecosystems. Research on biodiversity, ecosystem functioning, multiple stresses, and processes all figure strongly through combined expertise in ecology, environmental chemistry and ecotoxicology. Leadership is very effective, with a very open style, reflecting vision while allowing freedom for individual development of the individual researchers and PhD students. The research is explicitly multidisciplinary, as the group combines expertise in ecology, environmental chemistry and ecotoxicology. Methods vary from large-scale field monitoring to experimental manipulation and mathematical modelling. The latter has been central to the study of stability in complex systems, where this group has world-leading expertise. Importantly, there is a strong drive to validate model outcomes with real data.

The scientific quality of the group is excellent. Scheffer is recognised as a world leader and evidence from citations and publications shows that his work has a broad impact on ecosystem ecology and freshwater ecology. Koelmans' research on environmental assessment and environmental chemistry is also excellent, and is published in the highest ranking journals in the field of ecotoxicology. Other group members are rapidly increasing their own impact, and trends over the past ten years have been spectacular.

Productivity is high on both publications and PhD theses. There is a calculated and highly beneficial strategy to focus on quality rather than on quantity. Although the review panel fully endorsed this approach, productivity of the team as a whole was judged "very good" rather than "excellent" since there is moderate variability in outputs among staff members from excellent to more modest.

Relevance is excellent on scientific visibility (i.e. academic dissemination, as illustrated by publications in *Science*, *Nature*, *PNAS*, and top journals within the field of expertise) and with respect to the translation of scientific findings into policy (e.g. management of wetlands) and practical applications (e.g. absorption of organic pollutants by black carbon). A recent large-scale survey of 80 floodplain lakes in South America (SALGA project) exemplifies perfectly how intrinsic scientific value, local training, capacity building, local awareness and translation in sustainable management can be combined.

As a vibrant group with great perspicacity in leadership, the prospects of this group are excellent. There is a broad array of potential resources available and a good mixture of established and upcoming talent. However, success still depends critically on a few key individuals, especially Marten Scheffer. It is recommended that efforts are continued to increase the impact of all staff members. The team is currently moving to a new building, where the facilities will be excellent. The new location has also strong added value in being close to the well-equipped laboratories of other teams and Alterra.

Programme 8: Nature Conservation and Plant Ecology Group (WU-NCP)

Programme director	Prof. dr. F. Berendse
Research staff 2006	9.2 fte
Assessments:	Quality: 4
	Productivity: 5
	Relevance: 5
	Viability: 4

This group of long-standing eminence has as its main goal the generation of new scientific insights that contribute to the development of effective strategies to maintain and restore the biodiversity and functioning of natural ecosystems. Above all, the group emphasises interactions between plants, plants and soil, and between plants and the atmosphere. They blend models with experiments and observations, for example to examine the consequences of changes in nitrogen deposition, climate and CO₂ concentration to vegetation systems and their associated ecosystem goods and services. The work is characterised by strong inter-dependence between research quality and major value to management and policy.

On research quality, the leadership of this group is clear from contributions to very strong publications in *Nature*, *Science*, and *PNAS*, with consistently high quality outputs also in the top ranks of ecological journals. The towering international figure of Frank Berendse is central to nearly all of this performance, and there is no doubt that his own profile and position make him a world leader. Significantly, however, there is some asymmetry in research performance across this large group. We fully expect some of the gifted younger researchers around Berendse to contribute increasingly to research quality in future years.

In the current period, and over its history, this has been a hugely productive group, with per-capita publications among the very highest in SENSE. For high quality papers, proceedings, reports, book chapters, reports and a range of professional publications, outputs reflect an unwavering ethic of commitment and productivity. PhD training has been consistently high. As a major contributor in sheer numerical terms, the group is faultless.

In addition to its excellent productivity, this group scores very highly for the relevance of its work to solving major problems in environmental management. Not only has there been major contribution to the advancement of knowledge with respect to grasslands and agro-ecosystems, in disseminating the findings and influencing implementation by end-users, this group is a European role model.

Prospects for this group in the medium term are extremely good given the continued importance of agro-ecological themes and the group's relevance to global change research. In the longer term, vitality will depend on the progressive development of other researchers who can approach the productivity, profile and energy of the current leader.

4. Vrije Universiteit Amsterdam, Institute IES

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Animal Ecology Group 1: Community and Evolutionary Ecology	Very good	good	Very good	Very good
Systems Ecology Group	Excellent	Excellent	Very good	Excellent
Theoretical Biology Group	Very good	Good	Good	Good

Programme 9: Animal Ecology Group 1: Community and Evolutionary Ecology (VU-AE1)

Programme director	Prof. dr. H. Verhoef
Research staff 2006	6.7 fte
Assessments:	Quality: 4
	Productivity: 3
	Relevance: 4
	Viability: 4

Following a recent period of transition and the recruitment of several young and promising scientists, this group has developed a more focussed mission and research program. This has placed particular emphasis on the research interests of these younger scientists. The group works closely with Animal Ecology 2 at VU, and in many respects the two groups can be regarded as one. The new research focus is on two themes: community ecology with an emphasis on soil organisms and biodiversity, and evolutionary ecology, especially focusing on phenotypic plasticity. Many groups worldwide are working in one of these areas, but the linking of community and evolutionary ecology is novel and marks the group as developing an internationally distinct and quite unique mission. If successful in this endeavour, the group has the potential to become an international leader in this area. The research program is very good, with innovative ideas and a leader aware of the long term importance of encouraging the younger scientists in the group into leading roles. The group's strength is in theoretically motivated experiments and empirical studies, and the group is an important member of collaborative projects nationally and internationally.

The quality of the research is very good. The group has produced several very important papers on biodiversity and ecosystem functioning in high profile journals such as Nature and Science. The group is likely to become a national leader and an internationally competitive player in evolutionary community ecology.

Based on quantitative measures the productivity of the group is good, although reorganisation and the recruitment of new members has resulted in a somewhat lower productivity in recent years. The group is small, especially in terms of tenured staff, which implies fewer papers in absolute terms, while its relative impact is presently on the lower side of the SENSE groups. In contrast, production of PhDs has been very good taking into account the smallness of the group.

The relevance of the group's work is very good. Several major papers have had a large scientific impact. However, the potential of the group with respect to more applied aspects in policy and management has not been fully realised. The group can improve in this area given recent consolidation and changes in composition. All signs are that developments are in the right direction.

In the medium and longer-term, viability of the group is very good. It is promising to have a situation with three young and highly qualified scientists working together in a joint program that is both exciting and promising. There are small uncertainties associated with a likely change in group leader in the next few years. The review committee feels that the focus on the relationship between ecological community theory and evolutionary theory could help fully realise the group's potential.

Programme 10: Systems Ecology Group (VU-SE)

Programme director	Prof. dr. M.A.P.A. Aerts
Research staff 2006	6.5 fte
Assessments:	Quality: 5
	Productivity: 5
	Relevance: 4
	Viability: 5

This group has a clearly articulated and focussed mission to analyse how global change, in a range of forms, affects biodiversity and ecosystem function, and to project future ecosystem effects from current and past results. Although some of their work is carried out in the Netherlands, they have significant interests in Arctic, sub-Arctic and Antarctic locations where changing UV-B, warming and increasing CO₂ concentrations have major ecological effects. The group has a stated intention to perform their tasks at an internationally recognized level as evidenced by high-impact publication, prominence in relevant international networks and substantial external funding. In all these respects, this is a highly successful group carrying out research that is both scientifically excellent and highly visible internationally.

On quality, the Committee judged this to be an internationally leading group on the basis of their publication record in *Science* and *Nature*, as well as their consistently strong record of papers in the very highest ranks of *Ecology* and *Environmental Science* journals. Significantly, high-quality performance is apparent not only from the group leader, but also independently from other leading members. The group has sufficiently critical mass of effective researchers to deliver as international leaders across a well-integrated programme. While bibliometric analyses support the suggestion that this is a group of extremely high quality, finally it is the intrinsic strength of their science that places them in such a leading position.

A grading of 5 for productivity reflects a per-capita rate of publication in this group that was among the highest of all those examined. Significantly, this has been achieved with a high degree of consistency in leading journals and despite the major logistical demands of field research in highly challenging locations. PhD completion, although slower in the early period of assessment after the group's formation in 1997, is now consistently high.

On relevance, the review committee considered that the work in this group was topical, visible and globally valuable in scientific terms. Nevertheless, more could be done to disseminate the group's findings outside the research domain thereby increasing their impact. There is a need for all ecological and environmental researchers to demonstrate the wider value of their work, and in the global-change domain the opportunities are particularly large.

The research field in which this group operates is already highly topical, and likely to become even more pressing in future. Given the age structure, blend of established and promising young researchers, and current level of excellence, prospects for this group could not be better. On viability, therefore, we judge this to be a research group in its prime and with an excellent future.

Programme 11: Theoretical Biology Group (VU-TB)

Programme director	Prof. dr. S.A.L.M. Kooijman
Research staff 2006	9.7 fte
Assessments:	Quality: 4
	Productivity: 3
	Relevance: 3
	Viability: 3

The mission of the group is to develop and apply the Dynamic Energy Budget (DEB) theoretical framework to questions ranging from molecular biology to global ecosystem science, also described to the review committee as developing a “theoretical physics for biology” based on first principles. The group has a strong and dynamic leader, and his program has been fairly successful during its 25 years, and has provided a fresh perspective on theoretical aspects of biology. Being based on energy and mass balance in individuals, successful applications have been in ecotoxicology and population dynamics. An external reviewer was positive in his evaluation of the group. We have taken this into account in our assessment.

The group has focussed on theoretical development, using empirical data obtained in collaborations for applications in different fields. The core of the group is small. With only two university-funded and one externally funded researcher, it lacks critical mass. The management by the group leader seemed unclear, but this was clearly not a problem for the interviewed PhD students, who were happy with supervision and the group environment. The group has enrolled a large number of PhD students in recent years, of which less than 50% are part of SENSE.

A problem highlighted by previous evaluations was that the group needs a more pluralistic approach, because the narrow theoretical focus might jeopardise its long term viability. No action has been taken to redress this perceived imbalance, which reflects the particular and distinct interest of the group leader. Current success is therefore likely to come at the cost of reduced longer-term viability and low likelihood of any new leader emerging to take charge of this research theme.

The specific research program on DEB is interesting and innovative. The group leader is confident that the concepts will be progressively more accepted and disseminated across biology. The supporting evidence for its wide application from general textbooks and citations is not yet clear, although a current textbook authored by the group leader is widely available. The group leader was pessimistic about the future of the group at the university. The committee feels the lack of other theoretical perspectives in the group to be a potential problem for its long-term viability.

In its specific niche, the scientific quality of the group’s work is very good. The quality of publishing is good with several high-ranked journal papers. The theory has been presented in a well-received book by the group leader. The productivity of the group is good when judged against SENSE as a whole with respect to papers and PhD completion.

The relevance of the DEB program is high, with the training of students in quantitative, mathematical skills and their applications to biology as a major strength. At the same time, interactions with other students in the research school could be improved. Acceptance of DEB theory has been slow in academy and this decreases the scientific relevance of the group’s work in terms of dissemination of knowledge.

Although the short term viability over the coming 5-7 years is good, the long term prospects are lower for reasons outlined above. This, coupled with small core group size, affect viability of both the group and the DEB theory.

The group is strongly recommended to emphasise two things in future:

Firstly, training the next generation students and scientists in quantitative mathematical and formalised analysis of biological phenomena is of strategic importance for SENSE and Dutch science as a whole. Secondly, the group should give higher priority to ensuring that the DEB theory, which has large potential conceptually, gains wider acceptance and application. This can be achieved by translating it more effectively to academia that are not necessarily mathematically gifted.

5. Radboud University

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Environmental Sciences Group	Good	Good	Very good	Very good
Environmental Biology Group	Very good	Good	Very good	Very good

Programme 12: Environmental Sciences Group (RU-ES)

Programme director	Prof. dr. A.J. Hendriks
Research staff 2006	7.6 fte
Assessments:	Quality: 3
	Productivity: 3
	Relevance: 4
	Viability: 4

This group's distinct niche is in understanding physical and chemical pressures on plant, animal and human communities, in particular in the Rhine-Meuse-Scheldt delta. They use a blend of conceptual and mathematical models developed in interaction with laboratory experiments and field surveys. Combining research with strong end-user relevance, they also train PhD and MSc students to a high professional standard for entry into research, management and consultancy.

The group has gone through significant changes in leadership over the review period as Prof Nienhuis retired in 2003, Dr Rob Leueven held a caretaker role in 2003-2004, and Prof Jan Hendriks joined the group as leader in 2004. There have been major advances in research quality since that time, with external research funding, publications number and publications quality all rising. Core staff in the group are increasingly publishing a significant proportion of papers in high ranking journals in the environmental toxicology and chemistry fields, with others contributing effectively in freshwater and floodplain ecology. There is no doubt that research quality is now becoming increasingly competitive internationally, and this is evidenced by strong growth in the relative impact of the group's papers. However, judged across the entire review period and taking into account some variability in performance across the group, on quality this group is graded as a good national competitor with international visibility. The review panel strongly encourages the group members to maintain their newfound confidence in publishing, and to seek to place seminal outputs in the very best journals that integrate across its ecotoxicological and ecological research. Effective design and increased science excellence in PhD projects will also help to build quality.

The transitions of the last 5 years have meant some variability in research productivity, and on bibliometric indicators (e.g. per capita publications), their performance has been good when seen across the whole review period. The increase since 2004 is likely to augment productivity in future, and will clearly have beneficial effects on visibility when linked with the increasing quality noted above. There has been a steady stream of PhD students throughout all years.

The clear interface between research in this group and major problems in ecotoxicology and environmental management means that relevance in this group is high and rated very good. Strong emphasis on relevant training, end-user contact, strong contract funding, effective dissemination and good outreach all combine to reveal the group's strengths in this respect.

On vitality, the review panel scored this group highly. Current upward trajectory across a range of performance indicators, the importance of the group's research themes, the group's age-structure and increasingly improved balance between research and teaching all bode well for development in the coming years.

Programme 13: Environmental Biology Group (RU-EB)

Programme director	Prof. dr. J. Roelofs
Research staff 2006	10.0 fte
Assessments:	Quality: 4
	Productivity: 3
	Relevance: 4
	Viability: 4

This research group focuses on biogeochemical and ecophysiological studies of a wide array of wetland ecosystems. The group aims at a mutually synergistic interaction between fundamental science and applied issues, with a strong involvement in management and restoration of wetland ecosystems.

Quality is very high and reflects the high-quality work of a group that is well known internationally in its field. A significant part of the work is published in the top ecological journals, and there have also been two very timely contributions to *Nature*. A proportion of papers are also in more mid-ranking journals, and there is scope for some improvement. Within their research field, this research group is clearly a national leader and an internationally competitive player. A decline in the relative impact of publications over the past ten years reflects some change in the relative importance of some of the group's work over the last 10 years rather than any change in intrinsic quality. Nevertheless, there is some variance in the quality and quantity of research output among team members. The recent publication of two papers in *Nature* shows that the team grasps opportunities to increase the impact of their results.

Productivity is ranked as good. The number of PhD theses was relatively low in the first part of the evaluation period, but is now increasing. The number of A-publications is moderate, but has increased strongly in 2006. Publication output differs substantially among team members.

The relevance of the work is very high. There is an excellent dissemination of knowledge to water management authorities and organizations involved in nature restoration. Dissemination of advancements of scientific knowledge could be improved. The committee recommends that the team should design a strategy to present their approach and research in a way that generates strong enthusiasm. Given the intrinsically very attractive research themes, improvement is clearly possible.

This is a solid group with very good prospects in terms of resources and research themes. There is promising young talent, and hence a need to consider strategies for the future. Suggestions may be to make young promising staff explicitly responsible for specific research themes, to increase visibility of the intrinsic value of the research questions and their scope to generate high quality knowledge, and grow to combine higher output and outstanding quality.

The group tackles some highly relevant and intriguing questions, and has a distinct approach that should lead to innovative insights. The committee believes that there is scope for improvement in designing a vision to increase the visibility of the group and in emphasizing the specificity of the mission and the distinctness of the research group at a national and international level.

6. Utrecht University, Copernicus Institute

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Land Use, Biodiversity and Ecosystem Functioning	Very good	Good	Very good	Very good

Programme 14: Land Use, Biodiversity and Ecosystem Functioning (UU-ES)

Programme director	Prof. dr. M. Wassen, Dr. P. Verweij
Research staff 2006	10.0 fte
Assessments:	Quality: 4
	Productivity: 3
	Relevance: 4
	Viability: 4

The group is currently going through a restructuring phase following the departure of the former group leader Peter de Ruiter. A new senior member was being recruited at the time of the review, but his/her identity was not known to the review committee. The group will continue to work in three closely related themes: 1. Global change and ecosystems, 2. Biodiversity and biogeochemical cycling, and 3. Natural resource management and biodiversity conservation. Each of these themes is important at an international level, and they provide for an integrated, coherent training and research program. Each theme will be scientifically coordinated by the three senior scientists (Rietkerk, Wassen and Verweij respectively), while the new chair will be responsible for links with policy and society. The new organization seems well planned and the choices were well explained to the committee at the interview. The PhD students had a positive view of the restructuring and relocation of the Copernicus institute, indicating an active and scientifically stimulating environment for the group.

The research programme of the group is promising, with a very good vision and indications of good leadership. The programme is evolving through staff changes, and the developing links between science and policy are likely to be fruitful. The quality of the group is very good, with several excellent papers in world-leading journals, especially from research themes 1 and 2, showing international excellence. However there is some variation in quality within the group, and there is a need for greater and more even visibility in leading peer-reviewed journals among group members.

Although productivity is rated as good, it has also been variable and unbalanced among group members. Given the large potential in all three research themes, it is likely that productivity will increase in future across all research fronts.

The relevance of the work is very high. End-user contacts are excellent, and the societal impact of some of the work is very. Scientifically, the impact of the group is high reflecting a internationally competitive performance coupled with a leading role in the Netherlands.

The group has responded well to comments from previous reviews. Staff changes have been used positively to ameliorate weaknesses regarding societal impact. The age structure of the group is well balanced, adding further to future potential. The committee noted, however, the fact that most Ph D students tended to work on applied aspects. The potential to integrate basic and applied scientific themes, for example by bringing basic theory into applied ecology, was seen as a strength, but one that was not yet being fully realised. Gaps between themes 1, 2 and 3 could be bridged better, and theme 3 needs to improve in productivity and profile. To achieve this, it might be necessary to pay more attention to the design and conceptual framework of the studies carried out under theme 3. The prospects for longer-term viability are very good, and the group will most likely become international leaders together with the other groups at the Copernicus institute.

Appendix 1: Curricula Vitae of committee members

Prof. Jan Bengtsson, Dept. of Ecology and Environmental Research, Swedish University of Agricultural Sciences, Uppsala. Research focused on community ecology in spatially subdivided habitats, and on the linkages between population and ecosystem ecology. Study of the dynamics and species interactions in *Daphnia* metapopulations in rockpools since the early 1980-ies. More recently, he used soil organisms to study how food web structure influences ecosystem processes, both in theory and in an applied context. This has led to an interest in the importance of biodiversity for ecosystem functioning, and management of landscapes for biodiversity conservation. He is also interested in the long term dynamics of communities, and he is involved in studies of diversity and ecosystem services (mainly biological control) in agricultural landscapes.

Prof. Luc De Meester, Departement Biologie, KU Leuven, Labo Aquatische Ecologie & Evolutiebiologie. Research topics: Evolutionary ecology, using zooplankton (*Daphnia*) as model organisms; Micro-evolutionary responses to natural (e.g. predators and parasites) and human-induced stress (e.g. pollution, global warming, habitat fragmentation); Aquatic ecology of shallow lakes and ponds; Biodiversity and nature conservation (aquatic habitats; shallow lakes); Restoration ecology and Biomanipulation of shallow lakes and ponds; Ecology of resting egg banks in aquatic organisms; Community ecology of zooplankton; community assemblage; metacommunity structure; Population genetics of zooplankton; metapopulation biology.

Prof. Steve Ormerod, Cardiff University, School of Biosciences. Research interests in the relationship between catchment characteristics and the ecology of running waters and wetlands through the application of experiments, surveys and mathematical models. He is currently reader in Ecology and Head of Catchment Research at Cardiff University, and also editor of the *Journal of Applied Ecology*. Dr. Ormerod was a member of the Acid Waters Review Group and the Critical Loads Advisory Group.

Appendix 2: Overview of Scores

Table 1: Overview of scores

	Quality	Productivity	Relevance	Viability
Programme 7: Aquatic Ecology and Water Quality Management Group	Excellent	Very good	Excellent	Excellent
Programme 8: Nature Conservation and Plant Ecology Group	Very good	Excellent	Excellent	Very good
Programme 9: Animal Ecology Group 1: Community and Evolutionary Ecology	Very good	Good	Very good	Very good
Programme 10: Systems Ecology Group	Excellent	Excellent	Very good	Excellent
Programme 11: Theoretical Biology Group	Very good	Good	Good	Good
Programme 12: Environmental Sciences Group	Good	Good	Very good	Very good
Programme 13: Environmental Biology Group	Very good	Good	Very good	Very good
Programme 14: Environmental Sciences Group	Very good	Good	Very good	Very good

Table 2: SEP-scale; the meaning of the scores

Work that is at the forefront internationally, and which most likely will have an important and substantial impact in the field. Institute is considered an international leader.	Excellent (5)
Work that is internationally competitive and is expected to make a significant contribution; nationally speaking at the forefront in the field. Institute is considered international player, national leader.	Very good (4)
Work that is competitive at the national level and will probably make a valuable contribution in the international field. Institute is considered internationally visible and a national player.	Good (3)
Work that is solid but not exciting, 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 nationally visible.	Satisfactory (2)
Work that is neither solid nor exciting flawed in the scientific and or technical approach, repetitions of other work, etc. Work not worthy of pursuing.	Unsatisfactory (1)

Appendix 3: Schedule

Environmental Biology and Ecology Review Committee (EBE)

SUNDAY 17-06-2007	Utrecht
xx.xx – 15.00	ARRIVAL NH Centre Utrecht, Janskerkhof 10, Utrecht, Tel. +31.30.2313169
15.00 – 15.30	WELCOME
15.30 – 16.00	QANU: General introduction on the assessment and the review programme
16.00 – 16.30	SENSE: General introduction SENSE, with emphasis on the 3 different assessment levels: research groups; SENSE institutes and SENSE Research School
16.45 – 18.30	Internal RC meeting
19.00 – 21.00	DINNER
21.00 – 22.00	(meeting chairs)
MONDAY 18-06-2007	Amsterdam
09.30 – 10.30	Internal RC meeting
10.30 – 11.30	Presentation and discussion Theoretical Biology Group (TB-ICM/VU) nr. 11
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Animal Ecology 1: Community and Evolutionary Ecology Group (AE1-IES/VU) nr. 9
14.00 – 15.00	Presentation and discussion Systems Ecology Group (SE-IES/VU) nr. 10
15.15 – 16.45	Site visit + PhD (poster) presentations TB, AE1, SE) and discussion
17.00 – 18.00	Internal RC meeting
18.00 – 20.00	Dinner / Travel to Utrecht
TUESDAY 19-06-2007	Utrecht
09.30 – 10.30	Presentation and discussion Environmental Sciences Group (ESG-Copernicus/UU) nr. 14
10.30 – 11.30	Site visit + PhD (poster) presentations ESG and discussion ¾ hour
	Wageningen
13.00 – 14.00	Presentation and discussion Aquatic Ecology and Water Quality Management Group (AEW-WIMEK/WU) nr. 7
14.00 – 15.00	Presentation and discussion Nature Conservation and Plant Ecology Group (NCP-WIMEK/WU) nr. 8
15.15 – 16.45	Site visit + PhD (poster) presentations (AEW, NCP) and discussion
17.00 – 18.00	Internal RC meeting
18.00 – 20.00	Dinner
WEDNESDAY 20-06-2007	Nijmegen
10.00 – 11.00	Presentation and discussion Environmental Sciences Group (ES-RU) nr. 12
11.00 – 12.00	Presentation and discussion Environmental Biology Group (EB-RU) nr. 13

12.00 – 13.00	Lunch break
13.00 – 14.00	Internal RC meeting
14.00 – 15.00	Site visit + PhD (poster) presentations (ES, EB) and discussion
15.00 – 16.00	Internal RC meeting
16.00 – 17.00	Internal RC meeting / closure
17.00 – 18.00	
18.00 – 20.00	Dinner

Committee Environmental Earth Sciences (EES)

1. The review committee and the review procedures

Scope of the assessment and structure of this report

The Review Committee was asked to perform a research assessment of the following research programmes of the Wageningen Institute for Environment and Climate Research (WIMEK):

- Earth System Science – Climate Change Group (WU-ESS)
- Hydrology and Quantitative Water Management Group (WU-HWM);
- Soil Physics, Ecohydrology and Ground Water Management Group (WU-SEG).

This assessment covers the activities and the research in the period 2001-2006. The assessment is part of the 2007 review of the Netherlands Research School for Socio-Economic and Natural Sciences of the Environment (SENSE).

The Committee's tasks were to assess the quality of the named WIMEK research programmes on the basis of the information provided by the Institute and through interviews with the management and the research leaders, and to advise how this quality might be improved.

Part I, chapter 1 describes the composition of the Committee, its activities and the procedures followed by the Committee.

Part I, chapter 2 contains general remarks about the state of the art in the field of Environmental Earth Sciences.

Part II contains the assessment of the programmes.

Composition of the Committee

The composition of the Committee was as follows:

- Andrea Rinaldo, professor of Hydrogeomorphology and transport phenomena in the hydrological cycle - IMAGE Department of the University of Padova (chair);
- Hannes Flüher, professor of Soil Physics - Institute of Terrestrial Ecology (ITÖ) of ETH Zürich;
- Roland Schulze, professor of Hydrology - Department of Agricultural Engineering of the University of Natal.

Peter van Holten was appointed secretary to the Committee, on behalf of QANU (Quality Assurance Netherlands Universities)

A short curriculum vitae of the Committee members is included in Appendix 1.

Independence

All members of the Committee signed a statement of independence to safeguard that they would assess the quality of the Institute and research programmes in an unbiased and independent way. Any existing personal or professional relationships between committee members and programmes under review were reported and discussed in the committee meeting. The Committee concluded that there were no close relations or dependencies and that there was no risk in terms of bias or undue influence.

Data provided to the Committee

The Committee has received detailed documentation consisting of the following parts:

1. The Self Evaluation Reports of the research groups named before;
2. Copies of three key publications per research group;
3. Bibliometric study 1996-2004;
4. The Self Evaluation report of the WIMEK institute (for information);
5. The Self evaluation report of the SENSE Research school (for information).

The documentation included all the information required by the Standard Evaluation Protocol (SEP).

The three Environmental Earth Science research groups evaluated according to this protocol are all in a transition phase and are in the process of building up new working groups (professorships). This has been taken into account by the Committee in the assessment of the performance and potential of the groups visited.

The evaluation process was carefully organized and professionally structured.

Procedures followed by the Committee

The Committee proceeded according to the Standard Evaluation Protocol (SEP). Prior to the Committee meeting, each programme was assigned to a first and a second reviewer, who formulated a preliminary assessment. The final assessments are based on the documentation provided by the Institutes, the key publications and the interviews with the management and with the leaders of the programmes). The interviews took place on June 18, 2007 (see the schedule in Appendix 3).

Preceding the interviews, the Committee was briefed by QANU about research assessment according to SEP. On the same day, June 17, 2007, the Committee discussed the preliminary assessments. For each programme a number of comments and questions were decided upon. The Committee also agreed upon procedural matters in relation with the presentation by, and discussion with each research group. Each research group delivered in a short presentation the highlights of their programme, followed by a discussion with the review committee. Finally each research group presented its facilities. Rather than a tour to demonstrate these facilities, located in a different building, posters and video presentations were used. At the end of the visit programme the PhD students of the research groups presented their research in a poster session.

After the interviews the Committee discussed the scores and comments and made draft texts on June 18, the day after the visit. The texts were finalised through email exchanges. The final version was presented to the Institutes and SENSE on August 1, 2007. The comments of the Institutes and SENSE were discussed in the Committee and led to changes in the report on a number of points. The final report was presented to Board of the participating university and was printed after their formal acceptance of the report.

The Committee used the rating system of the Standard Evaluation Protocol (SEP). The meaning of the scores is described in Appendix 2.

2. General remarks

The **Earth System Science and Climate Change** (WU-ESS) group addresses Earth Systems research in 5 interlinked and interactive thematic research clusters covering fundamental and applied climate-land related issues. ESS is a newly established chair grouping at Wageningen UR, since April 2006 only. The ESS group has exceptionally strong leadership, ambitious goals and excellent funding. The strategy and policy of research appear sound and include a major effort in new initiatives in teaching and revisiting previous syllabi, with a particular emphasis on Integrated Water Resource Management.

The group is well represented in WUR as well as in national and international collaborations and networks, with members of the group often in leadership roles.

The group displays numerous strengths, perhaps above all the thrust into climate change research. If weaknesses are to be highlighted, these revolve around having to cope with two administrative systems, largely a legacy of a re-alignment of two previously existing groups.

The **Hydrology and Quantitative Water management** (WU-HWM) programme has to be seen in perspective. The former Chair holder left recently and a new Chair has been appointed only in April 2007. Overall the Committee has great confidence that the current leadership will ultimately succeed in providing vision, academic reputation and scientific research at the forefront, internationally.

The research work has been widely visible and the overall international reputation of the group is undeniable.

The group has been successful in obtaining national and EU funding. The Committee noted plenty of scope for the evolution of the programme and an impressive momentum to do so. Management and organization seem somewhat in need of reinforcement. The Committee has the impression that the group is understaffed. The Management style of the new Chair is appreciated

The **Soil Physics, Ecohydrology and Groundwater Management** (WU-SEG) group is in a state of transition, gearing up toward new goals in a drastically transformed constellation of personnel. From the 12 tenured academics just four will continue as fully active members of SEG. The group is clearly understaffed and under-resourced.

The main theme of the group is process understanding and quantification of water and element fluxes in field soils (unsaturated zone). The ecohydrology claimed by the above mentioned HWM group relates to the scale of entire catchments with a focus on the areal water fluxes between biosphere and atmosphere whereas the SEG group integrates the processes that control the water regime between subsoil up into and through the plant canopy, the latter being primarily based on field scale experimentation and modelling and the former on catchment-scale observations and modelling. The publication record of the group is very good and internationally well visible. The new measuring techniques for the monitoring of solute fluxes are a scientific breakthrough. The group has a high probability of becoming a prominent unit in soil physical research. The Committee rates the performance of the group 'Very good' in all aspects, i.e. quality, productivity, relevance and prospects. The personnel capacity however, is critically limiting its potential.

In general the Committee had a strong positive impression from the presentations of the groups of PhD students, whose scholarship and drive were assumed as a sign of great vitality of the program.

3. Wageningen University, Institute WIMEK

3.1. Assessment per institute

WIMEK aims to develop an integrated understanding of environmental change and its impact on the quality of life and sustainability, by i) conducting innovative scientific research, ii) offering PhD training and education, and iii) dissemination of emerging insights and recent results.

The policy of WIMEK is to contribute to the development of high quality national and international scientific research, focused on the multidisciplinary and interdisciplinary understanding of environmental change and its impact on the quality of life and sustainability.

WIMEK research leaders have developed a strong international network and participate successfully in national and international research programmes. WIMEK researchers are also actively involved in international policy assessments, such as IPCC and the Millennium Ecosystem Assessment and in national research programmes like Bsik 'Climate change and spatial planning' and 'Geoinformation'.

The WUR Executive Board has defined several research priorities for the years to come in consultation with the graduate schools and the science groups. These priorities are i) strengthening the knowledge base of the specialised research institutes by allocation of strategic research funds financed by the national government and enhancing synergy between the specialised research institutes and the university, and ii) identifying upcoming and fast developing research themes, which need extra financial investments in the coming years.

The development of innovative fundamental research and strategic research requires a stimulating academic environment in which researchers have ample freedom to develop and pursue their original ideas. Therefore, the WIMEK chair groups are autonomous in choosing and developing their own research topics.

Funding of the national and international research programmes is by NWO, EU, national and foreign governments, industries and other parties. The WUR Executive Board determines the general policy on the allocation of budgets among the research groups. The budget for education is based the real teaching and supervising efforts including the supervision of PhD students. On average 40 – 45% of the tenured staff time is available for research.

Extra research funds are granted for having attracted NWO funded post-docs or PhD students. This budget may be used to employ additional staff. The Executive Board grants, in addition research bonuses based on the scientific research performance. Furthermore, extra research funds may be generated from externally funded research projects.

The quality assessment of all tenured staff members is based on criteria determined by the SENSE Research School.

WIMEK has a strong position in environmental and climate research. The scientific quality, productivity and relative impact of the WIMEK chair groups varies from good to excellent. The international dimension of environmental issues requires active participation in international scientific research networks and intensive co-operation with foreign high quality research groups. The very limited research budget per chair group obtained from WUR, limits

the initiation of curiosity-driven research projects. The quality of the WIMEK/SENSE PhD education can be further improved.

3.2. Assessment per programme

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Earth System Science-Climate Change (WU-ESS)	Very good	Very good	Very good /Excellent	Very good /Excellent
Hydrology and Quantitative Water Management (WU-HWM)	Good /Very good	Good	Good	Very good /Excellent
Soil Physics, Ecohydrology and Groundwater Management (WU-SEG)	Very good	Very good	Very good	Very good

Programme 15: Earth System Science-Climate Change (WU-ESS)

Programme director	Prof. dr. P. Kabat
Research staff 2006	8.54 fte
Assessments:	Quality: Very good
	Productivity: Very good
	Relevance: Very good to Excellent
	Prospects: Very good to Excellent

A newly established Chair grouping at Wageningen UR, commencing only in April 2006 (i.e. in the last year of the period under review), the ESS group addresses Earth Systems research in 5 interlinked and interactive thematic research clusters covering fundamental and applied climate-land related issues across the range of scales from point to global and with both strong disciplinary and trans-disciplinary approaches.

This holistic and all-encompassing approach is, on the one hand, a legacy of the individual researchers making up the ESS group and their former affiliations, while simultaneously it is an innovative one.

The ESS group has exceptionally strong leadership through Prof. Kabat, has ambitious goals and excellent funding of the order of 3.5 mil Euro/annum (with more in the pipeline), made up of 90% from large and long-term external funds. The strategy and policy of research appear sound and include a major effort in new initiatives in teaching and revisiting previous syllabi, with a particular emphasis on Integrated Water Resource Management.

With each of the 5 thematic research clusters, there is simultaneously relatively high profile in-house expertise while there is strong interaction between clusters, with each appearing to be adequately funded. The group is well represented in WUR as well as in national and international collaborations and networks, with members of the group often in leadership roles.

The academic reputation of the group as a whole is sound, but is perceived to lean heavily on the new programme leader's pre-2006 prominence in international and national forums and in the members' historical publications record.

Given the vulnerability of the Netherlands to certain impacts of climate change, the national level research and coordination undertaken by the group is highly relevant as well as having been made highly visible to decision makers and the public at large.

The group displays numerous strengths, perhaps above all the thrust into climate change research across a range of scales, a focus on state-of-the-art observations and the trans-disciplinary nature of its work. If weaknesses are to be highlighted, these revolve around having to cope with two administrative systems (largely a legacy of a re-alignment of two previously existing groups), a perceived inadequacy of in-house administrative back-up (although this has recently been partially addressed), an overload of commitments and a perceived strong dependence on the reputation and drive of the programme leader (although the latter is at the same time a major strength).

Finally, the Committee has had a strong positive impression from the presentations of the group of PhD students, whose scholarship and drive were assumed as a sign of great vitality of the program.

The overall quality of the group is 'Very Good' (i.e. 4 on the SEP-scale), with some crystallization possibly still being required in the coherence of the programme (3) and allowing more members of the group to come more to the fore, but with the benefit of a highly prominent programme leader (5).

In relation to productivity the overall rating is 'Very Good' (4), with the output of professional papers being excellent, while to date the number of PhD theses completed is on the low side. The average is only 1.5 per year for the period under review, but with a significant number of new candidates registered, an annual output of 3-4 PhDs is expected in years to come.

Considering the stated mission of the group, the overall relevance of the programme is rated 'Very Good to Excellent (4-5)', in particular the efforts in relation with the dissemination of knowledge and, as far as a research group can go, the implementation of knowledge. The direct societal relevance of the research output for the period under review is more so in a Dutch context, although through contributions to and leadership of, *inter alia*, the International Dialogue on Water and Climate, the International Geosphere-Biosphere Programme, the Millennium Ecosystem Assessment and the Intergovernmental Panel on Climate Change, members of the group have made some significant contributions to the advancement of knowledge and its dissemination.

With its enthusiasm, dynamic leadership, overall age profile, good mix of experienced and new staff and high national and international profile, the prospects for this group are considered 'Very Good to Excellent (4-5)', with the proviso that the group can keep up with its commitments and not constantly places itself under time pressure.

Programme 16: Hydrology and Quantitative Water Management (WU-HWM)

Programme director	Prof .dr. ir. R. Uijlenhoet
Research staff 2006	8.23 fte
Assessments:	Quality: Good to Very Good
	Productivity: Good
	Relevance: Good
	Prospects Very Good to Excellent

The programme has to be seen in perspective. The former chairholder left recently (and much of the evaluation hinges of achievements directly or indirectly related to the past Chair's management), and a new Chair has been appointed only in April 2007. The transient character of the missions is obviously reflected in this fact, jointly with a complex legacy of the past in terms of achievements and directions. Overall, the Committee has great confidence that the current leadership will ultimately succeed in providing vision, academic reputation and scientific research at the forefront, internationally. The Committee's judgement has therefore to be seen as a whole and read somewhat in detail, we presume, because normative indicators of quality, productivity, relevance and prospects are necessarily a reflection of the past and the future merged together.

Innovative work is apparent from the programme, especially concerning the measurement, assimilation and modelling of hydrologic fluxes on a wide range of scales in space and time. Whereas one cannot look solely at the steady production of the research output in the previous review period, given the rather sharp discontinuities in scientific management the overall productivity is judged favourably. The programme has produced steady results on high-impact journals (clearly ranked at the top of the hydrological and water resources literature) over most of the period which could be examined (2006), with variable distribution within the group. The research work has been widely visible and the overall international reputation of the group is undeniable, although with different attributions to the old and the new leadership. In this sense the difficulties of the Committee in distinguishing past and prospective achievements (arguably the matter of foremost interest to SENSE) have to be acknowledged.

The group has been successful in obtaining national and EU funding, received prestigious scholarships and seems channelled through a sustainable academic pathway. The strive for fundamental catchment science and hydrology to overcome the quantitative water management is apparent, and this is lauded by the Committee. One notes, however, that on a proper balance such diversity is not seen as harmful, and the current leadership style, which is respectful of other existing capabilities and objectives in the academic environment, is appropriate and fruitful. The Committee noted plenty of scope for the evolution of the programme and an impressive momentum to do so.

Incidentally, the Committee speculated with keen interest about possible suggestions about such evolution. Specifically, the research programme is deemed interesting but in need of some critical decisions. Indeed catchment hydrology, the main theme, is an important issue both scientifically and for society at large. It is clear to the Committee, however, that the foremost scientific challenges ahead in this area will lie rather at the interface with other disciplines, within the same scales and processes – specifically, atmospheric sciences on one side and ecology on the other. In this sense the research avenue of the development, testing and interpretation of advanced observation methods for hydrological fluxes and states is much encouraged within the defining catchment science field chosen (or inherited). In this respect the Committee wel-

comes the directions suggested by the new Chair, whose energy and drive deeply impressed the Committee. Indeed the advanced observation techniques for natural phenomena and hydrological fluxes in particular are a sound and important area of research.

The Committee also made clear during the presentation that perhaps a definite aim at eco-hydrology (in the sense of water-controlled ecological processes occurring within the catchment and at related spatial and temporal scales) could be an important and suitable collective objective for the group, given the importance of the research at stake and the unique opportunities currently waiting in WIMEK and in this programme. Academic problems notwithstanding (which we do not underestimate), we observe that eco-hydrological processes at the scale of the catchment will be important and globally visible, and naturally suited to the experimental facilities, previous insight, scholarship and vocation of the group.

The Committee notes that this process, epitomized by the conversion of many important Hydraulic Laboratories to Geophysical Fluid Dynamics Laboratories, is likely to be slower in the Netherlands where by the nature of their drainage problems the hydraulic tradition is strong and prominent – yet perhaps it is a necessary transition which might be fruitful towards improved relevance of the research given the new directions.

A brief note of other facts:

- Management and organization seem somewhat in need of reinforcement. While indeed the overall count of fte seems in line with other groups, the Committee has had the impression of understaffing. The Management style of the new Chair is appreciated;
- The Committee has had a strong positive impression from the presentations of the group of PhD students, whose scholarship and drive were read as a sign of the great vitality of the program;
- It is somewhat unclear to the Committee (yet not necessarily inexplicable) how the different layers of coordination operate in the Netherlands academic environment. Specifically, the Committee wonders what actual mechanisms favour the interrelations and scientific collaboration among the different groups active in Hydrology (namely the groups number 15, 16 and 17 belonging to different Chairs) within SENSE and/or the Boussinesq Centre for Hydrology. Furthermore, the merit which the Institutions are gaining from the spreading of hydrologic research within three different Groups/Chairs, seems somewhat unclear.
- Dry bibliometric indicators cannot properly give the right impression of the academic quality of this group and of its scientific output if not properly considered. What matters in this case in particular, is the potential rather than the current integral of the past achievements, per se a by-product of age and history of management when not directly attributable to Faculty just recently left.

The scientific quality of the production is overall rated 'Good to Very Good' (3-4). National prominence and international visibility are undoubtedly achieved, both under the previous and the new management. To date, this group cannot be defined as a world leading group as a whole, although this Committee has high expectations that this might happen in the near future owing to all of the above.

The overall per capita productivity is 'Good' (3), and the drive to direct much of the scientific production (once directed to unrefereed sources) to refereed sources is visible and appreciated.

The scientific and societal relevance of the hydrologic issues pursued herein is perceived as 'Good' (3), as well as the prospective focus of the incoming activities. The Committee notes that a dramatic turnaround in the relevance could occur, should the group decide to aim at the cutting edge of interdisciplinary research centred around catchment scales and processes.

For all the reasons discussed above, the Committee is of the opinion that the perspectives are to be seen as Very Good to Excellent (4-5), in particular trusting the newly acquired leadership towards the creation of an international powerhouse of research and extension in the general area of catchment science.

Programme 17: Soil Physics, Ecohydrology and Groundwater Management (WU-SEG)

Programme director	Prof. dr. ir. S.E.A.T.M. Van der Zee
Research staff 2006	7.09 fte
Assessments:	Quality: Very Good
	Productivity: Very Good
	Relevance: Very Good
	Viability: Very Good

This unit is in a state of transition, gearing up toward new goals in a drastically transformed constellation of personnel. From the 12 tenured academics listed in Annex 1 of the Self evaluation Report, just four of them will continue as fully active members of SEG. The majority of the staff listed, is in the process of leaving or went on retirement. Two retired colleagues will certainly be partially available for advice and scientific support but unavailable to nucleate new programs. Hence the group is clearly understaffed and under-resourced, a problem that has to be taken care of. The assessment the professional performance of this group is difficult, because the scientific products presented in the self-evaluation report and during the interviews have been generated by a group that only partially continues to exist and the record of the newly formed group covers a very short period of production time.

The main theme of this group is process understanding and quantification of water and element fluxes in field soils (unsaturated zone). The group follows three alleys of research: (i) including the dominant role of heterogeneity on the water flow field and solute fluxes in stochastic models, (ii) developing new concepts for implementing the role of roots in the modelled system, and (iii) making use of the scientific treasure of the previous Chair by supporting the worldwide use of the integrated SWAP Model and shift the focus from agro-hydrology to the pedohydrology of natural ecosystems. Here we use the term pedohydrology in lieu of ecohydrology to clarify the different perspective and observation scale of the SEG and the 'Hydrology and Quantitative Water Management' (HWM) groups. The ecohydrology claimed by HWM relates to the scale of entire catchments with a focus on the areal water fluxes between biosphere and atmosphere whereas SEG integrates the processes that control the water regime between subsoil up into and through the plant canopy, the latter being primarily based on field scale experimentation and modelling and the former on catchment-scale observations and modelling.

Finally, the Committee had a strong positive impression from the presentations of the group of PhD students, whose scholarship and drive were assumed as a sign of the great vitality of the program.

Professor van der Zee is one of the scientists internationally leading the stochastic modelling of reactive solute transport in the Unsaturated Zone. He has a profound understanding of all facets of transport theory in soils. He is one of the very few who have done pioneering work at the interface between soil physics and soil chemistry.

Dr. de Rooij is a highly innovative experimentalist (with a proven experience in transport and geostatistical modelling). The new measuring techniques for monitoring solute fluxes in field soils and for expanding the measuring range of tensiometers are both a scientific breakthrough which he will be able to capitalize on in the planned research programs.

Dr. Metselaar is a newcomer in root research, but excellently qualified to dig into the field of modelling root morphology in the context of roots being a sink for water and elements in structured soils. He combines solid experience in soil physics, mathematics and plant physiol-

ogy which makes him fit to carry out original work to overcome one of the real gaps in soil physical research.

Dr. Van Dam warrants continuity to exploit the expertise accumulated under the guidance of Professor Feddes (SWAP model support centre). He complements the profile of the other three tenured academics by his ability to apply modern pedohydrology in operational decisions. Overall the Committee rates the quality of research as 'Very Good' (4).

Given the transitional constellation of the SEG personnel the number of completed dissertations (3.72 per year) is substantial and significantly above average. The number of A- and B-papers resulting from the 19 dissertations is limited (≈ 0.6 per dissertation). However, the publication record of SEG is deemed 'Very Good (4)' and internationally well visible despite the relative impact ratio being only slightly above one. The reason for this is the fact that members of the soil physics community traditionally publish in A-journals which raises the world average level of citations. The various publication categories are well balanced with class A- and B-papers being the dominant outlet. The significant number of books and book chapters are partly a legacy of the previous Chair (Professor Feddes). These contributions are well visible in the community.

Professor Van der Zee, Dr. de Rooij and Professor Feddes provided numerous highly appreciated services to the national and international community. The achievement of Dr. de Rooij as an EGU official (European Geosciences Union) needs to be emphasized because he established the European platform '*Unsaturated Zone*' sciences which now attracts many experts from overseas.

Funding: The percentage of NWO funding (fundamental science) is quite high and favourably rates the scientific reputation of this group.

The instrumental innovation for field use is a highlight of the past six years (multicompartment sampler and osmotic tensiometer). The same applies to the contribution in the field of transport theory. The SWAP model conceptualized and implemented by the Feddes group is one of the classics and used by hundreds of research units around the globe. Hence the group maintained, and still does, a user support on a high level. The input of this group spans from fundamental insights, over technical innovations, to actual use of the products in practice. Hence they serve a wide spectrum of customers. Overall the Committee rates the relevance as 'Very Good' (4).

The scientific concept of this group is a well conceived reorientation which makes optimal use of the knowledge import from SOQ, of a valorisation of Feddes' legacy, and of a new focus on roots as the sink for water and sensitive process control in hydrological and global climate models. This group has a high probability of becoming a prominent unit in soil physical research with the rare label of a convincingly integrated approach (soil physics complemented with soil chemical expertise and new input from root physiology and morphology, a rare combination of disciplines). The personnel capacity is, however, critically limiting the potential of this group and this Committee would recommend an extension of its permanent staff. Overall, the Committee rates the prospects of this group as 'Very Good' (4).

Appendix 1: Curricula Vitae of committee members

Prof. Andrea Rinaldo, Dipartimento IMAGE, University of Padova. Transport phenomena in the hydrological cycle. Hydrogeomorphology. Transport in heterogeneous porous formations. Fluvial hydraulics. Fractals in geomorphology. Stochastic modelling of natural phenomena. Computational spectral methods. Stochastic Modeling of Natural Phenomena. Networks in Nature. Ecological Size Spectra and Scaling in Ecosystems.

Prof. Hannes Flühler, ETH Zürich, Institute of Terrestrial Ecology (ITÖ), Soil Physics. Basic Issues: Transport of water, solutes, gas and heat in (real) soils; strong emphasis on conducting controlled field experiments that are based on clearly defined research questions; adapting and developing models that are suitable for describing those features that govern field-scale transport processes ; key is the dynamics of soil and rock structures and their influence on transport in those media; Environmental Issues: management practises and physical soil status, mobility of chemicals in the vadose (unsaturated) zone; transport phenomena in fractured rock as related to nuclear repositories; Methodological Issues: high resolution TDR-technology; image analysis and quantification of dye tracer distributions in soils.

Prof. Roland Schulze, Department of Agricultural Engineering, University of Natal.
Research Interests:

- Hydrological processes and scale issues
- Hydrological modelling (developer of ACRU model)
- Integrated catchments modelling
- Design hydrology
- Hydrological education
- Climate change impacts
- Guest Professor in hydrological modelling at IHE, Delft (Netherlands)

Appendix 2: Overview of Scores

Table 1: Overview of scores

	Quality	Productivity	Relevance	Viability
Earth System Science-Climate Change (ESS-CC)	Very good	Very good	Very good /Excellent	Very good /Excellent
Hydrology and Quantitative Water Management (HWM)	Good /Very good	Good	Good	Very good /Excellent
Soil Physics, Ecohydrology and Groundwater Management (SEG)	Very good	Very good	Very good	Very good

Table 2: SEP-scale; the meaning of the scores

Work that is at the forefront internationally, and which most likely will have an important and substantial impact in the field. Institute is considered an international leader.	Excellent (5)
Work that is internationally competitive and is expected to make a significant contribution; nationally speaking at the forefront in the field. Institute is considered international player, national leader.	Very good (4)
Work that is competitive at the national level and will probably make a valuable contribution in the international field. Institute is considered internationally visible and a national player.	Good (3)
Work that is solid but not exciting, 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 nationally visible.	Satisfactory (2)
Work that is neither solid nor exciting flawed in the scientific and or technical approach, repetitions of other work, etc. Work not worthy of pursuing.	Unsatisfactory (1)

Appendix 3: Schedule

Environmental Earth Sciences Review Committee (EES)

SUNDAY 17-06-2007	
xx.xx – 15.00	ARRIVAL NH Centre Utrecht, Janskerkhof 10, Utrecht, Tel. +31.30.2313169
15.00 – 15.30	WELCOME
15.30 – 16.00	QANU: General introduction on the assessment and the review programme
16.00 – 16.30	SENSE: General introduction SENSE, with emphasis on the 3 different assessment levels: research groups; SENSE institutes and SENSE Research School
16.45 – 18.30	Internal RC meeting
19.00 – 21.00	DINNER
21.00 – 22.00	(meeting chairs)
20.00 – 22.00	
MONDAY 18-06-2007	
xx.xx – 09.30	Travel to Wageningen
09.30 – 10.30	Internal RC meeting in Wageningen
10.30 – 11.30	Presentation and discussion Earth System Science Group (ESS-WIMEK/ WU) nr. 15
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Hydrology and Quantitative Water Management Group (HWM-WIMEK/WU) nr. 16
14.00 – 15.00	Presentation and discussion Soil Physics, Ecohydrology and Ground Water Quality Group (SEG-WIMEK/WU) nr. 17
15.15 – 16.45	Site visit; PhD (poster) presentations (ESS, HWM, SEG) and discussion
17.00 – 18.00	Internal RC meeting
18.00 – 20.00	Dinner / Travel to Utrecht
TUESDAY 19-06-2007	
xx.xx – 09.30	Utrecht
09.30 – 10.30	Internal RC meeting / closure
10.30 – 11.30	
11.15 – 12.00	
11.30 – 12.00	
	(chairs meet in General Committee, Wednesday 9:00 hrs)

**Committee Environmental Chemistry, Microbiology,
Ecotoxicology and Biotechnology (ECMEB)**

1. The review committee and the review procedures

Scope of the assessment and structure of this report

The Review Committee was asked to perform a research assessment of the Environmental Chemistry, Microbiology, Ecotoxicology and Biotechnology research at the Wageningen Institute for Environment and Climate Research (WIMEK), at the Institute for Environmental studies (IVM-VU) and at the Institute of Ecological Science (IES-VU). This assessment covers the activities and the research in the period 2001-2006. The assessment is part of the 2007 review of the Netherlands Research School for Socio-Economic and Natural Sciences of the Environment (SENSE).

WIMEK-WUR	18. Microbiology Group (only Environmental Microbiology part) 19. Environmental Technology Group 20. Soil Chemistry and Chemical Soil Quality Group
IVM-VU	21. Department of Chemistry and Biology
IES-VU	22. Animal Ecology Group 2: Ecotoxicology and Ecogenomics Group

The Committee's tasks were to assess the quality of the research programmes on the basis of the information provided by the Institutes and through interviews with the management and the research leaders, and to advise how this quality might be improved.

Part I, chapter 1 describes the composition of the Committee, its activities and the procedures followed by the Committee.

Part I, chapter 2 contains general remarks about the state of the art in the Environmental Chemistry, Microbiology, Ecotoxicology and Biotechnology fields.

Part II contains the assessment of the Institutes and programmes.

Composition of the Committee

The composition of the Committee was as follows:

- Prof. Willy Verstraete, professor of Microbiology and Technology at Ghent University, Belgium
- Prof. Colin Janssen, professor of Ecotoxicology at Ghent University, Belgium
- Prof. Laurent Charlet, professor of Earth and Planetary Sciences at the Université de Grenoble-I, France.³

A short curriculum vitae of the Committee members is included in Appendix 1.

In order to strengthen the soil chemistry expertise of the committee, prof. Hannes Flüher, professor in terrestrial ecology of the ETH Zürich, member of the review committee for Environmental Earth Sciences, participated in the evaluation of the Soil Chemistry group of WIMEK (prof. Van Riemsdijk). Furthermore, prof. Andrea Rinaldo, Dipartimento IMAGE, University of Padova, chair of the review committee for Environmental Earth Sciences, provided a preliminary assessment of this group.

³ Professor Charlet was unfortunately absent due to illness during the review but provided a preliminary assessment of the Soil chemistry group of WIMEK.

Geert van der Veen was appointed secretary to the Committee, on behalf of QANU (Quality Assurance Netherlands Universities).

Independence

All members of the Committee signed a statement of independence to safeguard that they would assess the quality of the Institute and research programmes in an unbiased and independent way. Any existing personal or professional relationships between committee members and programmes under review were reported and discussed in the committee meeting. The Committee concluded that there were no close relations or dependencies and that there was no risk in terms of bias or undue influence.

Data provided to the Committee

The Committee has received detailed documentation consisting of the following parts:

1. Self evaluations at programme/research group level (5), at institute level (3) and at the level of the research school
2. Copies of three key publications per programme;
3. Bibliometric study 1996-2004
4. A DVD with all SENSE background material

The documentation included all the information required by the Standard Evaluation Protocol (SEP).

The self-evaluations provided by SENSE were well documented and highly transparent. Although there were some methodological differences between the self-assessment of the various groups, the assessments in combination with the discussions of the committee with the research leaders allowed an objective evaluation of the research groups.

Procedures followed by the Committee

The Committee proceeded according to the SEP. Prior to the Committee meeting, each programme was assigned to a first and a second reviewer, who formulated a preliminary assessment. The final assessments are based on the documentation provided by the Institutes, the key publications and the interviews with the management and with the leaders of the programmes). The interviews took place on June 17, 2007 till June 19, 2007 (see the schedule in Appendix 3). A site visit was organised to the departments of environmental technology and soil chemistry and chemical soil quality. The committee was impressed by the magnificent facilities, infrastructure and state-of-the art equipment and the way it is managed. The department of microbiology could not be visited because it is in the process of moving to new facilities. There was a very positive and open interaction with 5 PhD students from each of these groups in an poster session, The quality, knowledge, motivation and eagerness to succeed was very well appreciated by the committee.

Preceding the interviews, the Committee was briefed by QANU about research assessment according to SEP. On the same day, June 17, 2007, the Committee discussed the preliminary assessments. For each programme a number of comments and questions were decided upon. The Committee also agreed upon procedural matters and aspects of the assessment.

After the interviews the Committee discussed the scores and comments and made draft texts. The texts were finalised through email exchanges. The final version was presented to the Institutes and SENSE on August 1, 2007. The comments of the Institutes and SENSE were dis-

cussed in the Committee and led to changes in the report on a number of points. The final report was presented to Boards of the participating universities and was printed after their formal acceptance of the report.

The Committee used the rating system of the Standard Evaluation Protocol (SEP). The meaning of the scores is described in Appendix 2.

For the assessment of the quality of the research the groups were compared at the international level with their peers. Publication and citation records were examined, major achievements were taken into account, their selected top-publications were evaluated and their capacity to attract highly qualified students and collaborators was discussed.

In terms of productivity the criteria were the number of publications, the numbers of Msc and PhD students, the patents and spin-offs. These values were judged in absolute values and in relation to the number of staff.

The relevance of the groups in relation to environmental sciences was judged at the international and local level. Furthermore relevance for science at such and society as a whole were taken into account. Elements such as recognition as a knowledge centre, participation in expert groups, editorial boards and professional societies are indicators for the former. Services and expertise rendered to industry and practical applications of scientific developments constituted the weighting for the latter part.

The prospects and viability were mainly based on their strategic vision with regard to their group and the surroundings. Moreover the concrete and practical means at their disposal for achieving or maintaining leadership were assessed. This includes personnel, infrastructure and policy issues at group, institute and university level.

2. General remarks

In the domain of Environmental Chemistry, Microbiology, Ecotoxicology and Biotechnology a number of rapid scientific developments and evolving social demands can be observed. In the scientific domain they particularly relate to genomics. In the societal domain global warming, biodiversity and pollution are major drivers, already leading to increasing public awareness and more stringent (EU) regulations. In order to solve the problems, new knowledge is necessary to determine mechanisms of environmental decay and in this way be better able to develop technology to increase sustainable development and use of renewable resources. This necessitates development in the above named fields.

The state of the art in the domain of soil chemistry and chemical soil quality is the understanding of the molecular basis of crucial soil processes such as the interactions of metalhydroxides and organic matter. The translation of basic chemical understanding of soil phenomena to major environmental management issues in the framework of soil quality and soil health and soil policy (e.g. water framework directive) is most valuable and challenging.

The focal point of current environmental microbiology is the understanding of micro-organisms and particularly microbial communities in relation to the functioning of natural environments and environmental biotechnological processes. The combination of the integration of innovative cultivation based and functional genomic studies is a general trend.

Recent developments in the field of environmental health focus on improving our understanding of the occurrence and impact of natural and anthropogenic stressors in ecosystems. The development and application of novel tools for detecting effects of and exposure to stressors are essential to further enhance our capacity to protect the environment. The use of new technologies such as ecological genomics, advanced chemical analytics and dedicated in vitro and in vivo test systems for elucidating impacts of environmental stresses are currently – from both an academic and a regulatory perspective- major research themes in this field.

The largest challenge for environmental technology is the transfer of scientific knowledge to solutions for problems in society. Technology is more and more, because of economic costs and environmental effects, moving from end-of-pipe solutions towards process integrated solutions. Reuse of water and materials and use of renewable resources are important parts of this approach because they address basic societal needs.

The research of the groups visited is all tuned to these trends, and certainly is geared to contribute, both in the domain of basic science and practical applications, to progress these research fields.

As the assessment of the individual groups in this report will show SENSE plays a competitive to leading role in this area in the world. No major shortcomings were identified.

However, in view of the current low interest of students for beta-sciences it is recommended to strongly advertise the empowerment to improve the living conditions of this planet that exists within the domains of science covered by this committee.

3. Wageningen University, Institute WIMEK

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Environmental Research at the Laboratory of Microbiology	Excellent	Very good	Very good	Good to Very good
Environmental Technology Group	Very good	Excellent	Excellent	Very good
Soil Chemistry and Soil Quality Group	Excellent	Very good	Excellent	Very good to Good

Programme 18: Environmental Research at the Laboratory of Microbiology (WU-MIB)

Programme director	prof. dr. W.M. de Vos, prof. dr. ir. A.J.M. Stams, dr. H. Smidt	
Research staff 2006	11.55 fte (2006, within SENSE)	
Assessments:	Quality:	Excellent
	Productivity:	Very good
	Relevance:	Very good
	Viability:	Good to Very good

The laboratory is a centre excellence in the field of anaerobic microbiology. It explores a number of new aspects in that domain, e.g. the elucidation of microbial function and interaction at the single cell level, the development of molecular markers to interpret metagenomics. This opens a variety of perspectives for acquiring new insights and developing new potentials in the domain of environmental microbiology.

The quality of the group can internationally be rated among the best in the domain of microbial ecophysiology, particularly the aspects of syntrophy qualify as excellent.

We acknowledge the fact that De Vos has a very high H-factor, but the work of Stams and Schraa, which particularly relates to the environmental research, also has an applaudable impact.

The productivity in terms of publications as very good, but the number of MSc-theses and PhD-theses is rated as good.

The relevance of the staff as measured through their invited lectures, their key-note speeches at international conferences and their presence in international committees is very good.

The socio-economic relevance of their research particularly relates to their interactions with the environmental technology group with environmental industries which are prominent on the international scene.

The prospects of the group relate to its new orientation in terms of systems biology. The fact that they have delineated the possibility to further promote the ecophysiology of syntrophic bacteria through metagenomics is highly valuable and will ensure the sustainability of ongoing high-level research. The focus of the director with respect to SENSE and the environmental researchers in his group requires attention.

Programme 19: Environmental Technology Group (WU-ETE)

Programme director	Prof. dr. ir. W.H. Rulkens, prof. dr. ir. C.J.N. Buisman	
Research staff 2006	22.32 fte	
Assessments:	Quality:	Very good
	Productivity:	Excellent
	Relevance:	Excellent
	Viability:	Very good

The group is involved to create new breakthrough technologies to establish new resource cycles. It has upfront a biotechnological component, which it combines with physics, chemistry and also social sciences. It is a well-structured organisation with good management in which concepts such as bio-crystallisation, bioavailability, bio-retention and bio-electrochemistry generate technologies for producing products such as recyclable matters reusable waters and renewable energies. Moreover the group has the special characteristics that it interfaces with the special needs of society for new solutions for environmental problems, both in developed and developing countries.

The group is gaining strength and is competitive at the international level. They exert a strong attraction to top master students and are at the process of delivering highly qualified PhDs. Their science output can as yet be qualified good, and actions are taken to improve it.

On the basis of the number of MSc and PhD students this group certainly deserves the qualification excellent. Also the group has a high output of intellectual property which it interfaces efficiently with appropriate (industrial) technology developers. The number of published papers and the calculated H-index indicate a high scientific productivity and ranks the among the best of SENSE WIMEK groups.

In terms of keynote lectures, editorial boards and leading roles in international scientific committees the staff certainly scores very good. Moreover their interactions with industry and scientific institutions like Wetsus, Bbasic and LeaF Associates can be regarded as best practice in the field of applied environmental technology. A large number of industrial installations, based on the research of this group, has been built all over the world. We also would like to applaud their achievements in low income countries where a number of technologies of the group are applied and associated training is provided.

The planned changes in staff and in the programme will certainly further enhance their international competitiveness. The three main domains in which they invest for the future (minerals, water and energy) are internationally rapidly evolving research fields and consequently worthwhile to pursue. The fact that they have reoriented their PhD intake will also improve their quantitative and qualitative output.

Programme 20: Soil Chemistry and Soil Quality Group (WU-SOQ)

Programme director	Prof. dr. W.H. van Riemsdijk, prof. dr. S.E.A.T.M. van der Zee	
Research staff 2006	9.72 fte	
Assessments:	Quality:	Excellent
	Productivity:	Very good
	Relevance:	Excellent
	Viability:	Very good to Good

The group is strongly focused on developing molecular based fundamental understanding of important soil chemical processes that can also be relevant for aquatic environment and processes occurring in waste systems. The areas of expertise relate to the interaction between ions and metal hydroxides, the importance of organic matter and the behaviour of ions in soil and the interaction between organic matter and minerals. All of these open new horizons for promising research and applications, moreover the sensor development made it possible to advance the fundamental understanding of transport processes of ions in the complex soil matrix.

The group is a world leader on the fundamental aspects of element behaviour in soils. It can be benchmarked against the best labs in this field worldwide. The publication record is excellent.

The output of scientific publications is very good, particularly considering their top quality. The number of completed master-theses is fair, the number of PhD-theses is very good.

On the scientific level the expertise of the tenured staff is internationally highly appreciated. Moreover major efforts have been made to implement the fundamental knowledge into application oriented domains. The effect that commercial partners have been willing to fully fund PhD projects illustrates their successful endeavours along those lines.

A number of new promising developments in research are explored, such as interfacing with soil biology, and exploring the potentials of understanding element behaviour in natural soil structures. The group is encouraged to further step up its efforts to explore and actively invest in new multidisciplinary scientific developments with potential, which are relevant for environmental chemistry and biology. The group is invited to attract more students and to further express their research strategy.

4. Vrije Universiteit Amsterdam, Institutes IVM and IES

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Department of Chemistry and Biology (IVM)	Excellent	Very good	Very good	Very good
Animal Ecology 2: Ecotoxicology and Ecogenomics Group (IES)	Very good	Excellent	Very good	Excellent

Programme 21: Department of Chemistry and Biology (VU-C&B)

Programme director	Prof. dr. J. De Boer
Research staff 2006	4.6 fte
Assessments:	Quality: Excellent
	Productivity: Very good
	Relevance: Very good
	Viability: Very good

The C&B department aims to contribute to the field of environmental health by developing innovative methods in the areas of exposure and effects assessments. The fundamental and applied aspects of this research should be considered as among the best internationally.

Their research focuses on identifying and evaluating emerging chemicals using a unique combination of chemical and toxicological methods.

In terms of quality the group is internationally competitive and ranks among the very good research teams in the world. They exhibit a good policy and dynamics concerning attracting international scientists. They are internationally recognised for their unique strategy of combining molecular toxicological tools, with high performance chemical analysis. Their publications are very high ranking.

The productivity per person of this group is remarkably high. Moreover there has been the creation of a spin-off and there is the outlook for a number of patents, based on the toxicological assays developed. However the number of MSc-theses and PhD-promotions is rather low. This is due to the fact that the department has very limited possibilities to attract students and to enrol them in their R&D. The group has taken several actions to improve these potentialities, for which they are complimented. The committee recommends that the structural positioning of the department is examined at a higher level, with a view to improving the access of this group to PhD-students and thus improving this component of the productivity.

The type of research performed by the group has both a high scientific and socio-economic relevance. Members of the group are represented at the national and international level in regulatory and advisory organisations. The group also has a considerable number of interactions with major industry organisations at a European level.

The department has developed a strategy in which chemistry and toxicology are combined to provide results on the potential risks of chemicals in the environment in a faster and more reliable way. Moreover, by their innovative approach of Effect Directed Analysis, they constantly search for important emerging pollutants. This line of research warrants continuation and is of major importance in the context of SENSE. Taking into account that the director was only recently appointed and five new staff members were added to the group, combined with their already excellent performance, the committee believes that the prospects of this team are excellent. In the opinion of the committee, the team could well be extended with an additional high-level staff member. Obviously the amount of university funding (only 6.5% of turnover) should be increased in order for the group to reach their full potential.

Programme 22: Animal Ecology 2: Ecotoxicology and Ecogenomics Group (VU-AE2)

Programme director	Prof. dr. N.M. van Straalen, dr. C.A.M. van Gestel	
Research staff 2006	9.7 fte	
Assessments:	Quality:	Very good
	Productivity:	Excellent
	Relevance:	Very good
	Viability:	Excellent

The main research area of this group is the examination of ecological effects of stress factors in the environment and the mechanisms by which animals (soil invertebrates) respond to these stressors. The group has developed a hierarchical approach to environmental toxicological issues by examining stressor effects from the molecular level up to population and community level. Although this research is in the first instant addressing fundamental questions it clearly has a good applicability and high societal relevance.

The department publishes high quality papers and provides highly appreciated and frequently used textbooks. To further improve the impact of their papers in the field the group leaders have analysed their publication strategy and are developing an improved approach.

In terms of output of number of papers per tenured staff member, the number of Masters graduating and PhD's defending their theses this group is rated excellent. Several IP products are in the process of being developed. The committee recommends that the department continues this high level of various outputs.

The department has a lot of influence on the international scene through participations in various commissions, editorial boards and professional organisations. Also at the national level their research has an impact on environmental policy. Overall the relevance to science and society is rated very good.

The combination of their established expertise in terrestrial stress ecology combined with new developments in ecological genomics certainly offers a very wide array of perspectives for the coming years. It is particularly appreciated that they consider genomics as a tool to interpret ecological phenomena such as biological availability of contaminants and functionality of invertebrate communities in soil ecosystems.

Appendix 1: Curricula Vitae of committee members

Prof. Willy Verstraete, is professor of microbiology at Ghent University, LabMET (Laboratory of Microbial Ecology and Technology). His R & D has a central theme: processes mediated by microbial mixed cultures. His team deals with microbial transformations in waters and soils and the gastro-intestinal tract. A variety of biotechnological processes, based on microbial consortia, are subject to R&D at LabMET. W. Verstraete has field experience with respect to design and operation of drinking water production plants (slow sand filtration), aerobic wastewater treatment (in particular with respect to nitrification-denitrification), anaerobic digestion of wastewaters and sludges, solid state fermentation of organic residues and bioremediation processes of soils and sediments. He has also gained experience in various aspects of pre- and probiotics used in human and animal nutrition.

Prof. Colin R. Janssen is professor of Ecotoxicology at Ghent University, Belgium where he directs the Environmental Toxicology Research Group, Department of Applied Ecology and Environmental Biology at the Faculty of Applied Biological and Agricultural Sciences. He holds a Masters degree in zoology and obtained his Ph.D. in environmental sciences from the same university. Since his appointment as research associate in 1987, C. Janssen and his research team have been conducting fundamental and applied ecotoxicological research in various areas such as development and application of alternative toxicity tests, sediment and effluent toxicology, biomarkers and endocrine disruptors, metal toxicology in aquatic and terrestrial systems and environmental risk assessment.

Prof. Laurent Charlet, professor of Earth and Planetary Sciences, Université de Grenoble-I, France, Department (LGIT-OSUG). His research interests are:

- Molecular modeling: Reaction pathways at solid/water interfaces ; DFT, MUSIC and DM models vs. SANS, XAFS, LITRE, Mössbauer and RPE data.
- Contaminant immobilization in clay-rich carbonated media: Cation exchange and structurally based surface complexation theory; application to the surface chemistry of sulfides, clays, carbonates and mixed mineral systems. Pathways and rates of reactions; Integration to reactive transport models.
- Anoxic media and emergence of life: chemistry of FeS protein clusters and Prion protein; early regulation of trace metal concentration and hydrogen break down coupled to amino acid synthesis; redox (Fe, Mn, S) and acid-base chemistry; transformation kinetics of inorganic (U, Se, Cr, As and Hg) and organic (TCE, Nitrobenzene) contaminants and their transport in confined anoxic environments.
- Large field scale experiments: Contaminant (As, Se, Hg) cycle in soils, surface- and groundwaters; field intensive studies on Arsenic (Bengale, Argentina, France), Selenium (Spain) and Mercury (French Guyana); paleoenvironmental archives.

Appendix 2: Overview of Scores

Table 1: Overview of scores

	Quality	Productivity	Relevance	Viability
18. WIMEK Microbiology	Excellent	Very good	Very good	Good to Very good
19. WIMEK Environmental Technology	Very good	Excellent	Excellent	Very good
20. WIMEK Soil Chemistry and Soil Quality	Excellent	Very good	Excellent	Good to Very good
21. IVM Environmental Chemistry & Biology	Excellent	Very good	Very good	Very good
22. IES Ecotoxicology and Ecogenomics	Very good	Excellent	Very good	Excellent

Table 2: SEP-scale; the meaning of the scores

Work that is at the forefront internationally, and which most likely will have an important and substantial impact in the field. Institute is considered an international leader.	Excellent (5)
Work that is internationally competitive and is expected to make a significant contribution; nationally speaking at the forefront in the field. Institute is considered international player, national leader.	Very good (4)
Work that is competitive at the national level and will probably make a valuable contribution in the international field. Institute is considered internationally visible and a national player.	Good (3)
Work that is solid but not exciting, 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 nationally visible.	Satisfactory (2)
Work that is neither solid nor exciting flawed in the scientific and or technical approach, repetitions of other work, etc. Work not worthy of pursuing.	Unsatisfactory (1)

Appendix 3: Schedule

Environmental Chemistry, Microbiology, Ecotoxicology and Biotechnology committee (ECMEB)

SUNDAY	
17-06-2007	
xx.xx – 15.00	ARRIVAL NH Centre Utrecht
15.00 – 15.30	WELCOME
15.30 – 16.00	QANU: General introduction
16.00 – 16.30	SENSE: General introduction
16.45 – 18.30	Internal RC meeting
19.00 – 21.00	DINNER
21.00 – 22.00	(meeting chairs)
MONDAY	
18-06-2007	
XXXX – 09.30	Travel to Wageningen
09.30 – 10.30	Internal RC meeting in Wageningen
10.30 – 11.30	Presentation and discussion Laboratory of Microbiology - Molecular Ecology and Microbial Physiology groups (MIB-WIMEK/WU) nr. 18
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Soil Chemistry and Chemical Soil Quality Group (SOQ-WIMEK/WU) nr. 20
14.00 – 15.00	Presentation and discussion Environmental Technology Group (ETE-WIMEK/WU) nr. 19
15.15 – 16.45	Site visit; PhD (poster) presentations (MIB, SOQ, ETE) and discussion
17.00 – 18.00	Internal RC meeting
18.00 – 20.00	Dinner / Travel to Utrecht
TUESDAY	
19-06-2007	
09.30 – 10.30	Internal RC meeting in Amsterdam
10.30 – 11.30	Presentation and discussion Department of Chemistry and Biology (C&B-IVM-VU) nr. 21
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Animal Ecology 2: Ecotoxicology and Ecogenomics Group (AE2-IES/VU) nr. 22
14.00 – 15.00	Site visit + PhD poster presentations (C&B, AE2) and discussion
15.15 – 16.45	Internal RC meeting
17.00 – 18.00	Internal RC meeting / closure
18.00 – 20.00	Dinner / Travel to Utrecht
	(chairs meet in General Committee, Wednesday 9:00 hrs)

Committee Integrated Assessment, Sustainable Systems Analysis and Spatial Management (ISS)

1. The review committee and the review procedures

Scope of the assessment and structure of this report

The Review Committee was asked to perform a research assessment of the WIMEK-WUR Environmental Systems Analysis Group; the IVM-VU Department of Spatial Analysis and Decision Support; Copernicus Institute UU Science, Technology and Society Group; IVEM-RUG Centre for Energy and Environmental Studies and ICIS-UM International Centre for Integrated Assessment and Sustainable Development. This assessment covers the activities and the research in the period 2001-2006.

The assessment is part of the 2007 review of the Netherlands Research School for Socio-Economic and Natural Sciences of the Environment (SENSE).

Institute	Programme
Wageningen Institute for Environment and Climate Research (WIMEK-WU)	23. Environmental Systems Analysis Group
Institute for Environmental Studies (IVM-VU)	24. Department of Spatial Analysis and Decision Support (SPACE)
Copernicus Institute for Sustainable Development and Innovation (Copernicus UU)	25. Science, Technology and Society Group
Centre for Energy and Environmental Studies (IVEM-RUG)	26. Centre for Energy and Environmental Studies
International Centre for Integrated Assessment and Sustainable Development (ICIS-UM)	27. International Centre for Integrated Assessment and Sustainable Development

The evaluation of the research programmes was based on the self-evaluation reports and other material provided by the Institutes and on interviews with the management and the research leaders. The committee also had the task to advise how the quality of the research programmes might be improved.

Part I, chapter 1 describes the composition of the Committee, its activities and the procedures followed by the Committee.

Part I, chapter 2 contains general remarks about the state of the art in the field of Integrated Assessment, Sustainable Systems Analysis and Spatial Management.

Part II contains the assessment of the programmes.

Composition of the Committee

The composition of the Committee was as follows:

- Dr. Lea Kauppi, Director General of the Finnish Environment Institute (SYKE)
- Prof. Thomas B. Johansson, professor of energy systems analysis and Director of the International Institute for Industrial Environmental Economics (IIIEE) at the University of Lund, Sweden
- Prof. William Lafferty, professor of political science and Director of the research programme ProSus at the Centre for Development and the Environment (SUM), University of Oslo. Professor of Strategic Research for Sustainable Development at the University of Twente.⁴

⁴ Professor William M. Lafferty was not able to attend the assessment sessions in Utrecht. His comments and preliminary assessment were forwarded to the Committee prior to the meeting in Utrecht.

External referent for the committee was Helen Couclelis, Professor of Geography at the University of California, Santa Barbara, California, USA.

Dr. Barbara van Balen was appointed secretary to the Committee on behalf of QANU (Quality Assurance Netherlands Universities)

A short curriculum vitae of the Committee members is included in Appendix 1.

Independence

All members of the Committee signed a statement of independence to safeguard that they would assess the quality of the Institute and research programmes in an unbiased and independent way. Any existing personal or professional relationships between committee members and programmes under review were reported and discussed in the committee meeting. The Committee concluded that there were no close relations or dependencies and that there was no risk in terms of bias or undue influence.

Material provided to the Committee

The Committee has received detailed documentation consisting of the following parts:

1. Self evaluations at the level of the programmes, the institutes and the research school
2. Copies of three key publications per programme
3. Bibliometric study 1996-2004
4. A DVD with all SENSE background material.

The documentation included all the information required by the Standard Evaluation Protocol (SEP).

Remark about the Standard Evaluation Protocol

The Standard Evaluation Protocol (SEP, see www.qanu.nl) provides guidelines to evaluate university research institutes and their research programmes. This report is limited to the research programmes concerning Integrated Assessment, Sustainable Systems Analysis and Spatial Management. The distinction between institute and programme was however not very clear for every group the committee assessed. In two cases the programme and institute were fully overlapping. The part of the SEP protocol that describes the assessment of research was applicable for this evaluation. The committee could get a good picture of the quality and productivity of each of the groups.

The self-assessment reports the committee had received were transparent and comprehensive, the interviews with the group leaders completed the picture.

The SEP protocol guided the committee through the process of assessment. The prescribed rating of the groups according to the four criteria: quality, productivity, relevance and viability was, however, very difficult. The value of the research programmes can not be described in simple ratings. The committee tried to express the differences between the assessed groups in the final ratings but the committee itself regards the argumentation that accompanies the ratings as the more valuable part of the assessment.

Procedures followed by the Committee

Prior to the Committee meeting, each programme was assigned to a first and a second reviewer, who formulated a preliminary assessment. The final assessments are based on the documentation provided by the Institutes, the key publications and the interviews with the management and with the leaders of the programmes. The interviews took place on June 18, 2007 till June 19, 2007 (see the schedule in Appendix 3). Due to reasons of health, Professor William M. Lafferty was not able to attend the assessment sessions in Utrecht. His comments and preliminary assessment were forwarded to the Committee prior to the meeting in Utrecht.

Preceding the interviews, the Committee was briefed by QANU about research assessment according to SEP. On the same day, June 17, 2007, the Committee discussed the preliminary assessments. For each programme a number of comments and questions were decided upon. The Committee also agreed upon procedural matters and aspects of the assessment. After the interviews the Committee discussed the scores and comments and made draft texts. The texts were finalised through email exchanges. The final version was presented to the Institutes and SENSE on August 1, 2007. The comments of the Institutes and SENSE were discussed in the Committee and led to changes in the report on a number of points. The final report was presented to Boards of the participating universities and was printed after their formal acceptance of the report.

The report of the external referent for the committee concerning programme 24 was received after the site visit.

The Committee used the rating system of the Standard Evaluation Protocol (SEP). The meaning of the scores is described in Appendix 2.

2. General remarks

Today the world is facing increasingly complex problems which require responses based on interdisciplinary insights and research from both social and natural sciences. The groups working in this field acknowledge that their research not only has to be scientifically valid and relevant to the policy debate, but also has to be accepted by stakeholders. This places some specific demands on the methodology development, which is one of the core issues in this field. The challenge for the research groups is to combine rigorous scientific research with stakeholders' tacit knowledge, perceptions and values. They deal, among others, with uncertainty issues, risks analysis, and methods that explicitly aim at effectively integrating stakeholders' knowledge into modelling for decision-making (i.e. participatory approach).

Another core subject in this field is the study and design of new governance arrangements for sustainable development and multi-level, multi-actor, and multi-sector societal arrangements for sustainable issues. Research is focused on the changing roles of governments, markets and the civil society in governance. Other research foci within this field are the changing relationship between public and private responsibilities for sustainable development and the innovative and potentially influential new types of governance on the local, regional and global level in the process of globalization.

The five groups that were evaluated by this committee were very diverse. They differed in size, in level and kind of funding, in subject and in methods. The position of the groups in university varied even more. Some of the groups are an institute themselves, others are part of a larger and more established institute. Some of the groups totally depend on external funding, while others receive almost all their funding from the university. It was therefore not easy for the committee to compare the groups and give a balanced assessment for each of them.

In general the societal and scientific relevance of the research of these groups is high. The research groups are productive and all score above the world average when using criteria like impact factor, citation indexes and H-index.

The quality of the research is generally good to very good and sometimes excellent.

Considering the challenges and problems raised by the global change, research in this field will remain highly relevant for several decades. The need for insights, answers and solutions will grow enormously in the next years. Thus the viability of the groups is generally good to excellent, although the size of the group and their position in the university makes some groups more vulnerable than others.

3. Wageningen Universiteit, Institute WIMEK

The Wageningen Institute for Environment and Climate Research (WIMEK) aims to develop an integrated understanding of environmental change and its impact on the quality of life and sustainability, by

- (i) conducting innovative scientific research,
- (ii) offering PhD training and education
- (iii) dissemination of emerging insights and recent research results.

The WU chair groups that participate in WIMEK are hierarchically embedded in one of the WU Departments and participate in one or more Graduate Schools. The Science Groups and WIMEK have different tasks and responsibilities.

The Environmental systems Analysis Group (ESA) is one the research groups of WIMEK participating in SENSE.

The mission of ESA is the development and improvement of innovative integrated research tools that address and enhance understanding of environmental change and sustainability, and the application of these cutting-edge tools to advance scientific understanding and support decision making locally, nationally and internationally.

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Environmental Systems Analysis group	Excellent	Excellent	Excellent	Excellent

Programme 23: Environmental Systems Analysis group (WU-ESA)

Programme director	Prof. dr. L. Hordijk, Dr. C. Kroeze, Prof. dr. R. Leemans		
Research staff 2006	5.7 fte		
Assessments:	Quality:	Excellent	
	Productivity:	Excellent	
	Relevance:	Excellent	
	Viability:	Excellent	

ESA studies complex environmental problems at an aggregated regional, continental and global level by identifying and analyzing causes, mechanisms, processes, impacts of, and potential solutions. ESA research is further typified by its innovative integrative multidisciplinary, interdisciplinary and transdisciplinary approaches. These approaches explicitly address the need of policy makers and other stakeholders. The issues that are addressed are pollution (e.g. causes and impacts of pollution, nitrogen fluxes, uncertainty analysis and scale issues in modelling), climate change (e.g. emission inventories, biogeochemical processes, impact assessments, mitigation and adaptation strategies) and changes in ecosystems; quantification and valuation of ecosystem functions and services.

The research approaches and tools include:

1. models integrating different components, dimensions and scales,
2. appraisal tools for ecosystem functions, services and their valuation,
3. integrated environmental assessments with special emphasis on participatory methods,
4. methods for analyzing and communicating uncertainty, and
5. decision support systems for integrated pollution and/or ecosystem management.

ESA strongly focuses on understanding environmental change including two specific research lines: 'Pollution management' and 'Ecosystem management'.

This group has established a strong programme, well-linked to policy makers. The mission of the group is to maintain the dialogue with policy makers to guarantee the applicability of the research results, to evaluate the potential of solutions and develop possible solutions. Before the previous research assessment in 2000 the group was substantially smaller with only a part-time professor as director. In the last six years there have been several personnel changes but this has not affected the coherence in the programme nor in the research group. On the contrary the committee was impressed by the results of this group, the strong vision, the seniority of the involved researchers, the productivity and quality of the research. The group is also highly committed to further development of the SENSE Research School. It has been successful in attaining research money, but is also supported by its own university. The group is strongly positioned internationally and nationally as well as in the own university and has very good cooperation with other prominent international research groups.

The programme has a good balance between scientific quality and relevance and is well focused.

The research programme is very coherent. It has an original approach and contributes significantly to the overall development of the research field. Both the programme director and the other members of the group are prominent in the field. The group has a very good publication strategy and the quality of the scientific publications is excellent. The committee has seen a positive trend in the quality of the publications as well as in the coherence of the programme over the last six years. Citation indexes indicate that the group scores above world average.

The group is very productive. It has delivered a number of PhD theses, professional publications and public oriented publications as well as policy reports and contributions to documentaries and programs on radio and television.

The publication list demonstrates the success of international collaboration and interdisciplinary research. ESA researchers are highly cited and frequently invited to give keynote lectures at international conferences.

The relevance of the research by this group is very high. It contributes to the advancement of knowledge in the field of integrated assessment, sustainable systems analysis and spatial management. The knowledge is very well disseminated and implemented. The group has been successful in disseminating the research results to the various stakeholders. The scientific and societal value of the research is reflected in the frequently asked advice by policy makers and professional organizations, reports to ministries and NGO's. A nice example of an innovative product with a high impact is the Natuurkalender that is coordinated by Ir. Van Vliet. This project aims to monitor, analyze, predict and communicate climate change induced changes in phenology. The project involves over 6000 volunteers and hundreds of schoolchildren. The results are communicated to the general public through a weekly, very popular radioV programme.

The long term viability of this programme is excellent. The relevance of this kind of research will even increase in the future. The group has a solid position in the Wageningen University as well as nationally and internationally. It has a basic funding from WU and good possibilities to gain other funds. The core staff is relatively young and has good prospects.

The future of the group looks very promising, it has several excellent scientists and a coherent programme.

4. Vrije Universiteit Amsterdam, Institute IVM

The Institute for Environmental Studies (*Instituut voor Milieuvraagstukken*, IVM) was established at the Vrije Universiteit Amsterdam (VU) in 1971 as the first academic institute for multi-disciplinary research into environmental problems in the Netherlands. Over the last 35 years IVM has built strengths across the social and natural sciences, shaping and responding to environmental research and governance issues.

Originally an independent institute within the VU, IVM was integrated into the newly-created Faculty of Earth and Life Sciences (FALW) at the university in 2001. As part of this merger process, IVM was reorganised into four departments: Chemistry and Biology (C&B); Environmental Policy Analysis (EPA); Economics and Technology (E&T); and Spatial Analysis and Decision Support (SPACE), now each with 20-25 researchers. Merger into the faculty has encouraged a greater focus on scientific quality and provided a basis for a growth in graduate teaching. In 2005 a Graduate Studies Programme was created at IVM as part of a new Graduate School for Earth, Environment and Ecology (Triple E) in FALW.

Organisationally, IVM retains a large measure of autonomy with its own management team, research strategy, budget and personnel policy. The management team reports to the Faculty Board on the institute's financial and scientific performance. Some 80% of IVM's activities are related to research, most of it funded externally. The need to raise project finance, to manage projects effectively and to communicate with a wide range of audiences – scientific and societal – imposes specific discipline on the institute's activities. Researchers are expected to show scientific quality, while also being socially relevant.

Multidisciplinarity is a feature within departments. IVM includes researchers with disciplinary backgrounds stretching from toxicology to international law. Beyond this, IVM collaborates in research with other institutes and with stakeholders, broadening still further the range of knowledge integrated into the research methods, analysis and outputs.

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Department of Spatial Analysis and Decision Support	Very good	Very good	Very good	Very good

Programme 24: Department of Spatial Analysis and Decision Support (VU-SPACE)

Programme director	Dr. R. Janssen
Research staff 2006	6.76 fte
Assessments:	Quality: Very good
	Productivity: Very good
	Relevance: Very good
	Viability: Very good

The Spatial Analysis and Decision Support department SPACE was established in 2001. The department brings together researchers working on spatial aspects of the environment. The department aims to develop tools for understanding and visualising the pattern and dynamics in environmental function and values. These methods and insights should serve societal decision-making on the spatial organisation of environment functions and values. The department sees it as its challenge to adopt powerful new analytical tools that facilitate more participative spatial decision-making, using often-disparate layers of information about land use, water resources and water quality. SPACE has three research themes linking research tools with domains of application:

1. Spatial modelling
2. Spatial assessment, and
3. Spatial decision support

This is an exciting department whose research programmes are designed to serve a critical societal mission, while at the same time contributing significant scientific research and methodological innovations. The department's research seeks to build bridges between the natural and social sciences (especially the decision sciences), between academia, decision makers and stakeholders, and between national and international research and application interests in the general areas of applied ecology and spatial decision making. The spatial focus provided by spatial analysis and associated geo-information techniques helps integrate these diverse interests and perspectives. A notable strength is the integration of natural and social science/planning skills not just within the group but often within the same individual researcher.

On the basis of the self evaluation report and the interview with representatives of the department the committee concluded that the SPACE group has succeeded in combining topics and tools in their research themes. There seems, however, be a disproportionately strong focus on natural systems modelling and hydrology/climate. More emphasis on the 'softer' dimension of the departments research interests (risk analysis, adaptation, valuation of environmental services etc) would provide better support to the mission of science and policy integration..

The group depends for a large part on contract money and has so far been successful in obtaining funding.

Access to data is a crucial question for this group. Mostly the data has been provided by the customer on a case by case basis. To safeguard the continuity of its activities the committee recommends the group to establish permanent cooperation with organisations that can provide the necessary data on a more independent basis.

Cooperation in research in the Netherlands is for IVM-VU also possible outside of SENSE. Some PhD students of this group do courses in SENSE but not all SENSE courses are relevant for their PhD students.

Our general impression is that this research group has great potential and is highly productive. The research is of good quality, of high relevance and it can support also the work of other research groups in SENSE.

The quality of the tenured personnel appears to be very high, and the research output is solid in both quantity and quality (judging from the impact factor, which has increased markedly during the current review period). Similarly, the professional service (editorships etc.) and national and international collaborations are strong overall. The research of this department has an original approach. It contributes significantly to the field. The department has a good publication strategy. The quality of the scientific publications is very good and they have a good scientific impact.

It appears from a cursory examination of the material provided that the group's major publications are disproportionately in the areas of natural system modeling and hydrology/climate science. A little more emphasis on the 'softer' dimensions of the department's research interests (risk analysis, adaptation, valuation of environmental services, spatial decision support, spatial planning and management, etc.) would provide better support to its stated mission of science and policy integration.

The group has made several significant contributions to practical tools and methodology in the area. The number of professional publications is significantly high. The number of PhD theses seems quite small.

There is an increasing need for the type of expertise that the group represents. Together with more thematically oriented groups they form a strong combination. Although the entire institute lacks a strong and coherent dissemination strategy, the contacts of this group with the field and stakeholders seem to be strong and guarantee the dissemination of results.

The financial basis of the department is good. The group has to find its funding mainly in contracts and projects with third parties and it has been successful in that aspect. The head of the department is very thinly stretched across numerous important and demanding posts. Several members of the department at the associate and assistant level demonstrate considerable talent and potential.

The percentage of contract-funded research is however very high (80.5%) compared with university-funded and NWO-funded research. Of the examples of projects listed in the self-evaluation, only four continue into 2008 and beyond. Information about strategy development and future plans is minimal in the self-evaluation. This suggests an opportunistic strategy of short-term adaptation to funding conditions that pragmatically may make sense, but which may conflict with the critical mission of the department, which is to help bridge the diverse gaps between academic research on the one hand and policy and planning applications on the other.

A strategic research plan for the SPACE department would help the unit maintain its identity within the broader context of IVM.

5. Utrecht University , Copernicus Institute

The Copernicus Institute for Sustainable Development and Innovation was created in March 2001, based on a joint decision of the Governing Board of Utrecht University, the faculty of Geographical Sciences (nowadays integrated in the faculty of Geosciences) and the faculty of Chemistry (nowadays integrated in the faculty of Science). The following goals were set with the establishment of the institute:

- to increase the visibility of the research at Utrecht University of the groups involved, in the Netherlands and abroad;
- to establish an organisation that facilitates the mutual co-operation within Utrecht University in the area of sustainable development and innovation and creates synergy;
- to advance the coherent execution of research activities within Utrecht University in the area of sustainable development;
- enlargement and widening of the scientific and societal forum regarding current and future research;
- to allow a better tuning between education and research and possibly stimulate new education in the areas Nature and Environment, Energy and Materials, Land use and Biodiversity, Steering and Innovation, and ‘Science, Technology and Society’.

Four groups participate in the institute:

1. Science, Technology and Society (STS), Faculty of Science, Department of Chemistry
2. Environmental Sciences (ES), Faculty of Geosciences, Department of Innovation and Environmental Sciences
3. Environmental Studies and Policy (ESP), Faculty of Geosciences, Department of Innovation and Environmental Sciences
4. Innovation Studies (IS), Faculty of Geosciences, Department of Innovation and Environmental Sciences.

The evaluation in this part of the SENSE review only concerned the research programme “Energy for Sustainable Development” of STS, which is a part of the total research of the STS-group. The STS-group is also involved in the research programme “Land Use, Biodiversity and Ecosystem Functioning” of the ES-group of Copernicus.

The mission of the Copernicus Institute for Sustainable Development and Innovation is formulated as follows:

“The Copernicus Institute investigates and develops processes and opportunities for innovative change towards sustainability. The institute thus seeks to contribute to the development of knowledge and techniques as well as methods and instruments in the field of sustainable development, taking note of related social debates and policy processes.

It is the ambition of the institute to make a difference – in science and education, and in society at large – in the exploration of a sustainable world.”

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Science, Technology and Society: Energy for Sustainable Development	Excellent	Very good	Excellent	Excellent

Programme 25: Science, Technology and Society: Energy for Sustainable Development

Programme director	Prof. dr. W.C. Turkenburg
Research staff 2006	14.86 fte
Assessments:	Quality: Excellent
	Productivity: Very good
	Relevance: Excellent
	Viability: Excellent

Science, Technology and Society is one of the four research groups of the Copernicus Institute. The research group performs disciplinary and multi-disciplinary research and provides education on science and technology for sustainable development, focused on energy, materials and the environment, land use and biodiversity, and managing environmental risks and uncertainties. The ambition of the research group is to make a difference in achieving a new role for science and technology contributing to sustainable development. The approach of this group is to build partnerships and collaborate with researchers and private and public sectors in the development of knowledge and strategies in the indicated fields, locally, nationally and internationally. The research of the group is organized in four sub-programmes:

1. Energy and Materials Demand and Efficiency
2. Energy Supply and System Studies
3. Energy and Global Change: Dealing with Risks and Uncertainties
4. Land Use and Biodiversity.

The sub-programmes 1, 2 and 3 form the research programme Energy for Sustainable Development. Sub-programme 4 is integrated in another research programme (Land Use, Biodiversity and Ecosystem Functioning).

The committee finds the achievements of this group impressive. The group has a strong leader who has been able to stimulate others to reach high standards. The group is internationally leading in the specific subjects of its focus. The researchers are well known and are invited as visiting professors or key lecturers in several countries and universities. The publication record is very good and there is a positive trend in scientific impact. The group is very productive. The members have a clear and coherent vision on the mission of the group as well as on the future perspectives of research.

The research of this group is at the forefront internationally and has an important and substantial impact in the field. The ideas and approaches adopted are original. The publication record is very good. The programme director and the other members of the research group have a prominent role in their field both nationally and internationally.

The productivity of the group is, considering the number of staff, very good. The group produced a number of excellent scientific and professional publications. The number of Phd theses is reasonable.

The relevance of the research by this group is scientifically and socially very high. The dissemination and impact of the knowledge is very good.

In view of the past scientific performance the committee evaluates the long-term viability of the programme as excellent. The group has a clear and coherent vision on the future activities.

This group has several excellent young researchers who can take over the lead and can guarantee a fruitful future of the research group.

6. University of Groningen, Institute IVEM

The Centre for Energy and Environmental Studies IVEM is an independent research and education Centre within the Faculty of Mathematics and Natural Sciences of the University of Groningen. IVEM originates from two predecessor groups working on energy and environmental issues.

IVEM and the RUG Centre for Isotope Research (CIO) jointly offer a two year English-language based MSc degree programme in Energy and Environmental Sciences.

IVEM is a key participant in the Energy Delta Research Centre (EDReC) of the University of Groningen.

Since 2000 IVEM manages the university-wide sustainability project and it is increasingly involved in sustainability-relevant reaching and research activities both within and outside the university.

The dual transition process towards an equitable and sustainable world is at the core of the IVEM research programme entitled: 'Transition towards sustainability and environmental quality'.

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Transition to sustainability and environmental quality	Good	Very good	Very good	Good

Programme 26: Transition to sustainability and environmental quality (RUG-IVEM)

Programme director	Prof. dr. A.J.M. Schoot Uiterkamp
Research staff 2006	5.64 fte
Assessments:	Quality: Good
	Productivity: Very good
	Relevance: Very good
	Viability: Good

The IVEM research programme on Transition to Sustainability and Environmental Quality builds on the notion that human societies use natural resources to meet their needs. Any resource use generates pressures on the environment. Rich western style consumption patterns generally give rise to a higher environmental impact, than those of poor development societies.

The programme is interdisciplinary and rooted in natural sciences and to a lesser extent in social sciences. The programme aims to analyze, design, implement and assess transition routes towards a more sustainable and environmentally compatible societal use of the earth's natural resources. The focus is on basic environmental research with global and long term perspective and secondary attention to applied environmental research.

The strategic choice of this group to focus on the role of consumers is original and innovative, since very little research is done on this side of the problem. The group is regionally oriented and well known in the northern part of the Netherlands. It has a special position within the Groningen University and is often asked to present their vision on actualities. The projects of the PhD students are not limited to the consumer perspective and do not reflect the mission of the group in all aspects. Cooperation in SENSE is very valuable for this group not only for the training of the PhD students but also for the contacts with other research groups in the field of environmental studies in the Netherlands. The group seems somewhat isolated in the north of the country and could benefit more from national cooperation.

The quality of the research is good. The focus on the consumers is original. The group contributes to scientific development in the field, but is mainly nationally and regionally focused. The number of publications in A-category journals has increased considerably in the last year.

The productivity of the group is very good. In the interview with the committee the programme director mentioned that the group is often asked to comment and advise on actual issues. That kind of productivity is not described in the SEP protocol but is considered valuable by the committee.

The social and scientific relevance of the research of this group is very high. This is also demonstrated by the regional function this group seems to have in commenting on actual issues and developments in the field.

The institute is very small. Especially the small number of senior and tenured staff makes the institute vulnerable. On the other hand the institute is strongly supported by the university through its funding. The group has, in view of its size, a considerable number of good and promising PhD students. Participation in SENSE is very valuable for this group. The committee recommends extending the co-operation with other research groups in SENSE.

7. Maastricht University , Institute ICIS

The International Centre for Integrated Assessment and Sustainable Development ICIS is a research institute within Maastricht University. It is a self-supporting business unit reporting to the Dean of the Faculty of Humanities and Sciences.

ICIS started in 1998 and developed into an international expertise centre for the integrated assessment of sustainable development. ICIS started with a team of 5 people, and expanded to 35 fte around 2001. For the last three years ICIS has a research staff of 21 people. In 2004 the founder of ICIS, prof. Rotmans left and was succeeded by prof. Martens. Since then the research focus is on developing Integrated Assessment methods and tools to address key sustainability issues.

The projects are funded by a variety of organisations for example the Netherlands Organisation for Scientific Research (NWO), the European Commission (EU) and private companies.

The institute has no permanent funding from university and is totally relying on external funds, especially contract money. All projects of this group start from the position or the view of the stakeholder.

The committee assessed the following programmes:

	Quality	Productivity	Relevance	Viability
Integrated Assessment and Sustainable Development	Good	Very good	Very good	Good

Programme 27: Integrated Assessment and Sustainable Development (UM-ICIS)

Programme director	Prof. dr. P. Martens
Research staff 2006	10.26 fte
Assessments:	Quality: Good
	Productivity: Very good
	Relevance: Very good
	Viability: Good

ICIS has a strong methodological focus. The core activities are the development and improvement of integrated assessment (IA) methods, tools and procedures in support of sustainable development practice. Current methodologies are participatory methods, scenarios, indicator analysis and IA modelling techniques. The selection of topics reflects the priorities and research agendas of national and international research programmes.

The committee has the impression that the programme has been strong but suffered (not in output but in size) from the departure of two of the three senior researchers. The group consists at this moment of young and mostly junior researcher. This group benefits a lot from the SENSE Research School especially for the PhD students and their training. The director has good contacts with other research groups within SENSE. The Committee even discussed the option of this group joining some other group within SENSE with a similar focus on methodologies. If this is not feasible, at least strengthening the cooperation further is strongly recommended.

Due to the necessity to fund the research by external contracts the focus of the research group is wide and lacks some coherence. The number of priority themes listed is high for such a small group. The group has, however, been successful in attaining all these contracts and projects. The quality of the research is good but not exciting. The relative impact of the publications is according to the criteria used far above world average. The prominence of the programme director is very good.

Considering the number of staff the productivity of the research group is very good, it is far above world average. The number of defended PhD theses can however be improved. Publications records seem to have a declining trend in quality, judging from the relative impact and the number of A-category articles.

The research is socially and scientifically very relevant, but not unique.

The committee has the impression that this groups depends too much on one person: the programme director. The committee did not get a clear picture of the other senior researchers in this group. The PhD students, however, who presented their projects to the committee, made a good impression.

Because of the dependence on external funding and of the reliance on the programme director, the programme as a whole seems vulnerable. Therefore, the committee strongly recommends strengthening the contacts with other research groups in SENSE.

Appendix 1: Curricula Vitae of committee members

Dr. Lea Kauppi, Director General of the Finnish Environment Institute (SYKE), Helsinki. Sustainable development, climate change, transboundary water questions, integrated assessments, science policy.

Prof. Thomas B. Johansson, Professor of energy systems analysis and Director of the International Institute for Industrial Environmental Economics (IIIEE) at the University of Lund, Sweden. Dr. Johansson obtained his Ph.D. in nuclear physics from the Lund Institute of Technology. From 1994 to 2001, he was Director of UNDP's Energy and Atmosphere Programme. He served on the Editorial Board of the World Energy Assessment, 1998-2000. In 2000, he was awarded the Volvo Environment Prize, along with three of his colleagues for the book *Energy for a Sustainable World*.

Prof. William Lafferty, University of Oslo, Centre for Development and the Environment. Research director for the programme ProSus. He is certified as professor in both political science and sociology, and has recently focused his research on problems related to the strategic implementation of sustainable development. His publications cover themes on the nature of sustainable development as concept and goal; democracy and the environment; sustainable communities; governance and sectoral policy integration; and strategies for "green innovation" in business. Lafferty has led several international projects in the field of sustainable development research, including a 12-nation project on "Sustainable Communities in Europe" (SUS-COM) for the European Commission, and a 9-nation project on "Implementing Sustainable Development in High-Consumption Societies (COMPSUS) - with James Meadowcroft. He was for many years Norway's delegate to the Governing Council of the International Political Science Association (IPSA), and served as Program Chair for the XVIII World Congress of Political Science in Quebec in the year 2000.

Appendix 2: Overview of Scores

Table 1: Overview of scores

	Quality	Productivity	Relevance	Viability
23. Environmental Systems Analysis Group, WIMEK-WUR	Excellent	Excellent	Excellent	Excellent
24. Department of Spatial Analysis and Decision Support, IVM -VU	Very good	Very good	Very good	Very good
25. Energy for Sustainable Development, Copernicus Institute UU	Excellent	Very good	Excellent	Excellent
26. Centre for Energy and Environmental studies, IVEM – RUG	Good	Very good	Very good	Good
27. Centre for Integrated Assessment and Sustainable Development, ICIS - UM	Good	Very good	Very good	Good

Table 2: SEP-scale; the meaning of the scores

Work that is at the forefront internationally, and which most likely will have an important and substantial impact in the field. Institute is considered an international leader.	Excellent (5)
Work that is internationally competitive and is expected to make a significant contribution; nationally speaking at the forefront in the field. Institute is considered international player, national leader.	Very good (4)
Work that is competitive at the national level and will probably make a valuable contribution in the international field. Institute is considered internationally visible and a national player.	Good (3)
Work that is solid but not exciting, 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 nationally visible.	Satisfactory (2)
Work that is neither solid nor exciting flawed in the scientific and or technical approach, repetitions of other work, etc. Work not worthy of pursuing.	Unsatisfactory (1)

Appendix 3: Schedule

Integrated Assessment, Sustainable Systems Analysis and Spatial Management committee (ISS)

SUNDAY 17-06-2007	
xx.xx – 15.00	ARRIVAL NH Centre Utrecht, Janskerkhof 10, Utrecht, Tel. +31.30.2313169
15.00 – 15.30	WELCOME
15.30 – 16.00	QANU: General introduction on the assessment and the review programme
16.00 – 16.30	SENSE: General introduction SENSE, with emphasis on the 3 different assessment levels: research groups; SENSE institutes and SENSE Research School
16.45 – 18.30	Internal RC meeting
19.00 – 21.00	DINNER
21.00 – 22.00	(meeting chairs)
MONDAY 18-06-2007	
XXXX – 09.30	Utrecht
09.30 – 10.30	Internal RC meeting
10.30 – 11.30	Presentation and discussion Department of Spatial Analysis and Decision Support (SPACE-IVM/VU) nr. 24
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Science, Technology and Society Group (STS- Copernicus/UU) nr. 25
14.00 – 15.00	Presentation and discussion Center for Energy and Environmental Studies (IVEM-RUG) nr. 26
15.15 – 16.45	PhD poster presentations (SPACE, STS, IVEM) and discussion
17.00 – 18.00	Internal RC meeting
18.00 – 20.00	Dinner
TUESDAY 19-06-2007	
XXXX – 09.30	Utrecht
09.30 – 10.30	Internal RC meeting
10.30 – 11.30	Presentation and discussion International Centre for Integrated Assessment and Sustainable Development (ICIS-MU) nr. 27
11.15 – 12.00	
11.30 – 12.00	Internal RC meeting
12.00 – 13.00	Lunch break
13.00 – 14.00	Presentation and discussion Environmental Systems Analysis Group (ESA-WIMEK/WU) nr. 23
14.00 – 15.00	PhD poster presentations and discussion
15.15 – 16.45	Internal RC meeting
17.00 – 18.00	Internal RC meeting / closure
18.00 – 20.00	Dinner
20.30 – 21.30	
	(chairs meet in General Committee, Wednesday 9:00 hrs)