

Academic Environmental Teaching at Utrecht University

Multidisciplinary bachelor's and master's programmes and the links
between research and teaching

Carel Dieperink & Peter P.J. Driessen¹

1. Introduction

This paper describes the programmes in Environmental Studies and Environmental Sciences offered at Utrecht University. Both programmes are structured in accordance with the uniform format for higher education in Europe and consist of two phases: a broad bachelor's degree in Environmental Studies or Environmental Sciences, lasting three years; and the research master's degree in Sustainable Development, taking two years. The bachelor's degree programmes were started in 2001, the master's in 2003. Both bachelor's programmes attract about 20 students a year. The master's programme in Sustainable Development has an annual influx of about 45 students.

Several of the bachelor- and master-level courses are taken by students from other disciplines. In this way, the programmes play a role in the 'greening' of the curricula. This greening was made possible by the introduction of an overall teaching concept for all of the bachelor's degree programmes at Utrecht University. As a result of this concept, all bachelor's and master's programmes at Utrecht University have some characteristics in common.

The master's programme on Sustainable Development has a strong link with the research programme on environmental issues, which is organised by the Copernicus Institute for Sustainable Development and Innovation.

2. General characteristics of bachelor's and master's degree programmes

Utrecht University offers 47 bachelor's degree programmes and 169 master's degree programmes in science, social science, and the humanities that focus on academic and career development. Learning is self-directed, and much attention is given to the development of academic skills. Within the new teaching system, students work more explicitly and consciously on their academic development; they are given greater personal responsibility for their studies.

¹ Copernicus Institute of Sustainable Development and Innovation, Utrecht University, P.O. Box 80.115, 3508 TC Utrecht, The Netherlands, e-mail: c.dieperink@geog.uu.nl, p.driessen@geog.uu.nl.

Most bachelor's degree programmes are in Dutch. To receive a bachelor's degree, students have to take 24 courses: a major programme of 18 courses of 7.5 ECTS each and a free choice of six elective courses. The major is the main curriculum of the bachelor's degree programme and consists of obligatory courses and major-bound electives. Students may freely select courses from other bachelor's programmes they are interested in. If they choose at least four courses in one discipline, this package may be listed on their diploma as a 'minor'. In order to make free choice feasible, Utrecht University aims at a uniform system of two semesters, each divided in two periods. Each course is given on specific days of the week according to a fixed time slot. After finishing their bachelor's programme, students can continue their studies in a one- or two-year master's programme. Most of these programmes are in English. Students may opt for a professional or a research master.

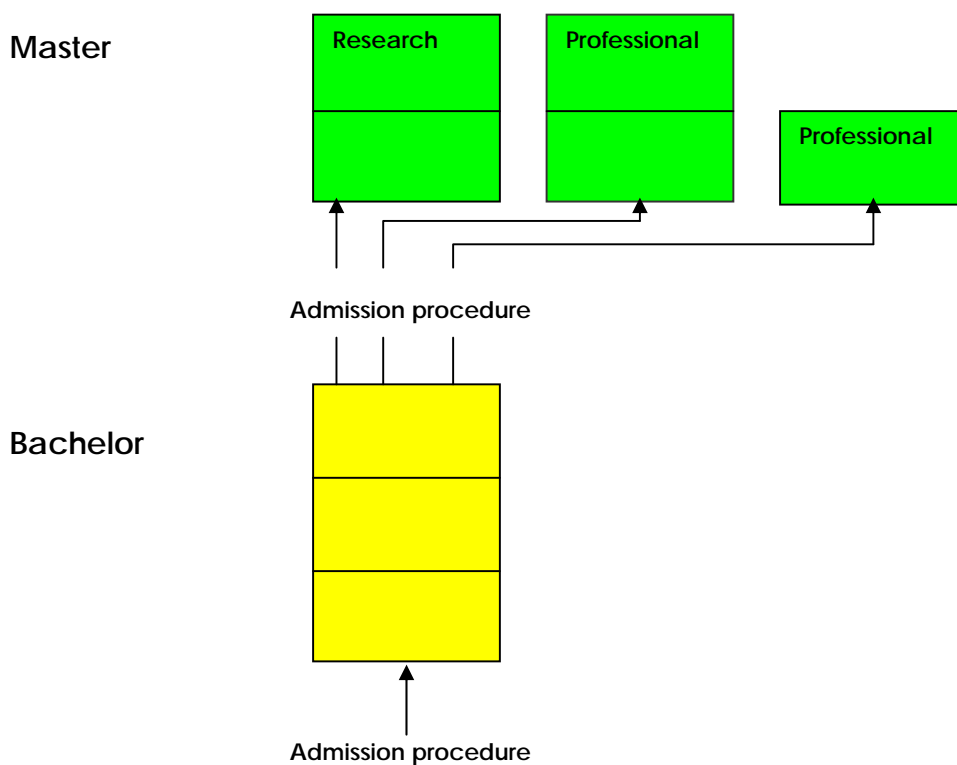


Figure 1: The educational system of Utrecht University

Interactive small-group learning is the guiding educational concept. This implies that students work in small groups on a specific topic and present the results of their analyses to each other. Mutual learning is stimulated in this way. The programme is also problem-oriented. 'Problem-oriented education' takes a concrete problem as the point of departure for the learning process. The acquisition of knowledge and skills is related to the analysis and/or solution of the problem in question. 'Activating education' is a form of teaching whereby the students themselves are largely in control of the learning process. They take their education into their

own hands by doing individual or group assignments, taking part in debates or simulation games, and applying the methods they have learned. A proactive educational format calls for intensive back-up on the part of the instructor in the form of study guidelines, instructions, manuals, and feedback on the students' performance.

A main component of the bachelor's degree programme is building academic skills: that is, developing scholarly techniques that are transferable to other settings. Specifically, students learn to analyse, argument, report, co-operate, and present their findings on an academic level. Their progress is assessed by means of a portfolio, a file assembled by the students themselves. It consists of their papers and the assessments made by the teachers as well as their own reflections on their achievements and learning process.

In order to help students plan their studies, especially in the bachelor phase, a group-wise tutor system is set up. Each group periodically discusses study planning and other issues with a staff member who acts as a tutor, a personal supervisor. The tutor also plays a role in the advice the students get after the first semester on whether a continuation of their major is recommended or not.

To stimulate continuous learning and active participation, the students are tested at multiple points during a course. Thus, the final evaluation for a course does not depend solely on a final exam. In general the final mark they get is based on at least three assignments (a paper, a test, a presentation etc.). As a rule, there are opportunities for feedback and improvement, depending on how the course is designed. The weighted average of the assignments should at least be 5.5 (on a scale from 1 to 10). Students with weighted averages ranging from 4.5 to 5.5 have one option to do an extra assignment in order to raise their final mark to 5.5. Resits are no longer possible.

3. Bachelor's Degree Programmes in Environmental Sciences and Environmental Studies

Main characteristics of the programme

Although the bodies of knowledge underpinning the two programmes differ, both put emphasis on the multidisciplinary character of the study. The bachelor's degree programmes in Environmental Sciences and Environmental Studies attract students with ample interest in the (social) scientific aspects of environmental issues and policies and who are willing to broaden their views and co-operate with students from the other discipline.

The programme for a major in Environmental Sciences focuses on the scientific analysis of environmental problems (defined as a friction in the relationship between society and the environment) and on the development of strategies to mitigate these problems. The major focuses on the analysis of causes and the development of models as a means to steer societal change in the direction of sustainable development.

The major in Environmental Studies concentrates on the social-scientific analysis of complex processes of societal change related to the aims of sustainable development. Besides the critical

analysis of these processes, the programme also covers the management of societal change and the role of innovations, project management and, knowledge management.

Admission procedure

Students with a college-preparatory secondary-school diploma are allowed to enter the programme. These students have at least a basic knowledge of mathematics and English. Students who want to enter the Environmental Sciences programme should also have taken high-school courses in chemistry, physics, or biology. High-school students are familiarised with the programme through open days and the Internet, for instance by the short films posted on several popular youth sites (e.g., www.kennisnet.nl).

Most courses in both bachelor's programmes are also open to external students, provided they meet the entry requirements (which in general are more strict for the natural-science courses than for the social-science courses). This offers them an opportunity to 'green' their curriculum. In practice, most of the external students are enrolled in curricula in human and physical geography, biology, physical planning, law, liberal arts & sciences, and science & innovation.

Mission

The aim of the bachelor's degree programmes is expressed in the following mission statement:

To educate students in the key concepts of and methods used in the environmental debate and to train them to participate in this debate on an academic level.

This mission statement is elaborated in more specific educational targets that can be found in appendix 1. In general, the environmental sciences have a multidisciplinary character. This implies that the programme in Environmental Sciences aims at an integration of knowledge from scientific disciplines like earth sciences – including physical geography, chemistry, hydrology, biology, toxicology, mathematics and physics. In the Environmental Studies major, the aim is to confront the students with knowledge from the policy sciences, sociology, human geography, physical planning, economics, and law. Apart from this, through co-operation with each other, the students should develop a broader view of the field and look beyond the borders of natural and social science while developing an attitude towards the integration of knowledge. The major programme prepares students for their future studies and career. Therefore, the curriculum is aimed not only at the transfer of knowledge but also at the development of academic skills. The students are trained to take an academic attitude and are acquainted with scientific approaches and instruments as well as with the broader philosophical and societal context of the discipline. The traditional approach to teaching – lectures and literature study – is supplemented with more activating elements like small-group debates, group papers and presentations, and computer labs. During all courses, students have the opportunity to improve their academic skills by debating and by writing and presenting papers in order to meet the requirements of their portfolios.

Content of the programmes

Figure 2 gives an overview of the majors in Environmental Sciences and Environmental Studies. Both majors consist of ten required courses (75 ECTS) and eight major-bound

optional courses (60 ECTS). Apart from this, students have a free choice of six electives. During the first year of the curriculum, the students take introductory courses (level 1). The second year is comprised mostly of context courses (level 2). In the third year, the students may opt for a specialisation on the theme of Environment and Land Use or on the theme of Environment, Production, and Consumption (level 3). Students finish their studies with a bachelor's thesis.

The general part

All students have to take courses in which they study and elaborate basic concepts and methods that are used in the environmental debate. The following courses belong to this general part:

1. Introduction to Environmental Sciences and Environmental Studies
2. Sustainable Development
3. Environmental Research Methods
4. Multidisciplinary environmental research project

Context courses

The implication of the multidisciplinary character of both Environmental Sciences and Environmental Studies is that environmental issues and strategies are placed in a broader scientific context. In order to achieve this, the curricula offer several context courses. Some of these courses are compulsory while others are optional. The context courses for students in Environmental Sciences are chemistry, biology, physics and environmental toxicology or technology assessment. Historical and philosophical aspects are dealt with in optional courses on the history of science, the philosophy of science, or the environment, population and resources. Two courses – one called Environment, Society, and Policy, the other called Environment, Behaviour, and Communication – familiarize the students with the societal context of environmental issues. Students in Environmental Studies take context courses in the philosophy of science, environmental law, sociology, environmental economics, and public administration.

Specialisation

Students in Environmental Sciences opting for the theme of Environment and Land Use take the following courses: Integrated Water and Soil Management; Nature Conservation; Hydroecology; and Environmental Impact Assessment. If they want to specialise in the theme of Environment, Production, and Consumption, they take the following courses: Environmental and Chain Management; Life Cycle Analysis and Technology Assessment; Energy Analysis; and Physics. They can continue this specialisation in the track called Land Use, Environment, and Biodiversity or in the track called Energy and Resources, both part of the master's programme in Sustainable Development. If students in Environmental Studies opt for the theme of Environment and Land Use, they take the following courses: Urban and Rural Environment; Environmental Impact Assessment; and Spatial law. Those who choose the theme of Environment, Production, and Consumption take the following courses: Environmental Management; and Lifecycle Analysis and Technology Assessment.

Required courses Environmental Sciences	Level	Required courses Environmental Studies	Level
<i>Introduction to environmental sciences and studies</i>	1	<i>Introduction to environmental sciences and studies</i>	1
<i>Sustainable development</i>	1	<i>Sustainable development</i>	1
<i>Research methods</i>	1	<i>Research methods</i>	1
Ecology and soil science	1	Environment, population and resources	1
Hydrology and air pollution	1	<i>Environment, society and policy</i>	2
Mathematics	1	Environmental law	2
<i>Environment, society and policy</i>	1	International environmental policy	2
Environmental systems analysis and models	2	Evaluation and design of environmental policy	2
Scientific research methods	2	Social scientific research methods	3
<i>Multidisciplinary environmental research project</i>	2	<i>Multidisciplinary environmental research project</i>	3
Major-bound optional courses (1 of 3)		Major-bound optional courses (2 of 4)	
<i>Technology assessment</i>	1	<i>Technology assessment</i>	1
Biology 1	1	Public administration	1
Chemistry 1	1	Physical planning	1
(1 of 2)		Human geography	1
<i>Philosophy of science</i>	2	(2 of 4)	
History of science	2	<i>Philosophy of science</i>	2
(1 of 3)		Environmental economics	2
Environmental toxicology	2	Environmental sociology	2
Environment, behaviour, and communication	2	Physical law	2
Physics 2	2	(3 of 4)	
(4 of 6)		<i>Environmental impact assessment</i>	3
<i>Environmental impact assessment</i>	3	<i>Environmental and chain management</i>	3
<i>Environmental and chain management</i>	3	Life cycle analysis and technology assessment	3
Eco-hydrology	3	Urban and rural environment	3
Energy analysis	3		
Integrated water and soil management	3		
Nature conservation	3		
(1 of 3)		(1 of 3)	
Bachelor thesis Environment and Land Use	3	Bachelor thesis Environment and Land Use	3
Bachelor thesis Environment, Production, and Consumption	3	Bachelor thesis Environment, Production, and Consumption	3
Bachelor thesis free choice	3	Bachelor thesis free choice	3

Figure 2: The curricula in Environmental Sciences and Environmental Studies (shared courses in italics)

Bachelor's thesis

The students finish their studies by preparing their bachelor's thesis. They are advised to write a thesis in line with their specialisation in one of the two themes. Another possibility is to write a thesis on an environmental topic of the student's own choice. This choice has to be approved by the committee for the exams. The thesis may consist of:

- a critical review of some scientific publications (e.g. PhD theses);
- a thesis to answer a specific research question;

- an elaborated research proposal;
- a scientific essay;
- a policy design.

Multidisciplinary courses in the bachelor's degree programme

In four required courses, the students are trained to develop a multidisciplinary attitude. In these courses, students of Environmental Sciences and Environmental Studies work together on common assignments. In multidisciplinary teams, they analyse issues or develop strategies to mitigate them. Ideally, group work fosters mutual learning among the group members. During the group work, students can learn from each other. They get better insight not only in the characteristics and possible contributions of other disciplines but also in the complexity of co-operative processes. Student assistants or PhD students guide, observe, and assess the group processes. Guidelines for work processes and products are provided in the course manuals or in the general portfolio manuals. In the course *Introduction to Environmental Sciences and Studies*, the students get working-group assignments in which they have to discuss how different environmental disciplines have contributed to research on a number of environmental case-studies. They have to analyse and integrate information from different sources on the cause-effect chain with reference to soil pollution and to analyse the environmental impacts of various activities in society. They conclude the course with a role-playing exercise on the planning of power facilities.

The course *Sustainable Development* deals with water issues and climate change in an interactive way using models. In the course *Research Methods*, the students become familiar with research design, data collecting, and analysing methods of social science and natural science. The students are split in four multidisciplinary subgroups. Each subgroup has to conduct its own research project: an impact assessment of changes in bus routes in the city of Utrecht; or an assessment of the quality of a recreation area, the water quality of a lake, or the ecological quality of a peat fenland. However, all students are involved in the data collection for all four projects. Besides conducting two surveys, the students participate in joint fieldwork to collect water quality samples and to monitor vegetation. During the *Multidisciplinary environmental research project* (level 3), the students co-operate in drafting a plan to improve either the environmental performance of the carpet industry or the drinking water supply of Amsterdam. These analyses are based on document study and on interviews with key stakeholders.

4. Master's Degree Programme in Sustainable Development

Main characteristics of the programme

The master's degree programme is entitled 'Sustainable Development'. It is taught in English and has highly selective admission requirements.

The main focus of this master's programme is the scientific analysis of the complex processes of change related to the pursuit of a sustainable society. Besides a critical analysis and evaluation of these processes, the programme also deals with the various means by which societal and/or technological changes can be implemented. These issues are viewed from a

multidisciplinary perspective. The programme comprises elements of the natural and social sciences. In an intensive programme, the students learn to apply scientific instruments in the areas of analysis, evaluation, and design. In addition, they become familiar with practical strategies for intervention. The programme devotes ample attention to the international dimension of sustainability issues.

Students enrolled in this programme should be interested in the issue of sustainable development. Moreover, they should be willing and able to analyse and evaluate complex processes from a multidisciplinary perspective.

Admission procedure

Any student who is interested in taking the master's programme has to go through an admission procedure. The Admissions Board plays a key role in that procedure. This Board is in charge of admitting students to the programme. Admission takes place according to a procedure that is established beforehand and is made public. This procedure is described in the Rules on Teaching and Examination. The deadlines for submitting applications for admission are announced each year on the website.

A student will only be admitted to the programme after earning a bachelor's degree (or its equivalent). This applies to all students, Dutch and foreign alike. For students who wish to be admitted but are not eligible for direct access, a decision will be made on a case-by-case basis to determine whether there are sufficient grounds for admission. These decisions will be based largely on the kind of prior education as well as on the student's motivation and talent. The minimum capacities that are required concern research skills, a basic level of knowledge in either the social or the natural sciences, and some general insight in sustainability issues and intervention strategies (from a social-science or a natural-science perspective). Moreover, foreign students should be able to communicate in proper English. They should have satisfactory results on the internationally recognised TOEFL test.

Students from institutions of higher professional education (in the Netherlands called HBO) may also be admitted. In any case, these applicants should have a relevant bachelor's degree. Each application will be reviewed to determine if there are sufficient grounds for admission. The minimum capacities mentioned above are also important criteria for students with a professional degree. When considering their applications, the Admissions Board may call for a supplementary load of courses from the bachelor's programmes. As far as possible, these would be part of the programmes in Environmental Studies and Environmental Sciences. By taking this supplementary package, the student would be able to meet the requirements for intake. In that case, optional courses can be designated for making up deficiencies.

Mission

The mission statement encapsulates the aims of the master's programme in Sustainable Development:

To educate scientists who will be able to make a substantial contribution to the transition to a sustainable society through their scientific research and their skills in the area of societal interventions.

The educational targets derived from this mission statement are elaborated in Appendix 2.

Sustainable development requires a process of change in which a balance is achieved among ecological, technological, economic, and social-cultural values, from the local to the global scale, in both the short and the long term. Academics can play an important role in this transition by integrating knowledge. First of all, the integration of knowledge is needed in order to analyse, describe, and explain sustainability issues (in terms of cause and effect) and place these issues in their societal context. Secondly, knowledge integration plays a role in the generation, assessment, and implementation of measures that make a transition to that sustainable society possible. Graduates with a master's degree in Sustainable Development can take various positions in research institutes, government, companies, and organizations in civil society.

The master's programme is classified as a 'research master'. It prepares students for a PhD study, ultimately leading to professions in scientific research. Graduates of the programme must be capable of writing a PhD dissertation. This competence profile is achieved in the following way:

- The programme devotes extensive attention to scientific theories (paradigms), theory building, and methodology.
- Students in the programme learn to apply scientific instruments for analysis, evaluation, and design, using them in an intensive and critical manner. They learn to use these tools during the fieldwork phase but also in other modules. In addition, students develop a research attitude, focused on accuracy, originality, critical thinking, creativity, etc.
- The assignments give students the opportunity to learn how to work in multidisciplinary teams.
- Students become acquainted with practical intervention strategies.
- Students write a master's thesis that is intended to generate new scientific knowledge.

The societal orientation of the master's programme makes it a good starting point for positions that do not directly involve scientific research. Graduates might find employment in the private sector, the public sector (national, regional, and local government), consultancy bureaus, and NGOs. In the course of their career, the graduates should be able to fill managerial positions, notably with respect to the integration of knowledge and policy and in the field of change management (particularly of complex processes of societal change). The graduates are also qualified for good jobs in the international market (EU, NGOs).

Content of the programme

In the first part of the programme, which is compulsory for all students, issues of sustainable development are discussed from a variety of standpoints. Students learn about the approaches used by both natural and social scientists and they have to work in multidisciplinary teams. In the second part of the programme, students choose a specialisation. The programme consists of three different tracks, allowing students to specialize in a natural-science or social-science profile, depending on their undergraduate education.

- Energy and Resources (natural sciences)
- Land Use, Environment, and Biodiversity (natural sciences)
- Environmental Policy and Management (social sciences)

Each track devotes attention to the theoretical background, research methods, and intervention methods. The student can broaden or deepen that basis in the room left in the curriculum for optional subjects. Students may fill that room with subjects that form part of the other tracks (where possible, taking the prerequisite prior knowledge into account). Alternatively, they can use the room to go into their own track in greater depth.

The programme culminates in a thesis. A research traineeship may form part of the final thesis project. After the thesis has been completed, the student must present the outcomes to the faculty staff and fellow students. In each case, a different student will be called upon to serve as discussant. The structure of the programme is set forth in Figure 3.

The student must have passing marks for all parts of the master's programme. The coursework is tested by having the student write papers, do assignments, and/or take an exam, which in some cases may be oral. The final research assignment is evaluated by the instructor who supervised the project, along with another instructor who does not bear direct responsibility for the supervision of the project.

Sustainable Development: the natural-science perspective (7.5 ECTS)		
The Sustainability Challenge (7.5 ECTS)		
Track A Energy & Resources (37.5 ECTS)	Track B Land Use, Environment & Biodiversity (37.5 ECTS)	Track C Environmental Policy & Management (37.5 ECTS)
Optional Courses (15 ECTS)		
Assessment of Sustainable Practices (7.5 ECTS)		
Master's Thesis Track A (45 ECTS)	Master's Thesis Track B (45 ECTS)	Master's Thesis Track C (45 ECTS)

Figure 3: Structure of the master's programme in Sustainable Development

The general part

The purpose of the general part of the curriculum – the part that each student is required to take – is to provide all of the students with the same scientific foundation on which they can build in the rest of their study.

The general part consists of the following courses:

1. Sustainable development: the natural-science perspective (7.5 ECTS)
2. The sustainability challenge (7.5 ECTS)
3. Assessment of sustainable practices (7.5 ECTS)

Multidisciplinary courses in the master's degree programme

In three obligatory courses students are trained to develop a multidisciplinary attitude towards sustainability issues. In these courses, science and social science students work together. The course *SD – The Natural-Science Perspective* gives students a general overview of the concept and content of Sustainable Development, including its history and attempts to operationalise this concept. Other topics in this course are the following: the role of knowledge, especially in the natural and engineering sciences, and the meaning of uncertain knowledge; formal modelling approaches and methods to capture sustainable development and the contribution of various scientific disciplines to model building; the consequences of interdisciplinarity and uncertainty on the operationalisation and implementation of sustainable development initiatives. The second course, entitled *The Sustainability Challenge*, takes a social-science perspective. This course is directed towards governance issues. Governance denotes the ability to create organisational, procedural, and formal frameworks that allow the parties involved (the state, business and civil society) to move forward on issues of sustainability. Starting from a discussion on the concepts of sustainable development and governing, the course analyses the architecture and functioning of various modern forms of governance. Furthermore, various fundamental issues are discussed: the relation between science and social science, between the environment and democracy, and between the environment, development and globalisation. In the third course, *Assessment of Sustainable Practices*, the leading perspective is 'evaluation'. Assessment of the sustainability of activities is one of the key issues in the debate about sustainable development. Sustainability assessments are made to evaluate the degree of sustainability, either of ongoing activities (retrospective or ex post evaluation) or optional future activities (prospective or ex ante evaluation). For both types of assessment, the students need the knowledge and skills to perform diverse tasks: to analyse complex sustainability issues; to develop and apply sustainability indicators; to apply methods to evaluate and integrate indicator values; and to generate and evaluate options for transitions.

Track A - Energy and Resources

The track Energy and Resources deals with the analysis of energy systems and materials systems. The object of study is the production and consumption of energy and materials in society. One research direction is to describe and explain historical developments; another looks toward the future and identifies possible technological and societal developments. An important research priority concerns the possibilities for sustainable development within these systems. To a large extent, this track makes use of a conceptual framework derived from the natural sciences, though it also uses knowledge and methods derived from the social sciences. Graduates will be able to apply the knowledge, methods, and techniques of the natural sciences, and to a lesser extent those of the social sciences as well. They will use them when analysing energy systems and materials systems and the possibilities for a sustainable development of these systems. Furthermore, graduates will have insight in the importance of

both the natural-science and the social-science analysis of sustainability issues and will have the skills needed to work in a multidisciplinary team.

The curriculum of Track A consists of the following elements:

- Energy and resource policies (7.5 ECTS)
- Energy conversion and environmental technology (7.5 ECTS)
- Research methods for energy and resources (7.5 ECTS)
- Consultancy project (15 ECTS)
- Master's thesis (45 ECTS)

Track B – Land Use, Environment, and Biodiversity

The track Land Use, Environment, and Biodiversity is a multidisciplinary natural-science programme. It is concerned with the interaction between land use and the quality of the physical and biotic environment. The multidisciplinary character of the programme shows up in the integration of knowledge from the fields of physical geography, hydrology, landscape ecology, toxicology, mathematics, physics, and chemistry. Some of the relevant priority areas are the following: land use; dispersal of substances in water, soil, and air; impacts on ecosystems and biodiversity; possibilities for remediation; and the value assigned to the quality of nature and the environment.

Graduates will be able to apply the knowledge, methods, and techniques (for instance, mathematical simulation models) of the natural sciences in an effort to improve the quality of the environment and biodiversity by way of changes in land use. Furthermore, graduates will have insight in the importance of conducting social-science analyses of sustainability issues and will have the skills needed to work in a multidisciplinary team.

The curriculum of Track B consists of the following elements:

- Themes in land use, environment, and biodiversity (7.5 ECTS)
- Ecosystem modelling (7.5 ECTS)
- Research project (22.5 ECTS)
- Master's thesis (45 ECTS)

Track C - Environmental Policy and Management

The track Environmental Policy and Management is a multidisciplinary social-science programme dealing with environmental issues and environmental policy. The multidisciplinary character shows up in the efforts to confront and integrate knowledge from the fields of policy science, sociology, human geography, planning, economics, and law. The programme is concerned with issues surrounding the management of sustainable development. The students are taught the research and intervention skills that they will need in the practice of their profession.

Graduates will be able to apply concepts, paradigms, and theories from the social sciences to analyse and explain issues of sustainable development and to design socially acceptable solutions for those issues. Furthermore, graduates will have insight in the importance of conducting natural-science analysis of sustainability issues and will have the skills needed to work in a multidisciplinary team.

The curriculum of Track C consists of the following elements:

- The sustainability challenge B (7.5 ECTS)
- International seminar (7.5 ECTS)

- Interactive methods (7.5 ECTS)
- Policy analysis (7.5 ECTS)
- Research methodology (7.5 ECTS)
- Master's thesis (45 ECTS)

Master's thesis

The master's thesis is a research project in which the student learns to conduct independent research, whereby new methods are developed and/or applied or existing methods are applied to a new problem. The research should be relevant from both a scientific point of view (it should expand the body of scientific knowledge) and a societal point of view (it should produce knowledge that can contribute to a better understanding or the solution of a problem). In total, the master's thesis research counts for 45 ECTS.

The programme co-ordinator keeps a file of possible topics for the research project. The research project may be carried out within university departments. All or part of the research may be carried out at a university outside the Netherlands, at other research institutes, or at consultancy firms, government agencies, etc. The supervision must be in the hands of an experienced researcher.

At the beginning of the project, a project plan should be made. This plan must include personal data, the background of the research, the problem definition and research question(s), theoretical approaches and analytical methods to be used in the project, a work plan (including time schedule), and an overview of the relevant literature.

The project is prepared by the student and is agreed upon with the supervisors. The project plan can be seen as a contract between the student and the supervisor(s). The project plan has to be approved by a professor or associate professor.

Internship

Students are offered the opportunity to do an internship in the stage of study dedicated to their thesis research. For instance, they may be trainees in tiers of government, research organisations, consultancy bureaus, NGOs, or companies. An internship is always part of a student's thesis research and thus constitutes 'research training in the field'. Arrangements for traineeships are made through the programme co-ordinator. The thesis supervisor must approve any arrangements for an internship beforehand.

There are several advantages of writing a thesis on the basis of research done during the internship. First of all, this is an opportunity to investigate problems that arise in everyday practice. Secondly, doing an internship broadens one's academic horizon. New insights can be gained and applied on the work floor. Thirdly, an internship is an opportunity to become acquainted with the practices one will later encounter in the profession.

Staff at both Utrecht University and the host organisation will supervise the trainee. On behalf of the university, the instructor who is supervising the thesis will be in charge of the internship; this instructor will also be the contact person for the organisation hosting the student. On behalf of the host organisation, an internship mentor provides supervision. This individual is primarily involved in the daily supervision (familiarising the student with the organisation, its working methods, objectives, and environment) as well as supervision at a more personal level (acting as confidant). The most important task of the university staff member in the

supervision of the internship is to monitor the methodology, content, and theoretical aspects of the research.

5. Research Institute and PhD programme

The master programme on Sustainable Development has a strong link with the research programme on environmental issues. This research programme is organised by the *Copernicus Institute for Sustainable Development and Innovation*. The Copernicus 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. 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. Within the Copernicus Institute there is specific attention for:

- Energy and materials demand and efficiency;
- Possibilities for a more sustainable energy supply;
- Land use, biodiversity, and ecosystem functioning;
- Innovation: systems, processes and policies;
- Governance for sustainable development;
- Integrative models and methods and the management of risks and uncertainties.

The Copernicus Institute houses a wide range of disciplines, with researchers from the natural and social sciences. There is input from the fields of physics, chemistry, biology, technology, economy, ecology, hydrology, soil science, geography, environmental sciences, innovation science, sociology, policy science, business studies, and the philosophy of science. Additional input is also guaranteed by the close relationship the institute has with the National Institute for Public Health and the Environment (RIVM) through two endowed chairs occupied by the director and a senior researcher of the RIVM at the Copernicus Institute. The researchers of the Copernicus Institute are also engaged as lecturers in the teaching programmes.

Within the Copernicus Institute sustainable development is broadly defined, in line with e.g. the report of the World Commission of Environment and Development (Brundtland report, 1987), the outcome of the United Nations Conference on Environment and Development (Rio de Janeiro, 1992), and the World Summit on Sustainable Development (Johannesburg, 2002). Consequently, striving for economic prosperity is as legitimate as striving to protect nature and the environment and striving for social justice, both across generations and within them. For each dimension of the issue of sustainable development – economic, social and ecological – there are questions about which values, goals, and principles are to be used, as well as about the effectiveness, efficiency, and justice of developing and applying options. Exploring sustainable development means investigating these questions in connection to each other. However, the starting point for the research programme of the Copernicus Institute is first and foremost the ecological dimension of sustainable development.

The staff is organised in four sections. The total research capacity in 2003 was about 40 fte, including 18 fte PhD students. In 2005 we will have about 35 fte PhD students. That means that the institute was very successful in obtaining external research funding, especially from the Science Foundation of the Netherlands (NWO).

About half the research of the Copernicus Institute is funded from external sources such as NWO, the European Commission, Ministries of the Netherlands, industries and other organisations. Often this research is executed in joint projects and programmes.

The PhD track at the Copernicus Institute is accessible to a limited number of persons with a master's degree. Funding for PhD projects is highly dependent on senior staff members who apply for funding by drafting research proposals. A further link between the research and teaching programme may result from a change foreseen in the PhD system and PhD funding in the Netherlands. The consequence of this will be a merger between the master's and the PhD programmes. This implies that talented candidates could be identified and recruited earlier.

5. Concluding remarks

In this paper we have outlined the educational programmes in Environmental Sciences and Environmental Studies at Utrecht University. Their multidisciplinary character makes these programmes unique in the Netherlands. The programmes are fairly new – the first graduates will receive their degrees in July 2005. Official accreditation by the NVAO (Netherlands Flemish Accreditation Organisation) should be forthcoming in two years' time. The programmes are broad in scope, dealing with a range of sustainability issues. But they are selective as well, emphasising the societal and scientific questions of energy, biodiversity, and governance.

The results of the new programmes are promising so far, though their international reach should be extended. We would like to start some mutual exchange programmes with other universities with similar curricula. We can offer foreign students an interesting programme within the inspiring institutional context of the Copernicus Institute for Sustainable Development.

Acknowledgements

The authors would like to thank Dr. Margien Bootsma for her constructive comments on an earlier version of this paper.

References

Utrecht University, Annual Report 2003, available on the World Wide Web:
<http://www.uu.nl/content/annualreport20031.pdf>

Utrecht University, Copernicus Institute for Sustainable Development and Innovation,
Available on the World Wide Web: <http://www.geo.uu.nl/20419main.html>

Utrecht University, Faculty of Geographical Sciences, Department of Environment and
Innovation, Masters Programme in Sustainable Development, Available on the World Wide
Web:
<http://www.geo.uu.nl/homegeosciences/studying/programmesinengl/mscprogrammes/sustainabledevel/22193main.html>

Appendix 1 Educational targets of the Bachelor's degree programmes

Educational targets of the Bachelor's in Environmental Sciences

After the completion of the major Environmental Sciences, students should

- have knowledge of the environmental sciences, especially of key concepts and methods
- have knowledge of the characteristics, scale, and causes of environmental issues and of scientific concepts in order to analyse, explain, and solve environmental issues
- have knowledge of the methods of the environmental sciences and be able to apply these methods to research on the cause-effect relationships between environmental problems and their physical aspects and to research on solutions for these issues
- have knowledge on the possibilities and limitations that scientific disciplines offer to analyse and solve environmental issues
- have knowledge of the multidisciplinary of Environmental Studies and Sciences as a profession and be able to see the (im)possibilities of multidisciplinary ambitions
- have knowledge of the use of scientific information to develop, implement, and evaluate environmental policy
- have knowledge of simulation and forecasting models for processes in environmental compartments and for the interactions between these compartments and be able to apply these models
- be able to transfer scientific knowledge on environmental issues to a wider audience, both in written and oral form
- have skills in project management, conducting meetings, and holding negotiations
- have knowledge of and be able to work in multidisciplinary teams in which they are able to confront and integrate insights and approaches from several scientific disciplines

Educational targets of the Bachelor's in Environmental Studies

After the completion of the major Environmental Studies, students should

- have knowledge of the body of knowledge of Environmental Studies, especially key concepts and methods
- have knowledge of the characteristics, scale, and societal causes of environmental issues and be able to analyse and explain human-environment relations on several scales
- have knowledge of the methodology of social-scientific environmental research and be able to develop a research design and motivate the choice between quantitative and qualitative methods to implement a research
- have knowledge of the multidisciplinary of Environmental Studies and Sciences as a profession and be able to see the (im)possibilities of multidisciplinary ambitions
- have knowledge of societal reactions on environmental issues (environmental awareness, environmental movement, and environmental policy) and the way these phenomena have been studied by social scientists
- have knowledge of the paradigms, problem fields, and empirical fields of social science, especially policy sciences, geosciences, and innovation sciences
- have knowledge of the (im)possibilities of several relevant disciplines in the analysis and solution of environmental issues
- have insight in complex processes of societal change related to the ambitions of sustainable development and be able to discern several governance strategies and assess their efficacy
- have knowledge of and skills in co-operation in multidisciplinary teams and, in these teams, to be able to confront and integrate knowledge and perspectives from different environmental disciplines
- be able to communicate about complex processes of societal change related to the ambition of sustainable development, both in written and oral form
- have skills in project management, conducting meetings, and holding negotiations

Appendix 2: Educational targets of the tracks of the Master's in Sustainable Development

In general, the graduates are able to:

- analyse the issue of sustainable development from a natural-science and social-science perspective
- engage in a scientific debate on the issue of sustainable development
- set up and carry out scientific research on the issue of sustainable development in a creative and independent manner
- formulate fundamental critique on the scientific work of others
- communicate natural-science or social-science knowledge on the issue of sustainable development verbally and in writing to a wide audience
- present the results of scientific investigation in the form of a scientific article or similar kind of publication

Track A, Energy and Resources. The graduates are able to:

- build upon a thorough (natural-science based) knowledge of how society uses and produces energy and materials and of the consequences for people, the economy, the environment, and future generations
- approach issues of energy and materials from an interdisciplinary angle, bringing in elements of natural science, social science, and economics
- conduct independent research on energy and materials systems at various scales (micro, regional, national, and international)
- design strategies to make energy and materials systems sustainable and to place those solutions in a natural-science and societal context

Track B, Land Use, Environment, and Biodiversity. The graduates:

- have insight in processes determining the interrelations between land use, environment, and biodiversity
- have insight in recent theories and developments in scientific research concerning land use, environment, and biodiversity
- are familiar with a number of important research methods, including methods to investigate effects of land use on environment and biodiversity, to model processes in ecosystems, and to evaluate the sustainability of scenarios for future land use
- are able to identify scientific problems related to developments in society and to translate them into a research design
- are able to conduct research in an independent and creative manner on a sustainable relation between land use and the quality of the environment and ecosystems.

Track C, Environmental Policy and Management. The graduates are able to:

- analyse and explain sustainability issues in the context of social, economic, cultural, and political processes – issues such as the internationalisation of politics and the economy; the changing relations between the state, the market, and civil society; the unequal distribution of wealth; and the individualisation of social life

- integrate insights and approaches drawn from different social-science disciplines in the framework of an analysis of sustainability issues and to design policy aimed at sustainable development
- analyse the policy that has been enforced thus far on sustainable development (that is, analyse policy in the form of deliberate intervention strategies that are targeted toward social change at the micro, meso, and macro level), and to evaluate that policy in terms of various criteria derived from policy science (such as efficiency, effectiveness, equity, contingency, legitimacy)
- design new strategies for intervention to promote sustainable development and to supervise and evaluate them; in particular, to be familiar with methods of interactive policy implementation
- develop and carry out scientific research in an independent and creative manner with respect to the societal aspects of sustainability issues and the solutions that can be reached through policy