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Breaking the boundaries — multidisciplinary environmental research at the University of Helsinki

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Introduction

Environmental research is one of the first academic areas in which multidisciplinary collaboration evolved. The International Geophysical Year in 1957–1958 — sponsored by the International Council of Science (ICSU) — was a model followed by a number of large international programs focusing on global environmental change. In the 1980s, several environmental problems (e.g. acidification, eutrophication, and air pollution) emerged and these problems were widely studied and discussed in the society. The debates in the 1980s started a new era in public environmental awareness and led to major developments in environmental sciences. These developments became the impulse for the public discussion on sustainable development on the political side, and the interest in global change research on the scientific side. Discussions on sustainable development and global change highlighted the notions that environmental problems must be examined in a global perspective and that humans and the society are closely integrated with the nature, thus necessitating an integrative, multidisciplinary approach to environmental questions. Solutions to environmental problems must be found through societal decision-making processes that are based on sound research.

In recent years, huge steps have been made in environmental sciences towards integrating and synthesizing research results to support societal decision-making. An illustrative example is the development of the scientific reports of Intergovernmental Panel on Climate Change (http://www.ipcc.ch/). The IPCC Working group reports gather the leading, state-of-the-art knowledge on various aspects of climate change (thousands of studies) into an integrated and summarized presentation including confidence levels of the statements.

Following the example of IPCC, most environmental issues are nowadays studied in international networks, programs and projects, which all aim at integrated large-scale summaries. Ongoing global programs include DIVERSITAS (biodiversity science), IGBP (International Geosphere–Biosphere Program), IHDP (International Human Dimensions Program on global environmental change), and WCRP (World Climate Research Program), as well as the one-year IPY (International Polar Year). These international collaborative programs are ultimately based on the efforts of individual scientists and research groups, working in universities and research institutes. For them, the microenvironment in which they work is equally important as the global scene. Face to face encounters, informal discussions, seminar presentations and

debates with researchers working in similar or related fields of science provide the input of facts and concepts which feeds the conscious and subconscious creative processes. With a dose of good luck, the preceding factors together may result in bright new ideas.

In a large, multi-faculty university, the knowledge of research groups on related research conducted in other departments or faculties may be vague or even missing. A survey carried out some years ago revealed that groups interested in environmental issues were found in all faculties of the University of Helsinki, including the Faculty of Theology with environmental ethics as a topic of study. Even though international co-operation is important, local collaboration is often easier to carry out and definitely less costly. To coordinate and support multidisciplinary research within the university, the Helsinki University Environmental Research Centre (HERC) was established in 2000.

HERC in action

The purpose of establishing HERC was to promote innovative, high-quality, and multidisciplinary environmental research pursued at the University of Helsinki and help researchers and students form networks and exchange their knowledge with stakeholders and the society. During 2001–2007, HERC funded altogether 11 independent projects and 8 consortia. The total financial input was some 3.5 million euros. In addition to research, HERC funded and organized various kinds of seminars, workshops and conferences. The traditional one-day HERC spring seminar was always well-attended. Its themes ranged from the challenges of multidisciplinary environmental research to energy issues. The events organized by HERC provided insights into current environmental research conducted at the University of Helsinki, and further increased the networking of researchers and end-users.

Funding of projects

HERC's first research funding period (2001–2004) included 5 large consortia and 8 smaller projects. The projects were chosen through a two-stage selection procedure with the following evaluation criteria: scientific quality, innovation, multidisciplinary and environmental relevance of the proposals. The funded research projects and consortia covered a broad range of environmental sciences, such as atmospheric sciences, soil biology, ecological sciences, and social sciences.

The articles in this issue represent HERC's second research period (2005–2007), for which 6 projects or consortia from among 57 applications were chosen for funding through a two-stage selection procedure. Again, the selected projects covered a diverse array of environmental research, ranging from evaluation of environmentally driven health risks to interdisciplinary efforts to combine natural sciences with social, historical and economic perspectives. Most projects were continuations of the projects from the first phase, since one funding period was inadequate to create significant multidisciplinary research and achieve integrated syntheses. The international evaluation carried out in 2003 also suggested that periods of at least 5 years would be needed to develop such multidisciplinary research as pursued within HERC. However, HERC itself had been provided with funding from the university only for 3 to 4 years at a time. Longer funding periods for research projects have therefore not been possible.

Lessons learned from HERC activities

Most of the funded projects successfully enhanced multidisciplinary environmental research at the University of Helsinki. One example of successful HERC research projects was the consortium entitled 'Responses of northern ecosystem carbon exchange to changing environment in different spatio-temporal scales' (REBECCA), which was a continuation of the TRACEFLUX consortium from the HERC's first research period. REBECCA studied various aspects of carbon exchange in boreal ecosystems at multiple spatial and temporal scales. Within the TRACEFLUX–REBECCA consortium, experts on atmospheric sciences, micrometeorology, hydrobiology, ecophysiology, palaeoclimatology, and environmen-

tal sciences worked together in order to achieve comprehensive understanding on complex processes of carbon exchange between ecosystems and atmosphere. The consortium published several research findings in peer-reviewed journals and got external funding (several Academy of Finland positions and projects). The research network also initiated a new centre of excellence: Nordic Centre for Studies of Ecosystem Carbon Exchange and its Interactions with the Climate System, NECC.

What made the TRACEFLUX–REBECCA consortium successful? A key element was the sound expertise of all researchers in their own research fields. The researchers represented well established research groups and had good facilities to perform their part of the project. However, involving top experts is not enough to explain the success of TRACEFLUX–REBECCA. An important role was also played by common activities, such as field trips, meetings and workshops which served as stimulants for knowledge exchange and new ideas. Moreover, the TRACEFLUX–REBECCA consortium as a whole was funded for 7 years (2001–2007), which appears to be a sufficient time period for developing multidisciplinary environmental research. In this volume, papers by Hari *et al.* and Huotari *et al.* present the recent results from REBECCA.

During the first and second funding periods, HERC also funded some so-called risk projects. The risks appeared in the form of (1) innovative, new ideas that, however, had not been tested before, (2) collaboration between research fields that had not collaborated before, and (3) new research groups or novice researchers. Although the risks were identified when allocating funds to these projects, the research proposals were considered to be promising enough to warrant taking the risk. During the research periods these projects seemed to share several common features. Firstly, the starting of the project was in many cases delayed due to difficulties in finding researchers (often Ph.D. students) to perform the work. Secondly, some of the planned research could not be done because additional funding was not received. Thirdly, as a result of the delays, these projects had problems in achieving the planned results. However, after completion of the funding periods it seemed that even these projects had succeeded in accumulating valuable results and external funding. Furthermore, the support from HERC helped the research groups establish their research fields among the environmental sciences. Thus, it was worth taking the risk.

The experiences gained during the first and second HERC funding periods showed that multidisciplinarity is a challenge. Some projects failed to achieve the planned multidisciplinary research due to certain identifiable reasons. On one hand, small projects employing only one researcher had difficulties in gathering multidisciplinary expertise. On the other hand, cutting the project funding into overly small parts did not provide the continuation needed within a multidisciplinary project (some of the projects and consortia used HERC funds for employing students for a few months at a time). Furthermore, the funding periods themselves (3–4 years) were too short to establish new research groups and complete the research from data collection to publications.

Future directions

The third 3-year operating period of HERC started in 2008. In addition to an open call for research projects, HERC decided to direct a part of its funds to a thematic research program carried out in collaboration with several national research organizations. The theme of the program is "Global Environmental Change — its Impacts, Scenarios and Control" and its aim is to create a truly interdisciplinary network of researchers, consisting of professionals from different fields, backgrounds and organizations. The research will deal with current issues within the theme and will provide — in addition to academic results — improved knowledge basis for societal decision-making. The program consists of several sub-themes, which are related to global environmental change and connected to each other. The researchers studying these different sub-themes are expected to work closely together, attend a regular seminar series on the research theme and learn from other fields of sciences. The previous experiences have namely shown that new innovations and ideas are often

born in intersections of existing disciplines. During the current funding period, special attention is being paid to environmental social sciences. The thematic program has a strong socio-political-economic component in it, and the open call for proposals emphasized environmental social sciences.

In the spring 2008, HERC and the network of Environmental Studies within the University of Helsinki decided to integrate their activities and form a common organization called Helsinki University Centre for Environment, HENVI. Merging the research and teaching activities aim at improving collaboration between researchers, university teachers and students and strengthening the link from new environmental research outcomes to current teaching. The continued aim of research carried out in HENVI is to bridge the gap between natural and social sciences, and to create an open dialogue between the disciplines. To deal with the complex problems in our environment, multidisciplinary experts who are familiar with both natural and social science practices are essentially needed. One of the future missions of HENVI is to educate such environmental professionals mastering a multidisciplinary approach to environmental problems.

In conclusion, the experiences from HERC and HENVI activities have shown that multidisciplinarity is essential in environmental research as the issues at hand are complex. Natural sciences can describe and analyze the problem, but when trying to find solutions to the problem, social sciences are needed. This combined understanding of the problem needs to be disseminated to decision-makers to form a basis for informed actions for remedying the environmental problem. It is also important to understand that multidisciplinary research takes time. One has to discuss and understand the different approaches and methods used by different disciplines, which inevitably is time-consuming. However, such research can be exciting and rewarding, and can make the world a little bit better.