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Special Contribution

Research Development: Research on the Human Dimensions of Global Environmental Change

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1. Introduction

In 1999 IGES hosted the Open Meeting of the Human Dimensions of Global Environmental Change Research Community. This was the third meeting in a biyearly series. This paper examines the present status of human dimensions research, as reflected by the presentations at the three Open Meetings of the research community. It also describes the work coordinated internationally by the International Human Dimensions Programme on Global Environmental Change (IHDP), described in more detail in the Science Plans of the four IHDP core projects. It looks at the developing research agenda within the international GEC research community and reflects on the implications of these developments for the research agenda of the Institute for Global Environmental Strategies (IGES), Japan.

Global Environmental Change (GEC) is as old as the planet Earth. Physical, chemical and biological processes have been shaping and reshaping the earth's environment since its infancy 4.5 billion years ago. In recent times, however, humankind has been one of the major driving forces of global environmental change, including climate change, deforestation, loss of biodiversity, pollution and desertification. In turn, individuals and societies are also experiencing the impact of the changes to their natural environment upon their own daily social, economic and political situations. These impacts may include water and food shortages, natural disasters, health risks, conflicts about resources and massive migration from areas most severely affected by environmental change.

The human dimensions of global environmental change comprise the causes and consequences of people's individual and collective actions, including the changes that lead to modifications of the earth's physical and biological systems and that affect the human quality of life and sustainable development in different parts of the world.

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The central questions to be addressed in human dimensions of global environmental change research are:

- How do human actions contribute to global environmental change?
- Why are these actions taken?
- How does global environmental change feed back into people's lives?
- What actions can be taken by whom to respond to, reduce and mitigate the effects of global environmental change?

2. Open meetings of the human dimensions of global environmental change research community

2.1. Introduction

The First Open Meeting of the Human Dimensions of Global Environmental Change Research Community was held at Duke University, United States, from June 1 to 3, 1995. The objective of the meeting was to bring together the growing human dimensions research community for exchange of information on current research, teaching and outreach; to encourage networking and to attract other natural and social scientists not previously involved in human dimensions research.

The 1995 meeting was sponsored by the U.S. Social Science Research Council and its Committee for Research on Global Environmental Change; the Human Dimensions Programme of the International Social Science Council; the Consortium for International Earth Science Information Network (CIESIN) and the Duke University School of the Environment.

Sanderson et al. (1995) reported that the 1995 meeting was attended by about 300 academic researchers, government experts and graduate students. The meeting had 6 plenary sessions, 25 small group sessions and additional lunchtime and evening sessions on special topics (such as global change education and agendas for international institutions). The topics of the plenary sessions and the small group sessions reflected both the organisers' sense of currently important topics in which substantial research was underway and suggestions from the larger human dimensions community.

The 1997 Open Meeting was held at the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, near Vienna, Austria. The objectives of the 1997 meeting were the same as those of the 1995 meeting, and the form of the meeting—a three-day meeting with a mix of plenary sessions, small group sessions and special lunchtime and evening sessions—was also the same (Jäger 1998).

The 1997 Open Meeting was sponsored by IIASA and the U.S. Social Science Research Council, with co-sponsorship from Directorate General XII of the European Commission; the U.S. National Science Foundation (who also funded the 1995 meeting), as well as the European Science Foundation; the International Human Dimensions Programme on Global Environmental Change (IHDP); the Environment Agency, Japan; the Asia-Pacific Network for Global Change Research (APN); the Swedish Council for Planning and Coordination of Research (FRN); ESRC Global Environmental Change Programme, United Kingdom; the Austrian Ministry for Science and Transport and the Austrian Ministry for Environment, Youth and Family.

Not only was the sponsorship of the 1997 meeting broader than that of 1995, the organising committee—the International Scientific Planning Committee (ISPC)—was international[1]. More than 280 participants from 29 countries attended the 1997 meeting. Although there were more participants from developing countries at the 1997 meeting, several participants observed that the balance still had to be improved. The number of small group sessions increased to 34 in the 1997 meeting.

The 1999 Open Meeting was hosted by the Institute for Global Environmental Strategies (IGES) in Shonan Village, Japan. It was sponsored by IGES, the Environment Agency of Japan, the APN, IHDP, the U.S. National Science Foundation, the Inter-American Institute for Global Change Research (IAI), the John D. and Catherine T. MacArthur Foundation and the Center for Global Environmental Research of Japan. Again, the organisation was undertaken by an international committee[2].

The 1999 meeting had a similar number of participants as the previous two meetings. Using funding from IHDP, the U.S. National Science Foundation, IAI and APN, it was possible to increase the number of developing country participants to almost 70.

Table 1. Topics of papers at the three open meetings (P=plenary talk; poster presentations and lunchtime seminars were not included).

	Duke (1995)	IIASA (1997)	Shonan (1999)
Land Use and Land Cover Change	3 + P	6	8 + P
Industrial Transformation	2	2 + P	5
Decision-Making Processes/ Institutions	5 + P	5 + P	5 + P
Climate Change	1	2	3
Perception, Attitudes and Behaviour	2	2 + P	5
Sustainable Development	P		1
Integrated Assessment	5 + P	6 + P	3
Demographic Change and the Environment		2	2 + P
Science/Policy Interface	2		3
Vulnerability	2	1	1
Conflict/Security		1 + P	4 + P
Urbanisation			3
Coastal Zone		2	1
Business and Trade	1	2 + P	1
Health		1 + P	1
Valuation of Ecosystem Services			1 + P
Consumption		1	
Energy		2	
Biodiversity		1	
Economics	1		
Property Rights	4 + P		
Databases	1	1	
Migration	P		
Historical Ecology	1		

1 Jill Jäger, IIASA (Co-chair); Steven Sanderson, United States (Co-chair); Angela Liberatore, European Union Commission; Yanhua Liu, China; John McNeill, United States; Shuzo Nishioka, Japan; Cynthia Rosenzweig, United States and IIASA; Jim Skea, United Kingdom and Pier Vellinga, Netherlands.

2 Shuzo Nishioka, Japan (Co-chair); Jill Jäger (Co-chair); Eckart Ehlers, IHDP; Lisa Graumlich, United States; Yoshinobu Kumata, Japan; Angela Liberatore, European Union Commission; Yanhua Liu, China; Elena Nikitina, Russia; Rajendra Pachauri, India; Ronald Rindfuss, United States; Roberto Sanchez, United States and Youba Sokona, Senegal.

2.2. Topics covered at the Open Meetings

Table 1 summarises the topics covered at the three Open Meetings. Clearly, the assignment of sessions to a particular topic is to some extent arbitrary. For example, the session on "Population and Land Use in China, India and the United States" during the 1999 Open Meeting could have been classified under "Demographic Change and the Environment" or under "Land-Use and Land-Cover Change". Similarly, it would be easy to combine "Industrial Transformation", "Business and Trade" and "Energy", to name but three topics, into a single category.

Nevertheless, despite some arbitrary categorisations, the table shows some interesting trends and raises some questions.

The level of interest in the four projects has either steadily increased or stayed stable over time. The number of small group sessions in "Land-Use and Land-Cover Change" (LUCC)—the topic of the oldest IHDP project, co-sponsored by the International Geosphere-Biosphere Programme (IGBP)—has steadily increased. In addition, the Plenary Sessions in 1995 and 1999 illustrated the progress being made in research in this area. Advances have been made in integrative research on this topic, in modelling, case studies and in database development.

The topic of "Decision-Making Processes/Institutions", closely related to the IHDP Project on "Institutional Dimensions of Global Environmental Change" (IDGEC), had a consistent level of interest at each of the meetings. The topic was the subject of a plenary session at each of the Open Meetings, but with quite a different emphasis at each one. The 1995 plenary focussed on international institutions, the 1997 plenary talk discussed issues of governance, while the 1999 talk examined the linkages between national and international decisionmaking processes.

The area of "Conflict/Security", the central theme of the IHDP project on "Global Environmental Change and Human Security" (GECHS), was not the subject of small group sessions in 1995, although there was a small group session on a related topic, "Environmental Justice and Economics". By the 1999 meeting, the topic was covered in 4 small group sessions, two of which were organised by the GECHS project. Another related topic, "Vulnerability", was the focus of two sessions in the first meeting and one each in the other two meetings.

The number of small group sessions on the topic of "Industrial Transformation" (IT) has increased over time, and one plenary session in 1997 was devoted to a presentation of the draft plan of the IHDP project. Some of these sessions have been organised by the IHDP IT project, but there were also many submissions of abstracts in 1999 from people not directly involved in the project. In addition, there have been sessions on "Business and Trade" (including a plenary talk in 1997), "Urbanisation" (a topic that was of particular interest in the 1999 meeting with 3 small group sessions), and "Energy" and "Consumption". The latter are all topics that fall within the remit of the IT project.

For the 1999 meeting, the International Scientific Planning Committee explicitly decided that although the topics of the IHDP projects could be covered in plenary sessions because they are clearly the focus of much ongoing research, presentations would not be made by members of the IHDP Scientific Planning or Steering Committees. All four IHDP projects were the focus of more than one small group session, but

these were not all organised or submitted exclusively by the IHDP community. Therefore, the 1999 meeting broadened the network of people involved with these issues.

Table 1 shows that a wide range of other topics has been covered at the Open Meetings. In 1995 there was one plenary session and four small group sessions on "Property Rights". Neither the 1997 nor the 1999 meetings had sessions on this topic. This might be a topic that was of particular interest to the U.S. research community involved in the organisation of the 1995 meeting. The question of "property rights" can also be absorbed into the broader discussion of "institutions", and has also been discussed explicitly with regard to questions of land-use and land-cover change.

The 1999 meeting showed a strong increase in the number of small group sessions that discussed "Perceptions, Attitudes and Behaviour". The sessions reported survey data about peoples' attitudes towards the environment in a wide range of countries. In contrast, the plenary session in 1997 on this topic questioned whether any meaningful relationships can be detected between attitudes and behaviour.

There has been relatively less interest in the subject of "Demographic Change and the Environment", which is perhaps surprising given the interest in the possible role that population growth has in causing environmental damage. The 1999 plenary talk referred to the large number of case studies, ongoing or already completed, exploring the linkages between demographic change, economic development and environmental pressures. Given these studies, it is puzzling that few sessions have been held on this topic. Future Open Meetings might succeed in attracting more scholars from this area of research and in stimulating debate about the need for more consistency in approach, so that generalisations can be drawn at higher levels.

The interest in "Integrated Assessment" was at its highest in 1997, and far fewer sessions were held on this topic in 1999. This is certainly to some extent a result of the fact that studies using integrated assessment methodologies are also reporting their results in sessions such as those on "Health", "Climate Change" and "Coastal Zone" rather than in sessions labelled "Integrated Assessment". It is probably also true that the integrated assessment community has its own fora for exchanging results and network-building (e.g., the Energy Modelling Forum and the European Forum on Integrated Environmental Assessment)[3].

The Kyoto Protocol negotiations appear to have stimulated increased interest in the topic of "Climate Change", with human dimensions research focussing, for example, on the institutional dimensions and economic implications of carbon management and the general design of policies and measures.

Despite considerable interest in the topic of global environmental change and "Human Health", especially after the publication of the Second Assessment Report of the Intergovernmental Panel on Climate

3 The EFIEA homepage is located at <http://www.vu.nl/ivm/research/efoea/> (20 June 2000). The Energy Modeling Forum (EMF) was established in 1976 at Stanford University to provide a structural framework within which energy experts, analysts and policymakers could meet to improve their understanding of critical energy problems. The eighteenth EMF study, EMF-18, focuses on "International Trade Dimensions of Climate Change Policies" and EMF 19 on "Technology and Climate Change Policies". For more information on the Energy Modeling Forum, please contact:

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Change (IPCC), this topic has not attracted much interest at the Open Meetings. Perhaps the new journal on Global Change and Human Health will stimulate the submission of more proposals on this topic to future meetings. Also, this is potentially a topic for the international global environmental change programmes in the future (see further discussion below).

There are a number of other topics for which there were one or two sessions at the Open Meetings. The "Science/Policy Interface" was discussed in 1995 and 1999 by the group centred at Harvard University's Center for Science and International Affairs[4]. Human dimensions issues in the "Coastal Zone" were addressed in 1997 and 1999 and will also be the focus of the September 2000 IHDP Workshop in Bonn, Germany for young researchers from developing countries. This is an area in which one of the core projects of IGBP, Land-Ocean Interactions in the Coastal Zone (LOICZ), is also interested. Surprisingly, there has been little interest in the human dimension issues related to "Biodiversity", although there was one session on the topic in 1997, and the topic does appear in some sessions related to land-use and land-cover change. "Historical Ecology" was the topic of one session in the first Open Meeting and "Databases" were discussed at the first two meetings (they were presumably also discussed in the 1999 meeting but not in sessions specifically set aside for such discussions).

Finally, it has been extremely difficult to attract the economics research community to participate in the Open Meetings. Only the 1995 Meeting had sessions that included this community (including the plenary session on "Sustainable Development"). Although the 1997 paper (Costanza et al. 1997) on "Valuation of Ecosystem Services" created controversy, intense discussion and further research, the inclusion of this topic in the 1999 programme as a plenary talk did not stimulate the submission of papers or proposals for small group sessions. On the other hand, a very interesting developing country perspective was provided at this talk, so more research reports in this area might be expected at future Open Meetings in developing countries.

In summary, the topics covered by the IHDP core projects have received increasing or constant high coverage at the three Open Meetings. This has provided each of the projects with the opportunity to strengthen its own networks of researchers. In addition, other topics have been discussed at the Open Meetings: perceptions, attitudes and behaviour; climate change; integrated assessment; urbanisation (which could also be subsumed under land-use and land-cover change) and human dimensions issues in the coastal zone. On the other hand, some research areas appear to be underrepresented at the Open Meetings, including demographic change and the environment, economics, health and biodiversity.

2.3. Japanese contributions to the Open Meetings on human dimensions research

At the 1995 meeting in the United States, there were no presentations by Japanese scholars. In fact the number of presentations by non-U.S. scholars at the 1995 meeting was very low, because this first gathering was focussed on ongoing research in the United States, where human dimensions research started early[5]. Table 2, therefore, only shows the presentations made by Japanese scholars at the 1997 and 1999

4 This group also presented its research (The Global Environmental Assessment Project) at a seminar in IGES in June 1999.

5 This is not to say that other countries did not have social science studies on environmental issues. However, the kind of research that we now refer to as "human dimensions research" with its broad interdisciplinarity and its concern with *global* environmental change (even if the necessary research is at the local and regional scales) is a relatively new area, and the United States already had a national committee on human dimensions research in 1989.

meetings. As in Table 1, the classification of papers is to a certain extent arbitrary, but the general trends are quite clear. First, the table shows the increased number of Japanese contributions in 1999. Some of this could be attributed to the fact that the location of the 1999 meeting in Japan encouraged more Japanese scholars to submit abstracts. However, it should be noted that the number of abstracts submitted in total was much higher in 1999, and the selection process was based first and foremost on scientific quality.

Table 2. Japanese contributions to the 1997 and 1999 Open Meetings (P=Plenary presentations. The numbers indicate the number of papers in small group sessions).

Topic of paper	1997	1999
Consumption	1	
Population		P
Health	2	2
Energy	1	
Attitudes and Behaviour	1	4
Industrial Transformation	P	7
Integrated Assessment	2	
Remote Sensing/LUCC	2	
Coasts	1	
Trade	2	
Governance	2	
Vulnerability	1	
LUCC	1	10
Decision-Making Processes		7 + P
Risk		1
Sustainable Development		1
Security		3
Urbanisation		2

The second major trend in Table 2 is the large increase in the number of presentations on IHDP-related topics. At the 1999 meeting there were 10 presentations on land-use and land-cover change, reflecting a strong and growing community of researchers in this area. Similarly, the number of presentations on industrial transformation and decisionmaking process greatly increased. The third trend in Table 2 is a reduction of the number of topics addressed. In 1997, over five topics had only one Japanese presentation. In contrast, this was the case for only two topics in 1999. Most of these presentations focussed on the "mainstream" topics of human dimensions research.

In summary, the Japanese contributions to the Open Meetings have increased in number, and there has been a strong trend towards a focus on the IHDP-related topics and other areas central to human dimensions research.

2.4. Developing country contributions to the Open Meetings

Contributions from developing countries to the Open Meetings have grown dramatically. Again, it is difficult to present a totally accurate picture on the basis of abstracts. In some cases first authors were not from developing countries but other authors were. In other cases, authors from developing countries were at institutions in developed countries, so their contributions were not counted. Despite such incon-

sistencies in counting, the trend is very clear—contributions from developing countries have increased. A large part of this trend can probably be attributed to the increase in funding for developing country participants in 1997 and particularly in 1999.

The 1995 Open Meeting included no plenary papers from developing country participants and only four presentations in parallel sessions: one from Mexico (Vulnerability), two from India (Property Rights) and one from Pakistan (Property Rights).

In contrast, the 1997 Environment and Security plenary talk was given by Sunita Narain from India. In addition there were 8 papers in parallel sessions: two papers from Brazil (Health, Industrial Transformation), four papers from India (LUCC(2), Coastal, Integrated Regional Assessment), one from China (LUCC) and one from Vietnam (Vulnerability). At the 1999 Open Meeting, Leena Srivastava from India gave the plenary talk on Valuation of Ecosystem Services. In addition, Zhao Zhidong from China and Eduardo Viola from Brazil participated as plenary commentators.

Bearing in mind some of the above-mentioned difficulties in counting, developing country participants presented 40 papers at the 1999 Meeting. In this respect, 1999 was a milestone for developing country participants, with twice as many plenary speakers and five times as many speakers in parallel sessions as in previous meetings. In addition, 7 developing country participants (3 from India, 2 from Botswana, 2 from China) presented posters at the 1999 meetings. This gave them an excellent opportunity to present their work.

The regional breakdown of the developing country papers at the 1999 meeting was:

Latin America:	11
Africa:	8
Asia:	21
Oceania:	1

Because this was the first meeting held in Asia and because APN provided generous support, the preponderance of Asian contributions is not surprising.

At the 1999 meeting the developing country contributions covered a wide range of topics:

Attitudes and Behaviour	Climatic Change
Coastal Zone	Conflict
Demographic Change	El Niño
Health	Institutions
Integrated Assessment	IT
LUCC	Urbanisation
Vulnerability	Water

The largest number of papers were on Land-Use and Land-Cover Change, Industrial Transformation and Coastal Zone.

3. The research agenda of the IHDP

3.1. Introduction

The International Human Dimensions Programme on Global Environmental Change (IHDP) was initially launched in 1990 by the International Social Science Council (ISSC) as the Human Dimensions Programme (HDP). In February 1996, the International Council for Science (ICSU) joined ISSC as co-sponsor of the IHDP, and the Secretariat was moved to Bonn, Germany through a generous grant from the German government. The restructured IHDP is a full partner with the International Geosphere-Biosphere Programme (IGBP), the World Climate Research Programme (WCRP) and DIVERSITAS—the international global environmental change programmes. IHDP is an international, interdisciplinary, non-governmental programme dedicated to promoting and coordinating research aimed at describing, analysing and understanding the human dimensions of global environmental change.

IHDP's programme is designed around its three main objectives of research, capacity building and networking:

Research projects. IHDP has four major international projects: Land-Use and Land-Cover Change, Global Environmental Change and Human Security, Institutional Dimensions of Global Environmental Change and Industrial Transformation.

An evolving agenda. IHDP works with the international social science community, with national human dimensions committees and with other global environmental change science programmes to identify emerging research opportunities to tailor its research agenda around today's needs.

Synthesis and policy output. As its projects produce results that are relevant to scientists and policymakers, IHDP will provide synthesis reports and policy-oriented summaries to contribute scientific bases for decisionmaking.

Research capacity building. IHDP supports research capacity building through its scientific activities and training workshops for young researchers. It emphasises the involvement of researchers from developing countries and young scientists in its research programme and scientific committees.

Scientific networks. IHDP provides opportunities for scientists to meet and collaborate at national, regional and international levels. It operates through its National Committees and international project offices and maintains a database of collaborating scientists.

IHDP is guided by an international Scientific Committee comprised of scientists from different geographic and disciplinary backgrounds. The Scientific Committee is appointed by ICSU and ISSC on the basis of scientific merit in the area of humans dimensions research. National Committees are essential components of the IHDP's networking and research strategy, which advocates a bottom-up approach. Currently, approximately 30 National Human Dimensions Committees and Programmes exist at various levels of development world-wide. One of the top priorities set by the IHDP is to promote and strengthen existing national committees and programmes, and to support the establishment of new ones.

The IHDP Secretariat has been located in Bonn, Germany since November 1996. The Secretariat provides direct support to the Scientific Committee, National Committees, IHDP Science Projects and other research initiatives. It also provides information services, such as the quarterly *IHDP Update* newsletter, the IHDP web page, and facilitates the mobilisation of research funds and the maintenance of relations with international organisations, including the United Nations system.

IHDP Science Projects are key mechanisms used to: (i) identify and generate new IHDP research activities in priority areas, (ii) promote international collaboration and (iii) link policymakers and researchers. Four major international Science Projects currently receive the full support of the IHDP: Land-Use and Land-Cover Change, Global Environmental Change and Human Security, Institutional Dimensions of Global Environmental Change and Industrial Transformation.

3.2. Land-Use and Land-Cover Change (LUCC) (co-sponsored with IGBP)

LUCC's objectives are to obtain a better understanding of land-use and land-cover changes (e.g., degradation, desertification and biodiversity loss) and of the physical and human forces behind these processes. LUCC helps to define links between land-use and land-cover changes and other critical GEC issues such as climate change, food production, health, urbanisation, coastal zone management, transboundary migration, and availability and quality of water. The principal scientific questions investigated by LUCC are:

- What are the major human causes of land cover changes in different geographical and historical contexts?
- How will changes in land use affect land cover in the next 50 to 100 years?
- How do immediate human and biophysical dynamics affect the sustainability of specific types of land uses?
- How might changes in climate and global biogeochemistry affect both land use and land cover changes, and vice versa?
- How do land-use/cover changes affect the vulnerability of land users in the face of potential climate change and environmental change in general?

The project concentrates on the following research foci:

(1) Land-use dynamics: comparative case study analysis;

(2) Land-cover dynamics: empirical observations and diagnostic models and

(3) Regional and global integrated models.

Further information on the LUCC project can be obtained in the Science Plan (IGBP/HDP 1995) and Implementation Strategy (IGBP/IHDP 1999), as well as from the LUCC website, which can be accessed from the IHDP website[6].

6 International Human Dimensions Programme on Global Environmental Change. <http://www.uni-bonn.de/ihdp> (20 June 2000).

3.3. Global Environmental Change and Human Security (GECHS)

The main goal of the GECHS project is to advance interdisciplinary, international research and policy efforts in the area of human security and environmental change.

What is "Human Security"? Human security is achieved when and where individuals and communities: (1) have options necessary to end, mitigate or adapt to threats to their human, environmental, and social rights; (2) actively participate in attaining these options and (3) have the capacity and freedom to exercise these options. The principal scientific questions investigated by LUCC are:

- What types of environmental changes threaten human security?
- How does environmental change threaten human security?
- What regions are the least/most secure?
- How do individuals and communities cope with the insecurities linked to environmental change?
- Why are some individuals, communities and regions more vulnerable than others?
- Why are some strategies more effective in one situation than in others?
- Can we predict future insecurities?

The project has currently identified the following thematic areas of study:

(1) Conceptual and theoretical issues in environment and human security;
(2) Environmental change, resource use and human security;
(3) Population, environment and human security;
(4) Regional models of environmental stress and human security and
(5) Institutions and policy development.

Further information on the GECHS project can be obtained from the Science Plan (IHDP 1999a) and from the GECHS website[7].

3.4. Institutional Dimensions of Global Environmental Change (IDGEC)

The IDGEC Project analyses the roles that social institutions play as determinants of the course of human/environment interactions. Institutions (collections of rules, decision-making procedures and programmes) are drivers of both systemic and cumulative environmental problems. Faulty institutional structures of property rights, for example, can lead to severe depletions of stocks of living resources or to excessive uses of ecosystems for the disposal of toxic wastes. Institutions constitute a cross-cutting theme. Consequently, the IDGEC aims to develop close links to other Global Change projects dealing with issues such as land use (LUCC), industrial transformation (IT) or coastal zones (LOICZ-IGBP). The principal scientific questions posed by IDGEC are:

- What roles do institutions play in causing and responding to global environmental change?

7 Global Environmental Change and Human Security. <http://www.gechs.org> (20 June 2000).

- How effective are institutional innovations that are designed to respond to global environmental change?
- What are the prospects for (re)designing institutions to confront environmental challenges?

Further information on the IDGEC project can be obtained from the IDGEC Science Plan (IHDP 1999b) and the website[8].

3.5. Industrial Transformation (IT)

The IT research agenda focuses on the relationship between changes in the industrial systems and changes in the environment. It aims to analyse the production and consumption of manufactured goods and services, the natural resource and energy transformations associated with these activities, their environmental impacts and the consequences of these impacts on the quality of life. The overall goal of the project is to discover ways to enable a transformation of the industrial system towards sustainability, or, in other words, ways to decrease the environmental impacts of industrial activities.

The Industrial Transformation research agenda includes the following foci:

(1) Energy and material flows
(2) Food
(3) Cities
(4) Information and communication
(5) Governance and transformation processes

The energy system is a major focus for research in view of its environmental implications at global and local levels. During the elaboration of the focus on energy, the Scientific Planning Committee of the Industrial Transformation Project (SPC-IT) decided to include the flow of materials because of the major links between energy and material flows. Food production and consumption were also prioritised due to their proximity to biodiversity issues and the major impact on the environment created throughout the production, processing, transport, consumption and waste cycle of food. International interdependencies were another argument for including a focus on food. Moreover, the potential connections between climate change and food production made this a priority topic. In view of the important spatial aspects of water and transport, the SPC-IT decided to include these issues in the more generic focus of cities. A special focus added to the priorities of the Science Plan is in the area of information and communication. Developments in this field are considered to be some of the major driving forces of societal transformation and have important implications for the global environment. Because information and communication is a major driver for transformation, it can also be considered a cross-cutting theme embedded in each of the research foci. Finally, it was decided to combine the areas of governance and transformation processes in a single research focus, with emphasis on analysing and understanding the driving forces that are changing the way society relates to the environment.

Further information is available in the IT Science Plan (IHDP 2000) and the website.[9]

8 Institutional Dimensions of Global Environmental Change. <http://www.dartmouth.edu/~idgec> (20 June 2000).

9 International Human Dimensions Programme on Industrial Transformation. <http://www.vu.nl/ivm/research/ihdp-it/> (20 June 2000).

3.6. Other IHDP initiatives

There is a wide range of other activities initiated or supported by IHDP, including the co-sponsorship of the Open Meetings described above. Three particular activities are mentioned here.

Firstly, in 1999 ICSU awarded a grant to IHDP, the International Geographical Union and the International Union of Physiological Sciences on "Setting an Agenda for Research on Health and Environment"[10].

There is a long history of anthropogenic changes to the environment posing problems for human welfare and health. However, in the past, most of the impacts have been local or regional in scale. Problems such as water and air pollution remain important causes of concern affecting millions of people. What is new is that there is now accumulating evidence that human actions are changing the environment on a global scale in ways that could cause widespread impacts on human health.

Concerns about the impacts of climate change, stratospheric ozone and the loss of biodiversity are now adding to the problems posed by more localised issues. Furthermore, the anticipated changes in physical and biological systems are likely to interact strongly with socio-economic factors such that the worst effects will be suffered by the most vulnerable populations in developing countries' economies in transition.

Understanding and managing the interactions among environmental change, development and population health is, therefore, a key scientific challenge that will require cooperation between different disciplines.

To develop research in this complex, multidisciplinary arena, a global agenda is required which will identify critical issues and develop means for researchers from varied backgrounds to work together to tackle issues where the impacts are increasing in number, intensity and global reach.

The issues are of such a magnitude that international cooperation among social, physical and life scientists will be required. The agenda, in the form of a final report, which is the ultimate outcome of this research process, will act as an instrument for facilitating the international and multidisciplinary cooperation required. Beyond the agenda, the position papers and the workshop reports will represent state-of-the-art syntheses and starting points for new research initiatives.

Finally, and perhaps most importantly, a unique process is proposed which will provide outstanding training and collaborative experiences by bringing together senior scientists, young scientists, women scientists, scientists from transitional economies and from developing countries.

Box 1. Setting an Agenda for Research on Health and Environment.

10 Setting an Agenda for Research on Health and the Environment. <http://geog.queensu.ca/h_and_e/healthandenvir/index.htm> (20 June 2000).

Second, IHDP, in collaboration with the Global Change System for Analysis Research and Training (START), organises a Summer Workshop once every two years for young scholars from developing countries. The Workshop is two weeks long, and the first objective of the workshop is to link these scientists with the International Human Dimensions Programme on Global Environmental Change (IHDP) and with other international global environmental change programmes and to encourage their regional and international networking activities. The second objective is to examine the human dimensions research priorities in developing countries. The Workshop in September 2000 will be on "Human Dimensions Issues in the Coastal Zone".

The third activity is a project funded through the European Union European Network for Research in Global Change (ENRICH) programme. The objective of this activity is to build and strengthen National Human Dimensions Programmes (NHDP) related to global environmental change within the European Union, Central and Eastern Europe and the Newly Independent States, and Africa in order to promote cooperative links, networks and exchange of data and information within and between these NHDPs. The project organised three workshops and has been very successful in attaining the above objectives and in strengthening national human dimensions activities.

4. Cross-cutting themes in global environmental change research

IHDP is the youngest of the international global environmental change research programmes. The oldest is the World Climate Research Programme (WCRP), the second is the International Geosphere-Biosphere Programme (IGBP) and the third is DIVERSITAS, An International Programme of Biodiversity Science. While IHDP's first priority is implementing the four core projects outlined above, it is increasingly interested in working on joint projects with the other GEC programmes. This arises in particular because the IGBP is currently synthesising the research carried out in its core projects over the past ten years or more. In producing this synthesis, IGBP has identified a number of cross-cutting themes that are not only of interest to a number of IGBP projects but also have significant human dimensions implications. The Scientific Committees of IGBP, WCRP and IHDP therefore proposed that research on these cross-cutting themes should be pursued in joint projects formulated and carried out by members of all of the GEC programmes. As a first step, Scoping Meetings will be held on each of the cross-cutting themes during the first half of the year 2000. These meetings will develop a common vision, an agreed scientific rationale and a single broad thematic structure for the cross-cutting themes. The themes are: Carbon, Food and Fibre, and Water.

Carbon. With respect to carbon, the research carried out in IGBP projects such as Global Change and Terrestrial Ecosystems (GCTE), Joint Global Ocean Flux Study (JGOFS) and Past Global Changes (PAGES) has led to a much better understanding of the global carbon cycle than was available 10 to 15 years ago. Research on carbon is also relevant to WCRP, especially to the Climate Variability and Predictability (CLIVAR) project. The CLIVAR project is attempting to understand and predict climate variability and climate change, including anthropogenic effects, on time-scales of a month to a century.

Furthermore, the topic of carbon is of central interest to three of the IHDP projects. It is of interest to the LUCC project because changes in land use and land cover have led to large changes in the terrestrial sources and sinks of atmospheric carbon. Indeed, one objective of the LUCC project is to produce spatially explicit data on how land cover has been changed by human use over the last 300 years. The IDGEC project focuses on carbon in two of its activities: the political economy of boreal and tropical forests and the institutional dimensions of carbon management. The latter activity presents an interesting topic related to what the IDGEC project calls "the problem of fit": whether there is compatibility between ecosystems and management systems.

Food and Fibre. Similarly, for the topic of food and fibre, both IGBP and IHDP projects have interests upon which a joint project can be built. In IGBP, for example, one sub-project of the GCTE project focuses on the impact of global change on agriculture, forests and soils, while the Global Ocean Ecosystem Dynamics (GLOBEC) has an interest in fisheries. Each of the IHDP projects has a focus related to the topic of food and fibre. In the LUCC project, the identification and quantification of the environmental consequences of increasing food, fibre and fuel supply is a LUCC research task, as well as the explanation of physical and social circumstances that lead to changes in land-use patterns. Furthermore, development of land-use change models is necessary for predicting future production areas. For the GECHS project, food and water security are central themes of research. A major focus of the Industrial Transformation project is the food production and consumption system, which is undergoing major transformations with as yet unknown environmental consequences.

Finally, institutions play an important role within the food and fibre sector. For example, the regulation of fisheries in economic zones is a topic being studied in the IDGEC project, which relates directly to this cross-cutting theme. Clearly, this topic is not only of interest to these two GEC programmes and other organisations such as the Food and Agricultural Organisation (FAO) and the World Bank; the agricultural research centres should also be involved in the development of research on the cross-cutting theme of food and fibre.

Water. The third cross cutting theme, water, is of central interest to the IGBP project, Biospheric Aspects of the Hydrological Cycle (BAHC), as well as to the WCRP project, Global Energy and Water Cycle Experiment (GEWEX). It is also of importance to a number of other projects. It is of concern to the LUCC project, because the LUCC project researches water issues in regional land-use/land-cover change, which in turn requires an assessment of water resources and use in regional LUCC studies that must consider hydrological resources, water infrastructure and water demand. Water and Human Security is one of the four key themes of the GECHS project, which has recently organised workshops on Water and Human Security in Southeast Asia and Oceania and on Conflict and Cooperation in the Salween Basin. There are plans to run a workshop on water and urbanisation in late 2000. In the IT project, the research foci on cities and transformation will consider the water (and transport) systems in particular. Finally, as in the case of food and fibre, institutions play an important role in both causing and responding to changes in the water "system".

After the Scoping Meetings on these three cross-cutting themes in 2000, joint projects across the GEC programmes and including other actors will be developed by the three GEC programmes with the help of small inter-programme planning groups.

5. The sustainable development research agenda

The Board on Sustainable Development of the U.S. National Research Council recently published its report *Our Common Journey: A Transition Toward Sustainability* (BSD 1999). The report provides an account of the "transition toward sustainability" over the next two generations in terms of the goals to be attained and the central challenges to be faced. The Board concludes, perhaps somewhat optimistically, that based on its analyses of persistent trends and plausible futures, a successful transition towards sustainability is possible over the next two generations. As it emphasises, however, this will require significant advances in basic knowledge, in the social capacity and technological capabilities to use the knowledge, and in the political will to turn this knowledge and know-how into action.

The GEC programmes are already making contributions to the knowledge base necessary for this transition. This Part examines the contributions of human dimensions research to the science agenda on sustainability. It then discusses further needs that are not covered at the present time by any of the global programmes.

The four core projects of IHDP each contribute substantially to advancing the science agenda on sustainability and to answering some of the important questions raised in the report of the Board of Sustainable Development. The report notes, "Knowledge about the most significant potential obstacles to sustainability is needed along with an awareness of the opportunities for deflecting, adapting to, or mitigating the threats" (Executive Summary, BSD 1999, 7). This is a central theme of the IHDP project on "Institutional Dimensions of Global Environmental Change" (IDGEC), which is analysing the role that social institutions play as determinants of the course of human/environment interactions.

The Board on Sustainable Development concludes, "For reporting on a sustainability transition, however, it is clear that multiple indicators are needed to chart progress toward the goals for meeting human needs and preserving life support systems, and to evaluate the efficacy of actions taken to attain these goals" (Executive Summary, BSD 1999, 9). It points to the need to look at critical zones of human-environment vulnerability. Research on vulnerability and criticality is a focus of both the IHDP project on "Global Environmental Change and Human Security" (GECHS) and the IHDP/IGBP project on "Land-Use and Land-Cover Change" (LUCC). Within the GECHS project, work on an Index of Human Insecurity aims to

- assist in providing a clear conceptual definition and working framework for the measurement of vulnerability and insecurity;
- assess the quality and reliability of data that is used to depict vulnerability and
- provide a visual mechanism with which to discuss the key issues relating to environment and human security.

The LUCC project in its Implementation Strategy (IGBP/IHDP 1999) outlines the following as a priority area of LUCC research:

> The other side of the coin of sustainability is the likelihood that, until we can uncover effective strategies for sustainability, we will live in an increasingly vulnerable world. These vulnerabilities are already evident in the inability of some populations to deal with climate variability, the potential for sea level rise, extreme events, resistant strains of viruses and bacteria, and growing inequities in entitlements to natural resources. In what ways will a growing urban population achieve its needs, and what demands do they place on the productive base of the planet?
>
> ■ LUCC will review the concepts of vulnerability and analytical methods that can complement land-use/land-cover change studies, including a set of hypotheses drawn from the literature;
>
> ■ LUCC will seek out case studies that illustrate vulnerabilities and unsustainable land-use scenarios to identify institutional, economic, political, and biophysical conditions that exacerbate vulnerability;
>
> ■ LUCC will model key determinants of non-sustainable and vulnerable systems at local and regional scales. Focus 1 will work with scientists modelling dynamic regional systems to include considerations of unsustainability and vulnerability in their scenario building.

Members of the LUCC and GECHS networks held a meeting during the 1999 Open Meeting of the Human Dimensions of Global Environmental Change Research Community (Shonan Village, Japan, June 1999) and formed a joint task force on issues of “Vulnerability and Criticality”.

The fourth IHDP project on “Industrial Transformation” (IT) is contributing substantially to one of the priority tasks for advancing the research agenda advanced by the BSD. The underlying question in IT research is how to continue economic and social development while reducing harmful environmental pressures. This research involves exploring the determinants of alternatives to unsustainable consumption patterns and the incentives for technological innovation as well as studying energy and materials intensity in human activities.

The Board on Sustainable Development identifies three priority tasks for advancing the research agenda:

Task 1. Development of a research framework that integrates global and local perspectives to shape a “place-based” understanding of the interactions between environment and society.

Task 2. Initiation of focused research programmes on a small set of understudied questions that are central to a deeper understanding of interactions between society and the environment.

Task 3. Promotion of better utilisation of existing tools and processes for linking knowledge to action in pursuit of a transition to sustainability.

As indicated above, IHDP's projects each contribute substantially to the research questions listed under Task 2. For Task 1, IHDP's research results could contribute to place-based sustainability science but the necessary research framework does not yet exist and can only be developed, as the BSD points out, with interdisciplinary and inter-programme collaboration.

Task 3 is extremely important and presents a challenge to international programmes to strengthen institutional capacity so that relevant knowledge and know-how are integrated and used in the sustainability transition.

The cross-cutting studies outlined in the previous Part could certainly contribute to the BSD's call for integrated approaches to research related to water, atmosphere and climate, and species and ecosystems. The BSD, however, explicitly calls for these studies at the regional scale. In this regard, it is important to note the remarks made by Berrien Moore, Chair of the IGBP Scientific Committee: "Regional themes will expand slowly and carefully. Such regional studies will allow specific linkages to societal issues; moreover, regional studies will allow 'full' system studies" (IGBP 1999, 38).

The report of the Board on Sustainable Development presents a major challenge for future research; it requires the development of a research framework for integrative studies at the regional scale. While "integrated regional assessment"[11] and some of the initiatives of the global programmes, including START, have regional foci, a lot of work must be done to prepare a framework for regionally-based global change studies.

The BSD report on the transition to sustainability identifies important areas for research. It also calls for a strengthening of institutional capacity, so that existing knowledge, know-how and capacity for learning about sustainability can be more effectively integrated and used. Much relevant knowledge, know-how and capacity rests in the existing global environmental change programmes: IGBP, WCRP and IHDP. The long-term financial and institutional stability of these programmes must be guaranteed. Without that stability, the programmes' individual and joint contributions to the sustainability research agenda are threatened. Certainly in the case of IHDP, while the research is playing and must continue to play a central role in "sustainability science", the necessary long-term financial and institutional stability is not secure at the present time.

Finally, it is important to note that the BSD report is not calling on the programmes to change their central research mission; indeed, it is calling for more and better support for that mission. Rather, the report is asking that the science-driven programmes contribute actively to the politically driven sustainability agenda to help create a new middle ground of policy-driven, basic-research based "sustainability science".

6. The IGES research agenda

After the establishment of IGES as a non-profit organisation under Japanese Civil Law in March 1998, initial research activities began in April 1998. At the present time IGES is evaluating the first phase of its program and considering the composition of its second phase. The research activities in the first phase

11 Center for Integrated Regional Assessment. <http://www.essc.psu.edu/cira> (20 June 2000).

were guided by a strategic plan for the fiscal years 1998 to 2000, which includes five research projects: Climate Change, Urban Environmental Management, Forest Conservation, Environmental Education, Environmental Governance. It also includes plans for a New Development Paths research project.

Climate Change. This project is studying different options of international cooperative mechanisms for climate change mitigation in the short-, medium- and long-term. This includes in-depth studies on emissions trading and the Clean Development Mechanism as well as studies of regional cooperative mechanisms in Asia.

Urban Environment Management. This project aims to present innovative ideas and models that will guide urban environmental policies in the face of economic development in Asia. Studies focus on mechanisms of urbanisation and environmental problems in Asian cities, Japanese experience, strategies for improving infrastructure and governance.

Forest Conservation. This project aims to prepare strategies for conservation and sustainable management of forests in Asia and the Pacific Region and to propose necessary legal and administrative supportive measures. The research is focussing on structural analysis of the underlying causes of deforestation, participatory forest management, timber trade and legal and administrative measures.

Environmental Education. This project aims to develop regional strategies and an international system for the implementation of environmental education in the Asia-Pacific region in order to promote environmental literacy and consciousness.

Environmental Governance. This project is examining the relevant processes and the actors involved in promoting and supporting effective environmental governance in the Asian region. It is studying how decisions are made, who makes them, how they are implemented, what information is available and from what source, how processes are reviewed, how these are influenced by internal and external forces, how systems are evaluated and how they can be adapted to respond to their challenges.

New Development Paths. This project will explore new patterns of development that would allow resource recycling and a low-waste society. The focus is initially on the Asian region, because development in this region could have major impacts on the environment in the 21st century.

Some clear links exist between the IGES projects and the IHDP research agenda. The most obvious link is between the Urban Environment Management Project (UE) and the IHDP project in Industrial Transformation (IT), where there have been joint workshops and participation of IGES scholars in IT meetings and in the development of the IT Science Plan. The IT project is now entering the implementation phase and the contribution of the IGES UE project to the Cities and Industrial Transformation focus of the IT project will constitute part of that implementation. As the APN Scoping workshop in Kobe in Japan in October 1999 showed (IHDP 1999c), there are a number of critical research questions related to urbanisation in the Asian region and associated pressures on the environment.

The IGES Climate Change Project (CC) links most closely at the present time with the IHDP IDGEC project, because the latter is studying the institutional dimensions of carbon management as one of its flagship activities. As the IDGEC activity develops in the coming months, it probably would be mutually beneficial to establish stronger links, to ensure exchange of insights and develop complementary activities.

The IGES Forest Conservation project (FC) studies topics that are of interest to two IHDP projects in particular, IDGEC and LUCC. The LUCC project also focusses on examining the causes of deforestation at the local/national level and the regional/global level. The FC focus on Legal and Administrative measures links closely with IDGEC's interests in the political economy of tropical and boreal forests and in the question of whether there is a misfit between scales of ecosystems and scales of management strategies.

The Environmental Governance project (EG) of IGES asks questions very similar to those of the IDGEC project, and the EG research focus on selected countries and regions in Asia is certainly highly relevant for IDGEC research activities. At the same time, it should also be highly relevant for the IT project, which has a focus on Governance and Transformation Processes.

Finally, the work on New Development Paths is relevant to all of the IHDP projects, because all of them have an element of forward-looking research. Obviously the strongest link is to the IT project, which is also looking at ways to combine economic and social development with reduced pressures on the environment.

There is no direct link between the IGES Environmental Education Project (EE) and the IHDP agenda. However, the aims of the project—in particular, the implementation of appropriate environmental education systems—are complementary to IHDP's efforts to support national human dimensions research activities and to enhance capacity for human dimensions research in developing countries. In the long-term, one would hope that the results of IHDP research would be included in environmental education.

In summary, there are considerable links between IGES projects and the IHDP research agenda, although these links have only been formalised in one case. IGES and IHDP would benefit mutually by strengthening the other links to provide exchange of information and results and ensure complementarity of research. In the case of the Forest Conservation project, one way to do this would be for the project to apply to become a LUCC Endorsed Project. The procedure for doing this is described in the LUCC Implementation Strategy (IGBP/IHDP 1999).

Because of their Asian regional focus and the aim to produce policy recommendations, the IGES projects respond well to the challenge posed recently by the U.S. Board of Sustainable Development for policy-driven, basic research to contribute to "sustainability science", with a focus on integrative studies at the regional scale. Certainly the IGES approach has emphasised the policy-driven and regional scale aspects of the research. The challenge will be to integrate these studies at some stage in the future.

7. Conclusions and recommendations

1. Human dimensions research is concerned with the causes, consequences and responses to global environmental change.

2. Three "open" meetings have been held to bring together human dimensions researchers to discuss their results and to establish and strengthen networks. Each of the meetings had on the order of 300 participants. The number of participants from developing countries has increased over time.

3. The topics covered by IHDP core projects have received increasing or constant high coverage at the three Open Meetings. This has provided each of the projects with an opportunity to broaden their networks. In addition, the Open Meetings have covered a wide range of other topics, including "perceptions, attitudes and behaviour", "climate change", "integrated assessment", and "human dimensions issues in the coastal zone". Some research areas appear to be underrepresented at the Open Meetings, including "demographic change and the environment", "economics", "health" and "biodiversity".

4. Japanese contributions to the Open Meetings have increased in number, and there has been a strong trend towards a focus on IHDP-related topics and other areas central to human dimensions research.

5. There is a strong move towards collaborative research across the international global environmental change research programmes: IGBP, IHDP and WCRP. In 2000 three cross-cutting themes will be explored—carbon, food and fibre, and water—and Scoping Meetings will develop a common vision, an agreed scientific rationale and a single broad thematic structure for these themes.

6. The Board on Sustainable Development of the U.S. National Research Council has concluded that a transition to sustainability is possible over the next two generations but will require significant advances in basic knowledge, in the social capacity and technical capabilities to use the knowledge, and in the political will to turn this knowledge and know-how into action. The major challenge for future research is to develop a framework for integrative studies at the regional scale.

7. There are considerable common interests between the IGES research projects and the IHDP core projects. A formal link exists only between the IGES Urban Environmental Management Project and the IHDP Industrial Transformation Project. Both IGES and IHDP would benefit from strengthening the other links in order to provide exchange of information and results and to ensure complementarity of research. This would also embed the IGES work in a broader international framework. Both IHDP and IGES also have a mutual interest in networking and capacity building.

8. The IGES projects have a strong element of regional focus on the Asian region. In this respect they could make significant contributions to the "sustainability agenda". However, after the first phase of research (1998 to 2000), a framework for integrative studies at the regional level will be needed.

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Acronyms

APN	Asia-Pacific Network for Global Change Research
BAHC	Biospheric Aspects of the Hydrological Cycle Project (IGBP Project)
BSD	Board on Sustainable Development (US National Research Council)
CC	Climate Change Project (IGES Project)
CIESIN	Consortium for International Earth Science Information Network (USA)
CLIVAR	Study on Climate Variability and Predictability (WCRP Project)
EE	Environmental Education Project (IGES Project)
EG	Environmental Governance Project (IGES Project)
ESRC	Economic and Social Science Research Council (UK)
FAO	Food and Agriculture Organisation
FC	Forest Conservation Project (IGES Project)
FRN	Swedish Council for Planning and Coordination of Research
GCTE	Global Change and Terrestrial Ecosystems Project (IGBP Project)
GEC	Global Environmental Change
GECHS	Global Environmental Change and Human Security Project (IHDP Project)
GEWEX	Global Energy and Water Cycle Experiment (WCRP Project)
GLOBEC	Global Ocean Ecosystem Dynamics Project (IGBP Project)
IAI	Inter-American Institute for Global Change Research
ICSU	International Council for Science
IDGEC	Institutional Dimensions of Global Environmental Change (IHDP Project)
IGBP	International Geosphere-Biosphere Programme
IGES	Institute for Global Environmental Strategies (Japan)
IPCC	Intergovernmental Panel on Climate Change

ISPC	International Scientific Planning Committee
IHDP	International Human Dimensions Programme on Global Environmental Change
IIASA	International Institute for Applied Systems Analysis (Austria)
ISSC	International Social Science Council
IT	Industrial Transformation Project (IHDP Project)
JGOFS	Joint Global Ocean Flux Study (IGBP Project)
LOICZ	Land-Ocean Interactions in the Coastal Zone Project (IGBP Project)
LUCC	Land-Use and Land-Cover Change Project (IGBP/IHDP Project)
PAGES	Past Global Changes Project (IGBP Project)
START	Global Change System for Analysis Research and Training
UE	Urban Environmental Management Project (IGES Project)
WCRP	World Climate Research Programme