1993

25-29 January, Ensenada, B.C., Mexico
SAC III: Third Meeting of the Scientific Advisory Council for the IGBP. IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Sweden. Tel: (+46-8) 16 64 48; Fax: (+46-8) 16 64 05

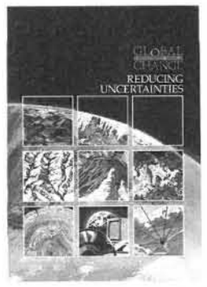
18-22 April, Eilat, Israel
Global Atmospheric-Biospheric Chemistry: The First Scientific Conference of the International Global Atmospheric Chemistry Project. IGAC Core Project Office, MIT, Bldg. 54-1312, Cambridge, MA 02139 USA, Tel: (+1-617) 253 4902, Telex: 921437 mitcam, Fax: (+1-617) 253 0354, E-mail: R.Prinn (Omnet)

ICSU

24 January, Ensenada, B.C. Mexico
ICSU Forum on Earth System Research (day before SAC III), ICSU Secretariat, 51 Bd. de Montmorency, F-75016 Paris, France, Tel: (+33-1) 45 25 03 29; Fax: (+33-1) 42 88 94 31

New Publications

IGBP Reports



Global Change: Reducing Uncertainties. Stockholm, International Geosphere- Biosphere Programme, 1992. 40 pp.

No. 18:2
Proceedings of the Asian Workshop, New Delhi, India, 11-15 February 1991.Collected papers presented at the Workshop.
Companion report to 18:1, the Recommendations of the Asian Workshop. A charge of $10 is made for each copy. It may be ordered from: Prof. R. R. Daniel, Scientific Secretary, COSTED, Asia Regional Office, 24 Gandhi Mandap Road, Madras 600 025, India.

No. 22
Report from the START Regional Meeting for Southeast Asia, Arranged by IGBP in collaboration with Human Dimensions of Global Environmental Change Programme (HDGEC), under the auspices of the Thai Minister of Science, Technology and Energy, His Excellency Professor Sanga Sabhasri.

Other IGBP Publications

Workshop report. [Report of the IGBP Workshop for South America in São José dos Campos, Brazil, including papers presented]. in: Revista Geofisica, 1990 (32) 246 pp. *The recommendations from the South American regional meeting were presented in IGBP Report No. 16.*

Asian Planning Meeting for the IGBP, Singapore, December 12-14, 1991. A Report, B. Babuji and R. R. Daniel (eds). 1992. 28 pp.

Global Energy and Water Cycle Experiment (GEWEX). Report of the Second Session of the WCRP-GEWEX/IGBP-BAHC Joint Working Group on Land-Surface Experiments, Greenbelt, Maryland, USA, 3-4 June 1991. (WCRP-61, WMO/TD-No. 437)

ICSU

An Agenda of Science for Environment and Development into the 21st Century. J C I Dooge, G T Goodman, J W M la Rivière, J Marton-Lefèvre, T O'Riordan, F Praderie (eds). Cambridge, University Press [for the] International Council of Scientific Unions, 1992. 331 pp.

IGBP National Committee Reports

Australia
Issues Related to Global Environmental Change in the Australian Region. A Proposal for Enhanced Research Funding. Canberra, Australian Academy of Science, October 1991. 39 pp.

Japan
First Report of IGBP-Related Studies in Japan. Japan National Committee for IGBP, March 1992. 119 pp. (Japan IGBP Global Change Report, 2)

France
Evolution of the Climate and the Global Environment. The French contribution in 1991, ed. by P. Buat-Ménard. Paris, Ministry of Research and Technology, 1992. 58 pp.

IGBP-related

Glaciers-Ocean-Atmosphere Interactions. V M Kotlyakov, A Ushakov & A Glazovsky (eds), 1991. 550 pp (IAHS Publication 208)

Inventorying and Monitoring Biodiversity. A proposal for an international network, ed. by F. di Castri, J. Robertson Vernhes and T. Younès. *Biology International*, 1992 (27), 28 pp.

Paleo-ENSO Records International Symposium. Extended abstracts. Volume prepared for the International Symposium on Former ENSO Phenomena in Western South America: Records of El Niño Events (Lima, 4-7 March 1992). 333 pp.

The Psychological Dimensions of Global Change, ed. by Kurt Pawlik. *International Journal of Psychology*, 1991, (26) 5, 545-673. (Special Issue)

The relevance of satellite missions to the study of the global environment. CEOS Committee on Earth Observation Satellites, British National Space Centre, London, 1992. 111 pp. (Prepared for the UNCED Conference Rio de Janeiro 1992)

Report of the Twelfth Session of the Joint Scientific Committee, held jointly with the Executive Group of the IOC/SCOR Committee on Climatic Changes and the Ocean. Bremen, Germany, 18-23 March 1991. Geneva, World Climate Research Programme. 100 pp. (WMO/TD No. 432)

Correction

In Global Change NewsLetter No. 9, March 1992, on page 15, the Chairmanship of Prof. Gordon A. McBean, recipient of a top award for meteorology in Canada, was given incorrectly. Prof. McBean chairs the WMO/ICSU Joint Scientific Committee for the World Climate Research Programme (WCRP).

Global Change (IGBP) Newsletter
Editor: Suzanne Nash
NewsLetter requests and change of address information should be sent to the IGBP Secretariat,
The Royal Swedish Academy of Sciences, Box 50005,
S-104 05 Stockholm, Sweden

ISSN 0284-5865

LAYOUT: IDÉBLUCK AB PRINTING: BERGS GRAFISKA, STOCKHOLM 1992

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GLOBAL CHANGE NEWSLETTER
No. 10 JUNE 1992
THE INTERNATIONAL GEOSPHERE–BIOSPHERE PROGRAMME: A STUDY OF GLOBAL CHANGE (IGBP) OF THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

CONTENTS

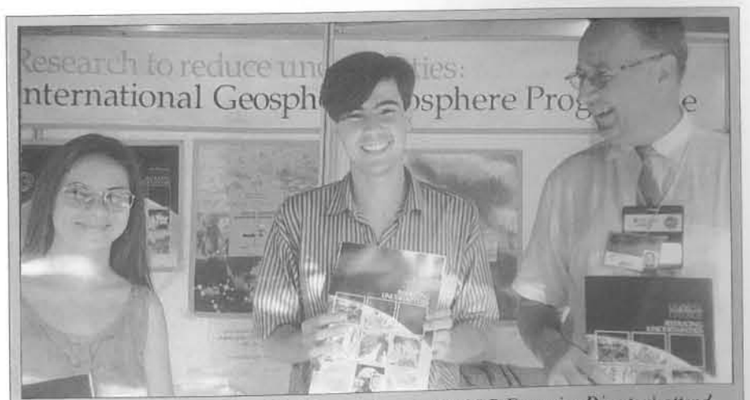
After Rio: the research challenge

Whilst much was achieved at the UNCED Earth Summit, its overall outcome showed that there is not yet sufficient political unanimity for decisive action that would slow the rate of global change.

The reason for caution by some governments is not just because of the perceived cost of reducing greenhouse gas emissions and other environmental protection measures. It is also because of the large uncertainties in the timing and magnitude of global change effects. That situation gives added urgency to global change research programmes, such as IGBP, that address the functioning of the Earth system – leading to predictions of its behaviour when subject to increasing human influences.

Thus there is now increased need for IGBP research to be relevant to policy makers. In addition to being of the highest scientific quality, it must also be well-integrated, focused on priority problems, and communicate its results as clearly and as rapidly as possible. One of the major scientific achievements of the 1980s has been the development of physically-based general circulation models: the task for the 1990s is to improve those models, and link them with the life-driven processes of the biosphere. The IGBP provides the framework for such science.

To increase awareness of IGBP, a full-colour booklet, "Global Change: Reducing Uncertainties", has been produced, in time for distribution at the Rio meeting. A copy of that publication is enclosed with this issue of the Newsletter, with additional distribution through National IGBP Committees, ICSU and other organizations. Should further single copies be required, these can be obtained free of charge from the IGBP Secretariat, Stockholm; for bulk orders, postage and handling will be charged.



IGBP made its presence felt at Rio. Thomas Rosswall (IGBP Executive Director) attended sessions of the UNCED meeting and gave presentations on IGBP to a wide variety of audiences. An IGBP exhibition booth at the Global Change Forum attracted considerable interest by governmental delegates, NGO participants and journalists. The booth displayed IGBP publications, and was used to distribute new leaflets on IGBP and START. In addition, the IGBP booklet "Global Change: Reducing Uncertainties" was officially launched at both the Global Forum and UNCED. The booth was manned by, from left to right, Alicia L. P. Mendonça, and Saulo de Tarso da Silva, here with Thomas Rosswall.

START from Concept to Reality

IMPORTANT NEW DEVELOPMENTS NOW HAVE SET A FIRM BASE FOR THE WORK OF THE IGBP GLOBAL CHANGE SYSTEM FOR ANALYSIS, RESEARCH AND TRAINING (START).

START Secretariat Established

At its most recent meeting in Ottawa in May, the START Standing Committee approved plans to establish an interim secretariat for START. As is the case for the IGBP Core Projects, a separate secretariat for START is needed. Over the past year, a considerable proportion of the efforts of the IGBP staff at the Stockholm secretariat has been devoted to START developments.

Earlier this year, representatives of the US Committee of Earth and Environmental Sciences (CEES), in particular Dr. R. W. Corell, and representatives of the Consortium for International Earth Science Information Network (CIESIN) offered to help establish an interim secretariat for START in Washington, DC. The START Standing Committee gratefully decided to accept this offer and to open the new office in Washington, DC on 1 July 1992. CIESIN will provide support for office staff and costs, while additional programme funds will be supplied by the National Science Foundation (NSF). This is in addition to funds to support START already provided by Germany, France, Japan, Switzerland and the US.

The Acting Director of the START secretariat will be Thomas Rosswall, who will be on leave-of-absence from his post as Executive Director of the IGBP for one year starting 1 September 1992. The Acting Executive Director of the IGBP during this time will be Dr. John Marks of the Netherlands, who has worked closely with the IGBP as Chair of the International Group of Funding Agencies for Global Change Research. The START Standing Committee has appointed a search committee for a permanent START Director, who will take over in September 1993. The members of this committee are W. Menden, Chair, R. Herrera, K. Higuchi, and R. Rockwell.

Inter-American Institute Established

On 12-14 May, representatives of eleven governments in the Americas met in Uruguay and signed the "Declaration of Montevideo" (see box) that establishes the Inter-American Institute for Global Change Research (IAI). The institute will coordinate and sponsor research on regionally-important aspects of global environmental change. The START Standing Committee has consequently offered to recognize the IAI as the network partner of START for three START regions: Equatorial South America (ESA), Temperate South America (TSA) and the Caribbean (CAR). The committee has also recommended that the Scientific Committee for the IGBP appoint the IAI Director as an ex-officio member of the START Standing Committee.

The IGBP and the Human Dimensions of Global Environmental Change Programme (HDP) are planning to sponsor several workshops jointly with the IAI to further develop projects for research to be performed within the framework of the IAI and START. The IGBP had already sponsored a regional meeting for Latin America in 1989, and there were plans for a second one in 1992 (Costa Rica). However, in view of the rapid development of the IAI, this second regional meeting for South America will be held when the IAI is firmly established, most likely early in 1993. In coordination with the IAI, the HDP is organizing a regional meeting to identify research questions and priorities for collaborative social-natural science research on the human dimensions of global change. These questions and priorities will be closely linked to the initial research foci of the IAI.

Global Environment Facility Funding Awarded for START

The Global Environmental Facility has awarded a grant in support of START regional research networks and centres in Latin America (through the IAI), Southeast Asia (initially focusing on the six Association of Southeast Asian Nations - ASEAN), with some initial funding for Africa north of the Equator.

The Global Environment Facility (GEF) is a three-year pilot programme, established in 1990 by representatives of a group of industrialized and developing countries, that provides grants and low-interest loans to help developing countries carry out programmes to relieve pressure on the global environment. The fund supports environment management, and the transfer of environmentally benign technologies. The facility is a cooperative venture among national governments, the World Bank, the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP).

START will work closely with the Inter-American Institute, in developing detailed plans for activities in this region. In Southeast Asia, a regional START Committee for the ASEAN countries has been established and will meet for the first time in Jakarta on 28-29 July 1992. The committee is charged with developing detailed plans for the regional network. A number of specialized workshops will plan proposals for research on the priorities identified by participants in the regional meeting held in Chiang Mai, Thailand, in January 1992 (see IGBP Report No. 22). In the Northern African region, a regional workshop for Africa will be held in Niamey, Niger from 23-27 November 1992. Plans for this region are developing rapidly following a visit to countries in the region by Thomas Rosswall, IGBP Executive Director, and Richard Moss, HDP Deputy Executive Director, during February of this year.

Declaration of Montevideo

Representatives of the States of the Americas met in Montevideo, Uruguay, on 12-14 May 1992 to sign an Agreement Establishing the Inter-American Institute for Global Change Research (IAI). The Meeting, chaired by the acting Minister of Foreign Affairs, Dr. Eduardo Mezzera, adopted this Agreement as a new international instrument intended to foster cooperation in global change research throughout the Americas.

The establishment of the Inter-American Institute as a regional network of research entities reflects both the vision of the scientific community and the political will of the States of the region. The Institute seeks to achieve the best possible international coordination of scientific and economic research on the extent, causes, and consequences of global change in the Americas, with the objective of significantly expanding the frontiers of knowledge and serving as an effective interface between science and the policy process.

The Representatives stressed that scientific interests should be the driving force in the implementation of the Institute's network, including its affiliated and associated research institutions. The expression of intent on the part of several countries to submit proposals to host Research Centres and the Directorate within the Institute's network was acknowledged and supported.

The Representatives agreed to establish an Implementation Committee which would be composed of representatives from interested signatory States to the Agreement and would be supported by a small staff. Other States were invited to participate as observers. This Committee was charged with laying the groundwork for the Institute to become operational promptly upon the entry into force of the Agreement and would continue to function until the first meeting of the Conference of the Parties.

It was further agreed that, in order to maintain the momentum generated by the opening of the Agreement for signature, representatives from signatory States shall meet immediately thereafter to discuss terms of reference, statement of work, and schedule the first meeting of the Implementation Committee. In addition, the representatives agreed to inform the United Nations Conference on the Environment and Development (UNCED 92) of the establishment of this Institute.

In signing this Communique, the Representatives express the collective will of their Governments to advance as much as possible the establishment of the Inter-American Institute for Global Change Research and to be guided during the period preceding the entry into force of the Agreement, by its principles and objectives.

Representatives of all countries were invited to sign this Communique to express their support for the Institute and their continued interest in becoming Parties to the Agreement as soon as circumstances would allow their full participation.

Argentina	Panama
Bolivia	Peru
Brazil	USA
Costa Rica	Uruguay
Dominican Republic	Venezuela
Mexico	

Education in Global Change

THE GLOBAL CHANGE PROJECT OF ICSU'S COMMITTEE ON THE TEACHING OF SCIENCE

BY D J WADDINGTON AND J STOLTMAN

The Committee on the Teaching of Science has prepared teaching units on global change that can be incorporated into the scientific curriculum of secondary schools. These can be used in the basic teaching of science, while expanding knowledge of global change. Those prepared to date are: The global carbon cycle; Remote sensing - a window on global change; The changing atmosphere; Clues from the past - glimpses of our future; Energy systems; Population and land use; and Oceans.

One of the principal aims of the Committee on the Teaching of Science (CTS) of the International Council of Scientific Unions (ICSU) is to further, on an international scale, progress in the teaching of science at all levels. To do this, CTS needs a large number of allies. Among the most important are the scientists working with ICSU. In the Education in Global Change project, our first major curriculum development project, we are receiving much help from IGBP.

We must attract able young people into our professions, showing them that science is one of the most worthwhile of human activities. It is also important that everyone leaves school understanding as much as possible of the science that is relevant to their understanding of the world in which they live; that scientists can only provide information for the solutions of the natural and man-made problems facing the human race, and within the political, social, economic and technological constraints imposed on them. Further, a common concern among scientists and educators is the extent to which these frontiers of research can be included in the school curriculum. A time lag of decades is not unusual for the inclusion of scientific research findings to the subject matter studied by secondary school pupils. This lag is especially unfortunate when issues of major concern are being addressed. The research undertaken on global change during the last decade is a prime example of highly pertinent research methodology and processes that should be incorporated into the school curriculum. The scientific and social dimensions of the research necessitate that secondary school students, both in their role as citizens and as future

policy makers, have the opportunity to learn about the results of this research.

Support for teachers

The issues that are currently facing scientists - such as global change - which are of massive interest to teachers and students alike, are not wilfully ignored by teachers. Many teachers will tell you that they would love to teach about the environment but there is no room in their teaching schedule; their time is constrained by curricula and examinations which they do not control. Others will tell you that they do not have the necessary up-to-date information. Some will say that the essence of science is to study simple situations so that cause can be related to effect and natural laws formulated. To study issues such as global change is to study highly complex situations governed by a large number of parameters, some not identifiable.

The Education in Global Change project accepts these points as valid and meets them head on. The project is founded on the following principles:

• There is no more room in the curriculum. We must convince teachers to substitute our materials for theirs. For example, when they introduce the electromagnetic spectrum, they can use our lessons on the greenhouse effect or remote sensing. If they want to give practice in data interpretation, then they can use the lesson on information that can be deduced from data on tree-ring studies in the unit "Clues from the Past - Glimpses of our Future", and if an example of gas liquid equilibrium is wanted, they may use the lesson in "The Global Carbon Cycle" on carbon dioxide and the oceans.

• We agree that teachers do not have the up-to-date information required. It is our job to seek authoritative data and interpretations and to make them accessible. This is one role for ICSU scientists. Another relevant role is to provide an exciting context in which to write science.

• Our experience with those units which have been used tells us that students are able to handle these complex issues. If we do not give them this experience, where else will they get it before they leave school and formal science lessons for ever - and who better to guide them than their science teachers?

The Committee on the Teaching of Science has begun this project by concentrating on producing teaching materials for students in senior secondary schools and colleges in the age range of 16-19 - but we are hoping later to address other levels of schooling. The units vary considerably in length, from two to twelve hours. Each one is easy for teachers to use and helpful for the less experienced teacher, relevant to senior secondary school science courses, illustrating important scientific principles, and interdisciplinary, yet covers activities suitable for selective use in biology, chemistry, physics and Earth science courses. They also encourage participation of students, giving them practical work, discussion, data collecting, and data interpretation. They are realistic in length, and can be taught within the constraints of their syllabus, at the same time being readily adaptable to programmes of general education and to local conditions. Advice to teachers is given for these changes. Parts of each unit can be used independently to illustrate a specific point. Further, it is possible to "sew together" parts of different units to produce one tailored to the aims of the teacher when different to those considered by the team.

• Readily adaptable for programmes of general education. The booklets we are producing are divided into the following four sections for each unit: i) An overview of the whole unit (a rationale) and of each lesson; ii) a brief outline for teachers which gives learning outcomes and the notes on the student activity, giving answers to the problems and other information to make the organisation of the lesson as smooth as possible; iii) information about the topic to extend the knowledge of teachers; and iv) student activity sheets which can be readily adapted by teachers to suit their specific requirements. If teachers wish to, these sheets can be copied (copyright is waived as long as the materials are used within their school or college).

Interesting for students

Science can discourage students both because they realise that is can be difficult, and because of the way it is often taught since the subject matter can appear to students as a series of arid and unprepossessing tasks, particularly if they are simply told to "learn it". To counter-act these effects, the CTS material is "student centred". It includes laboratory experiments, data collection, manipulation and interpretation; and encourages talks by students, class debates, and small group discussions.

For example, there is interest and understanding when students explain the chemistry of nitrogen oxides in terms of the role of these gases in the atmosphere. We find that students want to discuss the science; we find parents saying that science is now being discussed at home. The chemistry of nitrogen oxides is covered in a lesson entitled "To fly or not to fly" in the Changing Atmosphere unit. Students learn about the production of nitric oxide from supersonic transport planes and the reactions of nitric oxide in the stratosphere; they are then asked to predict what effect a new fleet of such aircraft may have on the stratosphere. They have to decide what data are required and what assumptions they need to make. They are faced with the very problems that scientists have when they predict the effects of scientific and technological changes on the environment, and that gives students a salutary lesson in the difficulties of looking into the future. In another part of the Changing Atmosphere unit, students, in getting to grips with the greenhouse effect, design an experiment to illustrate black body radiation (using thermometers and some graphite). In another they inspect absorption data of methane, carbon dioxide and CFCs (chlorofluorocarbons) to look for themselves at the idea of atmospheric windows. It is the students who do the work.

The Committee on the Teaching of Science held its first two development workshops for the Education in Global Change project in 1990 and 1991, at Berkeley and York, respectively. The drafts are being tried in schools in the UK, USA, France and India, the countries from where the participants of the workshops came. English version trials will continue into mid-1992, followed by some in French. We are also collaborating with the Committee on Science and Technology in Developing Countries (COSTED), to have a development workshop in Asia, and one with the International Council for Science Education (ICASE), perhaps in Latin America. These organisations will also help to distribute the materials.

This work has been funded principally by CTS, but we have had generous contributions from Unesco and from the National Science Foundation in the USA, for which we are most grateful. The academic contributions from global change scientists have been enormous.

For further reading see: D J Waddington (1992), *Kemia-Kemi* 19: 7, and for more information about the development and availability of the units, please contact Professor D J Waddington, Department of Chemistry, University of York, York YO1 5DD, UK, or Professor J Stoltman, Department of Geography, Western Michigan University, Kalamazoo, Michigan 49008-5053, USA.

John Marks, Acting Executive Director of the IGBP, September 1992 to September 1993. A personal introduction

As is mentioned in the report on START, Thomas Rosswall will be on leave of abscence from his post as the IGBP Executive Director from 1 September 1992. The SC-IGBP and ICSU Executive Board are pleased that Dr. John Marks has agreed to be Acting Executive Director during this year.

Dr. Marks is a Dutch citizen, with a Ph.D. in physics from Leyden University. He has been with the Directorate for Research and Science Policy at the Dutch Ministry of Education and Science since 1980. His present position at the Ministry is Head of the Division for Environment, Life Sciences and Research & Development Strategy. He has been involved in many international programmes related to global change, among them the International Group of Funding Agencies for Global Change Research (IGFA), the Earth Observation Programme of the European Space Agency, and the Human Dimensions of Global Environmental Change Programme (HDP). Here he describes his involvement in global change research:

Dr. John Marks

I became involved in global change research in 1987, the year the Brundtland report "Our Common Future" was published. In the Netherlands it was followed by a state of the environment report "Concern for tomorrow", compiled by the National Institute of Health and Environment. This report indicated what action would be required to reach sustainable development. It showed that drastic measures were called for to reduce emissions and spilling of resources.

The response of the government was the National Environmental Policy Plan that set a path to sustainability within one generation. This plan, and the Science Budget following it, analyzed the long-term oriented research that is called for to support the government policy and to reduce uncertainties. I was responsible for the preparation of this science policy document. In view of the global scale of human interventions, of the complexity of the problems involved and considering the size of the Netherlands, it was clear that research on these issues should be undertaken in close international cooperation. For certain issues this should be done at the European level, and for others global cooperation is necessary. It was then that I established my first contacts with IGBP. Subsequently I became involved with the funding agencies for global change research.

The strength of IGBP is the fact that it is a coherent, centrally coordinated programme with scientific priorities derived from an analysis of the problems of global change. It is based on a consensus in the international scientific community. IGBP must rely on nationally funded research contributions for its implementation. This is a flexible and realistic way of implementation that requires, however, high quality scientific management both of the core projects and of the programme as a whole, in order to maintain the coherence and to avoid overlaps on the one hand and gaps on the other.

IGBP has now moved into the implementation phase and I consider it a major challenge to contribute during my year in Stockholm to further strengthening of the science-led management of the programme. This is essential for maintaining the quality of IGBP.

I also think that time has come to start considering how to evaluate the research that is being performed and how the results can be fed into, for example, the work of the Intergovernmental Panel on Climate Change (IPCC). In this context the drawing up of an IGBP synthesis report in time for the next IPCC assessment in 1995 should seriously be considered. Such activities provide a focus for IGBP, complementary to the inherent scientific interest of the problems related to global change. In the end programmes like IGBP and the World Climate Research Programme and, hopefully soon, the programme addressing the human factors of global change, the HDP, will have to provide the fundamental knowledge base from which policy must draw.

Other IGBP Secretariat changes: From June first 1992 Cecilia Edlund, Assistant to the Executive Director, has left the IGBP and we are sorry to see her go. We are very happy that June Bawick, who has been with the staff for the past year, will be the new Assistant to the Executive Director.

IGBP Activities

Scientific Committee gives Task Force status for GAIM

The IGBP Global Analysis, Interpretation and Modelling (GAIM) project now has special status as a Task Force. This decision was made by the 4th meeting of the IGBP Scientific Committee (Munich and Rosenheim, Germany; 3 - 6 April), in recognition of the unique operational role of GAIM within the programme. Specifically, the GAIM Task Force has responsibility for the global synthesis of IGBP research, with broad and interactive relationships with all the Core Projects and the IGBP Data and Information System. Furthermore, the IGBP Scientific Committee will maintain close guidance of GAIM activities, many of which will operate on a shorter timescale (2 - 3 yr) than for the IGBP Core Projects.

Berrien Moore (Chair, GAIM Task Force) described to the Scientific Committee the operational plans for GAIM. These had been developed at the first meeting of the GAIM Core Project Planning Committee (Paris, 18 - 20 March). Moore reported that the overall aims of GAIM are to advance the development, evaluation and application of comprehensive prognostic models of the global biogeochemical system; and to couple such models with those of the physical climate system. The strategy proposed to achieve those objectives was as follows:

- employ a hierarchy of models to understand critical modelling issues, with emphasis on the coupling of models addressing sub-components of the total system
- design and implement studies that will assess the sensitivity and predictability of biogeochemical models at different levels of complexity
- promote systematic model validation and intercomparison within IGBP
- work towards a comprehensive simulation of the fully coupled system, in close collaboration with the modelling activities of the World Climate Research Programme (WCRP).

Two specific studies were planned to initiate GAIM implementation. Firstly, a 2- way coupling of vegetation and climate models; secondly, a 3-way coupling of carbon cycle models, to link the land, atmosphere and ocean components. The latter study would address key uncertainties regarding the present (and future) fate of anthropogenic CO_2.

Other agenda issues for the Scientific Committee meeting included reviews of the development of the proposed IGBP projects on Land Ocean Interactions in the Coastal Zone (LOICZ) and of the joint IGBP/HDP activity on Land-use and Land-cover Change.

An outline of the LOICZ Science Plan was presented by Patrick Holligan (Chair, LOICZ CPPC). The SC-IGBP endorsed the structure of that plan, and noted the attention it gave to defining aspects of coastal zone science that were of greatest relevance to global change. Four research foci were proposed for LOICZ: land-sea exchanges of matter; coastal responses to sea-level change; carbon fluxes and trace gas emissions; and prediction of change in the coastal zone. A full version of the LOICZ Science Plan is now in preparation, and a decision on formal acceptance of LOICZ as an IGBP Core Project will be made at the next SC-IGBP meeting (30 Sept - 2 Oct 1992; Saginaw, Michigan, USA).

Billie Lee Turner (Chair of IGBP/HDP Working Group) presented the case for a joint project on global land-use and land-cover changes. This would focus on how land use (and hence land cover) has been affected by socio-economic factors and other human activities, and the likely changes in land use and land cover between now and the middle of the next century. Implementation of such a project would include the development of a typology of important land cover conversions (based on the attributes of cover type, human driving forces and conversion processes); integrated case studies; and the development of global land use/cover models that can be coupled with other global models.

The SC-IGBP welcomed the progress that had been made in defining a land-cover/use agenda, and decided that a Core Project Planning Committee should be established to prepare the detailed Science Plan for this activity.

Invited participants to the SC-IGBP meeting included the Project Managers of BAHC, GCTE, IGAC and JGOFS. These individuals contributed greatly to the discussions, and attended an additional session at Rosenheim to review the funding of Core Project Offices and the funds necessary to conduct the Core Project research (with particular regard to the current exercise of the International Group of Funding Agencies for Global Change, IGFA) and other organizational issues.

The Munich venue for the first day of the SC-IGBP meeting provided the opportunity for involvement in the International Space Year (ISY) Conference, 'Space in the Service of the Changing Earth'. Several SC-IGBP members gave presentations in the global change sessions of that Conference.

Biospheric Aspects of the Hydrological Cycle

The BAHC Core Project has organized workshops on each Focus to develop implementation plans.

A planning workshop on "Microscale to Mesoscale Modelling of Moisture and Energy Transfer between Soils, Plant Canopies and the Atmosphere" was held in Canberra on 2-4 December 1991, hosted by the Division on Wildlife and Ecology of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia. The meeting developed the work plan within Focus 1. Agreements were made to develop closer interdisciplinary collaboration between hydro-meteorologists, hydrologists, ecologists, and soil scientists within the IGBP, particularly with regard to strengthened links between BAHC and the Global Change and Terrestrial Ecosystems (GCTE) project.

The status of BAHC Foci 2 and 3 will be reviewed meetings in the USA at the end of June.

The Scientific Steering Committee for BAHC held its second meeting in Berlin on 27- 30 April 1992, when the list of aims, activities and tasks for the four BAHC Foci were completed. The four BAHC research foci are:

1: Studies of water, energy and carbon transfer between, soil, vegetation and the atmosphere at patch scales

2: Regional scale studies of land surface properties and fluxes: experiments, interpretation and modelling

3: Interactions among the biosphere, water resources and climate - regional to continental scales

4: The weather generator project.

The Foci chairmen gave presentations of their implementation plans illustrating the tasks to be considered in BAHC as a whole, an overview of results, and additional contributions and proposals.

There was agreement that the observation programmes for future Land Surface Experiments should include, wherever possible, components which are of interest for quantifying nutrient and other cycles, in particular CO_2, and their interrelation with the hydrological cycle and the biosphere.

Thus BAHC interests included the quantification of nutrients and other material transported by water flowing on the land surface or through the soil and ground water into the rivers and further downstream. They need to be known for quantifying budgets for given land surface units; no other project intends to implement the required measurements and investigations. It was agreed that watershed-related studies are needed. Further discussions on these issues would be held with other IGBP projects, in particular GCTE, Land-Ocean Interactions in the Coastal Zone (LOICZ), and Global Analysis, Interpretation and Modelling (GAIM).

There were strong arguments to embed patch scale studies (planned within BAHC and GCTE) in large scale Land Surface Experiments and watershed related studies, and to also match, where possible, GCTE transect studies with such work. These aspects will be given special attention at coordination meetings to be held in the near future.

The text of the BAHC Implementation Plan is now being finalized, and will be published in the IGBP report series.

The first BAHC Open Meeting will take place on 16-18 November 1992 in Toulouse, France. (This meeting had earlier been planned for July 1992 in Estonia.) Plans will be presented for future BAHC research, and on collaboration with the WCRP on the Global Energy and Water Cycle Experiment (GEWEX). Major field experiments on land-surface processes, including the International Land-Surface Climatology Project (ISLSCP), will be also be an important part of the programme. Interested persons may contact Dr. Alfred Becker, BAHC Core Project Office, Institut für Meteorologie, Freie Universität Berlin, Dietrich-Schäfer-Weg 6-10, D-1000 Berlin 41, Germany, Fax: (+49-30) 838 71185.

Past Global Changes

Palaeoclimates of the Northern and Southern Hemispheres

At the latest meeting of the Past Global Changes (PAGES) Scientific Steering Committee in Berne (Switzerland) in April, implementation of the Palaeoclimates of the Northern and Southern Hemispheres (PANASH) project was a major item of the agenda.

PANASH is designed to establish the commonalities and interrelationships between known climate fluctuations in the two hemispheres. The project will target times of interest in both of the temporal streams of the PAGES project, and involves each of the project's three general research themes: solar and orbital forcing and response, fundamental Earth system processes, and rapid and abrupt global changes.

The immediate focus of PANASH is on a North/South inter-hemispheric integration of palaeo-data for the reconstruction of global climatic history. A map-plot of available data applicable to PAGES would show huge gaps. One of the important tasks of the PAGES Scientific Steering Committee and PANASH is to identify data deficiencies and to set in motion activities that will fill the gaps. The potential for improving our regional scale understanding of past environmental and climatic changes varies, but additional research should greatly enhance our knowledge of palaeo-ENSO, palaeo-monsoons, human impacts on the environment, carbon storage, etc.

It is of first importance that PANASH focus direct attention on thematic topics such as: the record of explosive volcanism in the northern and southern hemispheres, trace gas changes and their sources, and changes in glacier mass balance and sea level. These cut across the PAGES temporal streams and will ensure the accuracy of our reconstructions and multidisciplinary syntheses which will form the test bed for exercises in climatic modelling.

PANASH has been divided into two major research foci which relate to the activities of the PAGES chronological Streams I (the past 2000 years) and II (a full glacial cycle). PANASH I will focus initially on the more restricted period of the last 1000 years, and the PANASH II focus will be on environmental changes in the Northern and Southern Hemispheres: timing and phase relationships over the last 150,000 years.

Policy endorsement on Projects

Many individuals, groups and national or international organizations my wish to obtain official endorsement of their activities by PAGES. The implications for PAGES and in particular for the Core Project Office were discussed and it was decided that PAGES will give priority to those projects the Scientific Steering Committee initiates, such as the PANASH project, an initial research focus of PAGES.

It has also been decided to adopt for inclusion in PAGES research the three-level structure already recommended by the Scientific Committee for the IGBP, and announced in Global Change NewsLetter No. 7:

1. PAGES Core Research, consisting of large-scale, integrative projects that are international in scale and global in scope, and designed specifically to meet PAGES objectives. PAGES Core Research includes projects that have been initiated directly by the PAGES Scientific Steering Committee or components of national/international research programmes which contribute directly to the PAGES core research programme.

2. PAGES Regional/National Research that arises from national IGBP committees or from other national or regional groups of scientists. This research is designed to meet PAGES objectives at the national or regional level. PAGES Regional/National Research is an important part in the overall PAGES effort providing critical links between global-scale research and regional-scale activities which are of immediate concern to individual countries and regions.

3. PAGES-Relevant Research, that may be comprised of many smaller, locally-specific research projects initiated by individual investigators or institutions. Although contributing to the broad knowledge base that underpins the overall PAGES effort, the management and funding of this research will be the responsibility of the individual investigator(s). PAGES-Relevant Research will be referred to the appropriate IGBP national committee for

consideration and subsequent action.

Core Project Office

The PAGES Core Project Office will open in July in Berne, Switzerland. The Swiss National Science Foundation and the United States National Science Foundation have agreed to support the office for a period of five years. Dr. Herman Zimmerman, of the US National Science Foundation in Washington, DC, will join Prof. Hans Oeschger as Co- Director of the office.

In addition to the support of the PAGES project, products of the Core Project Office will be: i) a PAGES newsletter; ii) a PAGES source book of information and contacts for national programmes, group projects, and other activities relevant to PAGES; iii) a Palaeo- perspective document for the International Panel on Climate Change; and iv) bringing together small groups or teams with local funding where this will improve communication between groups and stimulate PAGES research. The present address of the office is at the Institute of Physics, University of Berne, Sidlerstrasse 5, CH-3012 Berne, Switzerland, Tel: (+41-31) 65 44 62, Fax: (+41-31) 65 44 05.

Goals beyond JGOFS: planning for GOEZS

The IGBP planning process has, from its earliest inception, recognised the special importance of the interacting physical, chemical and biological processes occurring in the upper ocean. These have a strong influence on the dynamics and trace gas composition of the atmosphere, and are therefore intimately involved in global change. Many aspects of upper ocean biogeochemistry are now being addressed by the IGBP/SCOR Joint Global Ocean Flux Study, that has close links with the WCRP World Ocean Circulation Experiment (WOCE) and the Tropical Ocean and Global Atmosphere study (TOGA). Nevertheless, it is unrealistic to expect these projects to achieve full interdisciplinary integration - and to provide the answers to all ocean-related global change problems - within their remaining lifetimes of 5-6 years.

A single project is therefore envisaged - the Global Ocean Euphotic Zone Study (GOEZS) - to build on the achievements of JGOFS and the physical oceanography of WCRP. Within GOEZS, there would be special emphasis on modelling, physical-biological interactions, remote sensing, other new technologies, and global data synthesis.

To take these ideas further, a GOEZS Working Group has recently been established as a joint activity of IGBP and the Scientific Committee for Oceanic Research. This group held its first meeting in Victoria, Canada, 29 April - 1 May, under the chairmanship of Dr Ken Denman (IOS Sidney, BC). Membership of the group includes the chairs of the JGOFS Scientific Steering Committee and the LOICZ Core Project Planning Committee, as well as representatives of the WOCE research community.

That meeting considered that scaling problems were likely to remain an unresolved issue within JGOFS, WOCE and TOGA. An interdisciplinary approach to spatial and temporal variability would therefore provide a strong focus for GOEZS. In particular, the relationship between event-scale variance ('weather') of ecosystem properties, and their larger scale means ('climate'). Until those two aspects can be satisfactorily connected, and described within holistic models, we will not be able to assess the reactive responses of the upper ocean to global change.

A document describing the basic features of a GOEZS project is now in preparation, so that its planning can be discussed with the wider research community. Although the field implementation of GOEZS would not take place until the late 1990s, it is necessary to proceed with planning and modelling studies as soon as possible. This will ensure that a scientifically strong successor to current activities is developed, meeting the needs of the overall IGBP research strategy.

Centro Cultural Riviera, Ensenada, Baja California, Mexico. Conference centre for SAC III

SAC III: Third Scientific Advisory Council for the IGBP

SAC III, 25-29 January 1993, will be hosted by the Mexican National Committee for the IGBP at the Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), in Ensenada, Baja California. The Director of CICESE, Dr. Mario Martinez-García, is the Chair of the IGBP Mexican Committee. Ensenada is located on the Pacific coast, 100 km south of San Diego, California, USA.

The IGBP Scientific Advisory Council is composed of representatives of National IGBP Committees, scientists nominated by members of the International Council of Scientific Unions (ICSU) and ICSU bodies adhering to the programme. Observers from other organizations, such as major UN bodies, are also invited to attend SAC meetings. They are held under the chairmanship of the President of ICSU.

The agenda is divided into two major parts. During the first 2 days, presentations will focus on new scientific findings that have helped narrow the uncertainties on global change. This session will not only include presentations on recent results from the established IGBP Core Projects but also presentations related to the World Climate Research Programme (WCRP) and the Human Dimensions of Global Environmental Change (HDP) Programme.

The proposed programme includes presentation and discussion of new IGBP developments on Land-Ocean Interactions in the Coastal Zone (LOICZ), Global Analysis, Interpretation and Modelling (GAIM), Ecological Complexity (GCTE Focus 4), Land cover/land use change (together with HDP), the System for Analysis, Research and Training (START) and a session on Global Data Bases and Global Monitoring. Meetings are foreseen of IGBP National Committees, and IGBP Liaison Persons from ICSU Scientific Members.

IGBP Partners

Stratospheric Processes and their Role in Climate (SPARC)

IGBP shares interests with the World Climate Research Programme (WCRP-see box) in improving understanding of radiative and chemical processes in the stratosphere and their role in global change. Plans for a project in this area (STIB: Stratosphere-Troposphere Interactions and the Biosphere) were developed with IGBP guidance, and have been reviewed by both the IGBP Scientific Committee and the WCRP Joint Scientific Committee.

Although IGBP decided not to establish STIB as a separate Core Project (see IGBP Newsletter No. 7, Sept 1991), many of the proposed studies on the biospheric impacts of UV radiation are to be included within the IGBP Core Projects on Global Change and Terrestrial Ecosystems and the Joint Global Ocean Flux Study, in collaboration also with the Scientific Committee on Problems of the Environment (SCOPE). The other components of STIB will form a new WCRP project "Stratospheric Processes and their Role in Climate" (SPARC). Thus the four SPARC research themes will address: i) the role of the stratosphere in climate change; ii) stratospheric process studies (associated with stratospheric ozone decrease - including the impact of anthropogenic emissions); iii) global change of the stratosphere; iv) stratospheric change and the penetration of UV radiation. Complex interdisciplinary questions regarding dynamical and radiative interactions between the stratosphere and troposphere, atmospheric chemistry and modelling the effects of natural and anthropogenic perturbations are involved.

Dr. Marie-Lise Chanin and Prof. Marvin Geller have been appointed as co-chairs of the SPARC Scientific Steering Group, whose membership also includes some of the former members of STIB and the WCRP Working Group on Atmospheric Chemistry and Transport (now dissolved). Representatives of the relevant IGBP projects will also be included.

The first meeting of the SPARC Scientific Steering Group will be held on September 19-20 in conjunction with a NATO Study Institute on the Role of the Stratosphere in Global Change (14-25 September, Carqueiranne, France). Contact: Dr. M.-L. Chanin, Service d'Aéronomie du CNRS, BP 3, 92371 Verrières le Buisson Cedex, France, Fax: (+33-1) 69 20 29 99.

The World Climate Research Programme

The WCRP is directed by the Joint Scientific Committee of the World Meteorological Organization and the International Council of Scientific Unions, and collaborates closely with the IGBP.

The major objectives of the WCRP are to determine i) to what extent climate can be predicted, and ii) the extent of man's influence on climate.

To achieve these objectives, the WCRP seeks to improve our knowledge of global and regional climates, their temporal variations, and our understanding of the responsible mechanisms; to assess the evidence for significant trends in global and regional climates; to develop and improve physical-mathematical models capable of simulating, and assessing the predictability of, the climate system over a range of space and time scales; to investigate the sensitivity of climate to possible natural and man-made stimuli and to estimate the changes in climate likely to result from specific disturbing influences.

In addition to the Chair, Prof. Gordon McBean, members of the Joint Scientific Committee are: E. Augstein (Germany) D. J. Baker (USA), K. A. Browning (UK), Y. Fouquart (France), S. Gadgil (India), G. S. Golitsyn (Russia), I. Karol (Russia), M. Manton (Australia), A. D. Moura (Brazil), T. Matsuno (Japan), S.-Y. Tao (China), T. Vonder Haar (USA).

Global Climate Observing System

The Second World Climate Conference held in October 1990 recommended that a Global Climate Observing System (GCOS) be established to meet the needs for climate system monitoring, climate change detection and response monitoring, especially in terrestrial ecosystems; data for application to national economic development; and research toward improved understanding, modelling and prediction of the climate system. The conference stressed that the further development and implementation of GCOS should be pursued with urgency by scientists, governments and international organizations. The first planning meeting for a Global Climate Observing System was convened by the Chairman of the Joint Scientific Committee for the World Climate Research Programme (WCRP) in early 1991, and a report from was published in IGBP NewsLetter No 6 (June 1991).

Four international bodies, the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of Unesco, the United Nations Environment Programme (UNEP), and the International Council of Scientific Unions (ICSU) have now joined together in forming a Joint Scientific and Technical Committee for GCOS. The committee is supported by a Joint Planning Office housed in the WMO headquarters in Geneva. Dr. John Townshend, member of the IGBP-DIS Standing Committee, is one of the ICSU members of the Joint Scientific and Technical Committee (JSTC) for GCOS.

The first meeting of the JSTC was held in Geneva in April 1992 when a programme of activities was drawn up to develop a detailed plan for GCOS. It was emphasized that GCOS requires a wide diversity of reliable observations with global coverage, with an appropriate resolution and continuity in time.

GCOS will make full use of existing programmes (such as the World Weather Watch), enhanced as necessary. A large

and substantially new component of GCOS will be a comprehensive observation system for the oceans; this will be based on the climate related component of the Global Ocean Observing System (GOOS) Other substantial new components will be comprehensive observation systems for the land surface and for the hydrological cycle. GCOS will provide much improved information on clouds and aerosols and their influence on the earth radiation budget. These factors currently account for the largest area of uncertainty in climate prediction. GCOS aims to better utilise existing data relevant to regional climate variability and change: in particular, providing assistance for developing countries to acquire and utilise data over their territories.

Observations from space vehicles will provide major contributions to all these components and GCOS will work closely with national and international space agencies and with the Committee of Earth Observations Satellites (CEOS) to ensure effective coordination and efficient use of resources. For the component of observations of the interior of the oceans, new techniques together with new international arrangements will be required.

Very large quantities of data will be generated from GCOS, so attention will be given to the adequate acquisition, handling, management, calibration, quality control, dissemination, utilisation and archiving of data. Of particular importance will be the assimilation of data into models in order to generate data sets of higher level products and fields.

List of the 53 IGBP National Committees and their Chairs

The date in brackets indicates the year of the Committee's establishment

Argentina (1990)
Dr. Mario N. Nuñes, Departamento de Meteorologia, Universidad de Buenos Aires, Pabellon 2 - Ciudad Universitaria, Buenos Aires 1428. Tel: (+54-1) 782 65 28, Telex: 18694 ibuba ar; Fax: (+54-1) 311 05 16; E-mail: rtnunez@criba.edu.ar.
Dr. Osvaldo E. Sala, Departamento de Ecologia, Universidad de Buenos Aires, Facultad de Agronomia, Av. San Martin 4453, Buenos Aires 1417. Tel: (+54-1) 52 09 03 or 51 15 89; Fax:(+54-1) 334 89 64; E-mail: sala@criba.edu.ar .

Australia (1986)
Prof. Bruce G. Thom, Department of Geography, Institute Building H03, University of Sydney, Sydney, New South Wales. Tel: (+61-2) 692 2886; Fax: (+61-2) 692 3644; E-mail: thom@estro.ucc.su.oz.au.

Austria (1990)
Prof. Siegfried J. Bauer, Institut für Meteorologie und Geophysik, Universität Graz, Halbärthgasse 1, A-8010 Graz. Tel: (+43-316) 380 52 56/55/61; Telex: 31662 ubgraz a; Fax: (+43-316) 355 66.

Bangladesh (1988)
Dr. S. D. Chaudhuri, Bangladesh Academy of Sciences, 3/8 Asad Avenue, Muhammadpur, Dhaka 1207. Tel: (+880-2) 31 04 25/60 68 68; Telex: 64 22144 srsbj.

Belgium (1988)
Dr. Oscar Vanderborght, Royal Belgian Academies of Sciences, Palais des Académies, 1, rue Ducale, B-1000 Bruxelles. Tel: (+32-2) 511 2629; Telefax (at Centre for Atomic Energy/UIA): (+32-14) 320 372.

Bolivia (1988)
Dr. Jaime Argollo, Facultad de Ciencias Geológicas, Universidad Mayor de San Andrés, Casilla de Correo 355, La Paz. Tel: (+591-2) 37 44 64; Telex: 3438 umsa bu; 3514 orstom bu, Telefax: (+591-2) 35 94 91.

Brazil (1988)
Prof. A. Azevedo Pacheco Leão, Academia Brasileira de Ciencias, Cx. Postal 229, Rua Alfilófio de Carvalho 29. 3°, Rio de Janeiro 20.001. Tel: (+55-21) 220 4794; Telex: 212087, Fax: (+55-21) 533 2342.

Bulgaria (1990)
Academician Blagovest Sendov, Bulgarian Academy of Science, 1 "7 Noemvri" St., Sofia. Tel: (+359-2) 87 77 31, Telex: 22424, E-mail: bsendov@cdp.uucp.

Canada (1988)
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Chile (1987)
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China (CAST) (1988)
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China (Academy of Sciences, Taipei) (1988)
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Colombia (1987)
Dr. José A. Lozano, Academia Colombiana de Ciencias Exactas, Fisicas y Naturales, Carrera 3a, No. 17-34 p° 3, Apartado 44.763 Santafé de Bogotá. Tel: (+57-1) 341 48 05; Fax: (+57-1) 283 85 52.

Cuba (1989)
Prof. Carlos Gómez Gutiérrez, Academia de Ciencias de la Republica de Cuba, Capitolio Nacional, Industria y San José, La Habana. Tel: (+53-7) 68914; Telex: 511290 acdcp cu.

Czechoslovakia (1987)
Dr. I. Nemesová, Institute of Physics of the Atmosphere CSAV, Bocni II, Box 1401, CS-141 31 Praha 4. Tel: (+42-2) 76 25 48; Telex: 121546 inop e; Fax: (+42-2) 76 15 49.

Denmark (1990)
Dr. Claus Hammer, Geofysisk Institut, Haraldsgade 6, DK-2200 Copenhagen. Tel: (+45) 31 83 85 00; Fax: (+45) 35 82 25 65; E-mail: glac@osiris.gfy.kk.dk.

Egypt (1988)
Prof. M. A. Ayyad, Botany Department, Faculty of Science, University of Alexandria, Moharran Bey, Alexandria.

Finland (1989)
Prof. Erkki Leppäkoski, Swedish University of Turku, Department of Biology, Vänrikinatu 3, SF-20500 Turku. Tel: (+358-21) 65 43 11; Telex: 62301 aabib sf; Fax: (+358-21) 51 75 53.

France (1988)
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Germany (BRD - 1987; DDR - 1988)
Prof. Hans-Jürgen Bolle, Institut für Meteorologie, Freie Universität Berlin, Dietrich-Schäfer- Weg 6-10, D-1000 Berlin 41. Tel: (49-30) 838 711 59, 838 711 17; Telex: (41)17 308740 fusat; Fax: (+49-30) 838 711 60; E-mail: H.Bolle.igbp (Omnet).

Greece (1988)
Prof. John Xanthakis, Research Center for Astronomy and Applied Mathematics, Academy of Athens, 14, Anagnostopoulou Street, GR-10673 Athens. Tel: (+30-1) 361 35 89.

Hungary (1987)
Prof. Joseph Tigyi, Biophysical Institute of the Medical University, PO Box 99, H-7643 Pécs. Tel: (+36-72) 140 17; Telex: 12500 pote h; Fax: (+36-72) 262 44.

India (1988)
Dr. A. P. Mitra, National Physical Laboratory, Hillside Road, New Delhi 110 012. Tel: (+91-11) 683 5480; Telex: 31-77384; Fax: (+91-11) 575 2678.

Indonesia (1992)
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Ireland (1988)
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Israel (1988)
Prof. Dan H. Yaalon, Institute of Earth Sciences, Hebrew University of Jerusalem, Givat Ram Campus, Jerusalem 91904. Tel: (+972-2) 58 42 48/58 46 86; Telex: 25391 hu il; Fax: (+972-2) 662 581, 666 804.

Italy (1990)
Dr. Angelo Guerrini, President, National Committee for Science and Technology of the Environment, National Council for Research, Piazzale Aldo Moro, 7, I-00185 Roma. Tel: (+39-6) 49 93 33 49; Telex: 610076 cnr rm i; Fax: (+39-6) 446 98 33.

Jamaica (1988)
Dr. Gladstone V. Taylor, Scientific Research Council, PO Box 350, Kingston. Tel: (+1-809) 927 1771/4 or 927 1912; Telex: 3631 srcstin ja, Fax: (+1-809) 927 5437.

Japan (1987)
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Kenya (1990)
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Mexico (1991)
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Netherlands (1987)
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New Zealand (1988)
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Niger (1991)
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Nigeria (1992)
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Norway (1989)
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Peru (1989)
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Philippines (1992)
Dr. Filomena F. Campos, National Research Council of the Philippines, General Santos Avenue, Bicutan, Taguig, 1604 Metro Manila. Tel: (+63-2) 822 0409; 822-0962-67.

Poland (1989)
Academician Prof. Leszek Starkel, Polish Academy of Sciences, Institute of Geography, Ul. Sw. Jana 22, PL-31-018 Kraków. Tel: (+48-12) 22 40 85; Telex: 825414 olpan pl.

Romania (1991)
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Russia (formerlly USSR Committee, 1988)
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South Africa (1987)
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Sri Lanka (1990)
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Sweden (1987)
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Switzerland (1987)
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Thailand (1989)
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Togo (1992)
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Uganda (1990)
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United Kingdom (1987)
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United States (1987)
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Venezuela (1988)
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Zambia (1990)
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Zimbabwe (1989)
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IGBP Meetings

1992

22-24 July, Saskatoon, Canada
GCTE Workshop on the Effects of Global on the Wheat Ecosystem. Mr. John S. I. Ingram, GCTE Focus 3 Associate Project Office, Department of Plant Sciences, University of Oxford, South Parks Road, Oxford OX1 3RB, UK. Tel: (+44-865) 275 079; Telex: 83147 forox gb; Fax: (+44-865) 275 060 or Prof. John W. B. Stewart, College of Agriculture, University of Saskatechewan, Saskatoon, SN7 0W0, Canada. Tel: (+1-306) 966 4050; Telex: 074-2659; Fax: (+1-306) 966 8894

27-31 July, Paris, France
GCTE/Observatory for the Sahara and Sahel/MAB Workshop: Monitoring Long-term Changes in Terrestrial Ecosystems. Dr. Jean-Claude Menaut, Ecole Normale Supérieure, Laboratoire d'Ecologie, 46 rue d'Ulm, F-75230 Paris Cedex, 05, France, Tel: (+33-1) 44 32 37 08, Fax: (+33-1) 43 29 81 72

28-29 July, Jakarta, Indonesia
Meeting of the START Regional Committee for South East Asia

13-16 September, Stockholm, Sweden
SCOPE/IGBP-GCTE Workshop on the Effects of Climate Change on Production and Decomposition in Coniferous Forests and Grasslands. Prof. Göran Ågren, Department of Ecology and Environmental Sciences, Swedish University of Agricultural Sciences, P.O. Box 7072, S-750 07 Uppsala. Tel: (+46-18) 67 24 49; Fax: (+46-18) 67 34 30.

30 September-2 October, Saginaw, Michigan, USA
5th Meeting of the Scientific Committee for the IGBP

8-9 October, Silsoe, UK
IGBP-DIS/GCTE Global Soil Data Base Workshop

19-24 October, Taipei, Taiwan
JGOFS Scientific Steering Committee. Dr. Geoff Evans, JGOFS Core Project Office, Institut für Meereskunde, Universität Kiel, Düsternbrooker Weg 20, Kiel, Germany, Fax: (49-431) 565 876, E-mail: JGOFS.Kiel (Omnet)

26-30 October, Bayreuth, Germany
GCTE Scientific Steering Committee Meeting, in conjunction with the meeting on the Design and Execution of Experiments on CO_2 Enrichment

November, Sioux Falls, South Dakota, USA
IGBP-DIS Land Cover Change Meeting

2-5 November, Raleigh, North Carolina, USA
LOICZ Open Meeting. Dr. Patrick Holligan, Plymouth Marine Laboratory, Citadel Hill, Plymouth PL1 2PB, UK. Tel: (+44-752) 222 772; (+44-752) 670 637

16-18 November, Toulouse, France
BAHC Open Meeting. Dr. Alfred Becker, BAHC Core Project Office, Institut für Meteorologie, Freie Universität Berlin, Dietrich-Schäfer-Weg 6-10, D-1000 Berlin 41, Germany, Fax: (+49-30) 838 71185

23-27 November, Niamey, Niger
Africa and Global Change: IGBP-HDP Regional Meeting.

December, Tokyo, Japan
Asian IGBP National Committees

December, Canberra, Australia
IGBP-DIS Standing Committee Meeting