

Subpolar Oceans: in connection with the symposium on Subpolar Oceans: Role in World Ocean and Climate. Dr. Laurent Labeyrie, Laboratoire Mixte CNRS-CEA, Centre de Faibles Radioactivités, Parc du CNRS, Gif-sur-Yvette, F-91198, France. Tel: (+33-1) 6982 3536, Fax: (+33-1) 6982 3568, E-mail: labeyrie@cole.cfr.cnrs-gif.fr

14 August, Glasgow, UK

PAGES Workshop on Comparison of Chronologies, in connection with the 15th International Radiocarbon Conference. Dr. Willem Mook, Centre for Isotope Research, University of Groningen, Wesstersingel 34, NL-9718 GM Groningen, The Netherlands. Tel: (+31) 2220 693 66; Fax: (+31) 2220 19 674

5-9 September, Fuji-Yoshida, Japan

International Symposium on Global Atmospheric Chemistry: Human Impact on the Global Troposphere. 2nd Scientific Conference of the International Global Atmospheric Chemistry Project (IGAC) and 8th Symposium of the IAMAP Commission on Atmospheric Chemistry and Global Pollution. Toshihiro Ogawa, CACGP/IGAC Symposium, Dept. of Earth and Planetary Physics, Faculty of Science, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan, or IGAC Core Project Office, MIT, Room 24-409, Cambridge, MA 02139, USA. Tel: (+1-617) 253 9887, Telex: 921473 mitcam; Fax: (+1-617) 253 9886

IGBP.NEWS

On 11 June the IGBP opened an electronic bulletin board on OMNET. If you wish to access it in Omnet, when at the "Command?" prompt, type in: "Check IGBP.NEWS", and at the next "Command?" prompt, type in "SCAN ALL". The board is described on OMNET as:

"IGBP.NEWS. Information on meetings and contacts for the International Geosphere-Biosphere Programme. The IGBP coordinates research on global change, with projects on terrestrial ecosystems, atmospheric chemistry, hydrological cycle, coastal zones, ocean fluxes, palaeoscience, land use/cover change, DIS, global biogeochemical modelling, and networks of regional research centres. Send items for posting to IGBP.Secretariat."

Publications

Global Change Reports

JGOFS Report No. 11. Reports of JGOFS Meetings held in Taipei, October 1992. Seventh Meeting of the JGOFS Scientific Steering Committee; Global Synthesis in JGOFS - A Round Table Discussion; JGOFS Scientific and Organizational Issues in the Asian Region - Report of a Workshop; JGOFS/LOICZ Continental Margins Task Team - Report of the First Meeting (1993). Baltimore: Scientific Committee on Oceanographic Research/JGOFS, 69 pp. *JGOFS Core Project Office, Institut für Meereskunde, Universität Kiel, Düsterbrook Weg 20, 24150 Kiel, Germany.*

CLIVAR. A Study of Climate Variability and Predictability (1992). Geneva: World Climate Research Programme. *World Climate Research Programme, World Meteorological Organization, Case Postale 2300, CH-1211 Geneva 2, Switzerland*

Quaternary Earth System Changes, ed. by H. Faure, L. Faure-Denard, T. Liu (1993). in: *Global and Planetary Change*, Elsevier, vol. 7, no. 1-3, 250 pp. (Special issue of papers presented at the Symposium of the INQUA Congress in Beijing)

The Ocean Observing System Development Panel. Interim Design for the Ocean Component of a Global Climate Observing System (1993). College Station (Texas): Department of Oceanography, Texas A&M University. 105 pp. *Copies may be obtained from Worth D. Nowlin Jr., Dept. of Oceanography, Texas A&M University, College Station, Texas 77843-3146, USA.*

National Activities

Canada
Canadian GEWEX Programme. A Conceptual Overview, prepared by the Canadian GEWEX Science Committee (1992) Gordon McBean (ed). 25 p. *GEWEX Secretariat, National Hydrology Research Centre, Saskatoon, Saskatchewan S7N 3H5.*

China (Beijing)
Contribution to Global Change: Biosphere-Atmosphere Interactions (1993). ed. by A. Ghazi. Proceedings of a Workshop held in Beijing, 1992. Brussels: Joint Research Centre of the C.E.C. 282 pp. *JRC-CEC, Rue de la Loi 200, B-1049 Brussels, Belgium.*

Czech Republic

Application of Direct and Indirect Data for the Reconstruction of Climate During the Last Two Millennia. Edited by Eliška Růžičková, Antonín Zeman and June Mirecki (1993). Papers presented at the national workshop of PAGES - Stream I, Brno, June 1992. 103 pp. *Dr. Růžičková or Dr. Zeman, Geological Institute, Rozvojová 135, 16500 Praha 6-Suchbát, Czech Republic.*

Norway

Biological Effects of Climate Change. An introduction to the field and survey of current research (1993), by Goerill Kristiansen. Oslo: Centre for International Climate and Energy Research (CICERO). 188 pp. *Goerill Kristiansen, NAVF, Sandakerveien 99, 0483 Oslo. Tel: (+47-2) 15 70 12, Fax: (+47-2) 22 55 71.*

Russia

Journal of Ecological Chemistry, International Edition, edited by Valerii A. Isidorov. Educational and Scientific Centre of Chemistry, St. Petersburg University and Alga-Fund. Quarterly. English edition from 1993 on. Annual subscription US\$ 60, plus \$12 for postage. *Alga-Fund: Post Box 634, 195009 St. Petersburg, Russia, Fax: (+7-812) 2185530; or to the overseas sales manager: E. Potapov, c/o EGI, Dept. of Zoology, South Park Road, Oxford OX1 3PS, UK.*

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No. 14

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THE INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME: A STUDY OF GLOBAL CHANGE (IGBP)
OF THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

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IGAC in Eilat

Two years ago, IGAC (the International Global Atmospheric Chemistry project) considered changing its name, adding a B for Biosphere. Since then, the project acronym has stayed the same, but there has been a radical shift in the research direction of a large, and growing, community of "upwardly mobile" environmental scientists.

This new, air-borne interdisciplinarity is now producing results. A particularly impressive selection - in both quantity and quality - was presented for discussion at the 1st IGAC Scientific Conference, held in Eilat, Israel (18-22 April). Thus there were over 70 oral papers, and a similar number of poster displays; of these, only a handful were 'pure' atmospheric chemistry. The majority provided new insights into the biotic processes at the land and sea surface that delivered (or removed) gases

and aerosols to the atmosphere, and the dynamics of their interplay, at the local, regional and global scale.

The structure of the Conference was based on the seven Foci, and around 20 Activities of IGAC. Fortunately, the sessions were not in parallel, since one of the main benefits of the meeting was the realization that different parts of the project shared common problems, with new, cross-cutting connections being developed.

For example, between the models (and experimental methods) for soil-air trace gas exchange in tropical and temperate regions. It was evident that the key factors determining the release and uptake of nitrogen oxides (such as N₂O) were now known, and could be quantified for many ecosystems - improving global budgets, and our understanding of how they would change in response to changing climate



The coastline of the Netherlands has been greatly influenced by human activity - and the possibility of sea-level rise is of considerable concern. See articles on p. 2 and p. 9

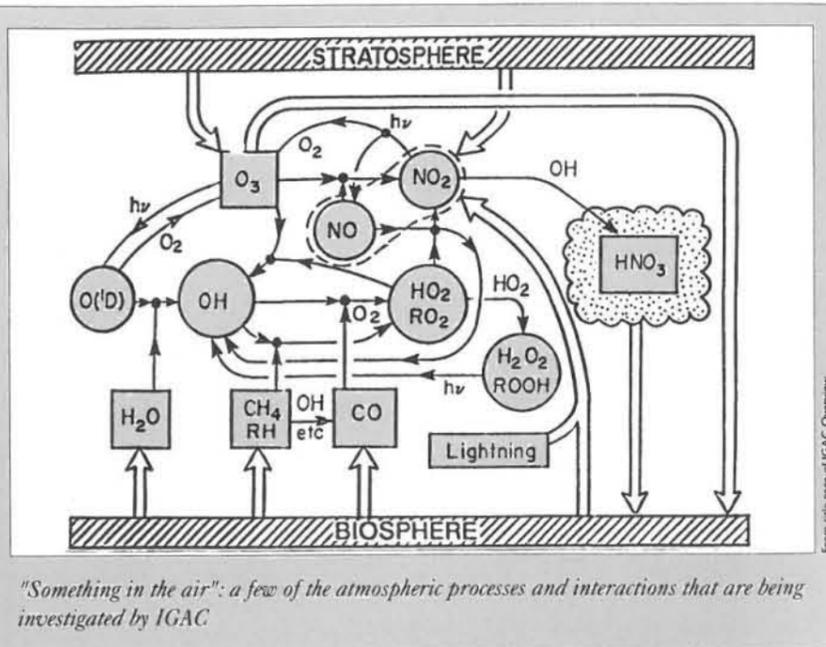
and land use. Another "hot" scientific topic was biomass burning, with field results reported from studies in Brazil, Africa, South-East Asia and Australia, and linked to large-scale and global changes in atmospheric composition.

Around 130 researchers attended the IGAC Conference, from 24 countries. To communicate at least part of the scientific excitement (and new results) of the meeting to a wider audience, it has been decided to publish the 13 invited papers as Conference Proceedings. The complete volume (Plenum Publishing Corp, NY) should be available in November, and will contain the following papers:

- Global atmospheric-biospheric chemistry (Prinn);
- Atmospheric impacts from biomass burning (Andreae);
- Methane emission from rice fields (Neue, Sass);
- Atmospheric chemistry of the East-Asian NW Pacific Region (Akimoto, Liu, Davis);



Ron Prinn, Chair of IGAC, opens the Eilat meeting



"Something in the air": a few of the atmospheric processes and interactions that are being investigated by IGAC

- Marine aerosol and gas exchange and global atmospheric effects (Huebert);
- Global measurements of photochemically active compounds (Wahner, Rohrer, Ridley, Atlas);
- Terrestrial biosphere-atmosphere interactions and land-use change in the tropics (Keller, Matson);
- Exchange of trace gases between the terrestrial biosphere and the atmosphere in the mid-latitudes (Smith, Robertson, Melillo);
- Multiphase atmospheric chemistry: implications for climate (Charlson, Lelieveld, Crutzen);
- Global emissions and models of photochemically active compounds (Penner, Atherton, Graedel);

- Terrestrial biosphere-atmosphere exchange in high latitudes (Reeburgh, Svensson, Roulet);
- Atmospheric chemistry and composition of air over the North Atlantic ocean (Penkett, Fehsenfeld, Prospero);
- Polar tropospheric chemistry and deposition (Barrie, Delmas).

Advance orders of the IGAC Conference Proceedings are now being accepted. The cost is US\$50 (includes shipping). To order, send a cheque or money order (in US\$), payable to the Massachusetts Institute of Technology, addressed to the IGAC Core Project Office, c/o Anne Slinn, MIT 54-1318, Cambridge, MA 02139, USA. Inquiries can be made by phone: (+1-617) 253 4902, or fax: (+1-617) 253 0354.

Land-Ocean Interactions in the Coastal Zone

LOICZ Science Plan well received at Project Meeting

Not everybody participating in IGBP has a coastline. But for those that do, the LOICZ project (Land-Ocean Interactions in the Coastal Zone) has generated a very high level of scientific interest. Researchers from over 30 nations participated in the first LOICZ Project Meeting (including strong representation from Africa, South America and South-East Asia), held in Raleigh, North Carolina, USA, 18-21 May.

The informal, yet well-structured, format of the meeting contributed greatly to its success. There were nine invited overview lectures on key research problems, plenary discussion sessions, and working group meetings on implementation issues (modelling, observation systems and data management, case studies, sea level, and human dimensions aspects) and regional studies (Europe, East and South-East Asia, Central and South America, Africa, East coast of North America, and global synthesis).

Any doubts there may have been regarding the acceptability of the LOICZ Science Plan (IGBP Report No. 25) were soon resolved: many countries were already using this document as the basis for developing their national plans. However, it was recognised that LOICZ had to go beyond assembling a collection of ongoing and planned national projects. The challenge is to achieve their coherence, necessary to gain a truly global perspective on such issues as riverine delivery of sediment, nutrients and other materials: the

role of the coastal zone in the carbon cycle; the importance of coastal ecosystems in maintaining and modifying the physical properties of the shoreline; and the implications of increasing human use of coastal zone resources.

The Project Meeting was followed by the first meeting of the LOICZ Scientific Steering Committee, under the chairmanship of Patrick Holligan. A strategy was developed for preparing an Implementation Plan for the project, for publication in 1994. The Project Meeting was considered to be very productive: however more attention needed to be given to human dimensions aspects (Focus 4), involving additional socio-economic expertise.

Societies and Coastal Zones

The Working Group that discussed Focus 4 at the LOICZ Project Meeting agreed that this activity will need to be cross-cutting, connecting studies on the effects of changes in external forcing or boundary conditions on the fluxes of materials within coastal systems (Focus 1), the biogeomorphology of sea-level rise (Focus 2) and social science research - in particular the parallel ideas that are being developed within the Human Dimensions of Global Environmental Change Programme (HDP). Focus 4 would need to actively encourage the integration of the natural science and social science components, with emphasis on the dynamic nature of the coastal system, and the importance of feedback processes.

The Working Group recognised that developing countries experienced a very wide range of problems associated with the use (and mis-use) of coastal resources, and that in those countries the problems of rapid change, due to population pressures, were especially acute. However, the priority will be to address the basic aims of the Core Project; otherwise it would become weak and diffuse.

Economic efficiency (based on an unsophisticated cost/benefit analysis) was not the only criterion to be considered in resolving resource use problems. It was also important to take account of the "quality of life" - issues that could not be so easily quantified in financial terms, such as mortality and morbidity of the population; environmental protection; equity; regional development; and the cultural and political acceptability of different response options.

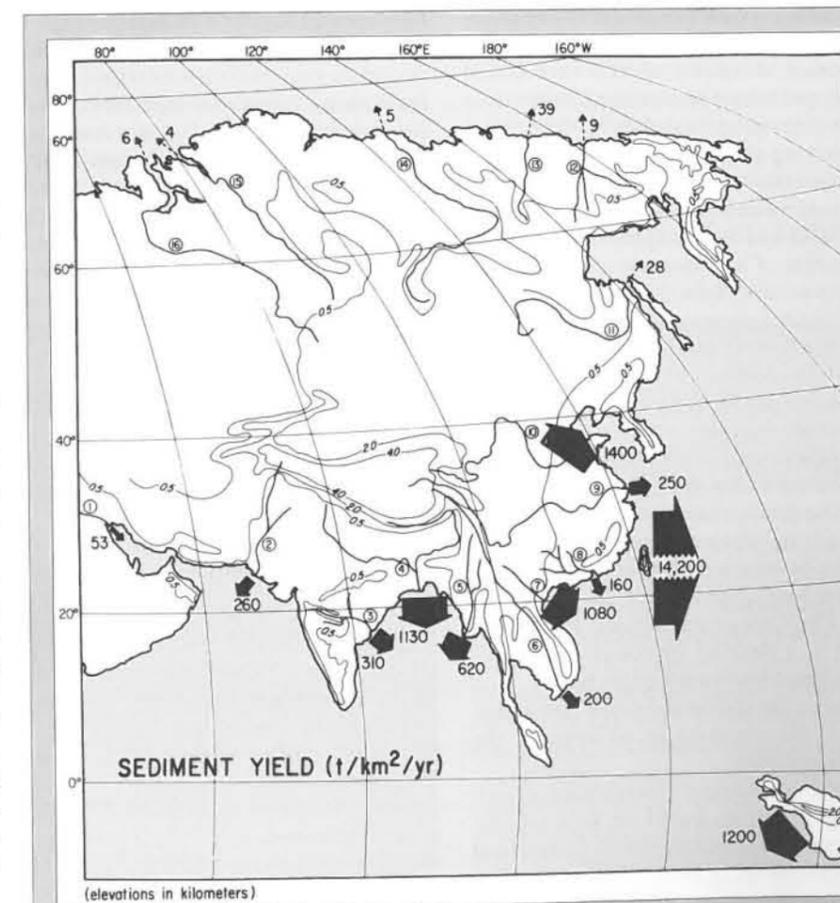
One conceptual starting point for collaboration between natural and socio-economic scientists is where natural ecosystems have evolved to retain and re-cycle nutrients. Human activities have opened



Participants at the LOICZ Project Meeting

up these cycles: "people make the land leak". Because of the known economic importance of coastal eutrophication problems (enhancing primary production, but decreasing the secondary production that can be exploited by humans), the ways in

which human activities influence land-sea nutrient transfers will undoubtedly be a key problem for LOICZ to address, requiring a "whole watershed" approach, similar to what has been developed for the Baltic.



New data have shown that small, fast rivers have a particularly important role in delivering sediment to the sea. The global implications of these findings will be investigated by the LOICZ project. Figure by J D Milliman.

Social and Natural Sciences

Land Use/Cover Change

A framework was created during the last two years for a working partnership between the IGBP's study of global change and the global change studies of the social science community. A joint working group with the natural scientists of the IGBP and the social scientists of the Human Dimensions of Global Environmental Change Programme (HDP) on Land Use and Land Cover Change (LUCC) led to a joint report (IGBP Report No. 24/HDP Report 5), and the creation of a Core Project Planning Committee (CPPC). The Committee met for the first time in Barcelona on 13-15 May to begin work on a science plan on land-use/cover, to provide a basis for establishing a LUCC Core Project between IGBP and HDP.

Three research foci were identified for research in IGBP Report 24: 1) The situational assessment (the identification of common 'situations' of land covers, land uses, and human factors which motivate or 'drive' those land uses); 2) Modelling and projecting global land-use and land-cover change (development of land-use/cover change models that link to other global models); and 3) Conceptual scaling (identification of relationships among driving forces at scales from the local to the global and the development of principles to govern the nesting of different levels of analysis). In addition, two other activities will be emphasized; data needs and development of a land-use classification.

The central intellectual and scientific challenge facing the Committee is integrating detailed case-study information on the driving forces of land-use/cover change in the development of a new generation of global land cover models.

The Committee defined the science plan as a detailed framework (or sets of integrated frameworks) that would:

- frame the critical questions that underpin the elements or activities in the science plan;
- develop a comparative typology of land-use situations based on relationships between the driving forces (human and biophysical) of land-use and use/cover consequences;
- conceptualise a case study protocol to be used for systematic testing of the use situations, including the dynamics on which the situations are identified;

- prioritise, in terms of IGBP and HDP needs, those areas of the world that would be useful for systematic implementation of the case studies in question;
- prioritise the attributes and needs of a land-use/cover model that can be used to examine and project critical land-use/cover changes (both conversions and modifications) across spatial and temporal scales;
- develop an approach for understanding the interactions of variables at different spatial and temporal scales in giving rise to common land uses and covers;
- outline a five year plan of action for a future Core Project.

Collaborative Research in the Natural and Social Sciences

Twenty-four social and natural scientists from throughout the Americas participated in an Inter-American Workshop to identify priority topics for research on the human driving forces and impacts of global environmental change in Latin America. The workshop was organized by the HDP, with the endorsement of the Inter-American Institute for Global Change Research (IAI) and support from the Universidad Autonoma de México (UNAM) and the US National Science Foundation. It was held at UNAM's Hacienda del Chorrillo in Taxco, México, from 28-31 March 1993.

Following presentations by Lourdes Arizpe (Mexico), Pablo Gutman (Argentina), Pablo Lagos (Peru), Linda Manzanilla (Mexico), Richard Moss (Sweden/USA), Steven Sanderson (USA), José Sarukhán

(Mexico), Diana Sawyer (Brazil), and David Skole (USA), participants formed working groups to address the overlap between the seven research priorities of the IAI and three important areas of human dimensions research: 1) Social dimensions of resource use; 2) Adaptation, mitigation and restoration: alternative strategies and their social costs and benefits; 3) Land use: driving forces and impacts of land-cover change.

These working groups produced a number of specific recommendations regarding opportunities for collaborative natural-social science research on the human dimensions of global change in the Americas. These recommendations will be published in the full report of the workshop, in the HDP report series.

In addition, participants reached several general conclusions and recommendations of interest to the IAI and the global change research community:

1. Multi- and inter-disciplinary research involving both social and natural scientists is essential to advance the scientific community's goals of developing a predictive understanding of how human actions will alter regional and global environmental systems and how human communities will be affected by global change.
2. The research agendas of the IAI and the HDP research community are largely consistent. It is possible to define many interesting and significant human dimensions research projects within each of the seven IAI research priorities.

IGBP Core Project Planning Committee on Land-Use/Land Cover Change

Billie L. Turner II (Chair)	Human Geographer, USA
David Skole (Co-Chair)	Natural Resources, USA
Gunter Fischer	Economist, Austria
Louise O. Fresco	Agronomist, The Netherlands (Focus 3 Leader)
Dean Graetz	Ecologist, Australia
Teitaro Kitamura	Regional Planner, Japan
Rik Leemans	Ecologist, The Netherlands
Liu Yanhua	Physical Geographer, China (Beijing)
Luiz Martinelli	Ecologist, Brazil
Elena Milanova	Physical Geographer, Russia
H.W.O. Okoth-Ogendo	Lawyer/Demographer, Kenya
Martin Parry	Human Geographer, UK (Focus 2 Leader)
Steven Sanderson	Political Scientist, USA (Focus 1 Leader)



At the Taxco Meeting. Seated, from left to right: Richard Moss, José Sarukhán, Lourdes Arizpe, Pablo Gutman, Diana Liverman

3. The best prospects for fostering research on the human dimensions of global environmental change within the IAI are to integrate appropriate topics and projects, into workshops and activities planned within each of the IAI research priorities rather than to establish a single isolated category for research on the human dimensions of global environmental change.
4. The success of IAI efforts to integrate human dimensions research into its activities will be determined by the extent to which social scientists from the region

are invited to participate fully in the process of planning the Institute's structure and activities. Consequently, the workshop recommends that consideration be given to:

- the inclusion of members of the global environmental change research community from the social sciences as well as from the natural sciences on national governments' delegations and national advisory groups for the IAI;
- the inclusion of social scientists on the scientific staff, or other appropriate bodies, within the IAI; and

- the inclusion of social scientists in the process of organizing and conducting the next set of workshops to further refine IAI scientific priorities and activities.
- 5. Development of systems that link existing national and international data on socio-economic variables is viewed by the human dimensions research community as a high priority. The workshop recommends that IAI activities to develop global change data bases and communications networks be coordinated with other global change data and information systems, especially HDP-DIS and the Consortium for International Earth Science Information Network (CIES-IN).
- 6. The Latin American region has a variety of natural and social phenomena related to global change that are unique and that thus constitute important subjects for study within the IAI. However, comparative research and opportunities for interaction with researchers in other regions with similar socio-economic conditions are also extremely important. The Global Change System for Analysis, Research, and Training (START) was felt by workshop participants to be an important mechanism for promoting inter-regional research and communication.

For further information, contact Cristina Poole, Secretary General of the HDP, Pomaret 21, 08034 Barcelona, SPAIN, fax: 34-3 417 9309

Africa and Global Change

Many international, regional, and national organisations joined forces to arrange a workshop on 'Africa and Global Change' in Niamey, Niger, 23-27 November, 1992. The workshop was organised by START, the Global Change System for Analysis, Research and Training, on behalf of the IGBP, the HDP, and the Joint Research Centre of the Commission of the European Communities, in collaboration with Météorologie Nationale du Niger, ICRI-SAT (International Crops Research Institute for Semi-Arid Tropics) Sahelian Centre, AGRHYMET (Agriculture, Hydrology and Meteorology Programme for the Sahel), ACMAD (African Centre for Meteorological Applications for Development), UNDP, UNEP, the Third World Academy

of Sciences, MEDIAS (Regional Research Network for the Mediterranean Basin and Sub-tropical Africa, France), the French Ministry for Cooperation and Development, the US Committee on Earth and Environmental Sciences, and the Consortium for International Earth Science Information Network. The meeting was planned by a regional organizing committee chaired by Dr. M. V. K. Sivakuma, ICRISAT Sahelian Centre, Niamey. Participants included natural and social scientists from many African nations and several international organizations.

Scientific presentations of research findings on a number of global change phenomena important to Africa served as a starting point for working group sessions to recom-

mend priorities for research and identify training, infrastructure, and data needs for carrying out this work. Working groups discussed: 1) Interactions between land-use changes, climate changes, and energy use; 2) Land use and climate change impacts on water resources, river basins, and coastal systems; 3) Past Climatic Changes in Africa, and 4) Global change impacts on agriculture and food security. In addition, organizational meetings were held to discuss the formation of regional networks for Northern Africa, the Mediterranean, and Southern Africa, Central and Eastern Africa; and to facilitate research on the human dimensions of global change in Africa. The detailed recommendations of these working groups will be published in the full work-



At the Niamey Meeting: 1st row, Jim Bruce, Erik Odada; 2nd row, Genady Golubev, Haroldo Mattos de Lemos, M.V.K. Sivakumar; 3rd row, Keiji Higuchi, John Marks

shop report in the IGBP report series. The scientific presentations will be published in a conference volume in association with ICRISAT.

A number of general conclusions, recommendations, and decisions were adopted by participants during the final session of the workshop, including:

1. Scientific cooperation within and among the distinct regions of the African continent is a high priority. The meeting welcomed the START initiative and agreed to support the development of regional research networks for the Mediterranean (MED), Northern Africa (NAF), and Southern, Central and Eastern Africa (SAF) regions. The workshop also recommended that regional networks in Africa develop appropriate links with networks in other continents, in order to establish a global network of networks for global change research.
2. Planning committees for NAF and SAF were established, with a strong recommendation that a similar planning committee be established for MED. Note was taken of the interest of the Commission for the European Communities in developing a partnership between African global change research efforts and the European Network for Research on Global Change (ENRICH). The workshop also noted the French MEDIAS initiative, which was seen as a means of promoting collaboration between MED and NAF.
3. The establishment of National IGBP Committees was viewed as important in promoting the development of global change research. In establishing such committees, efforts should be made to involve all relevant scientific expertise, including from the social sciences.

4. Additional workshops and planning meetings would be required to continue the development of the ideas brought forward in the working group reports. It was recommended that these meetings be organized within the framework of the emerging START networks for Africa.
5. Training and educational activities related to global change were seen as especially important for Africa. It was recom-

mended that a variety of mechanisms be developed, including graduate student fellowships, short-term and small research grant schemes, and technical training courses on important research methodologies.

6. Lack of equipment and infrastructure, including support for analysis, data management, and access to data bases, was highlighted as a serious impediment. The meeting recommended increased support for infrastructural development.
7. Lack of efficient communications is often a major constraint for inter- and intra-regional collaboration. It was recommended that access to electronic mail for regional research sites and networks be made a priority, and that attention should be given to the role of such international initiatives as IGBP-DIS, HDP-DIS, and UNEP-GRID in facilitating electronic access to important regional and global data sets.

In addition, the workshop gratefully noted the offer of the Ghana Academy of Arts and Sciences to host an initial NAF Secretariat. Participants also supported the recommendation that funds be raised to second an African scientist to the International START Secretariat to ensure that an African perspective was included in the further planning of the global START network.

START Objectives

The overall START objectives are:

- To promote the establishment of the institutional framework necessary in a region for the scientific community to develop a research agenda on regional issues of global importance and to connect that research agenda, whenever appropriate, to the international research agendas of the IGBP, WCRP and HDP.
- To enable scientists in the regions to improve the understanding of regional environmental changes which may cause and be caused by global change, and thus to develop the necessary scientific assessments upon which policy options for mitigating or adapting to global change can be developed.
- To build or augment national and regional capabilities to develop geo-referenced compatible data bases on variables relevant to global change, such as the natural and anthropogenic emissions and uptakes of greenhouse gases; to develop a network within each region which links together national data bases of relevance for regional modelling.
- To develop inter-regional coordination mechanisms for the implementation of a START global network of networks for global change research and assessment.
- To provide a framework for collaboration among governmental and non-governmental global change networking initiatives.

To achieve these objectives, the START-SC promotes the development of Regional Research Networks that will:

- (i) Stimulate and facilitate interdisciplinary research on regional aspects of the study of global change in both the natural and social sciences;
- (ii) Provide regional analysis, interpretation, and modelling in relation to global change;
- (iii) Strengthen regional participation in the projects of the IGBP, the WCRP, and the HDP. It is anticipated that the RRN will provide experimental sites (RRSs) with appropriate infrastructure that can contribute to IGBP Core Projects and other partners;
- (iv) Provide a focus for data and information management including data acquisition, quality control, archiving, and effective dissemination and exchange;
- (v) Strengthen indigenous scientific capabilities through training, collaborative research, and scientific and technical cooperation;
- (vi) Encourage the incorporation of global change research findings in the policy and implementation process; and
- (vii) Participate fully in START through exchange and collaboration with other RRNs.

Global Change Regional Research Networks

START is the name of the far-reaching project for incorporating regional research into a series of networks. It has aroused enormous interest in the international scientific community, with many enquiries for joining made to the IGBP Secretariat in Stockholm, and the International START Secretariat in Washington. The guidelines for building networks have now been established, and are presented here.



Guidelines for the development of a global network of networks and for participation in START

These guidelines complement the framework described in IGBP Report No. 15 (1990). Together, they provide information about the factors which the START Standing Committee will take into account in developing cooperative relationships among regional networks and institutions as contributions to the global change System for Analysis, Research and Training.

Background

Human activities have become a significant force affecting the functioning of the Earth system. Our use of land, water, minerals and other natural resources has increased more than ten-fold during the past two hundred years. Future increases in population and economic growth will intensify such resource exploitation. This has resulted in significant concern about changes in global biochemical and hydrological cycles as well as global energy flow and their consequences on the Earth system. Of particular concern is the potential serious impact of such global changes on the dynamics of the biosphere.

To resolve the major uncertainties in our understanding of the functioning of the Earth system and the impact of anthropogenic activities on the processes controlling the Earth system, the scientific community has promulgated three major international research programmes, namely the World Climate Research Programme (WCRP), International Geosphere-Biosphere Programme (IGBP), and the Human Dimen-

sions of Global Environmental Research Programme (HDP).

Global change predictions will be of greatest value to decision makers if they apply on a national and regional basis, and if scientists from throughout the region are involved from the beginning in the process through which they are generated. It is for these reasons that the START concept of interconnected Regional Research Networks, focusing on research relevant to the core projects of the international global change research programmes, has been developed by the international scientific community as represented by the IGBP, in association with the WCRP and the HDP.

Further basis for development of the START effort is provided in several inter-governmental declarations: by the UN General Assembly in 1989; by the Second World Climate Conference in 1990; and by the UNEP Governing Council in May 199.

START Framework

START provides a framework for establishing regional networks for analysis that will develop indigenous capacity to carry out research on the regional origins and impacts of global environmental changes such as global warming. START endeavours to address the needs for regional research with a global scientific perspective in the context of the three major international global change research programmes. The START effort is guided by the IGBP START Standing Committee, which includes representatives of WCRP and HDP and ex-officio representatives of START Regional Research Networks.

Although regional needs and conditions will define the specific structure of the collaborative mechanisms, each START Regional Research Network (RRN) will typically include a number of Regional Research Sites (RRSs) and a Regional Research Centre (RRC). The RRSs are institutions in the region with specialized expertise that enables research on important components of the global change research agenda and provide important foci for linkages with the projects of the international programmes. Typically, a RRS will be an existing research institution with strong capability in some area of the RRN's research agenda. In contrast, a major function of the RRC is to

provide a multidisciplinary setting whereby results from various disciplines concerned with global change phenomena can be synthesized in a framework that is policy-relevant. The RRCs will also have access to regional and global data bases that are necessary for analyzing both the contribution of the regions to global change phenomena as well as the impacts of global changes within the regions. Both RRCs and RRSs will offer training facilities and provide foci for indigenous capacity building in the region.

To promote coherent implementation of the START concept, 14 distinct biogeographic regions were initially identified covering the Earth's land surface and coastal regions. These regions were identified as guiding examples only, and the scientific communities in the countries concerned will decide on the most appropriate regional grouping.

The START concept implicitly involves intra- as well as inter-regional collaboration and entails the establishment of a world-encompassing system of RRNs. Intra-regional collaboration is one of the specific functions of an RRN. In order to ensure that inter-RRN collaboration on cross-cutting issues (such as communication linkages, facilitation of data exchange and management, etc.), occurs on a systematic and regular basis, the International START Secretariat has been assigned specific responsibility by the START-SC to facilitate the creation of a global network of RRNs. Past experience with such "global network of networks" functions, such as that carried out by the Consultative Group on International Agricultural Research (CGIAR), has shown that inter-regional coordination and integration ensures that overall research objectives at global levels are adequately met.

START Priorities

Initial priorities in developing START regional networks will be given to regions primarily comprising developing countries. Eventually, however, networking will be necessary in all regions to achieve a global network of networks. A major objective of START is to build the indigenous scientific capabilities and infrastructure required to enable scientists from developing countries to participate in all aspects of planning, coordinating and implementing the



necessary research on potential causes and regional impacts of global change. It is likely that without such an effort, which explicitly seeks to augment scientific capabilities and infrastructure in developing countries, scientists in these countries will mostly be involved in collecting data for research projects but will not be involved in analysis, interpretation and modelling efforts. They will thus not have the opportunity to develop the indigenous knowledge and information base needed by their own governments to formulate effective national policies. Without the significant involvement of their own scientists, moreover, developing countries could disregard research generated primarily in developed countries and hence could decide against taking appropriate policy measures.

The importance of giving priority to establishing Regional Research Networks in developing countries is also clearly indicated by the need to develop national and regional data bases of key variables related to global change so that research and analysis can proceed. In many cases, developing countries lack the resources required to design and compile these data and to coordinate national data collection efforts so that they can become part of integrated regional and global systems.

Through START, a regional focus will be developed that addresses how the regions contribute to global change processes and how global changes will affect the regions. Whereas national plans for global change research will be developed by the National IGBP Committees or other appropriate bodies, the WCRP, IGBP and HDP will provide the international scientific context for the START effort. Each region will set its own scientific priorities for global change research, primarily within the framework of the three international scientific research programmes. Certain activities coordinated within the Regional Research Networks may be region-specific, but this proportion will generally be a small component of the overall activities in order to achieve coherence

within the global network of networks.

The START framework will consist of all regional global change research networks that wish to participate in this international, coordinated effort. Some will be RRNs developed under the START-SC initiative, whereas others will be developed independently from START but will subscribe to its overall objectives. Each Regional Research Network will be autonomous with regard to organizational structure and determination of scientific priorities. Thus, RRNs will have considerable flexibility in formal organizational structure in order to accommodate the special needs and characteristics of each region, and they can participate in START so long as the essential functions of an RRN described in IGBP Report No. 15 and this document are provided for.

Essential Features of START Regional Research Networks

In order for an RRN to be effective it should have or develop:

- (i) A commitment to utilize existing scientific institutions, enhance their capabilities as necessary, and build new institutions as appropriate, throughout the entire region;
- (ii) A clearly defined global change-specific mission statement with specific analytic, research and training goals;
- (iii) Scientific competence and credibility relating to global change research and education;
- (iv) The necessary infrastructure, such as computing capability, laboratories, equipment, libraries and scientific and technical personnel;
- (v) An international orientation to science to facilitate scientific exchange and to be accessible both to scientists within the RRN and to scientists from other RRNs;
- (vi) The expectation of long-term stability of interest and credible support from the host and donor governments/organizations to provide financial support;
- (vii) Research and management func-

tions located in the region in which the RRN will operate; and

(viii) Regional Research Sites located in all major biogeographical zones representative of the region, in so far as possible.

Participation in the Networking Activities of START

General criteria necessary for global change Regional Research Networks to participate in the START initiative are:

- (i) A well-defined research agenda on regional global change issues, as well as focus on indigenous capacity building and training goals as described in the START objectives;
- (ii) Active promotion of participation in the research projects developed and coordinated by WCRP, IGBP and HDP;
- (iii) Desire to provide regional policy-makers with a solid and shared scientific basis for both regional and global policy development;
- (iv) Desire to share data, information, methodologies and research results with other RRNs;
- (v) Desire to foster full participation of all scientists in the region who contribute to and participate in the programmes of WCRP, IGBP, and HDP.

Each RRN is intended to be autonomous with regard to organizational structure and the determination of priorities within the framework of global change research. Thus, the RRN's will have considerable flexibility in formal organizational structure in order to accommodate the special needs and characteristics of each region.

Regional Research Networks wishing to participate in START should provide the START-SC with information regarding the organization, management, and scientific priorities of their initiative. On the basis of mutual agreement, the START-SC will invite such networking activities to nominate an ex officio member to the START-SC, and thus participate in START.

Additionally, parties seeking the support of the START-SC and the International START Secretariat during the planning phase of the networking activities are urged to contact the International START Secretariat.

International START Secretariat
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Tel: (+1-202) 457 5840
Tlx.: (230)49616179 start (easylink)
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E-mail: START.Secretariat (Omninet)
start@ciesin.org (Internet)

Global Change Research in the Netherlands

Although only a small country, The Netherlands has a well-integrated global change research programme involving both the natural sciences and the socio-economic and behavioural sciences. The articles that follow describe Dutch government actions in this area, and some of the recent activities of the Netherlands IGBP National Committee.

National Research Programme on Global Air Pollution and Climate Change

Said Zwerver, Secretary, Netherlands Research Programme for Global Change

The concern felt by the Dutch people for environmental threats at all spatial scales - national, regional and global - has led the country to adopt a well-defined and comprehensive climate policy, as well as establishing a national climate research programme. Climate-related research is conducted in national research institutes, large technical institutes, universities and commercial organisations. Much of this research is performed under the umbrella of the Dutch National Research Programme on Global Air Pollution and Climate Change (NRP).

The NRP was established in 1990 to lay a firm foundation for the development of climate policy: its main objective is to answer to the questions posed by policy makers. Briefly put, the main issues are: "What are the risks of climate change for our society? what measures are demanded? and what will they cost?". The NRP is intended to help to reduce uncertainty about the behaviour of the global climate system, as well as to diminish the possible consequences of climate change for the economy and for society. As subsidiary targets, the programme aims to strengthen the role of the Dutch research community, both nationally and internationally, and encourage a multidisciplinary approach.

Research activities

The Netherlands National Research Programme unites the physical and technological disciplines with the social and behavioural sciences together in a single framework. It is directed at two questions: "How does the Earth system work?" and "What are the possible solutions - prevention or adaptation?" The research activities are distributed over five themes: *cli-*

mate system, causes, effects, solutions and integration/assessment.

Research under the *climate system* theme is directed at the reduction of the scientific uncertainties in respect to the exchange between the different components of the climate system. The research examines, among other topics, the role of the clouds, oceans and vegetation, and the predictability of the system. The main theme of *causes* is the quantification of sources and sinks of greenhouse gases. These data can then be used to estimate future concentrations, thus allowing well-founded decisions to be taken in regard to limiting emissions. The research on *effects* is directed at the local and regional scale, focusing on the development of a better understanding of cause-effect relationships and



Adaptation to the consequences of the greenhouse effect in the Netherlands could mean raising the height of the dykes

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the reduction of uncertainties. The programme attempts to achieve a reasonable balance between site-specific studies for the Netherlands (e.g., as part of the regional hydrology of a catchment area) and studies that can contribute to the international knowledge base (such as the carbon budget, UV-B effects). Both natural science and socioeconomic studies are included in this research area.

Apart from description and an analysis of the problem, establishing policy also requires possible *solutions*. These could not be limited to purely technological ones; in part because the causes of the problem are not of a purely technical or technological nature either. That is why, when the programme was set up, the social and behavioural sciences were involved, together with the more traditional approach of the natural sciences. The NRP is performing a pioneer role in the Netherlands in its combination of heterogeneous disciplines as well as its attention to possible solutions.

Work in this area covers technical as well as economic, behavioural and social options. The solutions have to address the general policy objective of long-term (sustainable) development. Priority is given to prevention rather than to adaptation. The research covers: energy supply, saving of energy and materials, mobility and transportation, consumption patterns and lifestyles, economic and financial instruments, the development of societal support for preventive measures and, last but not least, the development of and cooperation with an international greenhouse policy.

Work on *integration/assessment* fulfils two objectives: to provide a framework for the integration of research results and guidance of research on unsolved climate issues which are relevant to policy makers, and to generate scientifically supported options for the establishment of standards and policy at national, regional (European) and global levels. Research activities include: assessment modelling and simulation; integration studies; risk analysis; policy context and options.

"Change"

The NRP newsletter *Change* provides information on scientific research and policy making related to global change. It is published in English, to encourage interna-

For a free subscription to the NRP newsletter *Change*, write to
Wolters-Kluwer Academic Publishers
Biosciences Division
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tional cooperation in the area of climate research, and has a circulation of 4000 in the Netherlands and abroad. By presenting Dutch climate research and the opinion of Dutch experts on global change to an international audience, *Change* contributes to the building of a world-wide climate research network, promoting the international exchange of information and cooperation between those involved in or interested in global change research and policy making.

Budget

The current first phase of the NRP (1990-1994) has a total budget of approximately US\$ 40 million. All this is 'new' money, raised by means of a special carbon tax on fuels. The Netherlands Organisation for Scientific Research (NWO) sponsors an additional research component, related primarily to understanding the climate system. The NRP's finances are spent under the guidance of a Steering Group comprising representatives of: the Ministries of Housing, Physical Planning and Environment; Transport and Public Works; Foreign Affairs; Economic Affairs; Agriculture, Nature Management and Fisheries; Education and Science; and Welfare, Public Health and Culture. A Programming Committee, made up of re-

searchers, formulates the scientific content of the programme. The management of the programme is done by a team drawn from the National Institute of Public Health and Environmental Protection (RIVM) and the Royal Netherlands Meteorological Institute (KNMI).

Programme evaluation

In 1992, two consulting firms carried out an external mid-term evaluation of the NRP. The review confirmed that the programme is of national and international importance. The evaluation report stated that the strongest attribute of the NRP is its potential for providing policy-relevant outputs that might otherwise not result from traditional research efforts. In order to maximise the benefits of the programme, the reviewers recommended that a strategic communication plan should be developed as an integral part of the NRP. This plan should identify key audiences and their information needs, and define a means of effectively addressing their requirements.

The final report and evaluation of the programme will take place during the first half of 1995. This will be preceded by an international symposium in Maastricht (20-25 November, 1994); see box.

Recently the NRP made an inventory of all Dutch climate-related research, both within the NRP and outside it. This exercise was initiated in response to a question from the World Meteorological Organisation that revealed the strong relationship between Dutch climate research and international programmes.

Relationship with the IGBP

When the NRP was set up in 1990 the development of the International Geosphere Biosphere Programme played an

important role, but the relationship is not yet optimal. The challenge of developing a climate research programme in the Netherlands was primarily taken up from the policy perspective, whereas the contacts with IGBP are mainly maintained via the scientific sector. There is a difference between the way scientific research and policy-oriented research fix their priorities. A further reason why the interaction is not optimal is that the NRP had to select concrete projects when the IGBP had not yet completed its science plan. Nevertheless, the NRP contains quite a number of projects that are related to the IGBP (see report below).

At the present time initiatives are underway in the Dutch scientific world to match more closely the national research effort with IGBP priorities. This has happened for PAGES and GCTE. The campaign is under the leadership of the IGBP National Committee, which was established by the Royal Netherlands Academy of Sciences. These initiatives may stimulate a the redeployment of scientific research in the appropriate areas, with results to be seen in the programming for the second phase of the NRP (1995-2000), now being planned.

Publications

Evaluation of the Technical Emphasis, Policy Relevance and Management Performance of the Dutch National Research Programme on Global Air Pollution and Climate Change. SPA-HCG (1992). Executive Summary, Washington/Amsterdam.

Inventory of Dutch Research on Global Climate Change inside and outside the National Research Programme. SPA-HCG (1993): Washington/Amsterdam.

During an international symposium in Maastricht (20-25 November 1994), an assessment will be made of the areas covered by the Netherlands Research Programme. Separate sessions will be held on the following subjects:

- the Earth system
- fluxes of greenhouse gases (CO₂, CH₄, N₂O)
- terrestrial ecosystems, including forests
- agriculture
- coasts and estuaries
- hydrology of catchment areas
- energy supply and
- use of energy and materials
- mobility and life styles
- instruments and international
- greenhouse policy
- integral modelling and scenario analysis
- risk analysis and policy options

Netherlands National IGBP Committee

Hans van Emden, Secretary of the Netherlands MAB/SCOPE/IGBP Committee

The Netherlands IGBP Committee has recently focused its attention on three IGBP Core Projects: Past Global Changes (PAGES), Global Change and Terrestrial Ecosystems (GCTE), and Land-Ocean Interactions in the Coastal Zone (LOICZ).

Past Global Changes

A symposium was organized on 15 December 1992, to identify research carried out in the Netherlands that could fit into the PAGES foci and activities, as defined in the PAGES Science Plan (IGBP Report No. 19). The introduction was made by Hans Oeschger, Chair of the PAGES Scientific Steering Committee, and the closing address was given by the Director of Science Policy of the Netherlands Ministry of Education and Science. Presentations by research workers and planners emphasised the key questions at which Dutch research is directed, their alignment with PAGES objectives and fundamental research plans, and identified gaps between the two. The symposium concluded that there is much research related to past global changes in the Netherlands; however, only a small part of it is a coordinated, multidisciplinary and long term effort, fitting directly in the PAGES aims. At the same time, Dutch science has substantial expertise in many PAGES themes, such as:

- solar and orbital forcing and response
- ice-sheet mass balance, deglaciation and global sea-level change
- palaeo-environmental responses to rapid and abrupt global change
- management of palaeodata, especially palynological data bases
- improving chronologies for palaeo-environmental research, especially ¹⁴C analyses

The next steps are to develop a Dutch contribution proposal asking the PAGES Scientific Steering Committee to indicate which items are directly relevant for PAGES and how these fit in the international contributions in these fields. The Dutch authorities will then be approached for sponsorship of this research.

Global Change and Terrestrial Ecosystems

The Netherlands IGBP Committee recently organized a symposium (12 March 1993), with the aim of defining the research carried out in the Netherlands which is relevant for GCTE. The heads of research departments gave an overview of the known research which fits into the



Aerial view of the Netherlands coast showing the island of Texel (left, with vegetation and sand tip), home of the Netherlands Institute for Sea Research where the LOICZ Core Project Office will be located

GCTE foci and activities. Bernard Tinker, member of the IGBP Scientific Committee, gave an introduction about GCTE. Dr. Verhoeff, the science director of the Ministry of Agriculture, Nature Conservation and Fisheries spoke of the financial aspects of the GCTE-relevant research in the Netherlands, and John Marks answered the question: why should researchers contribute to IGBP, what will advantage will it have for them? Adherence to the IGBP can offer scientists many advantages. These are: a well structured programme with internationally agreed scientific benefits; development of internationally agreed protocols of data gathering; access to a network of the best scientists in the field; advantages of scale because the national research effort is linked to a much larger, coherent, effort; and the increase of the effectiveness of national research spending.

Land-Ocean Interactions in the Coastal Zone

The IGBP Scientific Committee decided in January 1993 to gratefully accept the Dutch offer to host the LOICZ Core Project Office at the Netherlands Institute for Sea Research on the island of Texel. The proposal for supporting the CPO was regarded as a good model for other nations wishing to host a Core Project Office. The Dutch offer was made for a 5-year period. The post of Core Project Officer has been advertised internationally and will be filled in September. At the same time, the Netherlands IGBP Committee is setting up a national LOICZ

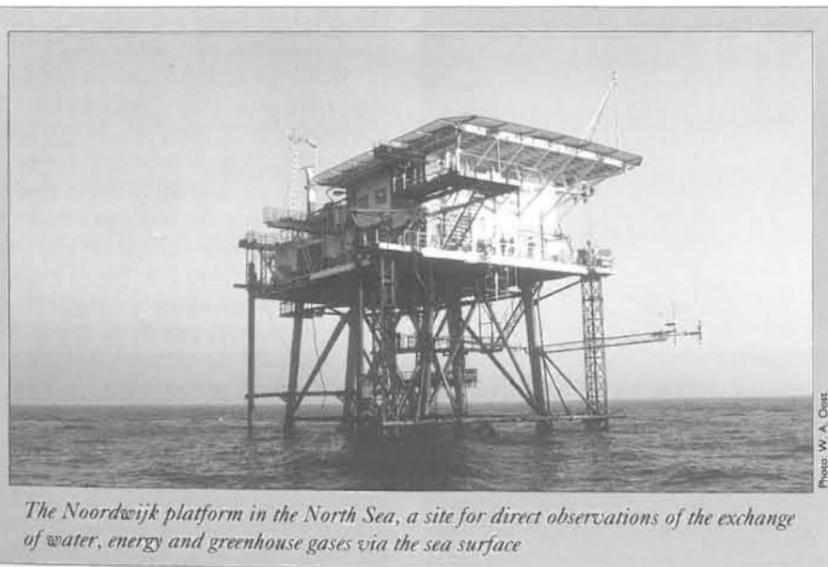
committee for the coordination and implementation of the Dutch contribution to the project, following the key questions of the LOICZ Science Plan.

As the other IGBP projects progress, the Netherlands IGBP Committee will focus on its contribution to them. In the near future a meeting will be held on the potential national contribution to Biospheric Aspects of the Hydrological Cycle.

START in Europe

During SAC III at Ensenada IGBP national representatives from many European countries began discussions on regional activities within the Global Change System for Analysis, Research and Training (START). As a result, a meeting took place in Amsterdam on 7-8 June to establish a European Network. The meeting focused on the need for a regional network on global environmental change and its human causes and effects. The meeting relates closely to the action of the European Network for Research in Global Change (ENRICH), an activity initiated by the Joint Research Centre of the Commission of the European Community.

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The Noordwijk platform in the North Sea, a site for direct observations of the exchange of water, energy and greenhouse gases via the sea surface

News from IGBP Committees

IGBP Officers visit Qingdao

Oceanographers have a tradition of large field campaigns and extensive international collaboration. It was therefore both natural and welcome that Hu Dunxin, Vice-Director of the Institute of Oceanology in Qingdao, invited the IGBP Officers to present lectures on their latest research topics, and meet with colleagues at this ancient port town on the Yellow Sea. James McCarthy (Chair, Scientific Committee for the IGBP), Robert Stewart (Vice-Chair, SC-IGBP) and Peter Liss (Treasurer, SC-IGBP), spent the day of 13 May in Qingdao, immediately following the Officers meeting in Beijing.

The Chairs of the China (CAST) Committees for the Joint Global Ocean Flux Study (JGOFS) and Land-Ocean Interactions in the Coastal Zone (LOICZ) are stationed at the Institute of Oceanology, a large research organization employing 1050 persons, including 700 scientists and technicians and over 200 professors. They serve more than ten academic departments and laboratories covering physical, chemical, geological and biological oceanography, that carry out a major part of the scientific activities of the Academy of Sciences in Beijing and the National Natural Science Foundation. The Institute has produced a number of new research findings, and has led or participated in international and bilateral joint programmes such as the China Japan Joint Programme on Material Flux in the East China Sea, and the Tropical Oceans and Global Atmosphere Programme of the WCRP.

Hu Dunxin was a member of the JGOFS international committee from 1988 to 1990, and established the China (CAST) JGOFS Committee in 1989, drafting its first science plan the same year. The plan refers specifically to margin flux in the East China Sea, where the two largest rivers, the Yangtze and the Yellow River, empty a large volume of sediment into the Pacific and where one of the widest shelves in the world is found. A key national programme on Margin Flux in the East China Sea has now been funded (1992-1995). Based on this plan, a joint China-Japan research programme on material flux in the East China Sea was endorsed between the government of China in Beijing and

the government of Japan, with Shizuo Tsunogai (Vice-Chair of the SC-IGBP) as leader for Japan, and Hu as leader for mainland China. At a China/Japan International Workshop on Margin Flux in the Northwest Pacific held in Qingdao, a proposal jointly made by American, Chinese (CAST and Academia Sinica), Japanese, Korean, Philippine and Russian scientists to expand the programme to a multinational one to cover all marginal seas in the north-west Pacific such as the South China Sea, the East China Sea, the Yellow Sea, the Japan Sea and the Okhotsk Sea.

Liu Ruiyu, former director of the Institute, Chair of the mainland Chinese LOICZ Committee (established in April 1993) and member of the LOICZ Core Project Steering Committee, presented the China (CAST) LOICZ draft science plan. The main foci of its first science proposal will be on land-ocean interactions in the Yangtze River estuary and the western East China Sea, in the Yellow River delta and adjacent area, and in the Pearl River delta.

From a report by Hu Dunxin, Institute of Oceanology, Qingdao

Academia Sinica, Taipei

In the autumn of 1992, two workshops organized by the IGBP Committee in Taipei addressed ocean science: the Joint Global Ocean Flux Study Scientific Steering Committee met with the local JGOFS Committees (19-23 October), to discuss global synthesis in JGOFS, scientific and organization issues in the Asian Region, and the JGOFS/Land Ocean Interactions in the Coastal Zone Task Team on Continental Margins met the following day. The workshops have been published in JGOFS Report No. 11, and in a special issue on JGOFS of the Bulletin of Marine Science and Technology, No. 12, Taipei.

This spring the IGBP Committee addressed another range of issues. A Regional Workshop on Environment and Sustainable Development was held on 1-4 March, in collaboration with COSTED (the ICSU Committee on Science and Technology in Developing Countries). Professor M. G. K. Menon, President of ICSU, opened the conference with a keynote speech on 'Agenda 21', the action plan of the United Nations Conference on Environment and Development.

The Workshop was organized to prepare a package of regional proposals for funding on Environment and Sustainable Development. The proposals submitted to COSTED addressed, among other topics, "Development of air-sea coupled global circulation models", "Modelling the regional climate changes and their impacts on water resources and ecosystems", "Control measures of methane emission from rice fields", "Management of watersheds", "Acid rain monitoring network in south and southeast Asia".

The approved proposals will be submitted by COSTED/ICSU to the United Nations Development Programme (UNDP). The package of projects will be used as a mechanism to involve scientists from developing countries of the Asian region to work on scientific topics of special relevance to the region, and which fall under the category of the recommendations of Ascend 21 (ICSU) and Agenda 21 (UNCED). Scientific cooperation between the countries of the region, including the setting up of research networks and intercalibration, is particularly encouraged.

The recent PAGES workshop in Taipei (21-23 April), on high resolution records of past climate from monsoon Asia - the last 2000 years and beyond, was cosponsored by the US National Science Foundation and the National Science Council in Taipei. Scientists from eight different countries attended; particularly noteworthy is that, for the first time, representatives from China (CAST) came to Taiwan an ICSU-related international conference.

Experts reported their findings for monsoon Asia, ranging from India to Japan to Australia. Historical documentary records from China and Japan were compared with the results from loess, corals, ice cores, tree rings, lake and marine sediments. It was the first time such diverse data were presented together, and better modelling of climate change in monsoon Asia is anticipated. The Global Change Committee of the International Union for Quaternary Research (INQUA) reported on their proposed five-year palaeo-monsoons project that will be incorporated into a report and serve as a solid basis for the joint INQUA/PAGES palaeo-monsoons project.

Arthur Chen, Sun Yat-Sen University, Kaoshiung, Taiwan

Kenya

The IGBP Committee in Kenya is developing vigorously. The Governing Council of the Kenya National Academy of Sciences has named project coordinators for START (Prof. R.W. Mwangi), PAGES (Dr. Eric Odada, a member of the Scientific Committee for the IGBP), Global Analysis, Interpretation and Modelling (Prof. W. Ogana), and Land Use/Cover Change

(Prof. H. W. O. Okoth-Ogendo, of the Land Use/Cover Change Core Project Planning Committee). Project working groups are being constituted, and coordinators for the other IGBP Core Projects are being identified.

The Kenya Academy of Sciences held a global change science day on 26 March. Prof. L. J. Ogallo, Secretary of the National Council for Science and Technology gave

a public lecture on Anticipated Climate Change in Kenya, followed by a national workshop "Case Study on Climate Change along the Kenyan Coast". Topics presented by the Kenyan IGBP members to the national scientific community addressed coastal physical and biological resources, and socio-economic and policy issues.

Core Project Updates

Past Global Changes

PAGES is pleased to announce that its Core Project Office, in Bern, Switzerland, is now fully functional. The office is staffed by Caroline Garrison, under the co-direction of Hans Oeschger (Chair of the Scientific Steering Committee; University of Bern) and Herman Zimmerman (US National Science Foundation, Washington, DC)

The first issue of *PAGES News* has just been published, and can be obtained from the PAGES Office in Bern. It details some of PAGES goals and plans for the future, and presents an overview of recent PAGES related activities.

At the PAGES Workshop in Puerto Rico on Coral Palaeoclimate Reconstruction (November, 1992) a group of international palaeoscientists discussed the tropical climate record provided by reef corals. Themes explored were: the evaluation of methods for coral chronology and climate reconstruction and the numerical analysis of coral based palaeoclimate data; how coral palaeoclimatology can best incorporate techniques and expertise from related fields; and strategies for coordinated studies of key oceanic and atmospheric phenomena using corals.

During the IGBP Meeting on "Africa and Global Change", Niamey, Niger 23-27 November 1992 (see p. 5) PAGES organized a workshop on past climatic changes in

Africa to discuss PAGES research goals and initiatives for the African continent. The proposal was made to establish "centres of excellence" at selected African institutions to act as magnets for PAGES focused research projects that would address the long-term problem of lack of resources and trained scientists in Africa. Eric Odada, a member of the IGBP Scientific Committee, is the contact for PAGES in Africa.

Palaeoclimates of Arctic Lakes and Estuaries (PALE) aims to reconstruct Arctic climatic variation over the past 150,000, 20,000 and 2,000 years. On 21-24 March, 1993, the Far East Branch of the Russian Academy of Sciences hosted a meeting of American, Canadian, Norwegian and Russian Scientists in Vladivostok, Russia, to discuss and adopt protocols describing the standard methodology for PALE. The Workshop prepared a protocol document summarizing procedures for collecting and analyzing proxy indicators of Arctic climate, dating lake and estuary sediments, and managing data. The meeting also identified two major programmatic needs: (1) modern calibration studies of surface lake sediments from Russian Arctic/sub-Arctic and parts of the Canadian high Arctic, and (2) AMS chronological control (ca. 1 date per 1000 years) for all palaeo-records. Participants recommended steps to ensure the close interaction of this programme with other research projects with similar goals

and timetables in different Arctic-rim countries.

Two of the future workshops will address data management coordination (Bern, 23-25 August), and late quaternary climates in the Americas, Pole-Equator-Pole (Panama City, 30 September-2 October). (See IGBP meetings on pages 15-16 for the full list)

News from JGOFS

Hugh Ducklow has succeeded Geoff Evans as the Core Project Scientist for the Joint Global Ocean Flux Study. He will serve that role for two years, with the first year spent at the Woods Hole Oceanographic Institution. That location will help to develop links between JGOFS and the World Ocean Circulation Experiment (WOCE), and to improve JGOFS data management capabilities - since Woods Hole is also the base for the WOCE Hydrographic Programme Office and the National Oceanic and Atmospheric Administration's National Oceanographic Center. The JGOFS-Buro in Kiel, Germany, will continue to assist in the overall coordination of the project: information and questions on general organizational issues should be addressed there. This office is staffed by Uli Wolf, Assistant Core Project Scientist, and Aida Starke, Secretary.

Specific responsibilities are as follows:

Hugh Ducklow will assure the overall supervision of JGOFS Core Project Office, with the links to JGOFS Scientific Steering Committee and IGBP; Task team liaison (Data management, IGAC-Biogeochemical Ocean Atmosphere Transfer, WOCE-WHP) and the editorial part of JGOFS Reports.

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Uli Wolf will assure the day to day function of Kiel office, JGOFS protocols, JGOFS Implementation, Cruise tracking and data catalogues. He will be assisted by Aida Starke, who will take care of travel and meeting logistics arrangements (such as the JGOFS-8 meeting in France in September), Kiel Office support and correspondence.

JGOFS Buro, Institut für Meereskunde, Dusternbrooker Weg 20, 24105 Kiel, Germany. Tel: (+49-431) 597 4019, Fax (+49-508) 457 2193; Fax (+49-431) 565 876. E-mail: jgofs@meereskunde.uni-kiel.d400.de (Internet), JGOFS. Kiel (Omnet).

Elizabeth Gross, Executive Director of the Scientific Committee on Oceanic Research (SCOR) will assure the links to SCOR, funding, production and distribution of JGOFS Reports.

SCOR, Dept of Earth and Planetary Sciences, The Johns Hopkins University, Baltimore MD 21218 USA. Tel (+1-410) 516 4070, Fax (+1-410) 516 7933, E-mail: E.Gross.SCOR

People

Honours

Marie-Lise Chanin was awarded the Ordre du Mérite in Paris on 14 June 1993. Dr. Chanin was first appointed by ICSU to the IGBP Special Committee in 1987, and re-appointed in 1990 to the Scientific Committee until her term expired in January 1993. She is Director of the Department of Middle Atmosphere at the Service d'Aéronomie of the French National Centre of Scientific Research, and member of the French Académie des Sciences. She is



Marie-Lise Chanin

presently leader of the WCRP project Stratospheric Processes and their Role in Climate (SPARC).

José Sarukhán was elected foreign associate of the US National Academy of Science

at the end of April this year. Dr. Sarukhán, Rector of the National Autonomous University of Mexico, was appointed member of the IGBP Scientific Committee by ICSU in 1990. His specialisation is tropical plant ecology with emphasis in population and ecosystem approaches, particularly biogeochemical cycles in tropical deciduous forest and the impact of land use patterns. His advances in this field have made important contributions to global change studies. (see group picture on page 5).

IGBP Staff

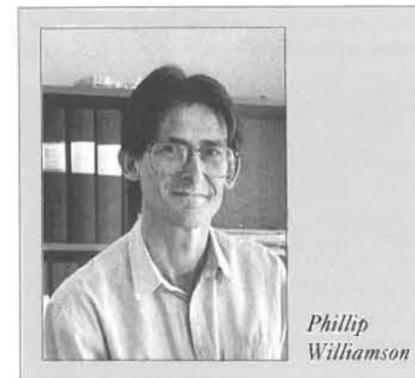
During the year that **Thomas Rosswall**, Executive Director of the IGBP, was in Washington to launch the START Secretariat, the development of START advanced by leaps and bounds. Now September is coming close, when he will return to Stockholm to assume again his responsibilities at the IGBP Secretariat.



John Marks (left) and Thomas Rosswall

John Marks, Acting Executive Director, will return to the Netherlands in September. He resumes his post as Head of the Division for Environment, Life Sciences and Research & Development Strategy at the Directorate for Research and Science Policy of the Netherlands Ministry of Education and Science. He brought to the IGBP strong experience in both national and international global change programmes that has been so beneficial during a year of major development for the IGBP.

Phillip Williamson, Deputy Executive Di-



Phillip Williamson

rector of the IGBP since 1991, will return to England in September, where he will be stationed at the School of Environmental Science, University of East Anglia in Norwich. With support from the National Environmental Research Council, half of his time will continue to be dedicated to international IGBP affairs.

Neil Swanberg will be the new IGBP Deputy Executive Director, starting in October. A U.S. citizen, Dr. Swanberg has a B.S. in zoology from the University of California at Davis and a Ph.D. from the Woods Hole Oceanographic Institution and Massachusetts Institute of Technology joint programme in oceanography. After obtaining his degree, he taught briefly as a visiting assistant professor at Dartmouth College, and then went to the Lamont-Doherty Geological Observatory of Columbia University for post-doctoral work on the symbiosis between algae and large solitary radiolaria. He joined the research staff at Lamont, where he worked for 7 years on



Neil Swanberg

various aspects of the biology of radiolaria. Much of his research has focused on biological questions which address issues of relevance to palaeontology, particularly aimed at using fossil evidence to interpret climatic change. During that time he became interested in high-latitude and isolated environments and started working on the protozoan fauna in Norwegian fjords, and later in the Norwegian and Greenland Seas. In 1987 he accepted a position at the University of Bergen in Norway, where he worked for several years on projects involving different groups of zooplankton in the Barents and Greenland Seas. When that work was finished in 1992 he returned to the U.S., and since then has worked as a Program Officer at the National Science Foundation, in the Polar Biology and Medicine Program in the Office of Polar Programs. His diverse background in sciences relevant to global change will be a great asset to the IGBP, and we are happy to welcome him on board.

IGBP Meetings

1993

26-30 July, Manila, Philippines
Southeast Asian Regional Committee for START (SARCS) and SARCS Scientific Advisory Panel meetings

29-31 July, New York, NY, USA
2nd Meeting of the Core Project Planning Committee on Land Use/Cover Change

16-20 August, Marshall, California, USA
IGBP/GCTE Workshop on Developing GCTE Transects and Study Areas for Biogeochemical Research and Ecosystem Dynamics Modelling, and BAHC Focus 3 meeting. Dr. George Koch, Department of Biological Sciences, Stanford University, Stanford, CA 94305, USA. Tel: (+1-415) 723 1179, Fax: (+1-414) 723 9253, E-mail: gwksu@leland.stanford.edu

21-26 August, Oppdal, Norway
Global Change and Arctic Terrestrial Ecosystems: an International Conference. Jarle I. Holten, Coordinator, GCTE Tundra Boreal Office, Norwegian Institute for Nature Research, Tungasletta 2, N-7005 Trondheim, Norway. Tel: (+47-7) 58 05 00, Fax: (+47-7) 91 54 33

23-25 August, Bern, Switzerland
PAGES Workshop on Data Coordination for Palaeoclimatology. Dr. J. Overpeck, NDGC/NOAA, 325 Broadway, E/EC, Boulder, CO 80303, USA. Tel: (+1-303) 492 5117; Fax: (+1-303) 497 6513

25-27 August, Beijing, China
Planning Meeting on Global Change Research Network of Temperate East Asia (START). Professor Ye Duzheng, Chair, National Committee for IGBP, Chinese Academy of Sciences, 52 Sanlihe Road, Beijing 100864, China. Fax: (+86-1) 851 1095, Tel: (+86-1) 868 361

26-27 August, Bern, Switzerland
PAGES Workshop on Ice Core Data. Dr. J. White, INSTAAR, University of Colorado, Campus Box 450, Boulder, CO 80309, USA. Tel: (+1-303) 492 5494; Fax: (+1-303) 492 6388

3-6 September, Tokyo, Japan
GCTE Symposium: Global Change Impacts on Terrestrial Ecosystems in Monsoon Asia (TEMA). In conjunction with the XV International Botanical Congress, 28 August-3 September. Dr. Tadaki Hirose, Biological Institute, Faculty of Science, Tohoku University, Aoba-yama, Sendai 980. Tel: (+81-22) 222 1800, ext. 3480, Fax: (+81-22) 263 9206

6-8 September, Tokyo, Japan
GCTE Scientific Steering Committee

9-11 September, Carqueiranne, France
JGOFS Scientific Steering Committee. Aida Starke, JGOFS Project Office, Institut für Meereskunde, D-24105 Kiel, Germany

8-11 September, São José dos Campos, Brazil
4th Meeting of the Joint WCRP/IGBP Working Group on Land-Surface Experiments; Planning of the Amazon Experiment

16-18 September, Bratislava, Slovakia
BAHC Workshop on Focus 4: the Weather Generator

20-25 September, Bratislava, Slovakia
Symposium on Precipitation and Evaporation

WMO, IAHS, IAMAP, UNESCO, FAO, IGBP/BAHC. Dr. Milan Lapin, Slovak Hydrometeorological Institute, Jeseniouva 17, 833 15 Bratislava, Slovakia. Tel: (+42-7) 371 392; Fax: (+42-7) 372 459; 372 034

29 September-1 October, Taipei, Taiwan
International Group of Funding Agencies for Global Change Research (IGFA). Dr. Ho Lin, Dept. of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan. Tel: ((+886-2) 363 6775, Fax: (+886-2) 363 3642

30 Sept-2 Oct, Panama City, Panama
PAGES Workshop on Late Quaternary Palaeoclimates in the Americas, Pole-Equator-Pole. Dr. Vera Markgraf, INSTAAR, University of Colorado, Boulder CO 80309, USA. Tel: (+1-303) 492 5117; Fax: (+1-303) 492 6388

13-15 October, Washington, DC, USA
Open Meeting of the PAGES Core Project Scientific Steering Committee. Dr. Herman Zimmerman, PAGES Core Project Office, Bärenplatz 2, CH-3011 Bern, Switzerland. Tel: (+41-31) 21 31 33; Fax: (+41-31) 21 31 68; E-mail: PAGES@ubclu.unibe.ch

mid-October, Berlin, Germany
5th IGBP-DIS Standing Committee

mid-October, Toulouse, France
First START Mediterranean Committee Meeting (MEDCOM)

20-22 October, Canberra, Australia
Land Use and Land Cover in Australia: Living with Global Change. Joint Australian Academies' Symposium. Prof. Bruce Thom, Chairman, Australian National Committee for the IGBP, Department of Geography, Institute Building HO 3, University of Sydney, Sydney, New South Wales. Tel: (+61-2) 692 2886; Fax: (+61-2) 692 3644; E-mail: thom@estrou.ucc.su.oz.au

22-26 October, Aussois, France
Strategies for the Use of Palaeoclimate Data Sets in Climate Model Intercomparison and Evaluation (NATO ARW and PAGES). Dr. J. Guiot, CNRS, Laboratoire de Botanique Historique et Palynologie, Faculté St. Jérôme, F-13397 Marseilles Cédex 13, France

24 October, Goa, India
1st START Bureau Meeting

25-27 October, Goa, India
7th START Standing Committee Meeting

8-11 November, Kyoto, Japan
International Symposium on the Sino-Japanese Cooperative Programme on Atmosphere-Land Surface Processes in the Heihe River Basin (HEIFE)/BAHC Focus 2 on Land-Surface Experiments. Prof. Yasushi Mitsuta, Disaster Prevention Research Institute, Kyoto University, Gokasho Uji, Kyoto 611, Japan. Tel: (+81) 774 32 3111, ext. 3200; Fax: (+81) 774 33 0026

15-18 November, Barcelona, Spain
GCTE/HDP Workshop: Global Change and Landscape Dynamics in Mediterranean Systems. Dr. Will Steffen, GCTE Core Project Office, CSIRO Division of Wildlife & Ecology, POB 84, Lyneham, ACT 2602, Australia. Tel: (+61-6) 242 1755, Fax: (+61-6) 241 2362, E-mail: B. Walker (Omnet); wls@cbr.dwe.csiro.au (Internet)

17-20 November, Oxford, UK
Land Use/Land Cover Change Project Modelling Working Group

30 Nov-3 Dec, Taipei, Taiwan

APARE/IGAC International Conference on Regional Environment and Climate Changes in East Asia. Dr. Chung Ming Liu, Dept. of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan. Tel: (+886-2) 362 3112, Fax: (+886-2) 363 3642, E-mail: liu@asc120.as.nut.edu.tw

1-3 December, Tucson, Arizona, USA
PAGES Workshop: Extracting Climatic and Other Environmental Signals from Millennial-Aged Tree-Ring Chronologies. Dr. D. Graybill, University of Arizona, Tucson, Arizona 85721, USA. Tel: (+1-602) 621 6469; Fax: (+1-602) 621 8229

December, St. Moritz, Switzerland
BAHC Workshop on Ecology and Hydrology in Mountain Regions

14-17 December, Texel, Netherlands
JGOFS Indian Ocean Planning Group. Dr. Bernd Zeitzschel, Institut für Meereskunde, Universität Kiel, Dusternbrooker Weg 20, Kiel, Germany

20-22 December, Mombasa, Kenya
INQUA-PAGES Palaeomonsoon Workshop and Planning Group. Dr. Stefan Kropelin, Freie Universität Berlin, Geomorphologisches Laboratorium, Altensteinerstr. 19, D-1000 Berlin 33 Germany. Tel: (+49-30) 838 4887, Fax: (+49-30) 838 4842

1994

16 January, Lilongwe, Malawi
3rd START Southern African Committee Meeting (SAFCOM)

17-21 January, Lilongwe, Malawi
First Regional South African Workshop for START. Lilongwe, Malawi. Prof. Z M Kasomekera, University of Malawi, Bunda College of Agriculture, PO Box 219, Lilongwe, Malawi. Tel: (+265) 277 222, Fax: (+265) 277 251, or 277 364

4-5 February, Boulder, CO, USA
PAGES/PALE Principal Investigators. Dr. John Andrews, Boulder, CO, USA. Tel: (+1-303) 492 8347; Fax: (+1-303) 492 6388

10-14 March, Bonn, Germany
8th Meeting of the Scientific Committee for the IGBP

14-16 March, Bonn, Germany
Fourth Meeting of the IGBP National Committees. Dr. Sabine Lütkeemeier, IGBP-Sekretariat, Institut für Meteorologie, Freie Universität Berlin, Dietrich-Schäfer-Weg 6-10, D-1000 Berlin 41, Germany. Tel: (+49-30) 838 71117, Fax: (+49-30) 838 71160, E-mail: H.Bolle.IGBP (Omnet)

6-7 April, Belgium
International Open Symposium on Freshwater Ecosystems. Dr. Oscar Vanderborgh, Royal Belgian Academies of Sciences, Palais des Académies, 1, rue Ducale, B-1000 Bruxelles. Tel: (+32-2) 511 2629; Fax: (+32-2) 511 01430, or at the University of Antwerp, Department of Biology; Fax: (+32-3) 328 0497

25-26 April, Washington, DC
IGBP-DIS Soils Working Group

23-27 May, Woods Hole, Massachusetts, USA
First GCTE Science Conference. Dr. Will Steffen, GCTE Core Project Officer, CSIRO, Division of Wildlife & Ecology, PO Box 84, Lyneham ACT 2602, Australia. Tel: (+61-6) 242 1748; Fax: (+61-6) 241 2362; E-Mail: wls@cbr.dwe.csiro.au (Internet)

1-3 June, Nantes, France
PAGES Symposium on Palaeo-processes in the