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



The Prime Minister of India, Shri Chandra Shekhar, addresses the participants at the opening session of the Asian IGBP Workshop in New Delhi on 11 February 1991. From right to left: Hon. Prime Minister Chandra Shekhar; Professor Thomas Rosswall, Executive Director, IGBP; Professor J. W. M. de Risière, Secretary General, ICSU; Professor M. G. K. Menon, President of ICSU; Professor A. P. Mitra, Director General of the Council of Scientific and Industrial Research; Professor R. R. Daniel, Chair, Indian National Committee for the IGBP; Professor P. N. Tandon. Also on the podium but not seen in the picture, Professor S. K. Joshi.

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IGBP Regional Workshop for Asia

NEW DELHI, 11-15 FEBRUARY 1991

The first IGBP Workshop for Asia was held at the National Physical Laboratory, New Delhi, India from 11 to 15 February 1991. The workshop was opened by the Indian Prime Minister Shri Chandra Shekhar, who addressed a gathering of 200 participants from Asia, Europe and the USA.

The participants represented Bangladesh, China (CAST, Beijing, and the Academy of Sciences, Taipei), India, Indonesia, Japan, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand, France, Poland, Sweden, the United Kingdom, the U.S.A. and the USSR.

Conclusions of the IGBP Asian Workshop

- The ominous warnings of global changes emerge from almost all existing scientific data, interpretation and modelling. If it does set in over the coming century, the economic burden and human suffering are going to be felt in developing countries. It is therefore in the interest of every developing country to encourage and support IGBP activities because, among other things, this will help to generate and strengthen a self-reliant multi-disciplinary nucleus of scientific experts, who can provide advice to their decision makers. It is too risky to wait for the "proof" for global change. It may then be too late to take corrective action.

- It is the responsibility of scientists from developing countries to create necessary awareness in their decision makers to support these activities in the overall national interest. Where needed, the IGBP Core Projects may be able to extend consultancy to these scientists in the formulation of their national plans. Developing countries must ex-

press their serious interest by joining the IGBP as National Members and make at least a token annual contribution.

- The tropical regions of the Earth's land surface (say $\pm 30^\circ$ latitude) are nearly all occupied by developing countries. There are a variety of IGBP relevant scientific problems that relate to what happens there - on the land, to the vegetation, in the atmosphere above and to the life forms including humans. Hence, it is an excellent opportunity for developing countries to take organized and serious steps to work on them and to participate in the benefits.

- In the absence of ground-based information in tropical regions that is needed for IGBP projects, scientists in these and other regions will need to explore all possibilities for access to the critical data, including remote sensing. When such initiative is taken by scientists external to the region of interest, this work should only be pursued with the full involvement of scientists from the region in all aspects of the research.

- A planned and serious effort is needed by developing countries, since ad hoc "cooperation" with advanced countries does not lead to enduring results that include national benefits or the development of self-reliant human resources.

- The Scientific Committee for the IGBP (SC-IGBP) should consider a formal mechanism for facilitating developing countries' participation in the IGBP in a manner that ensures, among

other things, that these activities are of national relevance and that they will lead to the growth of expert, inter-disciplinary, self-reliant manpower. There is an urgent need to set up a Special Group for this purpose with at least half the members from developing countries to advise the SC-IGBP about suitable steps to be taken for promoting IGBP activities in developing countries. Links should be established with other International Council of Scientific Unions (ICSU) bodies, such as the Committee on Science and Technology in Developing Countries (COSTED), the International Biosciences Network (IBN), the Committee on the Teaching of Science (CTS).

- Deliberate and planned effort should be pursued by the SC-IGBP to involve scientists from developing countries in the various committees and working groups. Even among developing countries such membership must be well distributed. Special efforts are to be taken to identify young and active scientists with leadership qualities for this purpose.

- The IGBP is planning a large number of Core Project open meetings, other planning workshops and scientific meetings during 1991-1992. All efforts are to be taken to increase the participation of scientists from developing countries in these meetings.

- Most developing countries have institutions of higher learning in scientific education or research. The IGBP being interdisciplinary, almost any

motivated scientist specialized in one or another scientific discipline can be trained in IGBP related problems. When a properly motivated scientist is selected judiciously, training for the IGBP becomes the most crucial element. Therefore the IGBP plan for developing countries must include training in all its dimensions - national, regional, international, on job, scientific exchange, etc.

- In IGBP studies, including those on the impact of global change on various Earth system components (projects like GCTE, GCEC, and BAHG)*, a good base-line data base is necessary. But many developing countries do not have such data available. Hence, collecting and systematizing such data is a pre-requisite. These gaps need to be identified and the prime responsibility given to the developing countries. However, if we leave the full implementation of this task to the developing countries, the present dearth of scientists specialized in these fields will delay the tasks unduly.

- Regional Research Centres (RRCs) can play a crucial role in fostering and strengthening IGBP work in developing countries. The recommendations in the recent report from the Bellagio Workshop (IGBP Report 15) should be acted upon with some urgency. Every effort must be taken to set up at least one RRC each in South America, Africa and Asia expeditiously.

- IGBP Modelling: Modelling is involved at individual, micro-and macro-ecosystem levels in every core project. This is needed to understand and improve the studies on the key processes and systems. We also need global geosphere-biosphere models to realize the final goal of the IGBP. Developing countries often have few scientists knowledgeable about modelling techniques. They need special assistance to make a serious entry in this area. Of special need here is training and opportunities to work for extended periods with experts in the field.

- Developing countries - their scientists, decision makers and their governments - must have a commitment to support global change studies on a long-term basis. They must demonstrate it in action by extending encouragement and at least modest resources to their scientists. ■

* (see IGBP Core Projects p. 10-18)

Second Meeting of the IGBP National Committee Representatives

LONDON, 4-6 FEBRUARY 1991

The Royal Society (the UK adhering body to the International Council of Scientific Unions and its constituent unions, scientific committees and programmes) hosted, in London, the second meeting of representatives of those countries which have established National Committees for the IGBP.

The first meeting of IGBP National Committees was held in Washington DC in January 1990. At the second meeting, twenty-six countries including four less developed countries, the Commission of the European Communities and ICISU itself, were represented by more than 40 scientists. Sir Anthony Epstein, Foreign Secretary of the Royal Society, welcomed the participants.

IGBP Developments

In the first session Professor Rosswall reviewed developments since the second meeting of the Scientific Advisory Committee in September 1990: The publication of the report of the Inter-governmental Panel on Climate Change (IPCC); the conclusions from the Second World Climate Conference, in October-November 1990; and the second meeting of the newly established IGBP Scientific Committee in December 1990.

He reported that the SC-IGBP had reviewed the recommendations from SAC II and taken appropriate action. Thus, to coordinate activities between

projects: IGAC, BAHG, GCTE, and DIS will convene a joint meeting in June to discuss landcover characteristics and how remote sensing information should be classified to provide a global landcover map that can be used by the projects. Interactions between JGOFS and Tropical Oceans and Global Atmosphere Programme-World Ocean Circulation Experiment (TOGA-WOCE)-World Climate Research Programme (WCRP) are also progressing satisfactorily. Interaction between BAHG and the Global Energy and Water Cycle Experiment (GEWEX) and the form this should take is being further discussed. It should be noted that a joint working group on land-surface experiments already exist. BAHG and GCTE are also jointly developing Soil-Vegetation-Atmosphere Transfer Models (SVATs). There is a need to further strengthen the interactions between PAGES and other IGBP Core Projects.

Core Project Planning Committees (CPPC) have been established for STIB and LOICZ. A Chairperson has been appointed for GAIM, and the composi-

tion of the CPPC will be finalized in the near future.

With regard to further development of GOEYS, it has been decided to invite Scientific Committee on Ocean Research (SCOR) to cosponsor a symposium on this topic to which representatives of WOCE (WCRP) will also be invited.

He also mentioned that, following a recommendation from the Second World Climate Conference and at the invitation of Joint Scientific Committee (JSC)/WCRP, a meeting on a Global Climate Observing System (GCOS) was convened in the UK in January 1991. The report from this meeting was published in March 1991. The development of Regional Research Centres has taken a major step forward through a meeting convened by IGBP and the Rockefeller Foundation in Bellagio last December (IGBP Report 15).

The IGBP and the International Social Science Council (ISSC) have appointed an ad hoc committee to address the issue of land-use change as per the Scientific Advisory Council (IGBP)(SAC) II recommendation. A preliminary version of their report will be ready later this year and two meetings are being planned (New York in April and Stockholm in the autumn).

The SC-IGBP has appointed an ad hoc committee under the chairmanship of Professor José Sarukhán to look into the needs for further global change education and training. The WCRP has been invited to nominate a representative to the group. It is expected that a preliminary report will be ready for the 3rd meeting of the SC-IGBP, which will be held in Tokyo 28-31 August 1991. ICSU has appointed two new members to the SC-IGBP: Professors S. K. Sinha from India and S. Tsunogai from Japan.

A regional meeting for Asia was held in New Delhi in February 1991 and one for Africa will be held in December 1991. A special session of IGBP and the Pacific is being organized as part of the Pacific Science Association meeting in Hawaii later this year.

The SC-IGBP has advertised a post as Deputy Executive Director and a number of very promising applications have been received. It is hoped that the appointment will take effect no later than 1 July 1991. There has also been an offer for a secondment of a Chinese scientist to the Secretariat, and other countries are encouraged to second scientists to the Secretariat for periods

of not less than one year.

The SC-IGBP intends to prepare an abbreviated version of IGBP Report 12 and an updated brochure. In addition, it is hoped that the Global Change NewsLetter can be published four times a year in the future.

Professor Rosswall furthermore suggested that national committees should address the following tasks:

- Development of plans for national contributions to the IGBP Core Projects;
- Nomination of key scientists for IGBP Core Project Open Meetings;
- Dissemination of IGBP literature within their country;
- Publicity for national activities in the IGBP NewsLetter;
- Maintenance of linkages to national funding agencies and hence to IGFA; and the generation of additional funding for the IGBP;
- Ensuring the proper briefing of delegates to meetings on environmental issues such as IPCC, WMO, and UNEP;
- Assistance in proper preparation of the science component of UNCED;
- Support of START;

Commission of the European Communities

Mr. P. Mathy, for the Commission of the European Communities (CEC), presented a report on CEC plans to implement two specific research and technical development programmes. When the meeting in London took place, these programmes were discussed by the Council and the European Parliament. One four-year programme (1991-1994) was to be centered upon the environment, with a total budget of 260M ECU's, of which 100-150M ECU's would be available for Global Change Research. Within this programme, scientific priorities were: (i) Natural climate change; (ii) anthropogenic climate change; (iii) climate change impacts; (iv) stratospheric ozone; (v) tropospheric physics and chemistry; (vi) biogeochemical cycles and; (vii) ecosystem dynamics. The second four-year programme, on marine science and technology, would command a budget of 104M ECU's, of which 30-45M ECU's would be available for Global Change Research. Within it, scientific priorities would be: (i) Processes and fluxes; (ii) circulation and exchange of water masses; (iii)

biogeochemical cycles and fluxes; (iv) interface and boundary processes; (v) biological processes and; (vi) marine biosciences. In setting these programmes, the CEC had taken note of topics chosen by the IGBP for Core Projects. Funding of these two programmes would be as research contracts and by concerted action. It was hoped that scientists from many European countries would participate in the CEC programmes.

United Nations Conference on Environment and Development (UNCED)

Professor J. C. I. Dooge, President-elect of ICSU, gave a stimulating talk on the nature of and preparations for the United Nations Conference on Environment and Development (UNCED) to be held in Rio de Janeiro, in June 1992. UNCED has been set up under a United Nations resolution (no. 44/228) regarding issues of major concern in maintaining the quality of the Earth's environment and especially in achieving environmentally sound and sustainable development in all countries. Its Secretariat is based in Geneva. Working Groups have been appointed to deal with each of the following 10 issues:

- Protection of the atmosphere;
- Protection and management of land resources;
- Conservation of biological diversity;
- Environmentally sound management of biotechnology;
- Protection of the oceans and coastal areas;
- Supply and quality of fresh water resources;
- Environmentally sound management of wastes;
- Environmental education;
- Living and working environment of the poor;
- Human health and quality of life;

Seven of these ten topics are especially relevant to ICSU and, in four of these, studies have begun. There were four main thrusts in preparation for UNCED: (i) Working parties and consultative groups have been asked to contribute to a report on each of the ten themes, and ICSU has agreed to review the scientific aspects of these reports; (ii) each country has been asked to prepare a national report and ICSU has

called upon each national scientific community to ensure that it makes an input. He stressed the need for IGBP scientists to be involved in this operation; (iii) a number of preparatory conferences organized on both a regional and disciplinary basis were to be organized and; (iv) ICSU and the Third World Academy of Sciences (TWAS) will convene an international conference on an Agenda for Science for Environment and Development into the 21st Century (ASCEND 21) to be held in Vienna on 24-29 November 1991. A major conference document would result from it. There are four co-sponsors for this meeting: The International Social Science Council (ISSC); the International Institute for Applied Systems Analysis (IIASA); the European Science Foundation (ESF) and; the Norwegian Research Council (NAVF). The programme would comprise three groups of 15 themes. Some 200 scientists are being invited to present papers. A preparatory meeting for it will be held in July 1991.

Core Project Developments

A session was devoted to reports by leading participants on the latest developments in each of the Core Projects. Particular points made were: (i) That there was a need for a very close linkage between the STIB Core Project and WCRP, and also for biologists to continue to be participants in it; (ii) that a close involvement of UN Agencies in the LOICZ project should be encouraged; (iii) there is a very strong case for BAHC to become a joint IGBP-WCRP project; (iv) that there was need to minimize overlap of effort in separate Core Projects.

JGOFS Presentation

Detailed presentations of the science of JGOFS were made by UK scientists occupying leading roles in the project. The presentations, summarizing the latest results of research arising from the North Atlantic cruises in 1989 and 1990 were: (i) Introduction - Dr. M. R. Fasham; (ii) North Atlantic Bloom Experiment - Dr. P. Williamson; (iii) North Atlantic CO₂ System - Dr. A. J. Watson; (iv) Particle Production in the Upper Ocean - Dr. R. P. Harris; (v) Fluxes to the Deep Ocean - Dr. R. S. Lampitt; (vi) N-S Palaeo-Oceanographic Transect - Professor I. N. McCave.

Regional Research Centres

Professor G. Golubev described the Global Change START project. This should consist of interacting networks of regional research sites, in each of which would be located a research center. The proposed START project is a world-encompassing system of Regional Research Networks (RRN), each of which includes a RRC and a number of affiliated Regional Research Sites (RRS). The RRC serves as the information centre for the regional network (RRN), with additional coordinating functions both within and outside the region. RRNs, through RRCs, are linked together to provide a global system through which scientific information is disseminated and research is organized to implement the core research projects of major international programmes including, but not limited to, the IGBP and the WCRP.

Role of Less Developed Countries (LDCs)

Professor J. Sarukhán, in a presentation on the role of LDCs, stated that participation in IGBP by LDCs was determined by: (i) The number of trained scientists in the country; (ii) the level of national awareness of the importance of global environmental research and; (iii) the necessary ability to fund such research. There was a need to increase substantially the level of funding available for research in LDCs and to note that the objectives of environmental research were necessarily long-term, which sometimes created difficulties for LDCs, in which political programmes and budgets were often conceived within a much shorter time perspective.

Human Dimensions of Global Environmental Change

In a presentation on social and economic aspects of global change, Professor H. K. Jacobson outlined the seven research topics recently identified by the ISSC. These were: (i) Social dimensions of resource use; (ii) perception and association of global environmental conditions and change; (iii) impacts of social, economic and political structures and institutions at local, national and international levels; (iv) land use; (v) energy production and consump-

tion; (vi) industrial growth and; (vii) environmental security and sustainable development. A work programme had been adopted with three sub-programmes on: Data; land cover and use and; design and development of research. The ISSC expects to set up a secretariat for the programme in Spain.

Funding of IGBP

There was extensive discussion of the future funding of IGBP, led by Professor P. S. Liss, IGBP Treasurer. For this, the secretariat had drawn up as a basis for discussion an IGBP prospective budget 1991-1994. Four types of funding required for IGBP were defined in it: (i) Core support for IGBP planning and coordination and participation of LDCs in such activities; (ii) funding of the establishment and operation of Core Project Offices (CPOs); (iii) funding for START activities and; (iv) funding of research. The funding of point (iii) has been described in the report of the Bellagio meeting of December 1990 and (iv) is perceived to be the responsibility of a variety of governmental and other bodies.

The meeting therefore devoted its attention to:

(i) Core Support

The main income is derived from national dues; other sources being, e.g. ICSU, United Nations Environment Programme (UNEP), GEC and private industry. In order to fund fully the listed activities, a further \$750K needs to be generated in 1991 from other sources. Any short-fall in support from these extra sources would mean an inevitable cutback in the IGBP scientific planning and coordination. The level of national subscriptions has hitherto been fixed unilaterally. From 1992, it was proposed that national dues should be fixed at a level determined by each country's subscription to the United Nations. The effects of inflation would be compensated by the addition of the official ICSU rate of 5% per year to national contributions after 1992. Problems caused by exchange rate fluctuations were common to all ICSU bodies and ICSU was to be encouraged to find a mechanism for alleviating them.

(ii) Core Project Offices

Some Core Projects are still to be established. Information is incomplete, but provisional costings can be esti-

mated and sources of some finances are already identified.

UK Global Environmental Research

An exposition of UK global environmental research was presented by Mr. D. Brown on behalf of the UK Global Environmental Research office. The UK Research Framework Report is due to be published later in 1991 by the UK Inter-agency Committee on Global Environmental Change (IAGEC). This Committee has set up sub-groups in seven work areas: (i) Climatology and hydrology; (ii) biogeochemical dynamics; (iii) ecological systems and dynamics; (iv) past environmental change; (v) socio-economic considerations; (vi) stratosphere processes and; (vii) data and facilities. Each sub-group would have input to the UK report. A data task force would consider the UK requirements for data handling, networking and exchange and would report to IAGEC by the end of March 1991. IAGEC is related for the UK to the International Group of Funding Agen-

cies for Global Change Research (IGFA), which is non-governmental, comprising major national and regional funding bodies. It provides for information exchange on national support for global change research, identifies where bottlenecks exist and considers mechanisms for them being removed or reduced, and seeks to ascertain each country's financial contribution to global change research.

Education and Training

Professor Sarukhán discussed education and training needs for Global Environmental Research. In each LDC, professional training was required to increase awareness about environmental problems during the education of engineers, architects, economists and media personnel, as well as of scientists. A short version of IGBP Report No. 12 would be a useful tool in engendering this awareness and would stimulate research and training. In LDCs there is a need: (i) To reduce per capita consumption of resources; (ii) to increase efficiency of energy use; (iii)

to build ecological costs into development and production processes and; (iv) to enable freer transfer of energy efficiency technology to LDCs.

Final Discussion

In a final discussion period the following decisions were taken:

- To encourage Professor Tigyí to collate a list of national committee contributions and interests in IGBP Core Project foci and activities;
- To recommend that future meetings of national committee representatives should be held biennially in alternate years to those of meetings of the Scientific Advisory Council, which would itself have input from national committee chairs;
- To recommend that BAHC should be a joint IGBP/WCRP Project;
- To recommend, in principle, that a future minimum level of national dues to IGBP should be based on each country's subscription to the United Nations. ■

IGBP National Committee Initiatives

Report from the USSR National Committee for the IGBP

The USSR Academy of Sciences attaches great importance to the International Geosphere-Biosphere Programme, convinced that studies under this programme will make it possible better to understand the development

of the Earth's nature in the next century, and will serve as the basis for making vital decisions.

Particular attention has been given lately within the USSR to ecological problems. A special programme on biosphere and ecology research has been prepared by the Academy of Sciences, which will be a scientific component of the State programme on the protection of the environment and on the rational use of natural resources. A Committee on ecology and the rational use of natural resources, which includes representatives from the Academy of Sciences,

has been set up in the new USSR Supreme Soviet. An important decree, "On urgent measures for the ecological improvement of the country", has been adopted by the USSR Supreme Soviet on the basis of a proposal made by this Committee.

The USSR National Committee for the IGBP was set up by decision of the Presidium of the USSR Academy of Sciences on June 27th, 1988. Its composition was defined, and the main directions of the participation of the Soviet scientific institutions in the IGBP were approved, in May 1989. Acad-

emician G. I. Marchuk was named Chair of the USSR National Committee for the IGBP, and the following prominent scientists were appointed his Vice-Chairmen: Academicians N. P. Laverov (geologist); K. Ya. Kondratjev (geophysicists); V. E. Sokolov (biologist). Corresponding Members of the USSR Academy of Sciences: Yu. A. Izrael (climatologist) and; V. M. Kotlyakov (geographer).

The USSR National Committee for the IGBP has decided to take, as the conceptual basis of the Soviet national programme, a study of stability and dynamics of natural systems using monitoring, experiments, and modelling. A number of representative ranges - Baikal, arid zones, tundras of the North Urals and Taimyr, the Kursk area and the Ubsu-Nur basin have been identified. A decision has also been taken to carry out research with regard to specific projects. Five such projects approved by the USSR National Committee for the IGBP are now being elaborated. Some of these will directly contribute to the IGBP Core Projects.

The following is proposed as a contribution to the International Global Atmospheric Chemistry Project (IGAC):

- Taiga marshlands in a changing climate and the emission of greenhouse gases.

The following studies will be performed in the USSR to contribute to the Joint Global Ocean Flux Study (JGOFS), although they are not formally part of the JGOFS Core Project:

- The ecosystem of the Black Sea;
- The Gulf stream;
- The global flow of matter and the effect of anthropogenic influences on the ecology of the oceans.

Studies are pursued relating to Past Global Changes (PAGES):

- Methods of obtaining data on the Earth's past.

The following is proposed as a contribution to IGBP Core Project Biospheric Aspects of the Hydrological Cycle (BAHC):

- The estimation of the impact of changes of the climate on the hydrological and biosphere processes of the Caspian Sea Basin.

The following is suggested to be included in Global Change and Terrestrial Ecosystems (GCTE):

- The Asiatic Ecological Meridian (including sub-projects The Enisei Meridian and The Ubsu-Nur Experiment);
- The dynamics of the vegetation cover, its structure and functioning, determination of the stability of terrestrial ecosystems in relation to global change.

Activities in the framework of Global Analysis, Interpretation and Modelling (GAIM):

- Global geosphere-biosphere modelling.

To reach the objectives of the IGBP Global Change Regional Research Centres (START):

- Setting up a network of stations for the IGBP on USSR territory.

The USSR has also suggested a number of additional international projects to be studied:

- Biogeochemical cycles at various stages of the existence of the Earth and how they are affected by anthropogenic factors;
- Global and regional changes of both natural and anthropogenic geographical systems;
- Optimization of the system of global ecological observations and data bases.

The following national projects are currently being implemented:

- A study of changes of biological systems including Man in the environment;
- The role of solar radiation in the physical processes of the geosphere and their influence upon the biological systems.

There are also plans to unify the methods of observation at a chain of observatories situated at the meridian 90° E (the Enisei Meridian Project) from the Arctic to the Antarctic, and to combine the efforts of the Academies of Science of some European and Asian countries for joint projects within the framework of the IGBP. The proposal to set up a chain of geosphere-biosphere stations and observatories has also been put forward with the studies to be carried out crossing of all Eurasia from Central Europe up to South-East Asia. Simultaneous observations at this chain of stations will make it possible to study the process of global change on the Earth's largest continent and is pro-

posed as a major contribution to the IGBP.

The next step will be the approval of national programmes in that part where international cooperation is possible. Soviet scientists are ready to invite to the USSR, on a working visit, experts from countries which show an interest in international cooperation.

The USSR's priorities of financial allocations lie in the equipment of ground research stations and space platforms with as high an accuracy as possible, together with unified instrumentation, which will make it possible to obtain comparable data on the basis of a single programme and to process these data in a common format. To support IGBP activities, the Soviet Union pays \$150,000 annual dues since 1990.

Report from the Netherlands National Committee for the IGBP

The Netherlands Committee for the International Geosphere-Biosphere Programme has actively participated in the formulation of its Core Projects as published in IGBP Report 12, and regards this report as a good guideline for its activities in the coming years.

Since the committee is also responsible for the Dutch input into the United Nations Educational, Scientific and Cultural Organization (Unesco) Man and the Biosphere Programme (MAB) and the IC/SU Scientific Committee on Problems of the Environment (SCOPE), it will also take care of the coordination of these three activities which share a common goal: To understand the large changes in our environment, especially those which are influenced by Man.

The committee is established by the Royal Netherlands Academy of Arts and Sciences. The secretary is also secretary of the Climate Committee of the Academy and of the Council for Earth Sciences; these bodies have several members in common to guarantee good cooperation. Discussion has started within the Academy about the involvement of the human (socio-economic) sciences in the questions on global change.

The committee is fortunate in that

its activities are supported by the Government of the Netherlands. Five departments have recently started a large research programme on the consequences of climate change (NOP). The input of IGBP into this programme is felt to be of great importance.

Our committee assists in developing the international programmes by stimulating participation of experts in the IGBP Core Projects. A coordinated attempt is being made to attract one CPO to the Netherlands. There is general support from the main science funding agencies to house the office for the LOICZ Core Project for the obvious reason that our low country has developed a broad and special knowledge on and interest in matters concerning coastal management. An offer is also made to house the proposed Carbon Isotope Analysis Centre which will be installed in the framework of the PAGES Core Project.

Besides this special selection there is a great interest in the other established or proposed core projects. Participation in the JGOFS and in PAGES is already underway. For the participation in the GCTE and GCEC Core Projects, preparations have already been made. Proposals are also generated for some of the DIS projects.

Financially the Dutch programmes will be supported by the Academy, the Ministry of Science and Education and by the Netherlands Organization for Scientific Research (NWO). This organization has established a body on Disturbance of Earth Systems that will guarantee a concerted interdisciplinary approach.

The Netherlands IGBP Committee is also involved in the organization of the General Assembly of the International Union of Biological Sciences (IUBS) at Amsterdam, 1-6 September, 1991, and especially of the symposium on Biological Diversity and Global Change, 3-4 September, 1991.

A Report from the IGBP Committee in China (Taiwan)

JGOFS-RELATED STUDIES IN TAIWAN, CHINA

Ocean Science in Taiwan, China, has experienced a rapid growth in this dec-

ade. The number of academic ocean research programmes has more than doubled, and the research fleet also includes a modern 50 m-class R/V Ocean Researcher 1 with well-equipped facilities and laboratories. The prospect of undertaking a major multidisciplinary study of waters surrounding Taiwan during the next decade was recognized and the Kuroshio Edge Exchange Processes (KEEP) programme was chosen as a major project.

The blocking of the Kuroshio by the continental shelf break off the northeast shore of the island of Taiwan is responsible for the generation of a shelf-slope circulation pattern that triggers a major exchange between the East China Sea and the western North Pacific Ocean. This exchange involves water of deep ocean origin and of strong fluvial influence. The interaction of these two water types is much more pronounced than that found inshore of the Gulf Stream off the southeastern coast of the United States. The circulation that promotes and sustains this exchange consists of a complicated system of Kuroshio branch currents, meanders, upwelling and frontal eddies. The proximity of this exchange to a well-developed logistic support base in Keelung, the contrast the exchange provides to the Gulf Stream frontal system, and the richness it offers in biological and geochemical implications make the system off northeastern Taiwan ideal for multidisciplinary studies.

The key study issues are:

- What processes dominate cross-frontal exchange and how far does their influence extend across the shelf?
- What is the action of fluvial, upwelling, advective, and benthic processes?
- What physical and biogeochemical factors control trophic dynamics and community structure in this region?

Monthly surveys across the upstream, meander, and adjacent Taiwan Strait regions are undertaken, which will resolve spatial and seasonal variations of the currents, hydrography, primary production, nutrients, particulate and dissolved organic carbon, zooplankton and phytoplankton abundance, fish larval abundance, sediment thickness, carbon and nitrogen accumulation rates, and nutrient regeneration rates.

Over 30 projects have been funded by the National Science Council. Ef-

forts will be made to coordinate this programme with other planned West Pacific experiments such as JGOFS and WOCE.

When the Sino-Filipino ocean scientists completed their first bilateral WOCE cruise, the R/V Ocean Researcher 1 held an open house in Manila on December 22. The ship, owned by the National Science Council and the Ministry of Education, was staffed by Taiwanese and Filipino scientists under a bilateral project to monitor the physical, chemical and geological properties of the waters off the Northern coast of Luzon.

The vessel's mission falls under the auspices of the WOCE Pacific Repeat 21 hydrography section. The cruise concentrated on the Bashi Channel which connects the Pacific Ocean and the South China Sea. Scientists from Taiwan, sponsored by the National Science Council and the Academia Sinica, are also planning a joint programme involving atmospheric and land experiments to come up with more accurate weather forecasts. Existing bilateral research programmes involve studies of plate tectonics and earthquakes.

Report from the Irish National Committee for the IGBP

Following the very favorable response from Irish researchers to the IGBP initiative, an Irish Committee for the IGBP was established by the Royal Irish Academy, the institution in Ireland which adheres to ICSU, and the Committee held its first meeting in July 1989. The membership is drawn from active research workers in areas of interest to the Global Change programme, from the Department of the Environment, and from other relevant national Scientific Bodies.

Within the Irish third level educational and state institutions at the present time there exists a core of scientists with particular expertise in atmospheric and environmental research. In addition, there are established field and monitoring stations in various locations throughout the country, and these stations are being increasingly used by research groups from outside the

country, working in cooperation with Irish scientific colleagues. This it is felt that Ireland has the capability to make a helpful contribution to the IGBP. The amount of funding available from local sources for global change research is quite small, however, and it is envisaged that Ireland can contribute best by identifying specific component tasks within the IGBP core projects which can be assigned to, and undertaken by, Irish research groups.

The Irish Committee sees itself as the official link between the IGBP organizational and: (i) Irish research workers active in the area of global change; (ii) relevant Irish national and governmental bodies. In the case of

each IGBP Core Project, the Committee has appointed one or more of its members to act as liaison person(s) with the Chair of the Scientific Standing Committee (or equivalent body) of the Core Project. The liaison person(s) will: (i) Keep the Committee informed about the progress of the project; (ii) keep relevant Irish research workers and organizations informed about the Global Change programme; (iii) attempt to match Irish research activity with specific tasks within the Core Project.

The Committee will endeavour to assist the liaison persons or relevant research workers involved in these research projects to attend Core Project meetings.

During the past year a comprehensive inventory of Irish research activity in areas relevant to the IGBP was compiled, this is being constantly updated. In order to bring the IGBP to the notice of scientific groups and organizations in Ireland, a booklet, which describes the Global Change programme and gives an Irish perspective on it, has been written and is a present being distributed.

The organizational activities of the Irish Committee have been supported by a grant from the Irish Government's Department of the Environment ■

Earth Systems of the West Coast of the Americas as Diagnostic Indicators of Global Change

E. R. FUENTES, H. FUENZALIDA, B. KRONBERG, AND H. A. MOONEY

(Condensed from an article to be published in *Trends in Ecology and Evolution*)

An important component of global change is the predicted increase in global mean temperature, due to rising levels of greenhouse gases. But how will we distinguish the effects of global warming from those of other co-occurring phenomena? How will we separate the effects of climate change from those of increased human pressure on the landscape?

Comparative studies of disjunct areas have proven useful in unraveling complex questions such as these. In studying the complexities of ecosystem response to global change phenomena, it may be fruitful to compare the temperate west coasts of North and South America. These areas have similarly controlled climatic systems, parallel biotic gradients (desert to mediterranean ecosystem to temperate evergreen forest), and similar ocean phenomena (east boundary currents, upwellings, El Niño events). But the two coasts are not

perfect replicates of one another. There are important differences in land-to-ocean ratios, in proximity to ice masses, and in the levels of industrialization. Given this matrix of variables, interesting comparative experiments are possible.

The current general circulation models (GCMs) suggest that the Northern and Southern hemispheres may experience nonparallel precipitation and temperature changes. In the Southern hemisphere, climate response is expected to be delayed due to the buffering effect of the oceans and the large Antarctic ice pack. In contrast, warming in the Northern hemisphere may occur more rapidly, accelerated by increasing greenhouse gas fluxes (primarily carbon dioxide and methane) from the extensive, carbon-rich tundra and boreal systems. This asymmetric response will afford an opportunity for clarifying the importance of different

variables in determining biotic responses to climate change.

The Chilean, United States, and Canadian National IGBP Committees, with the AAAS, the Chilean Academy of Sciences, the MacArthur Foundation and the Universidad de La Serena, held a multidisciplinary meeting in La Serena, Chile, last December to discuss these issues. The participating scientists suggest that global change study areas be designated along the parallel temperate climate gradients of western North and South America. Both low and high human impact sites should be included to try to make it possible to distinguish between the effects of large-scale global change and those of local, direct human impact. Research should focus on investigating the nature of change and identifying "keystone" species particularly sensitive to change.

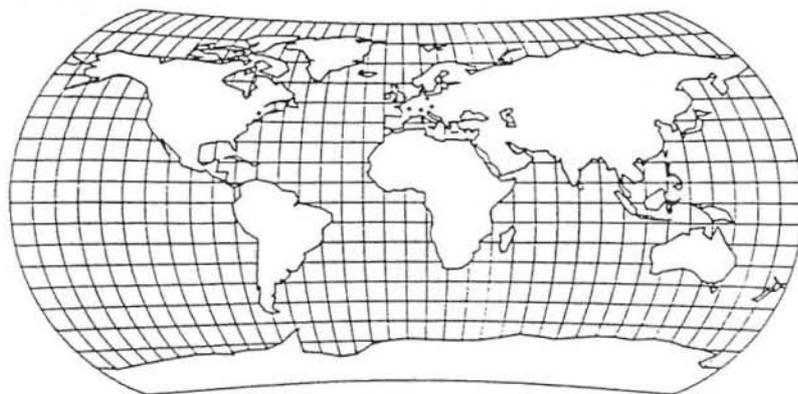
Core Project Offices

International Global Atmospheric
Chemistry Project (IGAC)
Operational
Cambridge, MA, USA

Joint Global Ocean Flux Study
(JGOFS)
Operational
Kiel, Germany

Biological Aspects of the Hydrological
Cycle (BAHC)
1991
Berlin, Germany

Global Change and Terrestrial Ecosys-
tems (GCTE)
Operational
Canberra, Australia



Past Global Changes (PAGES)
1991
Berne, Switzerland

Data and Information Systems (DIS)
Operational
Paris, France

IGBP Core Projects

The IGBP has defined a number of research priorities, formulated as questions, within which Core Projects are being developed. Each of these questions focusses on process linkages where the current state of understanding is insufficient to predict future global changes.

The Core Projects focus on the important sub-components of the global system. Each project must be intellectually challenging and scientifically sound, administered with minimal bureaucracy, and designed with provision for review and with flexibility to adapt to changing needs. The success of each of them will depend on the active involvement, in planning and execution, of the best scientists in each of the fields involved. In view of the global scope, a true international approach is necessary with the involvement of scientists throughout the world. The success of the overall effort will require strong national support and international coordination. The research priority questions and the projects that make up the programme are expected to evolve with new insights and understanding.

Core Projects have been developed during many planning meetings held by the IGBP over the past four years, where scientists from many nations of

the world participated. These Core Projects have been designated by the former ICISU Special Committee for the IGBP as established, proposed, or potential, reflecting the current status of endorsement by the world scientific community and the state of readiness for implementing the research.

The following is a list of the key questions and the Core Projects which have been identified to address these questions. For further descriptions, see IGBP Report 12.

Question 1: How is the chemistry of the global atmosphere regulated and what is the role of biological processes in producing and consuming trace gases?

International Global Atmospheric Chemistry Project (IGAC) (Established) Stratosphere-Troposphere Interactions and the Biosphere (STIB) (Proposed)

Question 2: How do ocean biogeochemical processes influence and respond to climate change?

Joint Global Ocean Flux Study (JGOFS) (Established) Global Ocean Euphotic Zone Study (GOEZO) (Potential)

Question 3: How will changes in land use affect the resources of the coastal zone, and will changes in sea

level and climate alter the coastal ecosystems?

Land-Ocean Interactions in the Coastal Zone (LOICZ) (Proposed)

Question 4: How does vegetation interact with physical processes of the hydrological cycle?

Biospheric Aspects of the Hydrological Cycle (BAHC) (Established)

Question 5: How will global changes affect terrestrial ecosystems?

Global Change and Terrestrial Ecosystems (GCTE) (Established) Global Change and Ecological Complexity (GCEC) (Potential)

Question 6: What significant climatic and environmental changes have occurred in the past, and what were their causes?

Past Global Changes (PAGES) (Established)

Question 7: How can our knowledge of components of the Earth system be integrated and synthesized in a numerical framework that provides predictive capacity?

Global Analysis, Interpretation and Modelling (GAIM) (Proposed)

Core Projects relating to the implementation of all core projects:

Data and Information Systems (DIS)

Global Change System for Analysis, Research and Training (START) ■

Established Core Projects

International Global Atmospheric Chemistry Project (IGAC)

Objectives:

- To develop a fundamental understanding of the processes that determine the chemical composition of the atmosphere
- To understand the interactions between atmospheric chemical composition and biospheric and climatic processes
- To predict the impact of natural and anthropogenic forcing on the chemical composition of the atmosphere.

Components:

Five regional foci on natural variability and anthropogenic perturbations of the marine atmosphere and of tropical atmospheric chemistry, trace gas fluxes in mid-latitude ecosystems, and the roles of boreal and polar regions in changing atmospheric composition. Three global foci on global distribution, transformation, trends, and modelling; cloud condensation nuclei as controllers of cloud properties; and intercalibrations and intercomparisons.

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Joint Global Ocean Flux Study (JGOFS)

Objectives:

- To determine and understand on a global scale the processes controlling the time-varying fluxes of carbon and associated biogenic elements in the ocean, and to evaluate the related exchanges with the atmosphere, sea floor, and continental boundaries.
- To develop a capability to predict on a global scale the response of oceanic biogeochemical processes to anthropogenic perturbations, in particular those related to climate change.

Components:

JGOFS has established subsidiary bodies of two types: strategy oriented task teams, and study planning groups. The task teams are: Global Survey, Process Study, Benthic Processes, Sedimentary Record, Time Series, Modelling, and Data Management. The Planning groups cover the Equatorial Pacific Ocean, the Southern Ocean, and the Indian Ocean. There is also a joint CO₂ Working Group between JGOFS and the Committee on Climate Changes and the Ocean (CCCO).

Time-series stations have been established near Bermuda and Hawaii, others will be set up in representative ocean regions. A process study of the North Atlantic phytoplankton bloom was completed in 1989. Projects in the early 1990s will study primary production in the equatorial Pacific, the high-latitude Southern Ocean, and the Indian Ocean. More studies are planned for the late 1990s.

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Global Change and Terrestrial Ecosystems (GCTE)

Objectives:

- To develop the capability to predict the effects of changes in climate, atmospheric composition, and land use on terrestrial ecosystems.
- To determine how these effects can lead to feedbacks to the physical climate system.

Components:

The GCTE Core Project envisages four kinds of activity: (i) Field experiments, reinforced with controlled environment experiments, within representative ecosystems and associated transition zones; (ii) development of ecosystem function models and land-cover change models, which themselves entail identification of functional biotic groups etc.; (iii) landscape analysis for the application of both experimental and modelling results at the landscape scale; (iv) development of an adequate geographic data base for a region so that observations and model output can be applied to real terrain.

The Core Project is organized into three Foci, each with three activities. The three Foci are: (i) Change in Ecosystem Physiology; (ii) Change in Ecosystem Structure and; (iii) Global Change Impact on Agriculture and Forestry.

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Past Global Changes (PAGES)

Objectives:

- To reconstruct the detailed history of climatic and environmental change for the entire globe for the period since 2,000 B.P., with temporal resolution that is at least decadal and, ideally, annual or seasonal (Stream I).
- To reconstruct a history of climatic and environmental change through a full glacial cycle, in order to improve our understanding of the natural processes that invoke global climatic changes (Stream II).

Components:

Specific efforts will address solar and orbital forcing and response; fundamental Earth system processes (trace gas composition and climate, impacts of volcanic activity, biosphere dynamics, and ice sheet mass balance); rapid and abrupt global changes and; multiproxy mapping. In each, Stream I will focus on the last 2000 years, and Stream II will focus on the glacial-interglacial cycles of the late Quaternary.

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To be established in Berne, Switzerland, mid-1991, jointly sponsored with the US.

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Biospheric Aspects of the Hydrological Cycle (BAHC)

Objectives:

- To determine the biospheric controls of the hydrologic cycle through field measurements for the purpose of developing models of the energy and water fluxes in the soil-vegetation-atmosphere system at temporal and spatial scales ranging from vegetation patches to GCM grid cells.
- To develop appropriate data bases that can be used to describe the interactions between the biosphere and the physical Earth system and to test/validate model simulations of such interactions.
- To describe changes at the continents that affect the interactions between the biosphere and the physical Earth system and to test and validate model situations of such interactions on the basis of appropriate data bases that have to be developed jointly with DIS.

Components:

Local-scale studies and the development of SVAT models; areal integrated studies and studies at scales up to the grid sizes of global models; global diagnostic land-surface change studies; regionalization of global model outputs ("weather generator project").

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The membership of the committee is presently under consideration.

Data and Information Systems (DIS)

Objectives:

- Identify minimum data sets crucial for the global scale of the IGBP programme
- Assess status of data sets and methods of creating information relevant to Core Projects
- Promote the development of IGBP relevant data bases not yet available
- Facilitate access to data bases by IGBP scientists

Components:

(i) Pilot projects for the creation of new data bases; (ii) quality control of existing global data sets; (iii) development of improved methodology for more accurate determination of land surface temperature from satellites; (iv) identification of data sets to be included in IGBP Data Directory and; (v) inter-network connections for access to the Directory

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System for Analysis, Research and Training (START)

Objectives:

- To promote cooperation among scientists within specific regions of the globe and among these regions in support of IGBP Core Projects and other international global change programmes
- To define and address regional research priorities
- To develop scientific information for regional policy makers

Components:

The proposed System for Analysis, Research and Training (START) is a world-encompassing system of Regional Research Networks, each of which includes a Regional Research Centre and a number of affiliated Regional Research Sites. The Regional Research Centre serves as the information centre for the regional network, with the additional coordinating functions both within and outside of the region. The regional networks, through the regional centres, are linked together to provide a global system through which scientific information is disseminated and research is organized to implement the core research projects of major international programmes including, but not limited to, the IGBP and the WCRP.

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Proposed Core Projects

Stratosphere-Troposphere Interactions and the Biosphere (STIB)

The Stratosphere-Troposphere Interactions and the Biosphere (STIB) project will be concerned with the processes through biogenic and anthropogenic emissions change the composition, radiation and dynamics of the stratosphere and how these changes in turn affect the biosphere. The planning is done in close collaboration with the World Climate Research Programme as regards the effects of stratospheric changes on climate.

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Land-Ocean Interactions in the Coastal Zone (LOICZ)

The coastal zone, where land, air and sea meet, is a region of high physical energy and biological diversity that is heavily exploited by man. It is also a zone particularly vulnerable to global change. For these reasons, the IGBP proposes a core project on the coastal zone with special emphasis on the interactions between land and sea under changing global conditions.

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Global Analysis, Interpretation and Modelling (GAIM)

The various IGBP Core Projects aim to achieve predictive understanding of the processes and interactions within and among rather distinct components of the global Earth system. The collection, analysis and interpretation of new data obtained in these projects, as well as development of new instruments, exploitation of satellite and other remote-sensing information will enable models of the interactions for the various components of the Earth system to be developed. A consistent effort is required to ensure that the knowledge gained about the components of the Earth system fits into a globally consistent and internally compatible description that can be used not only to understand the important biogeochemical cycles and processes, but also the feedback and interactions between the various sub-components that regulate the Earth system.

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Potential core projects

Global Ocean Euphotic Zone Study (GOEZZ)

A joint workshop with the Scientific Committee on Oceanic Research (SCOR) is being prepared for 1991 at which a group of ocean scientists will discuss the key issues to be addressed in a project to be based on the results from the Joint Global Ocean Flux Study and the World Ocean Circulation Experiment.

Global Change and Ecological Complexity (GCEC)

The Scientific Committee on Problems of the Environment (SCOPE) and the International Union of Biological Sciences (IUBS), in collaboration with the Unesco Man and the Biosphere Programme (MAB), have initiated a project to define the possible global relevance of "Global Change and Ecological Complexity". Based on the results from this project, the SC-IGBP will consider whether an IGBP Core Project Planning Committee should be set up. The Chairman of the Scientific Steering Committee for the SCOPE project is Professor Harold A. Mooney, who is also a member of the IGBP Scientific Steering Committee for Global Change and Terrestrial Ecosystems, and Chair of the United States National Committee for the IGBP.

IGBP Report Series

No. 1. The International Geosphere-Biosphere Programme: A Study of Global Change. Final Report of the Ad Hoc Planning Group. ICSU 21st General Assembly, Berne, Switzerland 14-19 September, 1986 (1986) (Out of print)

No. 2. A Document Prepared by the First Meeting of the Special Committee, ICSU Secretariat, Paris 16-19 July, 1987 (1987) (Out of print)

No. 3. A Report from the Second Meeting of the Special Committee, Harvard University, Cambridge, MA, USA 8-11 February, 1988 (1988) (Out of print)

No. 4. The International Geosphere-Biosphere Programme. A Study of Global Change (IGBP). A Plan for Action. A Report Prepared by the Special Committee for the IGBP for Discussion at the First Meeting of the Scientific Advisory Council for the IGBP, Stockholm, Sweden 24-28 October, 1988 (1988) (Out of print)

No. 5. Effects of Atmospheric and Climate Change on Terrestrial Ecosystems. Report of a Workshop Organized by the IGBP Coordinating Panel on Effects of Climate Change on Terrestrial Ecosystems at CSIRO, Division of Wildlife and Ecology, Canberra, Aus-

tralia 29 February - 2 March, 1988. Compiled by B. H. Walker and R. D. Graetz (1989)

No. 6. Global Changes of the Past. Report of a Meeting of the IGBP Working Group on Techniques for Extracting Environmental Data of the Past held at the University of Berne, Switzerland 6-8 July, 1988. Compiled by H. Oeschger and J. A. Eddy (1989)

No. 7. A Report from the First Meeting of the Scientific Advisory Council for the IGBP. Volumes I and II (1989)

No. 8. Pilot Studies for Remote Sensing and Data Management. Report from Working Group Workshop held in Geneva, Switzerland 11-13 January 1989. Edited by S. I. Rasool and D. S. Ojima (1989)

No. 9. Southern Hemisphere Perspectives of Global Change. Scientific Issues, Research Needs and Proposed Activities. Report from a Workshop held in Mbabane, Swaziland 11-16 December, 1988. Edited by B. H. Walker and R. G. Dickson (1989)

No. 10. The Land-Atmosphere Interface. Report on a Combined Modelling Workshop of IGBP Coordinating Panels 3, 4, and 5. Brussels, Belgium, 8-11

June, 1989. Edited by S. J. Turner and B. H. Walker (1990)

No. 11. Proceedings of the Workshops of the Coordinating Panel on Effects of Global Change on Terrestrial Ecosystems. I. A Framework for Modelling the Effects of Climate and Atmospheric Change on Terrestrial Ecosystems, Woods Hole, USA, 15-17 April, 1989. Edited by B. H. Walker. II. Non-Modelling Research Requirements for Understanding, Predicting, and Monitoring Global Change, Canberra, 29-31 August 1989. Edited by B. H. Walker and S. J. Turner. III. The Impact of Global Change on Agriculture and Forestry, Yaoundé, 27 November-1 December, 1989. Edited by S. J. Turner, R. T. Prinsley, D. M. Stafford Smith, H. A. Nix and B. H. Walker (1990)

No. 12. The International Geosphere-Biosphere Programme: A Study of Global Change (IGBP). The Initial Core Projects (1990)

No. 13. Terrestrial Biosphere Exchange with Global Atmospheric Chemistry. Terrestrial Biosphere Perspective of the IGAC Project: Companion to the Dookie Report. Report on the Recommendations from the SCOPE/IGBP Workshop on Trace-Gas Ex-

change in a Global Perspective. Sigtuna, Sweden, 19-23 February, 1990. Edited by P. A. Matson and D. S. Ojima (1990)

No. 14. Coastal Ocean Fluxes and Resources. Report of a CP2 Ad Hoc Workshop, Tokyo, Japan, 19-22 September 1989. Edited by P. Holligan (1990)

No. 15. Global Change System for Analysis, Research and Training (START). Report of a Meeting at Bellagio, December 3-7, 1990. Edited by J. A. Eddy, T. F. Malone, J. J. McCarthy and T. Rosswall (1991)

Other IGBP Reports

The International Science Plan for the Joint Global Ocean Flux Study. Scientific Committee on Oceanic Research, ICSU (1990). 61 p. Copies may be obtained from Ms. E. Tidmarsh, Executive Secretary, SCOR, Department of Oceanography, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada.

The International Global Atmospheric Chemistry (IGAC) Programme. A Core Project of the International Geosphere-Biosphere Programme. Editor, Ian E. Glabally. IAMAP Commission on Atmospheric Chemistry and Global Pollution (Mordialloc, Victoria, Australia, 1989). 55 p.

National IGBP Reports

Chinese Academy of Sciences, Taipei
Research Activities Relevant to Global Change in Taiwan, The Republic of China. NSC Global Change Program, ROC IGBP Committee. Taipei (1991)

India
CSIR Programme on Global Change, compiled by Steering Group on Global Change. Council of Scientific & Industrial Research, Anusandhan Bhavan, Rafi Marg, New Delhi 110 001 (1990). 125 p.

Global Change. Indian Contributions, 1980-1990. Compiled by Council of Scientific & Industrial Research, New Delhi. 29 p. (Global Change Series: Vol. 2 rev., Feb. 1991)

Geosphere-Biosphere Programme. ISRO/DOS Plan, October 1989. Indian Space Research Organisation, Department of Space, Government of India, Bangalore. 99 p.

Geosphere-Biosphere Programme. Activities of the Department of Science and Technology, its Aided Institutions and Service Organisations, February 1991. Ministry of Science and Tech-

nology, New Delhi. 96 p. (DST's Programme on Geosphere Biosphere Doc. 2)

USA

Research Strategies for the U.S. Global Change Research Programme. Committee on Global Change (U.S. National Committee for the IGBP) of the Commission on Geosciences, Environment, and Resources, National Research Council, National Academy Press, Washington, D.C. (1990). 291 p.

Global Change Related Reports

Commission of the European Communities. The Greenhouse Effect and its implications for the European Community. Edited by R. A. Warrick, E. M. Barrow and T. M. L. Wigley. Climatic Research Unit, School of Environmental Sciences, Norwich, UK (1990). 30 p.

IPCC. Climate Change, The IPCC Scientific Assessment. Edited by J. T. Houghton, G. J. Jenkins and J. J. Ephraums. Cambridge University Press, Cambridge, UK (1990). ■

IGBP Releases Plan for Global Change System for Analysis, Research, and Training (START)

The International Geosphere-Biosphere Programme: A Study of Global Change (IGBP) has just released a plan for the development of an international network of regional research centers and sites to gather data and analyze global change problems within regional contexts.

The plan for this initiative - START

- is the product of the Bellagio Conference on Regional Research Centres held last December in Bellagio, Italy. The meeting was organized by the ICSU Scientific Committee for the IGBP and sponsored by the Rockefeller Foundation. Participants included scientists in addition to administrators from science funding agencies. Their dis-

ussion built upon results of preparatory IGBP meetings addressing this topic and recommendations from the Second World Climate Congress.

In their report, the Conference participants recommend that START consist of Regional Research Networks, each spanning a scientifically coherent area. In aggregate, these regional ac-

tivities will provide comprehensive global coverage. Each network consists of a Regional Research Centre, where central computer and analytical facilities would be situated, and numerous affiliated Regional Research Sites.

Examples of questions to be addressed by START scientists in pursuing global change research are:

- Within regions, how do changes in land use and industrial practices alter water cycles, atmospheric chemistry, and ecosystem dynamics?
- How do such regional changes affect global biogeochemical cycles and climate?
- How will the ensemble of global change lead to further regional change in the biospheric life support system?

The Bellagio participants stressed the importance of ensuring that IGBP research, as well as research within the WCRP, and the Human Dimensions of Global Environmental Change, HD/GEC, is made possible in all regions of the Earth. This is a particular concern

in developing countries where resources required to initiate and support START facilities are scarce. With this in mind the conferees have designated three regions to be of highest priority for receiving the external funding assistance required to develop Regional Research Networks. These are the Equatorial South America, Northern African, and the Tropical Asian Monsoon regions. An additional three regions designated next in priority for assistance are the Temperate South American, Southern and Eastern African, and Central Arid Asian regions.

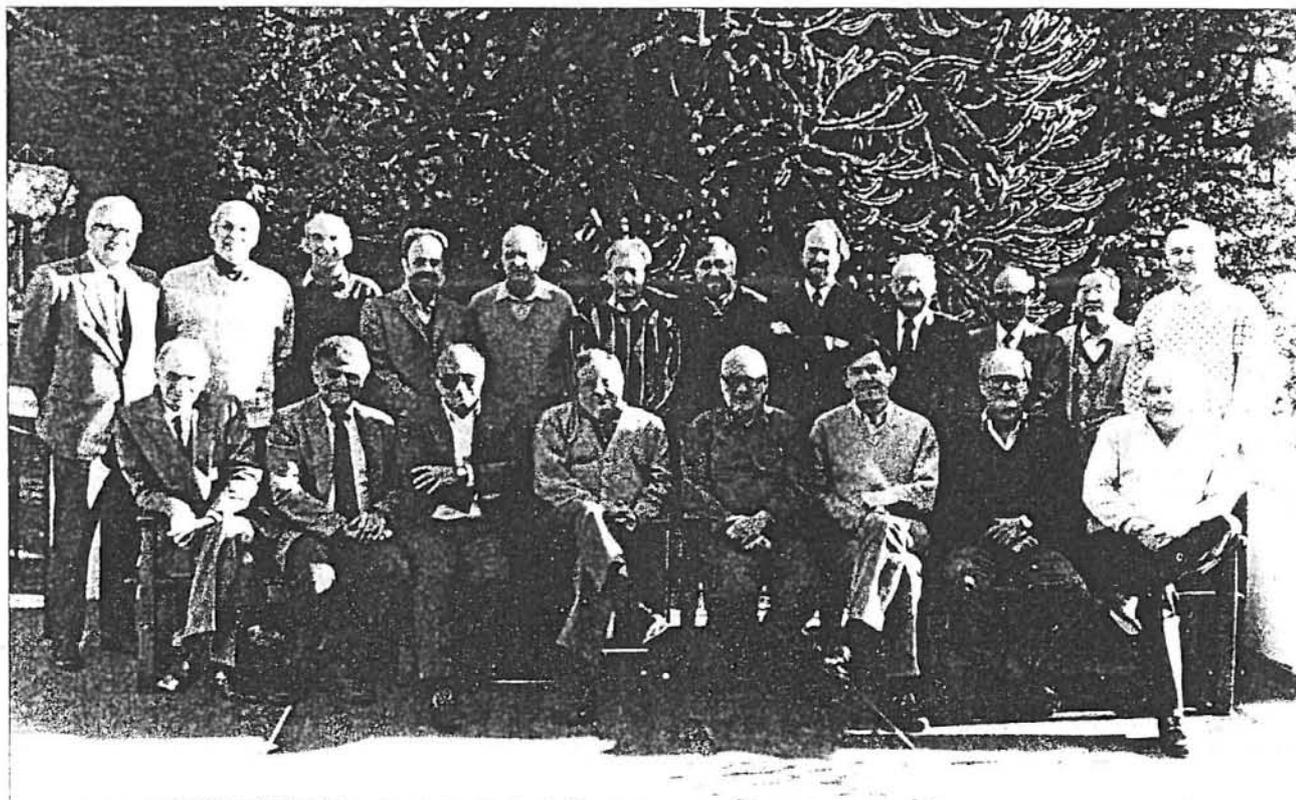
The French government has already begun planning a Sahara and Sahel Observatory to investigate climate change issues in Northern Africa. Similarly, the US government is considering an initiative to help facilitate the development of regional institutes for global change with initial focus in western hemisphere developing nations. Such initiatives provide significant impetus for START.

Eight other regions were delineated. The Bellagio conferees empha-

size that the establishment of Regional Research Networks in these more developed areas is also essential for proper global coverage. The Bellagio report calls upon the governments of countries in all regions to initiate Regional Research Network planning.

The next steps include the appointment of an IGBP Standing Committee to implement START, the establishment of a START Secretariat to facilitate this process, and the launching of a START Fellowship programme to involve young scientists in this endeavour. Preparatory meetings for the 1992 UN Conference on Environment and Development provide opportunity for all nations to consider how participation in START can enhance their effectiveness in executing regional studies and analyses of global environmental change.

Copies of the Bellagio Report (IGBP Report No. 15) are available from the IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Sweden. ■



Participants at the IGBP Conference for Global Change Regional Research Centres at the Bellagio Conference Centre, Italy, 3-7 December 1990. Top row, standing, from left to right: Dennis J. Greenland, Robert W. Corell, William O. Heal, Rafael Herrera, Umberto G. Cordani, Graeme Pearman, Jerry M. Melillo, James J. McCarthy, James C. I. Dooge, Keiji Higuchi, Li Wenhua, Thomas Rosswall; bottom row, sitting, from left to right: Jean Labrousse, John A. Eddy, Eneas Salati, Victor Rabinozitch, Thomas F. Malone (Conference Chairman), Genadi N. Golubev, Brian H. Walker, Paul G. Risser. Participating in the meeting but not in the picture: Marc Bied-Charreton, Pierre Mathy.

IGBP and Related Meetings

IGBP Meetings 1991

11-13 March, Mainz, Germany
Past Global Changes (PAGES) Scientific Steering Committee

22-26 April, Plymouth, UK
Land-Ocean Interactions in the Coastal Zone (LOICZ) Core Project Planning Committee

24-26 April, Stockholm, Sweden
IGBP Systems for Analysis, Research and Training (START)

25-26 April, New York City, USA
IGBP/ISSC ad hoc Working Group on Land-Use/Cover Assessment Study

7-10 May, Asilomar, CA, USA
Global Change and Terrestrial Ecosystems (GCTE) Focus 1

13-15 May, São José dos Campos, Brazil
International Global Atmospheric Chemistry Project (IGAC) Scientific Steering Committee

28 May, Honolulu, Hawaii, USA
IGBP Regional Workshop in connection with XVII Pacific Science Congress
Towards the Pacific Century: The Challenge of Change

2-4 June, Baltimore, MD, USA
Joint IGBP/WCRP Working Group on Land-Surface Experiments

10-14 June, (Trondheim)
Global Change and Terrestrial Ecosystems (GCTE) Focus 2

10-14 June, Stony Brook, NY, USA
Stratosphere-Troposphere Interactions and the Biosphere (STIB) Core Project Planning Committee

17-19 June, Toulouse, France
DIS/GCTE/IGAC/BAHC Joint Meeting on Land Cover Characteristics

12-14 June, Nairobi, Kenya
Intergovernmental Coordinating Panel and IGBP Officers

8-12 July, Cambridge, UK
Joint Global Ocean Flux Study (JGOFS) Executive Committee

2-9 August, Beijing, China
Past Global Changes (PAGES) Open Meeting, in connection with INQUA, XIII International Congress.

11-24 August, Vienna, Austria
Past Global Changes (PAGES) Open Meeting, in connection with IUGG Congress

28-31 August, Tokyo, Japan
3rd IGBP Scientific Committee

9-13 September, Wageningen, The Netherlands
Global Change and Terrestrial Ecosystems (GCTE) Focus 3

30 September-4 October, Bermuda, West Indies
JGOFS 6

Fall, Sweden
IGBP/ISSC ad hoc Working Group on Land-Use/Cover Assessment Study

December, Niamey, Niger
IGBP Regional Conference for Africa

September-October
JGOFS Equatorial Planning Group

IGBP Meetings Under Organization

Global Analysis, Interpretation and Modelling (GAIM) Core Project Planning Committee Meeting

IGBP/SCOR Symposium on Global Ocean Euphotic Zone Study (GOEZO)

Biospheric Aspects of the Hydrological Cycle (BAHC) Scientific Steering Committee

IGBP-Related Meetings

18-23 March, Bremen, Germany
ICSU-WMO Joint Scientific Committee for the World Climate Research Programme (WCRP)

4-9 April, New York, USA
NATO Advanced Research Workshop: Correlating Records of the Past

1-3 May, Brighton, UK
International Group of Funding Agencies for Global Change Research (IGFA) 3rd Meeting

27-31 May, Gif-sur Yvette, France
NATO Advanced Research Workshop: Paleoclimate Modelling

22-26 July, College Park, MD, USA
NATO Advanced Research Workshop: Prediction of Interannual Climate Variations

22-27 July, Lusaka, Zambia
Regional Workshop on Solar Radiation, Environment and Climate Change

26-30 August, Coblenz, Germany
NATO Advanced Research Workshop: Hydrological Data in Support of Climate Change Studies

1-6 September, Amsterdam, The Netherlands
IUBS General Assembly Symposium on Biological Diversity and Global Change

6-11 October, Beaverton, OR, USA
NATO Advanced Research Workshop: Global Cycle of Methane - Sources, Sinks, Distributions and Role in Global Change

7-11 October, Moscow, USSR
Unesco-Man and the Biosphere Programme Monitoring of Biodiversity Conference

15-19 October, Clemson, SC, USA
NATO Advanced Research Workshop: Climate Change - The Biological Implications

11-17 November, Los Angeles, USA
NATO Advanced Research Workshop: Modelling Sustainable Development and Global Environmental Change

6-9 December, Delhi, India
IGU Seminar on Monitoring Geosystems: Perspectives for the 21st Century

8-13 December, Berlin, Germany
66th Dahlem Workshop Global Changes in the Perspective of the Past

1992

April/May, Southampton, UK
NATO Advanced Research Workshop: Towards a Model of Ocean Biogeochemical Processes

21-25 September, Kiel, Germany
4th International Conference on Paleoceanography: Short and Long Term Global Changes ■

GLOBAL CHANGE NEWSLETTER

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IUPAB	Prof. D. Vucelie		
IUPAC	Dr. M. Williams		
IUPsyS	Dr. Kurt Pawlik		
SCOPE	Dr. Francesco di Castri		

We are pleased to announce here that Dr. Jacques-Louis Lions, member of the Collège de France and President of the French National Centre of Space Studies will receive, with John Julian Wild of the USA, the 1991 Japan Prize for contribution to world peace and prosperity through development of science and technology. The award will be presented on 25 April in Tokyo. It is sponsored by the Science and Technology Foundation of Japan.

The Social Science Research Council (SSRC) Seeks a Programme Officer

for the Human Dimensions of Global Environmental Change Committee

The SSRC anticipates adding a position as program officer for the Committee for Research on Global Environmental Change. This Committee focuses on the human dimensions of long-term environmental changes that occur at the level of continents or larger. Training and research on the environment are desirable but not mandatory in the applicant's record. More importantly, this person should be a social scientist trained at the doctorate level for research in economics, geography, political science, sociology, (or related fields); international in orientation and experience; capable of learning this interdisciplinary subject matter and; able to work with both social and natural scientists. We would also expect this person to assist the Council in collateral programme development e.g., in health and in epidemiology, peace and security, development or resource economics, quantitative modelling and methodology, or other areas.

This full-time position involves preparing and negotiating grant proposals for expansion of this programme; assisting in the design of research programmes and research consortia; planning seminars, workshops, and conferences; administering possible fellowship and grant competitions; supervising support staff; contributing to the Council's overall programme; and maintaining relationships with researchers and academic and research institutions throughout the world.

Applicants must hold the Ph.D. in a relevant field. Writing skills are essential. Administrative experience and demonstrated fund-raising ability are desirable. The Council seeks applications from scholars with several years of teaching, research, and/or administrative experience, although it may also consider recent recipients of the Ph.D.

Salaries are competitive with those at U.S. universities. The person appointed should be able to take up the position on or before September 1, 1991.

To apply send, before June 1 1991: i. A letter of application; ii. A curriculum vitae and; iii. Three letters of reference to: Global Change search, Social Science Research Council, 605 Third Avenue, New York, NY 10158, USA.



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