GLOBAL CHANGE
IGBP
NEWS LETTER

The International Geosphere - Biosphere Programme: A Study of Global Change (IGBP). No. 1 May 1989.

Introduction

In September 1986, the International Council of Scientific Unions (ICSU) General Assembly decided to establish the International Geosphere-Biosphere Programme: A Study of Global Change (IGBP). ICSU has a long experience in developing major international research programmes, such as the International Geophysical Year (IGY), the International Biological Programme (IBP), and the World Climate Research Programme (WCRP in collaboration with WMO), but the IGBP will be the most wide-ranging, and in its impact on our understanding of the future possibilities for mankind, the most important project that ICSU has ever undertaken.

The ad hoc Planning Group for the IGBP (IGBP Report No.1), which reported to the 1986 ICSU General Assembly, identified four main reasons for initiating the programme:

(i) A growing realization that the biotic and non-biotic components of the biosphere are inextricably interlinked, as exemplified in studies of the cycling of chemical elements critical to life, the sensitivity of climate to biotic and anthropogenic processes, and an array of questions arising from the study of the effects of the documented global increases in greenhouse gases.

(ii) The fact that human impacts on the Earth now approximate the scale of the natural interactive processes that control the global life-support system. Ready examples are climate change resulting from rising levels of greenhouse trace gases in the atmosphere, acid deposition, deforestation, soil depletion, and desertification.

(iii) An appreciation of the limits to habitability of the Earth; to produce adequate food supplies, fodder and fibre; and to maintain the quality of air, water and soils, and the integrity of the chemical cycles essential to life.

(iv) Contemporary advances in technology and in science that make it possible to study the Earth as an interactive system. These include new

The first meeting of the IGBP Scientific Advisory Council was held at the Royal Swedish Academy of Sciences, Stockholm in October 1988. From left to right: T. Rosswall, Executive Director, IGBP, J. J. McCarthy, Chairman IGBP, and M. G. K. Menon, President of ICSU and Chairman of the SAC meeting.

abilities to examine the Earth from space, and, equally important, the emerging capabilities of telecommunications, data handling and numerical modelling that are needed for global data handling and worldwide information exchange. Programmes of global observations have already been successfully carried out. These new technologies have enabled scientists to rapidly test new Earth theory to enhance the understanding of individual Earth components, and to explore the linkage that form the Earth as a living system.

The IGBP objectives are to describe and understand the interactive physical, chemical, and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human action.

In concentrating on interactive physical, chemical, and biological processes the IGBP will of necessity put less emphasis on studies that, though they have great strengths and momentum of their own, are already being addressed in existing initiatives, or that will less clearly contribute to our understanding of the changing environment on time scales of decades to centuries. Priority in the IGBP will therefore be given to those areas that deal with key interactions and significant changes on time scales of decades to centuries, that most affect the biosphere, that are most susceptible to human perturbations, and that will most likely lead to a practical, predictive capability of global change.

Certain underlying themes will receive special emphasis throughout the development and implementation of the programme (IGBP Reports No. 2 and 4). Each theme will contribute to the unique character of the scientific core of the IGBP, but because of their pervasive nature, it would be difficult and of questionable value to single out any one theme for individual programme development. The four themes are:

— Documenting and predicting global change.

— Observing and improving our understanding of dominant forcing functions.

— Improving our understanding of interactive phenomena in the total Earth system.

— Assessing the effects of global change that will cause large-scale and important modifications in the availability of renewable and non-renewable resources.

These themes are described in detail in the IGBP Report "A Plan for Action" (IGBP Report No. 4). A primary goal of the IGBP is to advance our capability to predict changes in the global environment through improved understanding of the Earth system. The development of this capability will require cooperative efforts with system modelers in order to incorporate the appropriate level of understanding of relevant global geological, biological, and chemical processes into current physical models of the Earth system.

This first issue of the IGBP Newsletter marks the initiation of the second phase of the IGBP planning effort. The IGBP Scientific Advisory Council met in Stockholm in October 1988 to discuss the "Plan for Action" report prepared by the Special Committee (SC-IGBP) for the IGBP. A report from that meeting and a summary of important decisions from the 3rd Meeting of the IGBP Special Committee are included in this issue.

The second phase of the IGBP planning effort will result in recommendations for a number of IGBP core projects. The report to the 2nd SAC-IGBP will be based on the deliberations of the IGBP Coordinating Panels, Working Groups, and the Scientific Steering Committee. In addition, close interactions with national IGBP committees are essential, and the SC-IGBP has invited the chairmen of these committees to the next meeting of the SC-IGBP (June 1989). Cooperation with ICSU scientific members is also necessary for the successful development of a strong research programme on "Global Change". The ICSU General Conference (October 1989) will constitute one important platform for such discussions.

We plan to publish an IGBP Newsletter three times a year. In addition to providing information from the IGBP to national committees, ICSU bodies, the UN system, and other international research bodies, we also hope that the newsletter will reach a large number of individual scientists, who have a professional interest in the IGBP. We welcome contributions to the Newsletter on items of relevance to scientific studies of "Global Change". Comments from the readers on the form and content will also be appreciated.

Thomas Rosswall
Executive Director, IGBP

IGBP Secretariat Staff

Professor *Thomas Rosswall*, Executive Director microbial ecologist with special interest in microbial regulation of biogeochemical cycles in general and biogenic trace gases in particular. On leave from the Department of Water and Environmental Studies, University of Linköping, Sweden.

Dr. *Gunilla Björklund*, Programme Officer, previously lecturer in environmental siences at the University of Karlstad, and in physical geography at Uppsala University, Sweden. Geologist with special interest in fluvio-morphological processes.

Dr. *Dennis Ojima*, Programme Officer, terrestrial ecologist and specialist in biogeochemical cycling of carbon and nitrogen. He comes from the Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO, USA.

Dr. *Hassan Virji*, Programme Officer on leave from the National Science Foundation, Washington, DC. He is an atmospheric scientist.

Ms. *Hildburg Berglund*, Assistant to the Executive Director. Ms Berglund is on leave from the Swedish Ministry for Foreign Affairs.

Ms. *Sophia Westlund*, Secretary

First Meeting of the Scientific Advisory Council for the IGBP

The IGBP Scientific Advisory Council (SAC) held its first meeting in Stockholm 24—28 October, 1988 to consider in detail the "Plan for Action" of the Special Committee for the IGBP (SC-IGBP) Report No. 4, (August 1988). The Council also considered the various reports that were submitted to the first meeting of the SAC from ICSU Bodies and Associates, from various National Committees for the IGBP, and from organizations outside of ICSU. The SC-IGBP will review these reports in detail at ensuing meetings of the SC-IGBP to derive recommendations for its general policies, in accordance with the IGBP Constitution.

During the two years that have elapsed since ICSU decided to launch the Global Change Programme it has become ever more obvious that a joint international effort of the kind that is being considered is of fundamental importance for the future habitability of the planet. It will document changes of world concern in the global environment, both as these occur in real time and as they have transpired in the past. To many, the IGBP is now seen as an essential element in making prudent plans for managing the common natural resources of the Earth, as recognized in the United Nations Report "Our Common Future, A Plan for Sustainable Development" and the resolution adopted by the U.N. General Assembly in 1987. A Global Change Programme directed at a better understanding of the Earth system will reduce the uncertainty in analyses and predictions of how the environment will be altered in the future and, through this understanding, can lead to more prudent policy decisions on the part of all the governments of the world.

General Conclusions

1. The Council reaffirmed the programme focus and general scientific priorities that formed the basis for the ICSU decision in 1986 to undertake the IGBP. Moreover, it found the general plan outlined in Report No. 4 to be basically sound and appropriate as the basis for more detailed development of programme components in the future. During this first meeting, the Council examined many of the features of the plan and provided specific recommendations and advice concerning virtually all elements of the plan. These are included, as working group reports, in a forthcoming final report from the SAC.

2. The Council noted that the concept of predictability is currently not applied with equal confidence among the disciplinary components of the planned programme. Moreover, application of predictability becomes more uncertain as disciplinary studies are combined in new ways. Since some measures of the eventual success of the programme will be based on the improvement of predictability, attention must be given to a more rigorous definition of predictability and its application in a programme of this complexity.

3. Success of the programme will depend on collaboration among disciplines to study global processes, but also on the development of new approaches and techniques within disciplines. As an example, historical data and information derived from natural archives will be used to document past global conditions and as tests for models. In addition, techniques for extracting environmental data of the past will of necessity be made more quantitative.

4. Development of the IGBP will demand a thoughtful balance between an organizational structure to support interdisciplinary research at the global scale and the need to foster new creative ideas that will arise from single investigators and teams of researchers.

5. There is an apparent paradox between the need for a bounded research programme and the need to understand global processes. Resolution of this paradox requires that the programme be defined to address issues which meet the priority criteria laid out in the original charge: "those areas of each of the fields involved that deal with key interactions and significant change on time scales of decades to centuries, that most affect the biosphere, that are most susceptible to human perturbation, and that will most likely lead to practical, predictive capability." Toward this end, the SC-IGBP must resist the inevitable pressure to broaden the programme beyond what can be done and done well in these areas. The Council affirmed the selection of the general research areas named in the four coordinating panels and four working groups as appropriate first steps in the iterative process of programme definition, and recommended that further refinement continue, including the establishment of realistic goals in all areas.

6. Although the IGBP is a new and unprecedented endeavour, its success depends on close collaboration with many related scientific programmes. These collaborative connections must be explicitly identified and delineated as the IGBP develops and as funding strategies are put in place.

7. The ultimate success of the IGBP will depend upon the imagina-

tion and dedication of top-flight scientific talent and also on the availability of adequate resources. As much attention must be paid to organizing financial support as is paid to organizing experiments. The Council recognized the need to establish a mechanism for coordinating the financial support of the programme, including the means through which participating nations will commit resources to joint efforts. Toward this end it expected that specific proposals be made for consideration at the second meeting of the Scientific Advisory Council in mid-1990. Some preliminary considerations were developed in the course of the SAC meeting by one of the working groups.

8. From its inception, the IGBP has recognized the importance of the human dimensions of global change. At the same time the programme has also recognized the practical need to focus on a limited set of central interactions that fall within the traditional disciplinary expertise of ICSU. Towards this end the Council affirmed the decision of the SC-IGBP to encourage studies of the human dimensions of global change in close communication with the social sciences and with endeavours now underway in this area. To accomplish this the SAC recommended (a) that a new staff position reflecting the human dimensions be established in the IGBP secretariat in Stockholm; (b) that Scientific Steering Committees, when they are established, include representation from the social sciences as appropriate; and (c) that a collaborative project be set up in the foreseeable future involving some aspects of human/natural science interaction.

9. While the IGBP is international in scope and global in focus, its success will depend largely on national efforts. Thus, the programme must recognize that it will be endorsed and eventually judged to some degree through perceptions of how it contributes to various national priorities. Toward this end, the design of the programme must be built with the aid of national programmes and in the light of national and regional interests.

10. The IGBP was first proposed as an ICSU programme in Stockholm in January 1983; it has been under study and definition, in one form or another, since that time. The Council felt that implementation of the Global Change Programme should commence as soon as possible in areas that are clearly central to its aims and which are at this time sufficiently defined to proceed as pilot activities. Toward this end the Council suggested that the SC-IGBP designate core programme elements and define specific pilot activities accordingly. The Council endorsed the proposal of the SC-IGBP that further elaboration of the Global Change Programme and specific project plans for core elements be developed during the next 18 months, to be discussed at a second meeting of the Scientific Advisory Council in mid-1990.

11. The Council recognized the fundamental importance of developing a rational schedule for data exchange and information analysis and the urgency to identify and to begin long-term measurements of a critical set of fundamental physical, chemical and biological parameters that will document the future course of significant global change. Toward this end it emphasizes the need to establish mechanisms for data and information exchange early in the programme development. The offer of the WG/WDC to prepare and distribute selected world data sets as an immediate pilot project was heartily endorsed.

12. The Council recognized the fundamental role of the World Climate Programme in the development of the Global Change Programme and urges the SC-IGBP to establish a structure for cooperation that will work to the common good of both programmes.

13. It is clearly in the best interests of the IGBP to involve as many nations as possible in the scientific activities of the programme, both in developed and in developing countries. Along this line the Council urged the SC-IGBP to consider the offer of Professor Salam, on behalf of the Third World Academy of Sciences, to institute a new IGBP focus within the organized, Third World scientific establishment.

14. The Council expressed a firm statement of commitment to initiate as soon as possible major new international research projects dealing with (a) the role of biota in the cycles of chemicals in the atmosphere which give rise to the greenhouse gas effect; (b) the role of oceanic organisms in the global carbon dioxide cycle; (c) the role of land plants in the exchange of energy and moisture between the land and the atmosphere; and (d) a coordinated effort to recover information from natural archives that will illuminate connections between atmospheric composition, global temperature, ice extent, solar history, and the distribution of land and oceanic organisms.

Reports to the First SAC-IGBP

A number of national reports were prepared for presentation to the SAC-IGBP together with reports from other international organizations. These provided important inputs to the discussions and were considered by the discussion groups in their deliberations. The texts will be included in the report from the SAC-IGBP, to be published shortly.

Reports from National Committees or National ICSU Members:

Australia, Belgium, Canada, Czechoslovakia, China (Beijing), China (Taipei), Federal Republic of Germany, France, German Democratic Republic, Hungary, India, Ireland, Israel, Japan, the Netherlands, New Zealand, Poland, South Africa, Sweden, Switzerland, United Kingdom, USA, USSR.

Reports from Scientific Organizations:

CCCO, COGENE, CTS, FAGS, IAHS, ICL, IFIAS, IIASA, ISSS, IUBS, IUGG, IUGS, IUPAB, IUPsyS, SCAR, SCOPE, SCOR, SCOSTEP, UITA, UNU, WDC

Second SAC

At the invitation from the French Minister for Research and Technology, Hubert Curien, the Second Scientific Advisory Council for the IGBP will be arranged in Paris 3—7 September, 1990.

Global Changes of the Past

The condition of the global environment of the past can be observed in ice cores and tree-rings, in ocean and lake sediments as well as in terrestrial deposits and pollen records. This opportunity to study global change of the past has provided compelling new evidence for linkages among the life processes and the physical and chemical conditions of the Earth system. These and other insights into the past can be used to interpret observed trends in contemporary data in the broader context of past changes, to evaluate Earth system models, and to hypothesize and investigate other interconnections. Breakthroughs in this area, exemplified by the evidence contained in ancient polar ice for systematic glacial-interglacial changes in the atmospheric abundance of trace gases such as carbon dioxide and methane, have led to new conceptual views of the linkages among biogeochemical processes and the physical aspects of climate. These and related findings have served to focus attention on not only the effect of climate change on life processes, but of equal importance, the potential of these processes to feedback to climate.

In studying global change, the International Geosphere-Biosphere Programme (IGBP) will depend on these invaluable records in order to better understand the causes and effects of contemporary changes. This will require careful assessment of the state-of-the-art and present limitations of various techniques, the development of new technologies, and improvements in the analysis of these data in order to facilitate more refined interpretation of past records. Integration and intercomparisons of the different records of the past will be an important aspect of this activity of the IGBP.

Opportunities in this area have been highlighted in the deliberations and reports of the Special Committee for the IGBP since its inception, affirming that the study of past geosphere-biosphere linkages is clearly an important component of a study of Global Change. However, the collective effort to study aspects of past change relevant to the themes of the IGBP have to date been without the broad transdisciplinary focus as well as the international support that is essential for full exploitation of these opportunities.

Thus, the Special Committee for the IGBP decided at its meeting in Stockholm (October 1988), following the first meeting of the IGBP Scientific Advisory Council, to give particular emphasis to research into records of the past global change by charging the first of the programme's Scientific Steering Committees with project development in this area. This project will encompass the past 150,000 years to include a full glacial-interglacial cycle. Particular studies will focus in greater detail on changes which have occurred during the Holocene (10,000 years B. P.), and especially during the past 1,000 years, when the human perturbation to the Earth system began to take on global proportions. Terms of reference for this new committee will include:

(1) assessing the possible contributions of planned or existing national and international efforts, including those of, for instance, the International Union for Quaternary Research (INQUA), as they pertain to the underlying themes and objectives of the IGBP;

(2) developing, within one year of appointment, plans for an initial multi-technique core IGBP project for coordinated field activities focussed on the IGBP themes and objectives; and

(3) initiating, within two years of appointment, pilot segments of this project.

Chairing the new Scientific Steering Committee is Professor Hans Oeschger of the Department of Physics, University of Berne, Sidlerstrasse 5, CH-3012, Switzerland. Tel. (+41—31) 65 44 05.

IGBP Planning Groups

The Special Committee has established five Coordinating Panels, two Working Groups and one Scientific Steering Committee to develop the IGBP plans until the 2nd Meeting of the Scientific Advisory Council (3—7 September 1990). The following is a brief description of the planning groups and a list of the scientists who have promised to serve as members of the group.

CP 1. Terrestrial Biosphere-Atmospheric Chemistry Interactions

The focus in this area is on identification of the terrestrial biosphere sources and sinks of greenhouse gases that are important for understanding regional and global atmospheric chemistry and the link to the physical climate system. The need to study the fundamental processes underlying the emissions from terrestrial ecosystems is driven by the lack of understanding of these processes and how to parameterize these processes in global and regional models of climate. The coupling of the terrestrial ecosystems and atmospheric chemistry is an important link in the Earth system control of climate.

P. J. Crutzen (FRG), Chairman (member SC-IGBP)
M.-L. Chanin (France) (member SC-IGBP)
R. J. Cicerone (USA)
J. R. Freney (Australia)
R. C. Harriss (USA)
J.-P. Malingreau (Italy)
P. Matson (USA)
J. M. Melillo (USA)
R. Prinn (USA)
W. S. Reeburgh (USA)
H. Rodhe (Sweden)
H. I. Schiff (Canada)
G. A. Zavarzin (USSR)

CP 2. Marine Biosphere-Atmosphere Interactions

The feedback between climate, ocean primary production and ocean CO_2 storage depends on global as well as regional characteristics of the biogeochemical cycles of carbon, nutrients and key trace elements, and on the climate control of the physical environment in the photic zone. A much better knowledge of the basic processes that couple physics, chemistry and biology in the sea, based on in situ and remote sensing methods of observation, is needed to make it possible to understand and to model this coupled marine-climate system. It is important to know the consequences of these climate-induced changes on photic zone physics and their effects on global biogeochemical cycles, including feedbacks to atmospheric concentrations of radiatively active trace gases of biogenic origin. There is also a need to consider land-ocean interactions and the role of the coastal seas in the global environment and possible consequences of sea level rise on coastal zones.

T. Nemoto (Japan), Chairman (member SC-IGBP)
B. Bolin (Sweden) (member SC-IGBP)
S. I. Rasool (USA) (member SC-IGBP)
J. D. Woods (UK) (member SC-IGBP)

CP 3. Biospheric Aspects of the Hydrological Cycle

The climate and land surface systems are dynamically coupled through the physical processes of energy and water supply, transformation and transport at the land-atmosphere interface. The biosphere works in concert with these physical processes to further modify this coupling. Large-scale patterns of climate are influenced by regional variability in the surface processes of the water cycle. Present physically based models need development which will reflect the dynamic coupling in the climate-soil-vegetation system.

S. Dyck (GDR), Chairman (member SC-IGBP)
J. C. André (France)
H.-J. Bolle (FRG)
M. Chahine (USA)
R. Dickinson (USA)
G. Farquhar (Australia)
S. Harrison (Sweden)
G. Kienitz (Hungary)
C. Körner (Austria)
L. C. Molion (Brazil)
S. W. Running (USA)
V. Targulian (USSR)

CP 4. Effects of Climate Change on Terrestrial Ecosystems

There is a need to understand the effects of climate change on soil and vegetation, including structure and species composition, both directly and through changes in ecosystem processes (e.g., nutrient cycling, primary productivity) and demographic processes. The rates of ecosystem change will vary among different regions of the world. It will be necessary to understand the processes through which vegetation will change and the mechanisms that determine the times lags in the responses of ecosystems to various types of climate change. Such studies of change in ecosystems should focus on those properties of vegetation and soil, which will feedback to the global environment (for example through changes in albedo and surface roughness but also of water (CP3) and biogenic trace gases; CP1). It is necessary to understand both natural ecosystems and those affected by man.

B. H. Walker (Australia), Chairman (member SC-IGBP)
C. Fu (China)
I. Fung (USA)
J. MacMahon (USA)
H. Nix (Australia)
C. Prentice (Sweden)
W. A. Reiners (USA)
J. W. B. Stewart (Canada)
M. J. Swift (Zimbabwe)
H. Tiessen (Canada)
P. M. Vitousek (USA)
I. Woodward (UK)
R. Zlotin (USSR)

CP 5. Global Analysis, Interpretation and Modelling

Many approaches to the analysis and interpretation of IGBP research will be of importance, and modelling is an essential component of these. A fundamental understanding of the geosphere-biosphere system, particularly the development of an integrated view, cannot be arrived at without the development of global models including the most important physical, chemical and biological processes. It is, however, essential to recognize the major difficulties and limitations of modelling. The problems of uncertainty and predictability should therefore be kept in focus.

B. Bolin (Sweden), Chairman (member SC-IGBP)
P. J. Crutzen (FRG) (member SC-IGBP)
J. D. Woods (UK) (member SC-IGBP)
K. Hasselman (FRG)
K. Ya. Kondratyev (USSR)
C. Nobre (Brazil)
G. Pearman (Australia)
M. Prather (USA)
D. S. Schimel (USA)
U. Siegenthaler (Switzerland)

WG 1. Data and Information Systems

An important theme of the IGBP is that of documenting global changes, both in real time and through the reconstruction of past changes in the global environment. One measure of the success of the programme will be whether scientists in 20 or 30 years time will have available to them the essential record (such as that of global changes in atmospheric CO2, in ozone and land use) that will be necessary to document significant global changes in the geosphere-biosphere, which have occurred and are occurring. This task will consider aspects of planning, data collection (from space, on the ground and in the sea, as well as historical records), quality control, and data storage and dissemination.

S. I. Rasool (USA), Chairman (member SC-IGBP)
F. Becker (France)
V. Boldirev (WMO)
J. Cihlar (USA)
H. Croze (UNEP)
R. da Cunha (Brazil)
G. Kullenberg (Unesco)
S. Ruttenberg (USA)
W. Sombroek (the Netherlands)
G. Withee (USA)

WG 2. Geosphere-Biosphere Observatories

A coordinated surface-based measurement network to study geosphere-biosphere processes is needed. A network of geosphere-biosphere observatories across ecosystem-biome types is one possibility for the acquisition of long-term data sets, ecosystem experimentation, validation of models, and ground-truthing for remote sensing. The need for monitoring, research and training will be considered with emphasis on a set of regional IGBP Research and Training Centres for stimulating regional and global analysis, interpretation and modelling.

R. Herrera (Venezuela), Chairman (member SC-IGBP)
E. S. Diop (Senegal) (member SC-IGBP)
W. S. Fyfe (Canada) (member SC-IGBP)
V. M. Kotlyakov (USSR) (member SC-IGBP)

SSC. Global Changes of the Past

The condition of the global environment of the past can be observed by using various techniques. The insights into the past can be used to interpret observed trends in data of past changes, as well as to investigate different types of interconnections between them. This core project will encompass the past 150,000 years to include a full glacial-interglacial cycle. Particular studies will focus in greater detail on changes which have occurred during the Holocene (10,000 years B. P.), and especially during the past 1000 years, when the human perturbation to the Earth system began to take on global proportions. The SSC is charged with developing a proposal for a multi-technique research project for discussion at the 5th Meeting of the Special Committee (November, 1989) and to develop plans for how this project can be initiated in 1990. The possible contributions of planned and existing international and national efforts will be taken into account.

H. Oeschger (Switzerland), Chairman (member SC-IGBP)
J. A. Eddy (USA) (member SC-IGBP)
A. L. Berger (Belgium)
B. Berglund (Sweden)
B. Frenzel (FRG)
T. van der Hammen (the Netherlands)
T. Liu (China)
C. Lorius (France)
C. Pfister (Switzerland)
N. Rutter (Canada)
F. Schweingruber (Switzerland)
N. J. Shackleton (UK)
M. Stuiver (USA)
A. A. Velitchko (USSR)

The Intergovernmental Panel on Climate Change (IPCC) and the Role of the IGBP

by B Bolin, Chairman IPCC

The possibility that the increasing amounts of greenhouse gases in the atmosphere might lead to global warming is becoming a general concern and issue on the political agenda in many countries around the world.

The idea of man-induced climatic change is not new, but became of central interest to the scientific community in the 1970s, when for the first time a three-dimensional general circulation model of the atmosphere was used to assess the likely climatic changes that were resulting from an enhanced amount of carbon dioxide in the atmosphere. The analysis was presented at the first GARP study conference on the global climate (1974). Some years later this led to an international agreement to launch a World Climate Research Program (WCRP) as a continuation of the Global Atmospheric Research Program. The WCRP is now in progress and is presently aimed mainly at studies of the role of the oceans in the climatic system.

In 1982, UNEP and SCOPE requested the International Meteorological Institute in Stockholm to take responsibility for an international assessment of our present state of knowledge in regard to the possible changes in climate that are caused by increasing concentrations of greenhouse gases in the atmosphere, and the influence of these gases on the terrestrial ecosystems. The assessment was intended to serve as a basis for discussions on possible measures to slow down and prevent such a development if judged necessary.

The study was completed in the spring of 1985 and was published in 1986 as SCOPE Report 29, Bolin, Döös, Jäger and Warrick (eds), The Greenhouse Effect-Climatic Change and Ecosystem, Wiley & Sons. An international conference was arranged jointly by the International Council of Scientific Unions (ICSU), the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in Villach, Austria, in October 1985 to discuss what conclusions could be drawn from the study. The key introductory sentence of the statement agreed upon by the participants of the conference reads: "As a result of the increasing concentrations of greenhouse gases, it is now believed that by the first half of the next century a rise in global mean temperature could occur which is greater than any in man's history."

At the same time The World Commission on Environment and Development, under the chairmanship of Ms Gro Harlem Bruntland, the Prime Minister of Norway, was engaged in the major study on "Our Common Future". The possibility of future climatic changes due to man's emissions of greenhouse gases into the atmosphere was also considered in that context. The Commission expressed the view that "the risk of global warming make heavy future reliance upon fossil fuels problematic." The World Commission study was completed in the spring of 1987 and discussed in the General Assembly of the United Nations in the fall of that year. A unanimous agreement was reached, recommending the UN members to consider seriously the implications of the findings by the commission.

Early in 1988, as a follow up to the ICSU/WMO/UNEP conference in 1985, the Beijer Institute of the Royal Swedish Academy of Sciences completed a more detailed study of the social and economic consequences of climatic change. This study in turn served as a basis for several international conferences in 1988; one arranged in Toronto by the Canadian government, another supported by the government of the Federal Republic of Germany in Hamburg in November 1988.

With reference to the resolution which was adopted by the UN General Assembly in 1987, based on the Bruntland Commission reports, UNEP and WMO agreed in 1988 to form an Intergovernmental Panel on Climate Change (IPCC). The task of this panel is to assess our present knowledge about ongoing and likely future changes in climate, their consequences as well as possible strategies and policies aimed at reducing or preventing such changes.

The Panel met in Geneva for a first meeting 9—11 November 1988, on which occasion general directives for the work were agreed upon. Three working groups were formed to prepare an assessment report on the basis of which international agreements can be reached and an implementation programme adopted. Working Group I: Assessment of available scientific information on climate change; Chairman Professor J.T. Houghton, U.K., Working Group II: Assessment of environmental and socio-economic impacts of climate change: Chairman Professor Yu. A. Izrael, USSR. Working Group III: Formulation of response strategies;

Chairman Dr. F.M. Bernthal, USA.

About 35 countries had announced their interest and 31 participated. Professor B. Bolin, Sweden, was elected chairman of the panel.

Simultaneously with the meeting of IPCC, the UN General Assembly agreed on a resolution for the protection of the atmosphere which had been submitted by Malta. The resolution also contains a request to UNEP and WMO to submit the IPCC report for consideration by the UN General Assembly. Although it was recognized by the participants of the Panel meeting, that a comprehensive report would require a major effort, it was agreed that a first report should be completed by August 1990 to be considered both by the Second World Climate Conference scheduled for 1990, and by the UN General Assembly.

All three IPCC working groups met at the end of January 1989 and the IPCC Bureau had its first meeting a week later to consider and coordinate the proposed working schedules for the working groups. The next meeting of the whole Panel will take place in Nairobi at the end of June this year. It is expected that a good number of other nations will join the efforts on this occasion.

The work of the IPCC aims to provide a basis for policy decisions, but not coordinationof research in the field. Although a first report is to be completed in 1990, it is obvious that work of the Panel will continue for a good number of years. In the meantime the World Climate Research Programme is developing its research activities, and the IGBP with its broader research aims, including global changes in the chemistry and biology of the earth's system, is evolving. Obviously, it is desirable that these three efforts, all of which aim to resolve a series of global issues, work in close collaboration during coming years. A division of responsibilities in the manner that has now been evolved seems logical and should help in fostering an orderly implementation of the large amount of work that is required. The IGBP has been invited to contribute to the work of the IPCC Working Group I, and the Special Committee should carefully consider the most appropriate way to organize its work so that it is in the best possible position to play its proper role.

Six Senior Research Fellows for the IGBP Sub-Groups

An agreement has been reached with the Wissenschaftskolleg zu Berlin, which will allow six senior fellows to be based in Berlin for approximately six months each. These senior fellows will work closely with the chairmen and members of the IGBP sub-groups to develop the research programme. The IGBP has also advertised for a number of post-doctoral fellows to work with the chairmen of the IGBP groups.

In addition to developing the research programme, the senior fellows, chairmen and post-doctoral fellows will be charged with writing a review document outlining the current status of our knowledge in the IGBP priority areas, discuss conflicting theories of how global change will affect various systems and potential feedbacks affecting the global system, and where gaps may exist in our current understanding of earth system science. This review document will be published commercially as a companion volume to the report to the SAC-IGBP describing the proposed international research programme.

So far, the following scientists have been invited:

Prof. *H. Schiff*, York University, Canada (CP1)

Prof *L. C. Molion*, Instituto de Pesquisas Espaciais, Brazil (CP3)

Prof. *W. A. Reiners*, Dept. of Botany, Univ. of Wyoming, USA (CP4)

Dr *H. Virji*, National Science Foundation, Washington, DC, USA (CP5)

Prof. *J. W. B. Stewart*, The Saskatchewan Institute of Pedology, Canada (CP1 and 4)

Prof. *M. J. Swift*, Dept of Biology, Univ. of Zimbabwe, Harare, Zimbabwe (CP4)

Meeting of the Special Committee for the IGBP Stockholm, October 1988

A meeting of the Special Committee was held in association with the first Scientific Advisory Council of the IGBP. The meeting reached the following decisions

- to design core "Global Change " projects in two categories with equal priorities: (1) Core "Global Change" projects coordinated by the IGBP itself or in collaboration with another body and (2) core "Global Change" projects coordinated by another body.

In addition to core Global Change projects initiated by the IGBP, the Special Committee identified two additional international research activities, coordinated by other bodies, as crucial to the success of the Global Change programme, and discussions are under way to recognize them as core projects. The two projects are:

The International Global Atmospheric Chemistry Programme (IGACP) of the International Commission on Atmospheric Chemistry and Global Pollution (ICACGP of IAMAP/IUGG); and

The Joint Global Ocean Flux Study (JGOFS) of SCOR.

- to reassess the original charges of the Coordinating Panels and Working Groups in the light of the SAC discussions. In view of the overarching role of modelling in the IGBP, it was decided to set up a fifth Coordination Panel on "Global Analysis, Interpretation and Modelling", chaired by Professor Bert Bolin, Stockholm, Sweden, and to dissolve the present Working Group on "Global Modelling".

As there is an urgent need for a coordination between various approaches to retrieve data on "Global Changes of the Past", it was stressed that this is an area of high priority. Therefore, the first IGBP Scientific Steering Committee on "Global Changes of the Past" was established, under the chairmanship of Professor Hans Oeschger, Berne, Switzerland.

- to expand the membership for the Coordinating Panels and Working Groups.

-to establish an IGBP Interagency Coordinating Committee and to invite UNEP, Unesco, and WMO to nominate one member each. The IGBP will be represented by its Executive Committee. The first meeting of the ICC-IGBP was held in London (UK) on 11 January, 1989.

- to invite each ICSU scientific member to nominate a correspondent to the IGBP.

IGBP Meetings

List of IGBP Planning Meetings

1989

4—7 April
Meeting of SSC (Scientific Steering Committee on Global Changes of the Past)
(Berne, Switzerland)

16—18 April
Meeting of CP 4 (Coordinating Panel on Effects of Climate Change on Terrestrial Ecosystems)
(Woods Hole, USA)

19—20 April
Ad hoc group meeting on "IGBP Needs for Remote Sensing Data"
(Boston, USA)

10—12 May
Meeting of WG 2 (Working Group on Geosphere-Biosphere Observatories)
(New York, USA)

8—11 June
CP 3/CP 4/CP 5 joint meeting (Coordinating Panels on Biospheric Aspects of the Hydrological Cycle; Effects of Climate Change on Terrestrial Ecosystems; and, Global Analysis, Interpretation and Modelling)
(Brussels, Belgium)

13—15 June
4th Meeting of the SC-IGBP and Chairmen of National IGBP Committees
(Brussels, Belgium)

16—17 June
4th Meeting of the SC-IGBP (continued)

23 July — 4 August
Second Global Change Institute and meeting of partial SSC
(Snowmass, USA)

4—8 September
WG 1 Demonstration on the use of global data sets (in conjunction with UNITAR workshop)
(Accra, Ghana)

Early autumn
Meeting of CP 1 (Coordinating Panel on Terrestrial Biosphere — Atmospheric Chemistry Interactions)

19—21 September
Ad hoc meeting on Coastal Seas (CP2)
(Tokyo, Japan)

25—27 September
Workshop on GBOs (Geosphere-Biosphere Observatories)(together with USA)
(Warsaw, Poland)

28—30 September
Meeting of WG 2 (Working Group on Geosphere-Biosphere Observatories)
(Warsaw, Poland)

September
Meeting on end-to-end performance of remotely sensed marine data (WG 1)
(Tokyo, Japan)

9—13 October
Meeting between IGBP Senior Research Fellows, IGBP Post-doctoral Fellows and available IGBP CP, WG and SSC Chairmen
(West Berlin, FRG)

12 October
Meeting between EC-IGBP and ICSU Scientific Members
(Lisbon, Portugal)

14 October
2nd Meeting of the ICC-IGBP
(Lisbon, Portugal)

15—16 October
4th Meeting of the EC-IGBP
(Lisbon, Portugal)

18—20 October
"Modelling the Global Carbon Cycle"
Study Conference arranged by CP 5 (Coordinating Panel on Global Analysis, Interpretation and Modelling)
(Heidelberg, FRG)

23—27 October
Regional IGBP Meeting for Latin America
(Bogota, Colombia)

6—10 November
Meeting of partial SSC
(West Berlin, FRG)

6-10 November
5th meeting of the SC-IGBP
(West Berlin, FRG)

11—13 November
Meeting between CP Chairmen, Senior Fellows and Postdocs
(West Berlin, FRG)

Autumn
Meeting of CP 3 (Biospheric Aspects of the Hydrological Cycle)

27 November - 1 December
WG1 Workshop/Training Course on the"Utilization of Global Data Sets" (in collaboration with UNITAR and UNEP) (Africa) and"Impact on Climate Change on Agricultural and Forestry Production" (CP 4 / ABN / IFS / CSC)
(Cameroon, Africa)

1990

January
Media and Information Advisory Committee Meeting (together with SIPI)

mid-February
Meeting of SSC
(Berne, Switzerland)

19—23 February
"Trace Gas Exchange in a Global Perspective", SCOPE / CP 1 Workshop
(Stockholm, Sweden)

12—13 March
"Modelling Ocean-Atmosphere Interactions, including the Effects of Primary Production in the Ocean", CP 2 / JGOFS Workshop
(London, UK)

19—20 March
5th Meeting of the EC-IGBP
(Moscow, USSR)

23—24 March
6th Meeting of the SC-IGBP
(Moscow, USSR)

17—21 April
Ad hoc IGBP Editorial Committee

Early 1990
Meeting of CP 5

Early 1990
Meeting of CP 2

Early 1990
Meeting of CP 3

Early 1990
Regional meeting for South-East Asia
(Malaysia)

Early 1990
"Landuse and Vegetation Changes: Past, Present and Future",
CP 4 Workshop

Early 1990
WG 1 Workshop on "Intercomparison of ISLSCP Data for Surface Temperature Measurements"

2 September
Media seminar together with SIPI
(Paris, France)

3—7 September
2nd Meeting of the SAC-IGBP
(Paris, France)

1990
Ad hoc Meeting on Data Directories and of WG 1

1990
Workshop on the Effects of Climate Change on Agriculture and Forestry in Latin America (CP 4)

1990
WG 1 Follow-up Workshop on the "Utilization of Global Data Sets"

1990
Workshop on Geosphere-Biosphere Observatories (WG 2)
(Bangkok, Thailand)

1990—1991
"Effects of Landuse Changes and Biomass Burning on Trace Gas Release from Terrestrial Ecosystems" (CP 1)

IGBP Reports

Nine Reports

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)

2. A Document Prepared by the First Meeting of the Special Committee, ICSU Secretariat, Paris 16—19 July, 1987 (1987)

3. A Report from the Second Meeting of the Special Committee, Harvard University, Cambridge, MA, USA 8—11 February, 1988 (1988)

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)

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

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)

7. Report from the First Meeting of the Scientific Advisory Council for the IGBP, Stockholm, Sweden 24—28 October, 1988 (in preparation)

Report from a Meeting of the IGBP Working Group on Data and Information Systems held at WMO and UNEP/GRID, Geneva, Switzerland 11—13 January 1989. Compiled by S. I. Rasool and D. Ojima (in preparation)

Southern Hemisphere Perspective of Global Change: Scientific Issues, Research Needs and Proposed Activities. Report from a Workshop held in Mbabane, Swaziland 11—16 December,1988. Complied by B. H. Walker (in preparation).

New IGBP Related Publications

Scales and Global Change. Spatial and Temporal Variability in Biospheric and Geospheric Processes. Ed by T. Rosswall, R. G. Woodmansee and P. G. Risser. SCOPE 35, 1988. Chichester: John Wiley & Sons. ISBN. 0 471 91828 8

Universidade de Sao Paulo, Instituto de Geociencias, Boletim IG-USP. Publicacao Especial No 6: Encontro Sobre Mudancas Globais. 1988. ISSN 0102 6275

Global Change. Proceedings of the Elizabeth and Fredrick White Research Conference 24—27 February 1988. Convened by the Australian National Committee for the IGBP Cosponsored by the Federal Government. Canberra: Australian Academy of Science. ISBN 0 642 13849 4

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Congratulations

We are very pleased to announce that the 1989 Tyler Award is shared between Professor P. J. Crutzen, Max Planck Institute for Chemistry, Mainz, FRG and a member of the Special Committee for the IGBP and Professor E. D. Goldberg, Scripps Instute for Oceanography, La Jolla, USA.

We would like to remind our readers that the 1988 recipient of the Tyler Award was another member of the SC-IGBP, Professor B. Bolin, Department of the Meteorology, University of Stockholm, Sweden.

Editorial

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