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

Highlights from the SC-IGBP Meeting

Turning Points

The 8th SC-IGBP was Thomas Rosswall's last SC-IGBP meeting as Executive Director of the IGBP, and Peter Liss' first meeting as the new IGBP Chairman. These personnel changes come at a time when the IGBP is solidly in the implementation phase for most of its Core Projects, and when events, both internal and external are rapidly shaping and influencing the further development of the programme. Significant among these events are: the publication of the Work Plan (Report No. 28) for IGBP research during the next five years, the consolidated collaboration between the IGBP and the International Group of Funding Agencies for Global Change Research (IGFA), the planned evaluation of the IGBP, and improved circumstances for the IGBP operating budget and the final repayment of the loan from the Royal Swedish Academy of Science. These topics dominated the discussions at the 8th meeting of the SC-IGBP, held in Troisdorf, Germany. Given these circumstances and their potential influences on the IGBP, it was appropriate that the SC-IGBP discuss in depth where the programme has been and where it is going. The current and future status of the IGBP were focal points for much of the discussion.

Several of these topics are closely inter-related. Both the stage of development of the IGBP and the relationship with the IGFA have helped to improve the financial situation. This has been the direct result of increased payments by many member countries, which have met and sometimes even exceeded their IGBP target contributions. The improved financial situation will, in turn, allow the programme to come nearer to achieving its function as originally envisaged.

IGFA Resource Assessment

The IGFA process, and particularly the 1993 IGFA Resource Assessment, has addressed the issue of the level of funding required to achieve the objectives of the IGBP Core Projects and Framework Activities. In this process all IGBP components were asked to estimate the financial resources required to carry out their scientific plans. The major nations were also asked to give information on the funding available in their countries for IGBP research. The three-tier structure of core, regional and relevant research was a necessary prerequisite for the 1993 assessment. A major conclusion was that although total amounts of funding available for biogeochemical global change research may be approximately equivalent to the IGBP needs, the amounts allocated to core research, as opposed to global change research generally, are in most instances totally insufficient. The assessment process is considered highly important and IGBP and IGFA have agreed that it is to be repeated in 1994 based on the experience gained in the first compilation. As was the case in the 1993 assessment, HDP and WCRP will also be included.

In 1994 IGFA and IGBP National Committees will compile a list of national projects in the first two categories of the IGBP three-tier structure of global change research. The lists will be sent to Core Project Offices, for classification of projects into core research and regional/national research. The CPOs and SSCs will also identify any additional projects which should be included in the resource assessment. In addition the Core Projects will provide an update of the resources needed to conduct the research outlined in the 5-

CONTENTS

1	Highlights from the SC-IGBP Meeting
2	Comments on the IGBP 5-year plan
4	The IGBP Nations
6	Land-Use Change in the Humid Tropics
9	IGBP-DIS/CEOS Pilot Project Exchange of High Resolution Satellite Data
10	People with the IGBP
11	Intergovernmental Panel on Climate Change
12	IGBP-WCRP Working Group on Land Surface Experiments
13	Regional Research Networks The Mediterranean Basin and Asia
15	Global Change and the Antarctic
16	JGOFS Training course: flux monitoring in the Indian Ocean
17	New Zealand elevated CO ₂ project
18	Meetings
19	Publications

year plan. The Core Projects will, in particular, identify perceived gaps in funding that will have a major impact on the successful conduct of the project. The assessment will ensure that IGFA and the IGBP have a consistent view of what should be included under the core research category and it will also help to identify inadequate funding situations in more detail. Thus, although considerable effort is necessary on behalf of the IGBP, there are also important opportunities to identify specific areas in need of additional funding through this process.

Central Funding

At the IGFA meeting in Taipei in January the IGBP submitted its Five-year Plan with a request to IGFA members for additional funds to support the central activities of the IGBP. The funds for the Secretariat and for the co-ordinating activities of the programme have never reached the level originally planned. As more projects have reached their implementation phases, and especially as more efforts are made to integrate activities between Core

Projects, there is a need for more funds for co-ordinating activities. The IGFA members concurred with this and agreed to increase their funding for the central co-ordination activities of the Secretariat and for inter-Core Project co-ordination. IGBP had also requested IGFA endorsement for additional requests to fund intra-Core Project activities and for participation from developing countries and from countries with economies in transition. The IGFA noted that it was easier for most countries to fund Core Project activities within the sphere of their respective national funding programmes, and that funding for participation from developing and transition economies should come through START. Overall, IGBP views the IGFA process as promising for identifying additional funds to add support to its central activities.

Evaluation

The results of the IGFA Resource Assessment will undoubtedly be important for the planned evaluation of the IGBP. The plan for that evaluation was outlined and discussed at the meeting.

The Scientific Committee for the IGBP is carrying out a continuous evaluation of both the overall development and its specific components. However, the SC-IGBP has also identified a need for an external evaluation of the programme and initiated a process leading to such an external evaluation. ICSU and IGFA have accepted the invitation to co-sponsor this process. Such an evaluation should consider both scientific as well as management aspects. In order for the review to be available for consideration by the 4th Scientific Advisory Council for the IGBP, it should be completed no later than September 1995.

The IGBP will be reviewed as a whole, as will each of its Core Projects. There will be major inputs to this process needed from the Core Projects, and each will plan its interaction with a review sub-panel of experts. A Sponsors Group will be established to advise on the implementation of the evaluation and review. This group will consist of six members representing the three sponsoring bodies: ICSU, IGFA, IGBP. An Evaluation Committee of 10-12 distinguished leaders in science and policy will be identified by the sponsors group. These individuals should have broad experience in relevant scientific and/or policy areas, but should not be directly involved with the IGBP. Some of the members will have knowledge of the sister programmes HDP and WCRP and be familiar with the policy process, including IPCC and INC/FCCC. This committee will be solely responsible for the planning and conduct of the evaluation within the terms-of-references established by the Sponsors Group.

IGBP Information

The IGBP has published a directory of the people involved in the programme, and GCTE has published a catalogue of GCTE research. These have produced an awareness of the importance of generating summary information about the IGBP and its activities. With plans underway for a classification and summary of Core Project research for the IGFA Resource Assessment, such information will become available for each Core Project. In an effort to provide additional information to the IGBP reviewers, IGAC has started planning a bibliography or database of papers which have been produced as a result of IGAC research, and the other Core Projects will follow suit. It was stressed that prompt publication of the scientific results of the IGBP in refereed international journals is essential with due acknowledgement given for the work being part of the IGBP. DIS is making plans for an IGBP Internet interface to provide general

IGBP Core Projects: a "rich tapestry" or "flagship" model

Commentary by Eric J. Barron, Earth System Science Center, Pennsylvania State University, USA.

The recently released work plan for the IGBP (*IGBP in Action: Work Plan 1994-1998*) is a well thought-out description of scientific goals addressing significant issues in global change. The importance and relevance of the IGBP Core Projects is clearly evident. However, an examination of the breadth of IGBP projects, and my own comparison of IGBP with WCRP (World Climate Research Programme), identifies more than one model for international scientific programmes.

The first "model" might be called the "rich tapestry" model. This model creates a broad umbrella to include a wealth of national and individual contributions (a positive attribute). A primary focus of effort in this "model" is collaboration and communication. The rich tapestry model incorporates a wide variety of effort, often including pre-existing efforts or national programmes which fit naturally within the scope and direction of the international Core Project. The negative aspect of this "model" is that many projects incorporated within the Core Project may not derive their identity from IGBP. This may well influence the visibility of IGBP and the ability to seek funding in support of the valuable IGBP efforts. IGBP recognition for

communication, fostering activities and fine workshops may be insufficient for its long-term health.

A second "model" might be termed the "flagship" model. In this case, the effort is focused on a task-oriented activity which is accessible to the large community. Major field experiments or modelling activities draw and promote international scientific collaboration and advancement. The major benefit of this model is that the research becomes strongly identified with IGBP (as TOGA is identified with WCRP) and such efforts become major resource attractors. The primary negative aspect of this "model" is that it is not inclusive and the scientific community must choose a major effort for extra emphasis within the rich diversity of important efforts.

The reading of the Work Plan for IGBP indicates that many of the Core Projects have focused, task-oriented activities that derive their identity from IGBP. These projects also appear to derive better financial support. However, this is not a universal approach. I believe that the long-term health of IGBP could be enhanced if all the Core Projects could develop "flagships" within a rich diverse effort which would enhance IGBP visibility and enhance IGBP funding. This view on the visibility of IGBP efforts is likely to be very different from national to nation, but I believe it will broadly promote the very worthwhile goals of the IGBP.

information about IGBP, and START is thinking about ways to connect areas which are not currently linked to Internet.

There was also a discussion of plans for an IGBP book series. As a number of the Core Projects begin to generate synthesis and summary information there will be a need for publication in book format. This must not interfere with the normal route of primary publication in journals, etc., but would serve as a gathering point for global synthesis and over-arching activities.

The Future

The plan for the evaluation, and the discussion of the Five Year Work Plan gave rise to an interesting discussion on the future of the IGBP; namely, when and how will the Core Projects, and IGBP itself draw to an end? It was argued that as the Core Projects have clearly defined goals, they should also in principle have clearly defined lifetimes, but this is likely to be a continuing debate. There was a feeling that these must be adjusted, depending on the degree to which compromises are necessary in funding. The lifetime of IGBP as a whole was somewhat more difficult to define.

Two main models emerged from the discussions. The first was that the IGBP would continue to support new Core Projects as they evolved from the ideas and discoveries of the old, and that this could in principle go on for a very long time. Inherent in this argument was the

idea that if IGBP were terminated before global change problems were satisfactorily resolved, then the scientific community would only have to re-invent it, losing considerable momentum in the process.

The second argument was that the programme itself must set a final goal and be terminated when that goal is achieved. This was supported by those who felt that future new ideas were not going to come from the existing IGBP research community, but from the next generation of scientists, and that they would need to build their own structure. There was a compromise position, that having built a structure such as the IGBP which appears to work, it would be unfortunate to dismember this structure. This argument favoured the idea of periodic re-evaluation of the overall programme and its goals. Implicit in that review is that there must be assurance that there are new people, ideas and questions being entrained into the IGBP process. It was observed that as long as this is the case and there is a clearly identifiable need for international co-ordination, that IGBP should continue to exist. This issue will continue to be debated by the SC-IGBP.

Other SC-IGBP Agenda

Much of the rest of the meeting was spent in discussing the progress and status of IGBP Core Projects, with detailed presentations made by DIS, GAIM, LOICZ, LUCC and START.

Prof. Oscar Vanderborcht, chair of the

Belgian National Committee presented a proposal for an IGBP Core Project on the role of freshwater systems in global change. This was discussed at some length by the committee, and it was decided that while it was a very important topic, it was over-arching and overlapping with existing projects in a way that made it difficult to identify as a Core Project. Some freshwater issues are already being considered in IGBP Core Projects. For example, freshwater biodiversity will be addressed by Focus 4 of GCTE and water resources by BAHC. To examine the larger issue, ICSU has established the Scientific Committee on Water Research (SCOWAR), to provide the objective, scientific expertise in water resource problems required to address frontier science issues. The SC-IGBP will invite SCOWAR to consider how the role of freshwater research could best be addressed in the context of ICSU and other organisations. The 9th SC-IGBP meeting will be held in Australia on 12-15 December, 1994.

National Committee Meeting

After the formal closure of the SC-IGBP meeting, the members participated in the opening of the National Committee Meeting, held at the Gustav Stresemann Institute, in Bonn Germany. Here the Core Projects each presented their current status and the members were able to participate in an interesting debate on the relationship between the Core Projects and the National Committees.

Four interacting scales of "Environmental Turbulence"

Commentary by W. Richard Peltier, Department of Physics, University of Toronto, Canada

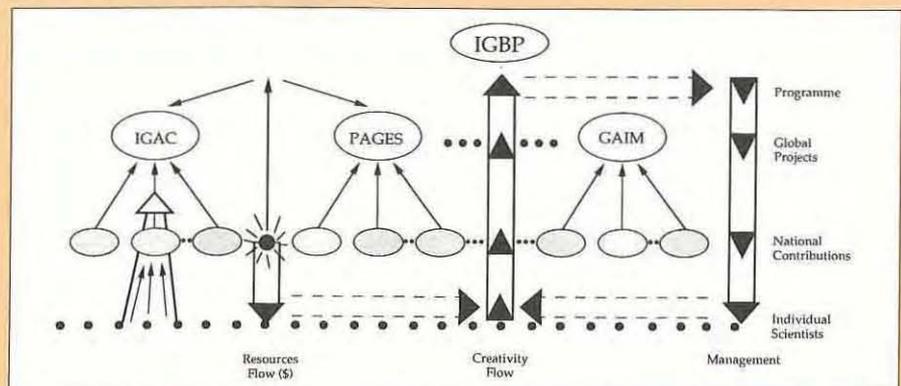
The work plan that has now been developed for the next five years of activity within the IGBP is clearly ambitious and will be a challenge to complete. In part the challenge will involve orchestrating the interactions between what I, in the diagram, imagine to be four interacting scales of "environmental turbulence".

The four scales of activity are those (from bottom to top, in the cartoon) at the level of the individual, at the level of the national, at the level of the individual Core Projects, and at the level of the Programme as a whole. These interactions are seen to be mediated by three flows, these being flows of resources, of creativity, and of management. In my view, as recorded in the figure, these flows are all "down-gradient" in the sense that they originate at the level in which the quantity that is flowing reaches its highest concentration.

I see the programme involving a single

main loop in which the collective individual scientific creativity is driving an innovative syntheses of ideas at the largest scales which is aided and abetted by a flow of "orchestration" through management. At times it may appear that the latter flow impedes the former. In any event the cycle requires continual catalysis in the form of resources that emanate almost entirely from the national scale. In order that the programme deliver on

the promise implicit in our five-year work plan, we require that this catalysis be enhanced if possible so that the reaction be sustainable. We need to invest real effort in the short term to see to it that the programme becomes a much more important aspect of the national scientific fabric that is now the case in many countries. Nothing will better ensure that this does in fact occur than our continuing focus on quality.



Musings on IGBP structure, by Dick Peltier

The IGBP Nations

In January 1993, at the Third Scientific Advisory Council for the IGBP, the German IGBP National Committee invited the IGBP national representatives to Bonn in March 1994 for their next meeting. The Bonn meeting was planned to serve two themes: to inform the National Committees about the most recent IGBP scientific activities, and to strengthen the role of the National Committees for the benefit of the IGBP, allowing them greater input into the IGBP development.

The Bonn meeting benefited from the presence of most of the members of the Scientific Committee for the IGBP, which held its 8th meeting during the three days prior to the National Committees, and the participation of the Core Project Managers who met in Bonn as well. The National Committee meeting was extremely well-attended, with greater participation of national representatives than ever before. Over 150 persons attended, and 57 nations were represented.

IGBP National Committees Meet

The Fourth Meeting of National IGBP Committees took place in Bonn-Bad Godesberg, Federal Republic of Germany, from March 13-16, 1994. The meeting was hosted by the German IGBP Committee, and organized by its IGBP Secretariat in Berlin. The Deutsche Forschungsgemeinschaft (DFG), the Federal Minister of Research and Technology (BMFT), the European Commission, the IGBP committees of Norway and Switzerland, as well as the Global Change System for Analysis, Research and Training (START) and IGBP helped finance the participation of representatives from developing countries, and countries with economies in transition.

Hans-Jürgen Bolle, Chair of the German National IGBP Committee, chaired the meeting. The welcome speakers were Horst Hagedorn, the chair of the DFG Senate Commission on Environmental Research on behalf of the Deutsche Forschungsgemeinschaft, Werner Menden on behalf of the Federal Ministry of Research and Technology, Jim Dooge as President of ICSU, and Peter Liss, the Chair of the Scientific Committee for the IGBP.

The agenda during the coming days covered the full scope of IGBP Core

Projects and Framework Activities, and addressed National Committee issues. At the end of the meeting Professor Bolle warmly thanked Thomas Rosswall in the name of all the National IGBP Committees for his never failing dedication to organise and promote IGBP research.

The German IGBP Secretariat in Berlin will soon publish a report in full.

Programme development

The National IGBP Committees welcomed the IGBP 5-Year Plan. It was noted that this is the first major document to describe the IGBP during the implementation phase and as such will serve a valuable purpose in informing the science community, research funding agencies, and policy makers of the current status of the programme.

Eric Barron (USA) advised each Core Project to ensure that certain "flag-ship activities" (see box p. 2) be identified that would have a very prominent IGBP label and be evidence of initiatives that would probably not have been taken without the programme. Through such activities, the Core Projects can be identified more uniquely with the IGBP.

It was recalled that the IGBP, together with HDP and WCRP, is a necessary element in the development of national and international strategies to deal with global environmental change issues.

However, it was strongly felt that the general knowledge about IGBP must be improved. The publication of scientific results from IGBP research must be accelerated, primarily in international scientific journals, where a special acknowledgement of IGBP, or of being part of IGBP, should be added in the summary.

The National Committees welcomed the plans for an IGBP book series as long as it does not detract from publication of primary results in refereed journals and that the publications are produced as inexpensively as possible. It was noted that as the IGBP Core Project and Framework Activities are already publishing books with synthesis of results and reviews of current knowledge, to have such volumes all published in one series would increase the visibility of the IGBP.

The Role of National IGBP Committees

National Committees must play a strong role in the development of the programme. They have an obligation to ensure that information regarding the programme reaches the science community in the respective countries, but they must also make certain that the Core Projects and Framework Activities are fully aware of the national programmes and that these are taking into account in the definition of IGBP research according to the three-tier structure.

National funding agencies often have developed their research plans independently of the IGBP. Consequently, the national research plans are not always congruent with the IGBP Core Project science and implementation plans. At the international level, the SC-IGBP decides on the scientific priorities upon the advice of National Committees and internal discussions. The National Committees should play an important role at the national level to help define the priorities for participation in global change research in general and the IGBP in particular. It is important that the national IGFA members and the National Committees interact to develop a coherent view of the national programme priorities.

Integration of National Research Projects into IGBP Core Project Activities

The IGBP Secretariat should circulate information regarding the format for nations to report on their projects for possible inclusion in the top-two categories of IGBP research. For countries with a national IGFA member, this will be done in conjunction with the IGFA 1994 resource assessment. Thus, each Core Project and Framework Activity will receive information from National IGFA members/National Committees with lists of projects to be evaluated for inclusion as core IGBP research or regional/national IGBP research.

National IGBP Committees should thus serve as the first filter for research, passing proposals on to the Core Projects and Framework Activities. National Committees may chose to establish sub-committees or liaison persons for Core Projects of particular interest to them to ensure that all relevant research is included in the national assess-

ment and to be responsible for efficient communication with the Core Projects. It is essential that the IGBP through its Secretariat, keeps all National Committees fully informed about the developments at the international level.

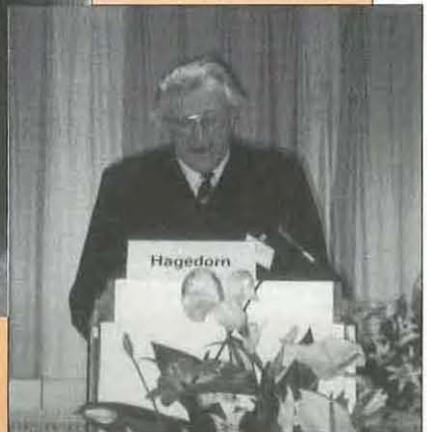
Capacity building

The National IGBP Committees, keenly aware of the urgent need for training scien-

tists in developing countries in all areas relevant to global environmental change, encourage all governmental and non-governmental organisations involved in promoting education and training in developing countries to include global environmental issues in their priorities. It was further mentioned that, whenever possible, this education and training should be linked to research taking place in the respective developing countries and re-

lated to problems of national concern.

As the National IGBP Committees of a START region are all represented in the regional START Committees, they are expected to participate actively in the definition of selection criteria for the Regional Research Sites and the definition of criteria for facilities, infrastructure and training capabilities of the Regional Research Centres.



The Bonn meetings, 10-16 March, 1994

Clockwise, from the top:

The members of the Scientific Committee for the IGBP, the IGBP Secretariat, and the Core Project Managers

Horst Hagedorn, Chair of the German Senate Commission on Environmental Research, welcomes the delegates to the Fourth Meeting of the National IGBP Committees

Informal discussions in Bonn: Rindayi Chimonyo (Zimbabwe), Prem Jain (Zambia), Boitumelo Kgarebe (Botswana), John Perry (USA)

In the garden of the Gustav-Stresemann-Institut in Bonn: the organisers of the 4th National IGBP Committee. From left to right, Arne Spekat, Sabine Lütke-meier, Gisela Brehme, Gisela Post

Delegates at the Bonn meeting: from left to right, Eric Odada (Kenya), Werner Menden (Germany), Dieter Ehhalt (Germany), Genady Golubev (Russia), Hans-Jürgen Bolle (Germany), Friedrich Beese (Germany)



Land-use Change in the Humid Tropics

Report of the GCTE Transects Workshop Working Group on Land-Use Change in the Humid Tropics (Marshall, CA, USA, August 1993); Endorsed by the BIG Science Task Team (BAHC-IGBP-GCTE) in January 1994 as an appropriate framework for IGBP studies on land-use change in the humid tropics.

Why transects in the humid tropics?

The humid tropics are a high priority region for global change studies because of the significant impact of land-use change (usually the conversion of forests to agricultural use) on biogeochemical cycles, particularly the global carbon cycle. The impact occurs in two phases: (i) the initial clearing of the forests, the techniques of which are important in determining the short-term alterations to biogeochemical cycles, and (ii) the type and intensity of the subsequent agricultural use, which are critical in determining the longer term effects.

In addition to biogeochemistry, the conversion/intensification sequence impacts on other important, related ecosystem processes. These include the biotic control of water and energy exchange between the land surface and the atmosphere; the composition, structure, and production of regrowth forests; and ecological complexity and its relationship to ecosystem function.

In these transect studies the primary focus is on biogeochemical cycles. The overall objective of the studies is to determine the effects of land clearing and subsequent land use on quantities, pathways and processes of carbon and nutrient loss (or gain). The studies will also examine the effects on the hydrological cycle and on the composition, structure and production of regrowth forests. Although studies of the impacts of clearing and subsequent land use on the complexity/function relationship are not included in the design of these transects, the transects do offer an excellent framework for their later inclusion, as well as for collaborative work on climate change impacts on tropical agriculture and for other GCTE Focus 3 studies.

The use of the term 'transect' here refers to a 'conceptual' transect rather than a physically contiguous transect based on a

variation in a controlling environmental parameter such as temperature or precipitation. For land-use change in the humid tropics, the controlling parameter on which the gradient is based is intensity of land use, normally determined by agricultural strategies and techniques.

Which transects?

GCTE proposes six studies, two for each of the three major humid tropical regions - Central and South America, Central Africa, and Southeast Asia. In each case one study will focus on forests at the wetter end of the range, while the other will be centred on drier tropical forests. The dry tropical forests are important because they are experiencing rapid rates of land conversion, the conversion from forest to agriculture is usually permanent, and the rates of gas emission (particularly N_2O) are very high.

The comparison of a wet with a dry tropical forest in each of the three regions will give insights into how precipitation may modulate the responses of biogeochemical cycles to land-use change. Thus, although dry, closed canopy forests are not normally considered to be part of the humid tropics, they will be for the purposes of this study.

The three transects are proposed in:

- (i) Central/South America: humid forest in the Amazon to dry forest in Mexico
- (ii) Southeast Asia: humid forest in Sumatra to dry forest, possibly in Thailand
- (iii) Central Africa: humid forest, possibly in Cameroon, with the dry forest to be identified.

The research design

The framework for the IGBP transects in the humid tropics is based on an integration of the relevant components of IGAC, BAHC, GCTE and LOICZ operational plans. The transects will have five elements: (i) intensive process studies (the 'budget-closing experiment') at one or possibly two sites in each transect; (ii) a more extensive network of observational studies along the major gradient (land-use intensity); (iii) networks of measurements and associated algorithms designed for scaling results to the region; (iv) remote sens-

ing studies to determine the extent, rate and type of land conversion and subsequent land use; (v) modelling studies to synthesize and integrate the experimental results and to quantify the consequences of future land-use change scenarios.

Intensive process studies

Although a number of biogeochemical studies have already been carried out in the humid tropics, particularly in the Amazon Basin, there has not yet been a study which closes element budgets associated with the land-clearing process. Thus the intensive process study proposed here aims to measure all the major pathways of element loss, hydrologic as well as atmospheric, during and following land clearing.

The study will be based on a small watershed scale (a few km) and carried out over a 5-year period to follow the biogeochemical changes associated with the conversion of primary forest to agricultural use. Both atmospheric and hydrological pathways of element loss will be measured, as well as changes in soil pools. The large pulse of element loss (again both atmospheric and hydrological) during and immediately after clearing (burning) of the forest will be measured. The change in element fluxes with the subsequent agricultural use of the land over a 3 to 4-year period will be determined. In short, an intensive biogeochemical process study of the land cover conversion process itself will be undertaken.

Atmospheric measurements will include both chamber and tower-based (eddy correlation) measurements of emissions of important trace gases (e.g. NO , N_2O , CH_4 , CO , CO_2). Hydrological fluxes will be determined by measurement of stream flow, sediment loads and chemistry in the watershed. Soil-plant measurements include soil moisture and structure, litter decomposition rates, and microbial process measurements. The measurements will be undertaken throughout the 5-year period, before, during and after land clearing.

The land clearing technique (slash-and-burn, mechanical, targeted logging) and subsequent land use adopted (pasture, agriculture - low to high input, plantation forestry, post-logging regrowth) will be chosen for the study to be representative of the region.

Extensive network

The intensive process study will be complemented by a regional network of sites measuring element fluxes on plots of various land-use types and histories (e.g., chrono-sequence studies). This network will form the primary gradient for the humid tropics transects. The sites, of course, will not be physically contiguous or form a linear pattern in physical space, but will be organized by intensity of land-use to form a conceptual transect.

The network will consist of small, plot-scale sites at which a number of processes are measured. Atmospheric exchange will be monitored by standardized chamber measurements of important trace gases (NO , N_2O , CH_4 , CO , CO_2). Soil measurements include soil moisture dynamics; groundwater chemistry, carbon, nitrogen and phosphorus stocks; carbon and nitrogen isotopes; microbial biomass; and nitrogen mineralization and nitrification.

At some sites, tower-based land-atmosphere energy and trace gas exchange measurements (sensible and latent heat, CO_2 , HCs, O_3 , CH_4 , NO , NO_x and N_2O) will be made. This will be aimed at determining the biotic control on water and energy fluxes, in addition to element fluxes from the land surface and will provide an excellent set of reliable data for the validation and improvement of land-surface models in GCMs.

At sites where agriculture has been abandoned or where the forest has been allowed to regrow directly after clearing, the species and functional type composition, structure, biomass, and leaf area index of the regrowth forest also will be determined. At some of these sites leaf-chamber measurements of NMHC, CO_2 , NO_x , H_2O , CO , O_3 , as well as tower-based measurements of trace gas, water and energy exchange, will be made to determine the variations with functional type in canopy exchange processes.

The following characteristics will be determined for each site: soil properties (physical, chemical, biological); land-use history; climate (precipitation - particularly seasonality - temperature, wind speed/direction, radiation); vegetation composition, structure and biomass; topography - hill slope and structure.

Considerable effort is required to coordinate and integrate the extensive site network (particularly in the Amazon basin, where existing work will probably provide most of the sites needed for the network). A special effort will be made to standardize measurement techniques and data protocols as far as possible, and to identify and include those sites with long-term studies.



Scaling-up/ extrapolation

The scaling-up of the hydrological fluxes of elements to the region will be centred on a basin-wide network of hydrological stations measuring water flow, sediment loads and water chemistry. The latter is particularly important for closing element budgets on a watershed and basin basis. Such a network already exists in the Amazon basin.

Scaling-up the small-scale measurements of trace emissions from the individual sites in the transect will be accomplished by using aircraft flights and the boundary-layer averaging technique. The latter will rely on those sites within the extensive network that have tower-based

measurements of gas fluxes. The flights will include measurements of atmospheric stability, depth of mixed layer, radiation, O_3 , CO_2 , H_2O , HCs, NO , NO_2 , PAN, organic nitrates, NO_y , HCHO, H_2O_2 , and aerosols for studying and modelling chemical transformations in the atmosphere.

Remote Sensing

Remote sensing studies will provide the extent and rate of land cover conversion in the regions. Such a study has already been completed for the Amazon basin, and plans for similar studies in the other two humid tropical regions are well advanced. Of particular importance is the accurate determination of the type and history of land-use for linkage to the ground-based process studies and observations.

The remote sensing studies should be expanded to include estimates of canopy structure and canopy chemistry when the technology is available.

Modelling

Modelling studies will provide an integrating framework for the experimental and observational studies, and for predicting consequences of future land-cover change. For each process, models at the patch and regional scales are required, as well as methodologies for translating between the scales.

Existing models that may be useful cover biogeochemistry, water/energy exchange, forest production models, forest succession models, 2-D atmospheric transport models linked to models of atmospheric chemistry and of trace gas emissions; models linking land-cover change with biogeochemistry.

Coordination

Initially two region-specific coordinating committees, consisting of representatives of the relevant IGBP Core Projects and scientists, will be formed for Central/South America and Southeast Asia. Their role will be to guide the development of the integrated IGBP study in their particular regions. The groups will eventually merge into a single IGBP humid tropics study committee to cover the three pan-tropical regions. The GCTE Core Project Office will act as an interim coordinating node until the committee structure is established.

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Exchange of High Resolution Satellite Data CEOS/IGBP-DIS Pilot Project

The CEOS/IGBP-DIS Pilot Project was initiated at the Sixth Plenary of the Committee on Earth Observation Satellites (CEOS), in London in December 1992, in collaboration with IGBP-Data and Information System. Its objective is to assess the applicability of data exchange principles in support of global change research. One of the seven principles adopted at the sixth plenary clearly states that:

"Non discriminatory access to satellite data by all users for global change, climate and environmental research and monitoring, is essential. This should be achieved within the framework of the exchange and sharing mechanisms set up by CEOS members."

CEOS invited IGBP-DIS to propose a pilot project for data use by IGBP Core Projects, in which the applicability of this principle would be tested for exchange of high resolution data. The project also involves commercial considerations, especially in relation to data from Landsat, the Satellite pour l'Observation de la Terre (SPOT), the Marine Observation Satellite (MOS), European Remote Sensing Satellite (ERS), and the Japanese Earth Resources Satellite (JERS). The project has now been extended to include data from Indian Remote Sensing Satellite (IRS) as well.

This Pilot Project developed rapidly during this last year. Both the space agencies concerned and the IGBP scientists are eager for this project to succeed. The specific objectives of the Pilot Project are:

- (i) to ascertain what data are available from existing high spatial resolution satellite systems for global change research projects within IGBP;
- (ii) to assemble datasets from existing archives for selected IGBP Core Projects;
- (iii) to develop and implement a data acquisition model for acquiring new high resolution data sets to support selected IGBP Core Projects;
- (iv) to provide the global change research community with ready access to these data at the marginal cost of reproduction.

IGBP Data Requirements

In early 1993, IGBP-DIS solicited from the Core Projects their prioritised requirements of high resolution satellite data. The responses were coordinated by Will Steffen for Global Change and Terrestrial Ecosystems (GCTE), Hans-Jürgen Bolle for Biospheric Aspects of the Hydrological Cycle (BAHC), and David Skole for Land-Use/Cover Change (LUCC), the Global Change System for Analysis Research and Training (START) and Global Analysis, Integration and Modelling (GAIM). IGBP-DIS subsequently consolidated the data requirements for these Core Projects and Framework Activities into a document distributed in June 1993 to all CEOS members.

Satellite observations provide precise, quantitative data for measurement of deforestation and other forms of land-cover conversion, and for monitoring land-cover change generally. With the increased spatial resolution available from Landsat, SPOT, MOS, ERS, JERS, and IRS, it is possible to map and to measure precisely land-cover conversion, or provide local test-site data for calibration and validation of coarse resolution data.

For example, in the studies of the global carbon cycle, although we know that most of the recent increase in atmospheric carbon dioxide has been due to fossil fuel combustion, as much as one third is derived from land-cover conversion. In fact over the last 200 years the total release of carbon dioxide from land-cover conversion has been approximately equal to that from fossil fuels. The precise amount is uncertain. Estimates of the net flux of carbon from land cover change range from $0.4 - 2.5 \times 10^{15}$ gC yr⁻¹. Three factors contribute to this uncertainty: i) the rate of deforestation, particularly in the tropics, ii) the fate of deforested land (i.e., the amount of secondary forest regrowth and re-clearing) and iii) the stock of biomass and soil organic matter and the response of these variables to disturbance. The first two uncertainties are of deciding importance and could best be reduced with high resolution satellite data.

The use of high resolution data will be critical in answering the following questions for carbon cycle research:

- what is the rate of deforestation in the tropics?
- how much formerly forested land is in secondary succession, and how much deforested land is abandoned each year?
- how much forested land is logged, particularly in the temperate and boreal regions?
- how much land is burned each year?

These same measurements on land-cover conversion address the fluxes of trace gases such as N₂O, CH₄, CO and O₃, and help in improving estimates of the sources and sinks of the gases.

One type of study carried out by IGBP requiring high resolution data is one performed along a transect of a thousand kilometres or more of varying climate and/or ecosystem. For example, the North Australian Tropical Transect (NATT) is a research programme, extending from Darwin to Alice Springs, whose objectives are to determine the effects of soil and climatic variability, land management and global climate change on the savannas of Northern Australia. NATT takes advantage of the gradient of decreasing mean annual rainfall with increasing distance from the north coast of the Northern Territory. By conducting studies at varying levels of rainfall, a better understanding can be gained of ecological processes on a continental scale. A similar transect study is being conducted in West Africa. By comparing results from the two studies, the effects of vastly different human pressures will be seen.

Studies to be undertaken within the NATT programme include determination of land degradation within Australian tropical savannas, emissions of trace gases during fires, effects of land management on the water cycle, and the development of co-operative programmes with local land care groups and state and federal agencies where appropriate. The highest priority of data requirement for this project will be to obtain recent data sequences (over the last 2 years) across the transect using Landsat

or SPOT imagery. Also it will be important to have a long-term data base (approximately 20 years) over several sites to assist in time sequence analyses of ecosystem change. A combination of Landsat and SPOT measurements over the same site will allow analysis of the functional characteristics of vegetation cover.

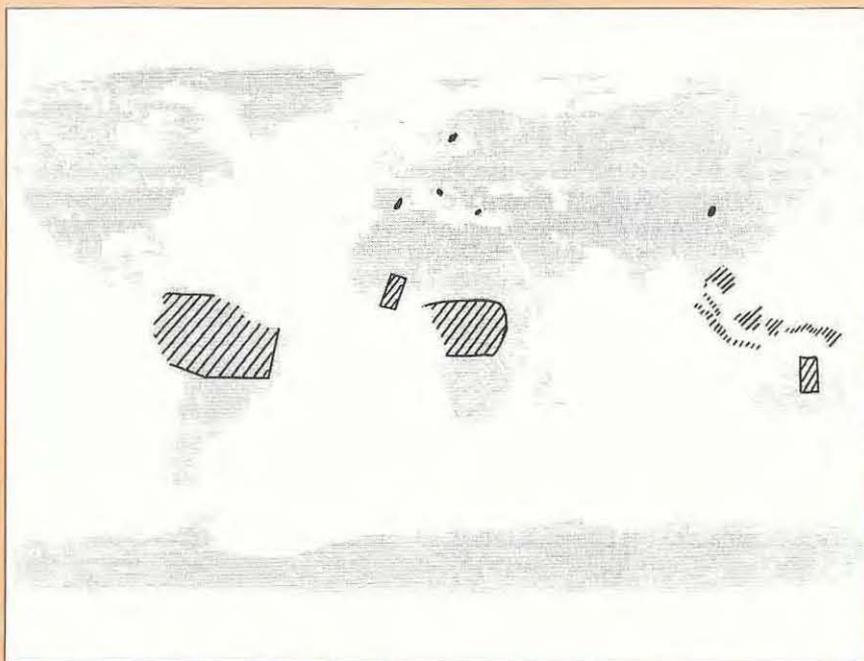
BAHC studies vegetation-water interaction on regional scales. This involves modelling of water and energy balance, scaling algorithms, measurements of vegetation-water interaction, and surface fluxes. To this end simultaneous satellite measurements are being conducted over several sites in Europe, North Africa, the USA, Russia, and China. The areas investigated are the size of a SPOT scene (60 x 60 km), and their study usually covers five months in a year starting during the 'green-up' phase and going to the 'dry-down' conditions of vegetation. Frequent coverage of the area by high resolution images are the highest priority requirements for this project.

The overall requirements for the CEOS/IGBP-DIS pilot project concerned two transects (Australia and West Africa), the tropical forests in Africa and South America, and several smaller sites in European coastal areas (the Mediterranean and the Baltic), and one inland site in China (see figure). The total estimate of data required is of the order of 100 scenes/year of SPOT-multispectral, 50/year of SPOT-panchromatic, 300 scenes/year of MOS and about 200 scenes/year of Landsat-thematic mapping. The period proposed is three years, starting 1993.

CEOS response

The replies from the space agencies were positive and encouraging. The proposed availability to selected global change researchers up to 400 thematic mapper scenes/year at the "copying" price of \$240/scene. The National Space Agency of Japan reported the availability of approximately 300 scenes/year of MOS-Multispectral Electronic Self-Scanning Radiometer data over East and Southeast Asia, which could be purchased at the cost of \$90/scene. The French Centre National d'Etudes Spatiales proposed a twofold arrangement to provide SPOT data to IGBP. First, some SPOT scenes could be made available at a special price (\$1200/multispectral; \$1500/panchromatic scene) through SPOT Image and its partner data-receiving stations. Second, partner contributions from the United Kingdom, Sweden, Belgium, Australia and the European Commission would enable the purchase of

High Resolution Data Coverage for CEOS/IGBP-DIS Pilot Project



Investigations chosen for the Pilot Project are 1) Tropical Deforestation and Regrowth in Brazil, Central Africa, and Southeast Asia, lead by David Skole (University of New Hampshire, USA); 2) Transect studies in Australia and West Africa, lead by Will Steffen (Canberra, Australia); 3) European and Chinese Field Studies, lead by Hans-Jürgen Bolle (Berlin, Germany) and Adriaan Van de Griend (Holland)

a 'limited number' of scenes at a special price of \$200/scene.

Late in 1993, discussions with the European Space Agency (ESA) and the Indian Satellite Research Organisation (ISRO) were also initiated. A request for SAR data from ERS-1 over tropical forests and North Australia has been very favourably received by ESA. ISRO has offered IGBP researchers access, at modest cost, to more than 10,000 scenes of Landsat-thematic mapper, and IRS 1 A and B archived in digital form at the ISRO Centre in Hyderabad, India.

Pilot Project Schedule

With the agreements all in place, we envision the following steps to successful completion of the project.

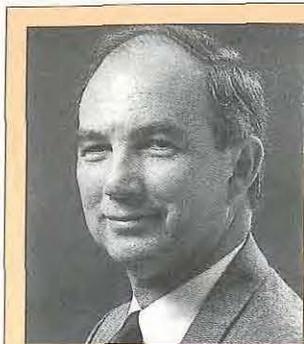
- Phase 1 - Definition (1993-1994): definition of common data format, identification of available data, precise definition of data required (location and number of scenes), framework for data access and distribution.
- Phase 2 - Execution (1993-1995): assemble existing (pre-1993) archived data, acquire new data (post-1994), distribute data to Core Project teams/data analysis.
- Phase 3 - Evaluation (1994-1996): analysis of data, scientific results, evaluation of project.

During these three phases, IGBP-DIS will provide co-ordination from the IGBP side of the Pilot Project, while CEOS provides co-ordination for all of the participating space agencies and data providers. IGBP-DIS is appointing a Working Group to monitor and track the development of the project. IGBP-DIS will ensure that the approach taken, and the ensuing activities of the Project, continue to enhance the goals of Global Change research within IGBP and help enhance the value of the high quality data acquired by the space agencies. An update on the activities and progress of the Pilot Project will be undertaken on a yearly basis at each of the CEOS Plenaries, culminating in a final assessment of the project in 1996.

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People with IGBP



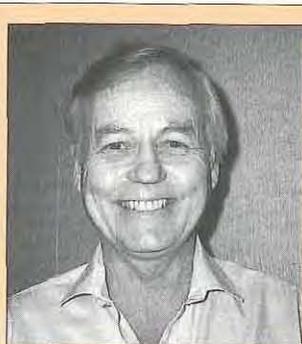
Gordon
McBean

Gordon A. McBean has been appointed Assistant Deputy Minister, Atmospheric Environment Service, Environment Canada, leaving the University of British Columbia where he was Professor of Atmospheric Sciences and Head of the Department of Oceanography.

Professor McBean also came to the end of his term as Chair of the Joint Scientific Committee (of the World Meteorological Organisation, the Intergovernmental Oceanographic Commission, and the International Council of Scientific Unions) for the World Climate Research Programme. The Chair of the JSC-WCRP is an *ex-officio* member of the Scientific Committee for the IGBP, and McBean will leave this committee as well, but still be part of the IGBP through his membership in the Board of Directors of the Canadian Global Change Programme.

Before joining the University of British Columbia, Professor McBean was senior scientist with Environment Canada, and Chairman of the WMO/Canadian Academy of Science working group on atmospheric boundary-layer problems. Professor McBean's major research field is on atmosphere-ocean interactions, the role of storms in climate, and oceanic heat and water balances. He is a fellow of the American and the Royal Meteorological Societies, and recently received the Patterson Medal, the highest Canadian award for distinguished service in meteorology.

The new Chair of the JSC-WCRP is **W. Lawrence Gates** who now joins the Scientific Committee for the IGBP. Professor Gates is the founding Director of the Program for Climate Model Diagnosis and Intercomparison at the Lawrence Livermore National Laboratory, Livermore, California. Gates has many years of experience with the IGBP: he became a mem-



Larry
Gates

ber of the IGBP Task Force on Global Analysis, Interpretation and Modelling in 1992, and was a member of the US Committee for an International Geosphere-Biosphere Program in the planning days before the IGBP was launched by ICSU in 1986.

Before joining the Lawrence Livermore National Laboratory Gates was Chairman of the Department of Atmospheric Sciences, Oregon State University in Corvallis, Oregon, and founding Director of the Climatic Research Institute, at the same university. His scientific background is in meteorology.

Gates has carried out many international and large-scale scientific planning activities similar to those of the WCRP and IGBP. To mention only a few, he was member and Co-Chairman (1973-1975) of the Panel on Climatic Variation of the US Committee for the Global Atmospheric Chemistry Project (GARP) at the National Academy of Sciences, and continued on the Climate Dynamics Panel of the US Committee for GARP in 1975-1981. He was member of the Climate Research Committee, Climate Research Board and Committee on Atmospheric Sciences, National Academy of Sciences from 1980-1983; founding editor in 1985 of *Climate Dynamics*, Chairman of the Steering Group on Global Climate Modelling of the WCRP, and since 1990 leader and organizer of the WCRP Atmospheric Model Intercomparison Project.

IGBP Secretariat

Thomas Rosswall, Executive Director of the IGBP, has accepted the post of Vice-Chancellor at the Swedish University of Agricultural Sciences in Uppsala, where he will assume his new duties on 1 July. The search for a new Executive Director has been initiated. We hope to be able to

announce the who the new Director will be, and bid a proper farewell to Professor Rosswall, in the June issue of the *Global Change Newsletter*.

In April **Risa H. Rosenberg** joins the staff at the IGBP Secretariat in Stockholm as Programme Officer. Dr. Rosenberg holds two bachelors degrees from the University of Pennsylvania, one in biology and the other involving anthropology/psychology studies. Since receiving her Ph.D. in Ecology and Evolutionary Biology at Cornell University, she has conducted research in a variety of venues: in Sweden (at the Department of Zoology, University of Stockholm, first under the auspices of the Fulbright Commission, then with the American-Scandinavian Foundation), Panama (associated with the Smithsonian Tropical Research Institute), and Australia (as staff member of the School of Biological Science, University of New South Wales).

Dr. Rosenberg has published papers in applied and theoretical ecology, population biology and genetics, behavioral ecology and conservation. In addition she has been involved in biodiversity, Global En-



Risa Rosenberg

vironmental Facility of UNDP issues, and conservation biology. Her diverse background covering both natural and behavioral sciences, will be an asset to the IGBP.

During 1994 both **June Barwick** (Assistant to the Executive Director) and **Lisa Cronqvist** (Assistant to the Deputy Exec-

utive Director) are on maternity leave, and are being replaced by **Cynthia Deaves**, originally from the UK, and **Magdalena Kanger**, from Sweden.

IGBP Framework Activities

IGBP-DIS

To reinforce coordination between the IGBP Data and Information System (IGBP-DIS), and other committees, members of IGBP Core Projects are joining the DIS Standing Committee. **Berrien Moore III**, Chair of the Task Force on Global Analysis, Interpretation and Modelling (GAIM), has recently joined the DIS Standing Committee, to enhance the clear interrelation between the two activities. Berrien Moore, a mathematician with experience in modelling, is Professor of Systems Research at the Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Durham, NH, USA.

Hugh Ducklow, JGOFS Core Project Scientist, at Woods Hole, Massachusetts, USA, is a new member of the IGBP-DIS Standing Committee. He also represents the JGOFS-SSC on the JGOFS Data Management Task Team. His background is in environmental engineering, but work with Lamont Doherty Earth Observatory (Columbia University, New York) led him to oceanography. His research interests are in marine microbial ecology, with emphasis on bacterioplankton carbon fluxes in estuarine, coastal and oceanic systems, and modelling of plankton dynamics.

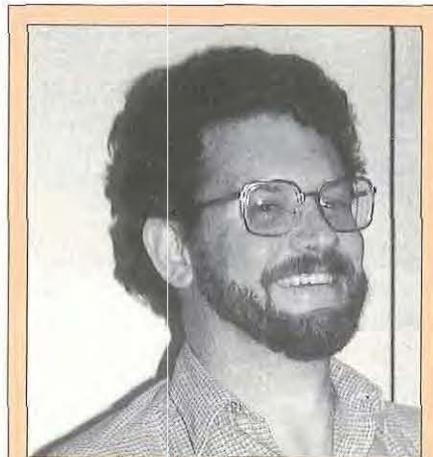
In July Ducklow will take up the position of Glucksman Professor of Marine Sciences at the Virginia Institute of Marine Sciences, College of William and Mary, Williamsburg, Virginia USA.

GAIM

Patrick Montfray is a name to add to the membership list of GAIM Task Force that appeared in the December 1993 issue of the Global Change Newsletter. Dr. Montfray is a research scientist at the Centre des Faibles Radioactivités, Laboratory for Climate and Environment Modelling of the National Centre for Scientific Research and the Atomic Energy Commission, Gif-sur-Yvette, France. His expertise is in carbon cycle modelling, atmospheric carbon dioxide monitoring, and isotopic constraints, including interactions with atmospheric and oceanic circulations.

START

Kazuhiko Takemoto has recently joined the Standing Committee of the Global Change System for Analysis, Research and Training. Dr. Takemoto is Director of the



Hugh Ducklow

Research and Information Office, Global Environment Department, Japan Environment Agency, Tokyo, where he works for global environmental research projects, and research and development of satellite monitoring sensors for the ozone layer. His background is in city planning and engineering (Tokyo University), and in international public policy (Johns Hopkins University). He also participates in the Intergovernmental Panel for Climate Change Working Group III, addressing interdisciplinary issues, particularly integrated socioeconomic analyses.

Dr. Takemoto is head of the Interim Secretariat for the Asia-Pacific Network for Global Change Research.

Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the body responsible for the scientific and technical assessment underlying the Framework Convention for Climate Change agreed in Rio de Janeiro in June 1992. The IPCC was created in 1988 by the United Nations Environment Programme and the World Meteorological Organisation. It is partly financed by these organisations, and partly by voluntary contributions from various countries.

The Chair of the IPCC is **Bert Bolin**. Professor Bolin was actively involved in the initial planning and implementation of the IGBP, from the time he chaired the *ad hoc* planning for the IGBP during 1984-1986, and through his terms as Vice-Chair of the Special Committee for the IGBP, and its successor the Scientific Committee for the IGBP, from 1987 to 1992.

The task of the IPCC is carried out by three Working Groups, of which Working Group I is concerned with the Scientific Assessment of Climate Change. Working Group I published its first assessment in 1990, with an update in 1992. In order to make preparations for its next assessment, due in September 1995, the group met in Shepperton (UK) in early December last year. Several points of relevance to IGBP scientists came out of the discussions.

The structure of the 1995 report will be similar in many respects to the earlier assessments, but obviously updated using the most recent information. Many IGBP scientists are involved in writing the cen-

tral chapters covering topics such as The Carbon Cycle, Trace Gases, Aerosols, Radiative Forcing, Climate Variability and Change, Climate Processes and Models, Sea-Level Change, and Detection of Climate Change.

Of particular interest are two chapters on Responses to Environmental Change, and Feedbacks to Climate of the Terrestrial and the Marine Biosphere. In contrast to the earlier assessments, this time the marine and terrestrial biospheres will have separate chapters, and IGBP scientists will be heavily involved in their preparation. Finally, the chapter called Narrowing the Uncertainties in the 1990 report, will now be called Advancing our Understanding, and once again it will be principally authored by the Chairs of the Scientific Committees of the WCRP and the IGBP.

The Working Group I Support Unit is located at the Meteorological Office, Hadley Climate Centre, Bracknell, UK. It is headed by **Bruce Callander**.

Working Group II addresses the impacts of climate change and the means for mitigation and adaptation. The Support Unit is located at the Office of the US Global Change Research Program, in Washington, DC, where it is headed by **Richard H. Moss**. For two years prior to heading the WG II Support Unit, Dr. Moss was programme officer at the IGBP Secretariat, ensuring the liaison between the Human Dimensions of Global Environmental Change Programme and the IGBP.

Land-Surface Experiments IGBP/WCRP Joint Working Group

The Joint Scientific Committee for the World Climate Research Programme (JRC-WCRP) and the Scientific Committee for the IGBP (SC-IGBP) consider it especially important to develop multi-disciplinary participation in major field studies of land-surface processes planned and implemented by the Global Energy and Water Cycle Experiment (GEWEX), the International Satellite Land-Surface Climatology Project (ISLSCP), Biospheric Aspects of the Hydrological Cycle (BAHC), Global Change and Terrestrial Ecosystems (GCTE), and the International Global Atmospheric Chemistry Project (IGAC). In order to facilitate such



cooperation, they have agreed to reconstitute the joint IGBP-WCRP Working Group on Land-Surface Experiments, with a broader membership and with the following terms of reference:

1. To advise the Joint Scientific Committee of the WCRP and the Scientific Committee for the IGBP on priorities for, and the design of, land-surface field studies on scales of 10 x 10 up to 300 x 300 km, involving both *in situ* and remotely sensed observations of the atmospheric boundary layer, terrestrial hydrology, vegetation and soils.
2. To promote multi-disciplinary participation in land-surface process studies planned by WCRP and IGBP, beginning with GEWEX (ISLSCP), BAHC, GCTE and IGAC, and organize the collaboration of scientific teams interested in participating in these studies.
3. To prepare documents describing the planned experiments for distribution by WCRP and IGBP to scientists interested in participating in these experiments, in order to serve the second objective above.
4. To facilitate the exchange of information among groups of scientists involved in such experiments and the dissemination of results to the wider global change and climate research community, through the formulation of protocols and delivery schedules of data from each experiment.

The members of the Working Group have been appointed for an initial period of two years. They are:

Chair

William J. Shuttleworth, Department of Hydrology and Water Resources, University of Arizona at Tucson, USA. Professor Shuttleworth's field of expertise is in land-surface processes experimentation and modelling on different scales. He is the initiator of experimental campaigns in the tropics, and other large-scale experiments on land-surface atmosphere interaction.

Members representing WCRP

Ann Henderson-Sellers, School of Earth

Sciences, Macquarie University, North Ryde, Australia. Professor Henderson-Sellers directs the Climate Impact Centre, and is professor of physical geography. Her numerous research interests include climatology, numerical modelling and monitoring at a global scale of the atmosphere, hydrosphere, cryosphere, land surfaces and the biosphere. She is also a member of the SC-IGBP.

Piers Sellers, Hydrological Sciences Branch, National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland, USA. Dr. Sellers's expertise is in modelling energy and water fluxes at the land-surface atmosphere interface, in particular in global circulation models.

Members representing IGBP

Robert C. Harriss, Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Durham, NH, USA. Professor of Earth Sciences and Natural Resources, with a 15-year experience with NASA including the Global Tropospheric Experiment, and research and teaching interests in energy and environmental research and policy, remote sensing, natural hazards and conflict resolution. Representing IGAC.

Anne M. Jochum, The German Aerospace Research Establishment, Institute of Atmospheric Physics, Oberpfaffenhofen, Germany. Dr. Jochum is Head of Atmospheric Instrumentation Division, and her research interests are air-borne geoscience and scale aggregation of fluxes in the atmospheric boundary layer. Representing BAHC.

John D. Tenhunen, University of Bayreuth, Germany. Professor and Chair, Plant Ecology, Bayreuther Institute of Terrestrial Ecosystem Research. Recent research covers the development of physically based models of forest gas exchange at small watershed scale, material exchange processes, and quantitative description of gas exchange, at the vegetation/atmosphere interface. Representing GCTE.

Regional Research Networks

The Mediterranean Basin: Planning for a Regional Research Network

A START Planning Committee for the Mediterranean (MEDCOM) has just been established as a result of the recommendations of the Workshop on "Africa and Global Change" held in Niamey (Niger) in November 1992 (see IGBP Report 29).

The first meeting of MEDCOM took place in Toulouse, France, on 8-9 November, 1993. MEDCOM members received up-to-date information on recent events concerning START, MEDIAS (the Toulouse-based Regional Research Network for the Mediterranean Basin and Subtropical Africa, who hosted the meeting), the European Community ENRICH programme, and national programmes of relevance in the countries represented in the Committee (Algeria, Bulgaria, Egypt, France, Greece, Israel, Italy, Spain, Tunisia, Turkey; in addition, Morocco and Portugal will be invited to join.)

The main outcome of the MEDCOM meeting was the definition of a draft work programme based on the discussion of major scientific issues of relevance for the Mediterranean region in relation to the

research plans of IGBP, WCRP and HDP. These are: (i) reconstruction of palaeoclimates; (ii) modelling of weather patterns and their evolution; (iii) availability and quality of water; (iv) land degradation and desertification processes; (v) impacts of changes in climate and atmosphere composition on natural and agricultural systems; (vi) marine and oceanic processes; (vii) assessment of changes in biodiversity; (ix) effect of forest fires and desert dust; and (x) regional issues of sustainable development.

In order to define these scientific objectives, and to define specific projects that may be approached in a spirit of regional cooperation, MEDCOM proposes to organise a large regional workshop with international participation. Other dedicated workshops on issues such as the need to establish networks of observing stations along transects from the Mediterranean to the desert, or the need to access or develop regional data bases, are also envisioned.

MEDCOM will identify potential Regional Research Sites, in collaboration with National IGBP Committees, build directories and catalogues of scientists, institutions and projects of relevance to global change in the MED region using national or international sources, and identify national needs for capacity building and training. The interim MEDCOM secretariat is at MEDIAS, in Toulouse.

The participants elected Professor M. A. Ayyad (Egypt) and Dr. J.-L. Fellous as Co-Chairs of MEDCOM, and decided to hold the next meeting in Alexandria in September.

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Jean-Louis Fellous, MEDIAS-FRANCE, Centre National des Etudes Spatiales, 18 avenue Edouard-Belin, BP 2102, F-31055 Toulouse Cedex, France. Tel: (+33) 61 28 26 67, Telex: 531 081 f, Fax: (+33) 61 28 29 05, E-mail: J.Fellous (Omnet) fellous@cnesta.span.cnes.fr

Temperate East Asia

The second meeting of the START Regional Committee for Temperate East Asia (TEACOM) was convened at the United Nations University (UNU) in Tokyo, on 16-17 January 1994, under the joint sponsorship of the Japan National IGBP Committee, START, and the UNU.

One of the major tasks of this meeting was the report by participating members of preliminary inventories of national interests and capabilities in global change research. The reports covered the priority global change research topics, major institutions and key individual scientists in-



At the MEDCOM meeting:
from left to right:
M. Brini (Tunisia),
V. Sharov (Bulgaria),
Y. Djellouli (Algeria),
R. Rockwell (USA; START
Standing Committee),
S. Geraci (Italy),
J.-L. Fellous (France;
MEDIAS),
M. Ayyad (Egypt),
A. Konan-Brou (Côte
d'Ivoire; NAFCOM Liaison),
A. Carrière (MEDIAS), D.
Yaalon (Israel),
J. M. Moreno (Spain),
V. Tritakis (Greece)

involved in global change research, institutions and facilities that could be suitable for *START training activities, and data management and monitoring.*

It was agreed to make a survey of the ongoing projects and those being planned in the Temperate East Asia region, and to discuss the possible role of TEACOM in them at the next meeting.

The following steps were decided:

- Establish the first version of the TEA regional inventory by mid-July
- Hold the next TEACOM meeting in Ulaanbaatar on 1-4 August 1994. TEACOM will then consider a proposal on the establishment of a *START Regional Research Network* that will be submitted to *START*, with a request for help in the search for funding
- Arrange the first Global Change School "Frontiers of Global Change Science" in Beijing, 6-12 August, 1994, in collaboration with the Pacific Science Association Task Force for Global Environmental Change
- Establish an interim TEACOM Secretariat at the Chinese Academy of Sciences in Beijing. A rotating chairmanship system was suggested, with the terms running in the interim period between TEACOM meetings. M. Badarch (Mongolia) will serve as the TEACOM Interim Chair.
- The UNU expressed strong support for the TEACOM regional training action. A course, sponsored by the UNU and UNESCO, on the application of satellite data and information to global change research, with a focus on land cover and land use, is planned for March 1995.
- To ensure Links to *START* regions, a joint TEACOM, Southeast Asia Committee for *START* (SARCS), and South Asian Regional Committee for *START* (SASCOM) meeting focusing on monsoon-driven ecosystems will be held in 1995.

Conghin Fu, Laboratory of Climate Research (LCR), Institute of Atmospheric Physics, Chinese Academy of Sciences, PO Box 2718, Zhongguancun, Beijing 100080, China. Tel: (+86-1) 256 2458, Telex: (850) 22474 aschi cn, Fax: (+86-1) 256 2458

An Asia-Pacific Regional Network

Delegates from Australia, the People's Republic of China, India, Indonesia, Japan, the Republic of Korea, Malaysia, Pa-

kistan, New Zealand, the Philippines and Thailand gathered in Tokyo for the second intergovernmental workshop to consider the establishment of an Asia-Pacific Network for Global Change Research (APN). Delegates from international global change network initiatives attended as observers, representing IGBP, *START*, the Inter American Institute for Global Change Research (IAI), and the European Network for Research in Global Change (ENRICH).

Rationale

The Asia-Pacific region has more than half of the world's total population and its rate of economic growth is the highest of any region in the world. This region also contributes to global change in a major way. Global change, in turn, will impact both ecosystems and socio-economic activities in the region, and a better knowledge base is necessary to identify strategy options for sustainable development.

At the first workshop of the APN in December 1992, it was recognized that it is necessary to advance scientific knowledge in the Asia-Pacific region to address global change issues, and that "links among the global change research institutes should be improved in the Asia-Pacific region as a vehicle for comprehensive global change research of the region, and for smooth and effective regional cooperation on the issue. This can be implemented by support of existing regional networks and by progress toward a broader Asia-Pacific network."

Global change research can be referred to as 'decentralised mega-science', which requires international cooperation. The international scientific community has developed three major research programmes addressing the need to reduce scientific uncertainties related to global environmental change: the World Climate Research Programme (since 1980), the International Geosphere-Biosphere Programme (since 1986), and the Human Dimensions of Global Environmental Change Programme (HDP, since 1990). These programmes, together with other international scientific initiatives, provide a coherent framework for global change research collaboration.

The three programmes have developed plans for capacity building and strengthened research on regional contributions to and impacts from global change through the Global Change System for Analysis, Research and Training (*START*). Governments have realised the importance of promoting regional networks for global change research that will provide essential support for research, capacity building, and exchange of information. The IAI, ENRICH, and APN would be expected to provide

necessary governmental support to the scientific process of reducing uncertainties related to global environmental change.

In the development of regional initiatives, it is essential that these build on national programmes and priorities. Research efforts at the national level with strong coordination and harmonization are particularly important. National committees or other appropriate arrangements provide focal points in the scientific communities, but appropriate modalities need to be developed at the national level to ensure that proper consideration is given to collaborative activities among HDP, IGBP and WCRP and with other relevant activities, including those of the UN system.

Governments have also established national bodies to provide advice for policy development related to global change. Appropriate mechanisms for interaction between governmental bodies and the scientific community at the national level will facilitate the development of regional collaboration and participation in the international programmes.

General Principles

The second APN workshop developed some general principles that should guide the further development of the APN concept.

- (1) promotion of regional cooperation in global change research on issues which are either particularly relevant to the region, or which correspond to regional impacts of truly global phenomena; to encourage interdisciplinary research and to give priority to activities which no single state or institution can perform efficiently in an isolated way; to reinforce solidarity and coherence in the region in dealing collectively with problems of mutual interest;
- (2) standardization, collection, analysis and exchange of scientific data relevant for global change research;
- (3) improvement of scientific and technical capabilities and research infrastructure of nations in the region;
- (4) promotion of cooperation with research networks in other regions; and
- (5) development of appropriate mechanisms for transfer of technology and technical know-how in recognition of the recommendations of AGENDA 21 of UNCED.

Future Tasks

The delegates agreed that two working groups should be organized with members representing all countries and regional research networks in the region that wish to participate in the further development of the APN.

The first working group will identify specific areas of global change research programme activities important to the region, which could be strengthened through the APN. Items for consideration for this working group will be:

- (a) defining the scope of global change research relevant to the APN
- (b) reviewing the current state of global change research and observation in the Asia-Pacific region and research topics member countries would like the APN to focus on;
- (c) identifying the components of global change research within the international programmes of IGBP, WCRP, HDP, and of associated networking initiatives of START that are relevant to the APN;
- (d) identifying priority research topics for the APN; and
- (e) deciding a schedule for the implementation of these activities.

The second working group will recommend appropriate organizational structures and procedures required to fulfil the objectives of the APN, bearing in mind the existing intergovernmental and non-governmental structures in the region.

Items for consideration by the second working group will include:

- (a) mechanisms to ensure appropriate support to regional and interdisciplinary research projects;
- (b) measures to improve research capabilities in the Asia-Pacific region;
- (c) mechanisms for compilation, management, dissemination and use of relevant regional land global datasets;
- (d) a framework to support regional synthesis and scientific assessment of relevance to policy development;
- (e) other structures or procedures needed to accomplish the APN objectives and tasks.

Members of these two working groups would consist of nominated representatives of participating countries, and of representatives of the regional research networks of START (HDP/IGBP/WCRP).

Both working groups shall report to the third APN Workshop with their recommendations. This workshop will be held in approximately a year's time (early 1995) to discuss future action on APN for the governments of the region.

Kazuhiko Takemoto, Director of the Research and Information Office, Global Environment Department, Japan Environment Agency, 1-2-2 Ksumigasaki Chiyoda-ku, Tokyo 100, Japan. Fax: (+81-3) 3504 1634

Global Change and the Antarctic

At its 22nd biannual meeting in 1992, the Scientific Committee on Antarctic Research (SCAR, a scientific committee of ICSU), recognising that global change research in the Antarctic has unique aspects that require special attention, established a new Group of Specialists on Global Change and the Antarctic (GoS/GLOCHANT) to guide its global change activities.

This action was taken after a lengthy development of the report "The Role of the Antarctic in Global Change: An International Plan for a Regional Research Programme", published by SCAR in 1993. The GoS was charged by SCAR with four responsibilities: i) to provide linkages and communication within SCAR; ii) to provide liaison between SCAR and the major international programmes on global change; iii) to plan and implement a regional programme of global change research in the Antarctic; and iv) to recommend a management structure to implement a co-ordinated programme on global change research in the Antarctic.

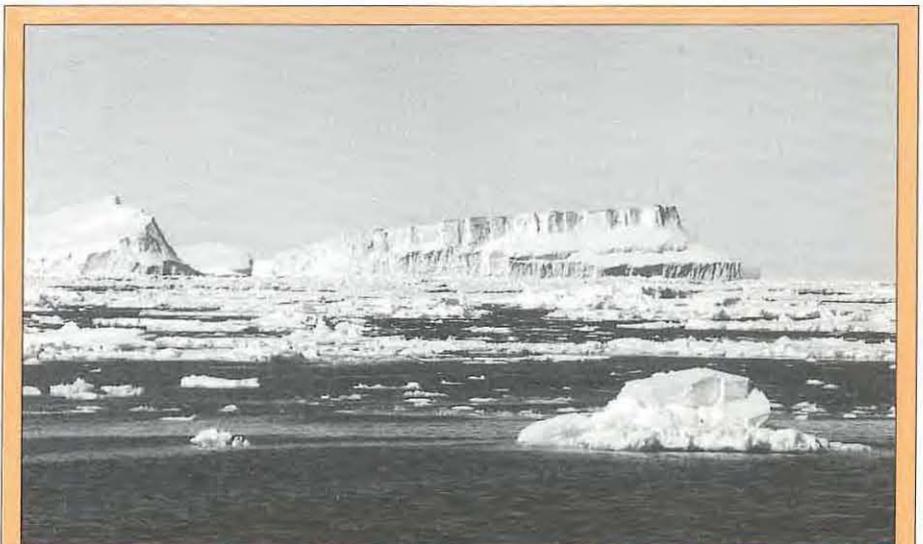
The GLOCHANT group held its first meeting in Cambridge (UK) in February, 1993. The main business of the meeting was first to review ongoing and planned activities of the many international programmes and projects that involve Antarctic research, particularly those of IGBP and WCRP, and then to produce a plan for furthering research in the Antarctic (the

continent and the surrounding ocean) on subjects important to understanding and predicting global change. Individual GLOCHANT members were assigned responsibility for liaison with the various programmes.

Planning and Co-ordination Groups

The group decided to establish sub-groups to plan future actions in particular areas. These comprise five Planning Groups: PG 1: The Sea-Ice Zone, PG 2: Global Palaeoenvironmental Records from the Antarctic Ice Sheet and Marine & Land Sediments, PG 3: Antarctic Mass Balance and Sea Level, PG 4: Trace Gases, Aerosol Particles, and UV Radiation in the Antarctic Atmosphere, and PG 5: Biogeochemical Cycles; and two Co-ordination Groups, one on Data and one on Numerical Modelling. Planning Groups differ from Co-ordination Groups in that the former are concerned with activities physically based in the Antarctic and must therefore include direct co-ordination with the operators of national Antarctic programmes.

The membership of the first three Planning Groups, which all have strong ice-related emphases, was completed in time for them to meet during the Fifth International Symposium on Antarctic Glaciology last September, also in Cambridge (UK). Each group identified a topic for first attention. Planning Group 1 will address the understanding and modelling of the role of



The mass balance of the Antarctic ice-sheet is one of the GLOCHANT areas of study

sea ice in the coupled atmosphere-ice-biota-ocean system; Planning Group 2 will first concentrate on ice-core drilling, and Planning Group 3 seeks first to determine the present-day mass balance of the ice sheet. Constitution of the other Groups is now also virtually complete; Planning Group 5 will take as its topic for first attention the determination of the present and past annual primary production of the Southern Ocean.

At the meeting of the IGBP Past Global Changes (PAGES) Scientific Steering Committee in October 1993, attended by the GLOCHANT convenor, an agreement was reached to ask the GLOCHANT planning group on palaeoenvironmental records to provide, on behalf of both PAGES and SCAR, detailed co-ordination between the several countries with plans for deep ice-core drilling. Consequently, the palaeoenvironmental records group met with representatives from these countries in Col de Porte (Grenoble, France) in February of this year, and laid out a framework for the development of a specific co-ordination plan.

Regional Antarctic Research Centre

At the beginning of that same week in February, GLOCHANT held its second annual meeting, also in Col de Porte. A major focus was to establish a GLOCHANT Regional Research Centre, with the hope that it can develop in an appropriate way and eventually become the START Regional Research Centre (RRC) for the Antarctic region. These deliberations were aided immeasurably by the participation in the whole meeting of Neil Swanberg, Deputy Executive Director of the IGBP.

If plans go forward without undue delay, the group expects that the GLOCHANT RRC will be in operation next autumn. It also expects that by then there will be established a Special Fund, to which national Antarctic operators and other organisations interested in global change research will be encouraged to make voluntary contribution, and which will be used primarily to support the meetings and workshops of the GoS and its Planning and Co-ordination Groups.

Unique Antarctic Programmes

The GoS/GLOCHANT is aware of some concern in the scientific community that GLOCHANT activities will duplicate or compete with other programmes and projects that have Antarctic components. Nothing could be further from the group's intention. The GoS takes it as its first order of business to keep well informed about other programmes and to act as a co-ordina-

tor between them and SCAR activities to the enhancement of both; the joint work with PAGES on deep ice-core drilling is a case in point. Only where a gap in scientific coverage is identified will a new programme or project be recommended to SCAR.

For example, members of the GoS are deeply involved in the work of Southern Ocean JGOFS, Southern Ocean GLOBEC, and the SCAR programme on the Ecology of the Antarctic Sea-Ice Zone, which is designed to be complementary to the JGOFS and GLOBEC Southern Ocean projects. The GoS sees a possible role in helping to co-ordinate the activities of these projects, but it does not plan to develop

new programmes in these areas. On the other hand, there is no international programme designed to determine the mass balance of the Antarctic ice sheet; the GoS/GLOCHANT will develop one to fill that gap.

The next meeting of the GoS/GLOCHANT is provisionally planned for Tokyo in April, 1995.

Charles R. Bentley, Convenor, SCAR GoS/GLOCHANT, and SCAR Liaison to the IGBP, Geophysical and Polar Research Center, University of Wisconsin-Madison, Lewis G. Weeks Hall for Geological Sciences, 1215 W. Dayton Street, Madison, Wisconsin 53706-1691, USA. E-mail: bentley@geology.wisc.edu

JGOFS Training Course: Flux Monitoring in the Indian Ocean

The JGOFS Implementation Plan (IGBP Report No. 23, 1992) calls for a Process Study in the North-Western Indian Ocean in 1994/1995. This process study is prepared by the JGOFS Planning Group for the Indian Ocean, which has met four times in the last three years. One proposal of this international group was to facilitate training courses especially for young scientists from countries bordering the Indian Ocean.

At the initiative of Prof. Bernd Zeitzschel, Leader of the JGOFS Indian Ocean Planning Group, and the JGOFS

Core Project Office in Kiel (Germany), this proposal was submitted and accepted as a contribution of the German government to the Intergovernmental Oceanic Commission (IOC) Trust Fund. The course, organized by Dr. Kitazawa of IOC, in collaboration with the national IOC committee of Germany and the Kenyan National Commission for UNESCO, was held in Mombasa, Kenya from 15-27 November 1993.

The Director of the Kenya Marine and Fisheries Research Institute in Mombasa, Dr. Ezekiel Okemwa, was the local host,



Trainees, lecturers, and members of the JGOFS team at the JGOFS Training Course on Flux Monitoring in the Indian Ocean, Mombasa (Kenya), November 1993.

and the two-week course was held in cooperation with his Institute. The course consisted first of collecting samples and data during a half-day research cruise, followed by exercises and laboratory analysis, lectures and discussions.

The course was designed to introduce scientists of the region to the Joint Global Ocean Flux Study itself, to test the JGOFS Core Measurement Protocols to see whether they would be useful for developing countries, and to acquaint the scientists with current scientific and technical knowledge. Thirteen trainees were selected from Egypt, India, Kenya, Madagascar, Maldives, Nigeria, Sri Lanka and Tanzania.

The team of lecturers consisted of Bernd Zeitzschel (Germany), Martien Baars (Netherlands), Peter Burkill (UK), and Uli Wolf (Germany), and additionally of the members of the JGOFS Indian Ocean Planning Group who held a meeting halfway through the course. The trainees were invited to attend this international meeting to be involved in the planning of the process study at a relatively early stage.

The participants were introduced to advanced oceanographic techniques and the ways in which they were to be applied in the upcoming JGOFS-Arabian Sea studies. The instructors, on the other hand, were reminded that the core measurement protocols used in JGOFS cruises assume the availability of laboratories equipped with up-to-date instruments and access to well-equipped ocean-going research vessels. We learned that these assumptions are not necessarily realistic for research in many of the developing nations, including several countries bordering the Indian Ocean.

Many basic JGOFS observations, however, do not require elaborate equipment. One of the goals of the training course was to inspire scientists of the region to inaugurate programmes of basic measurements in their local waters.

To foster the partnership in science during the Arabian Sea process study, bunks on research vessels from Germany, India, the UK and USA should be made available to accommodate scientists from that area.

An additional possibility to obtain significant participation of regional scientists would be to charter a sea-going research vessel for an appropriate time period to provide these motivated colleagues a chance to plan and to run their own expedition as part of the JGOFS Arabian Sea process study. Suggestions are highly welcome.

Bernd Zeitzschel, Institut für Meereskunde, Düsternbrookweg 20, D-24105 Kiel, Germany. Tel: (+49-431) 597 3860, Fax: (+49-431) 565 876, E-mail: B.Zeitzschel (Omnet)

Elevated CO₂ Project in New Zealand Forest Ecosystem

The global atmospheric concentrations of carbon dioxide (CO₂) and other greenhouse gases are increasing, which may result in climate change. The productivity of New Zealand's forests and the distribution of native forests are expected to be affected significantly by the predicted changes. However, large-scale planting of forests offers the potential to offset the increase in CO₂ concentration by the uptake and storage of carbon.

The New Zealand Forest Research Institute and Landcare Research have set up a unique, long-term collaborative research project to determine the effects of increased CO₂ concentration and temperature on the uptake and storage of carbon by forest ecosystems. The project also will provide information about the processes of tree growth, productivity, and wood quality in the future climate. This research is one of 37 official contributions to GCIE Core Research.

Radiata pine and red beech trees will be grown for up to four years in 16 large open-top chambers, in which the CO₂ concentration and temperature will be maintained at today's conditions, or increased to simulate the conditions predicted for the end of the next century.

Each open-top chamber consists of an aluminium framework, 4.5 m tall and 3.6 m in diameter. A large fan forces air into a

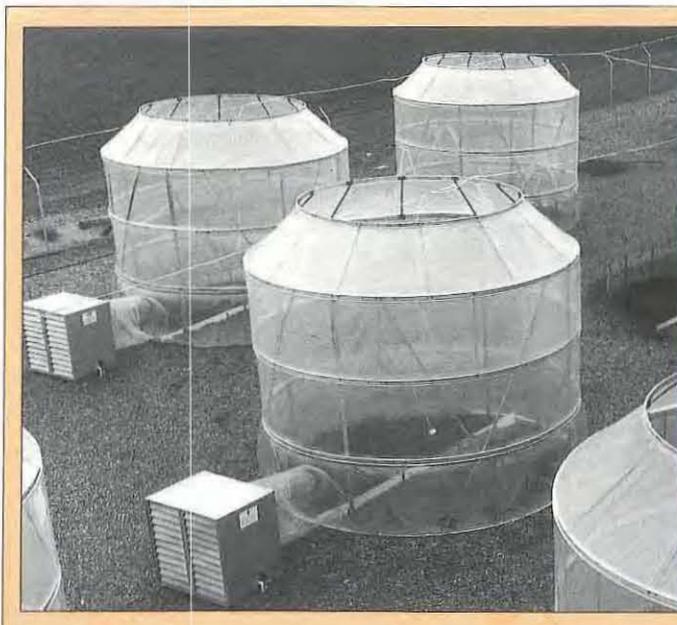
double-walled section at the base of the chamber, where the air is mixed and passed through holes into the chamber and out the top. The sloping section at the top narrows the air flow out of the chamber and limits the intrusion of outside air. The top is open, so the trees grow in conditions as close to those in the natural environment as possible.

The trees will be planted as young seedlings and grown until they fill the chambers. Some of the radiata pine have been cloned from 8-year old trees, and these will behave as if they were mature trees.

A large quantity of CO₂ is required to maintain the increased concentration in the chambers. The project is being set up adjacent to the Christchurch City Council's Wastewater Treatment Works, where CO₂ is being separated from waste biogas. After one year of setting up, the project begins in October 1994.

International collaboration has been important in setting up this project. The chambers have been provided by the USDA Forest Service and we have continuing links with research groups in the USA, Germany, UK and Japan. This work is funded by the Foundation for Research, Science and Technology and the Christchurch City Council has provided the land and the source of CO₂.

David Whitehead, Landcare Research, PO Box 31001, Christchurch, New Zealand



Open-top chambers, in which the CO₂ concentration and temperature will be maintained at today's conditions, or increased to simulate the conditions predicted for the end of the next century. A New Zealand research project to determine the effects of increased carbon dioxide on the uptake and storage of carbon by forest ecosystems.

IGBP Meetings

1994

21-25 March, Chiang Mai, Thailand
Southeast Asia Regional Committee for START (SARCS) Workshop to develop methodologies for studies of land-use/cover change.

28 March-1 April, Bilthoven, Netherlands
Application of Forest Stand Models to Evaluate Global Change Issues. Dr. Thomas M. Smith, GCTE Focus 2 Office, Department of Environmental Sciences, University of Virginia, Clark Hall, Charlottesville, VA 22903, USA. Tel: (+1-804) 924 7642; Fax: (+1-804) 982 2137

29-30 March, Amsterdam, Netherlands
LOICZ Focus 4 Workshop: Economic and Social Impacts on Global Change on Coastal Systems

29-31 March, Paris, France
GCTE Workshop on Soil Degradation under Global Change

8-10 April, Accra, Ghana
Second Meeting of the Northern Africa Regional Committee for START (NAFCOM). Prof. Ebenezer Laing, NAFCOM Secretariat, Ghana Academy of Arts and Sciences, Airport Residential Area off Agostino Neto Road, Accra, Ghana. Tel: (+233-21) 777 651/4, Fax: (+233-21) 777 655

9-12 April, Beijing, China
PAGES PEP II Symposium and Workshop: Changes in palaeoclimate and palaeoenvironment in the last 200,000 years along Pole-Equator-Pole: Arctic, Asia, Australia and Antarctica. Bob Wasson, Division of Water Resources, CSIRO, GPO Box 1666, Canberra, ACT 2601, Australia. Tel: (+61-6) 246 4911, Fax: (+61-6) 246 5800, or Liu Tungsheng, Institute of Geology, Academia Sinica, PO Box 634, Beijing 100011, China. Tel: (+86-1) 202 7766, Fax: (+86-1) 491 9140

11-15 April, Philippines
SARCS Workshop to develop methodology for assessing greenhouse gas emissions

13-14 April, Beijing, China
PAGES Executive Committee Meeting. Dr. Herman Zimmerman, Division of Atmospheric Sciences, Rm. 775, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA, 22230, USA. Tel: (+1-703) 306 1527; Fax: (+1-703) 306 0377.

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

2-6 May, Strasbourg, France
LOICZ Workshop: Databases on Riverine Inputs to the Coastal Zone. John Milliman, School of Marine Sciences, College of William and Mary, P.O. Box 1346, Gloucester Point, VA 23062-1346, USA. Tel: (+1-804) 642 7105, Fax: (+1-804) 642 7009, E-mail: J.Milliman (Omnet)

2-13 May, Mordialloc, Australia
SARCS Training Course on General Circulation Models

4-6 May, Townsville, Australia
LOICZ Focus 2 Workshop on Mangrove biogeomorphology

5-6 May, Washington, DC, USA
PAGES Abrupt Climate Change planning meeting

9-11 May, Jakarta, Indonesia
SARCS and Netherlands Foundation for the Advancement of Tropical Research (WOTRO) Workshop on Coastal Zone Research in Southeast Asia. Dr. Anugerah Nontji, Director Research and Development Centre for Oceanology, PO Box 4801, JKTF Jakarta 11048, Tel: (+62-21) 683 850, Fax: (+62-21) 681 948, or Dr. Renée Van Kessel-Hagesteijn, Secretary General WOTRO, PO Box 93128, NL 2509 AC The Hague, The Netherlands

9-13 May, Lund, Sweden
PAGES/GCTE/DIS Workshop on Palaeovegetation Mapping: the Last Glacial Maximum to Present. Dr. I. Colin Prentice, Sweden, Tel: (+46-46) 10 41 76; Fax: (+46-46) 10 44 23, or Dr. Thompson Webb, USA, Tel: (+1-401) 863 3128; Fax: (+1-401) 863-2058)

9-13 May, Nairobi, Kenya
GCTE Planning workshop on complex agro-ecosystems

15-19 May, Wageningen, The Netherlands
GCTE Potato Network Inauguration

17-20 May, Raleigh, North Carolina, USA
GCTE Workshop on Design and Methodology for a Network of Intensive Forest Experiments

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

30 May-1 June, Roscoff, France
JGOFS North Atlantic Planning Group. Richard Lampitt, Institute of Oceanographic Sciences, Deacon Laboratory, Brook Road, Wormley, Godalming, Surrey GU8 5UB, United Kingdom. Tel: (+44-428) 684 141, Fax: (+44-428) 683824, E-mail: rsl@unixa.ncrc-wormley.ac.uk

6-7 June, Canberra, Australia
PAGES Pole-Equator-Pole Executive Committee planning meeting. Bob Wasson, Division of Water Resources, CSIRO, GPO Box 1666, Canberra ACT 2601, Australia. Tel: (+61-6) 246 4911, Fax: (+61-6) 246 5899, E-mail: hut94@cbr.dwr.csiro.au

6-10 June, Texel, Netherlands
LOICZ Scientific Steering Committee

8-10 June, Canberra, Australia
PAGES Scientific Steering Committee

15-18 June, Kyoto, Japan
Land-Use/Cover Change Core Project Planning Committee.

17-19 June, Singapore
SARCS Workshop on Socio-Economic Research Agenda for Global Change

25-27 June, Karlsruhe, Germany
BAHC Workshop on Evaluation of Downscaling Methods, in conjunction with the UNESCO International Symposium on Water Resources Planning in a Changing World. Ephrat Lahmer-Naim, BAHC Core Project Office, Institute for Meteorology, Freie Universität Berlin, Carl-Heinrich-Becker-Weg 6-10, D-12165 Berlin, Germany. Fax: (+49-30) 838-711 85

4-8 July, Gaborone, Botswana UPDATE
START Southern African Regional Workshop. Prof. Z. Kasomekera, SAFCOM Secretariat, Bunda College of Agriculture, University of Malawi, Box 219,

Lilongwe, Malawi. Tel: (+265) 277 222, Telex: 43622 mi, Fax: (265) 277 364/251 and M. B. Sekhwele, National Institute of Developmental Research and Documentation (NIR), University of Botswana, Private Bag 0022, Gaborone, Botswana. Tel: (+267) 35 63 64, Fax: (+267) 35 75 73, or 35 65 91

6-8 July, Potsdam, Germany
GAIM/IGBP-DIS/GCTE Workshop on Net Primary Production Modelling

12-15 July, Canberra, Australia
GCTE Workshop on Improved Pastures and Rangelands Research Network

14-16 July, Wallingford, UK
BAHC Scientific Steering Committee meeting

25 July-19 August, Serdang (Kuala Lumpur), Malaysia
SARCS-GCTE Training Course on Modelling Ecosystem Response to Global Change.

1-5 August, Ulaanbaatar, Mongolia
3rd Meeting for the START Regional Committee for Temperate East Asia (TEACOM)

8-12 August, Beijing, China
START Regional Committee for Temperate East Asia (TEACOM) International Symposium and Summer School on Global Change in Asia and the Pacific Regions. c/o LASG, Institute of Atmospheric Physics, Chinese Academy of Sciences, PO Box 2718, Beijing 100080, China. Tel: (+86-1) 256 0172, 257 1939; Fax: (+86-1) 256 2347.

10-13 August, Singapore
5th Meeting of the Southeast Asian Regional Committee for START (SARCS)

14 August, Glasgow, UK
PAGES Workshop on dating techniques and comparability of chronologies, in connection with the 15th International Radiocarbon Conference. Willem Mook, Netherlands Institute for Sea Research, P. O. Box 59, Landsdiep 4, 1797-SZ 't Horntje, NL-1790 AB Den Burg - Texel, The Netherlands. Tel: (+31-2220) 693 66, Fax: (+31-2220) 19 674, E-mail: NIOZ.TEXEL (Omnet)

August, Stanford, California, USA
GCTE Focus 4: Global Change and Ecological Complexity Open Meeting. Osaldo Sala, Department of Biological Sciences, Stanford University, Stanford CA 94305-5020, USA. Fax: (+1-415) 725 9253, E-mail: osvaldo@jasper.stanford.edu

5-9 September, Fuji-Yoshida, Japan
International Symposium on Global Atmospheric Chemistry: Human impact on the global troposphere. 2nd Scientific Conference of the International Global Atmospheric Chemistry Project (IGAC) and 8th Symposium of the IAMAP Commission on Atmospheric Chemistry and Global Pollution. Toshihiro Ogawa, CACGP/IGAC Symposium, Dept. of Earth and Planetary Physics, Faculty of Science, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan.

7-10 September, Brussels, Belgium
START Standing Committee, and First START Regional Directors Meeting

10-12 September, Fuji-Yoshida, Japan
IGAC Scientific Steering Committee Meeting.

20-22 September, Alexandria, Egypt
2nd START Regional Committee for the Mediterranean (MEDCOM) Meeting. Professor Mohamed Ayyad, University of Alexandria, Alexandria, Egypt. Fax: (+20-3) 545 7611

September/October, Belize

LOICZ Workshop on Focus 2: Biogeomorphology of carbonate shorelines. John Pernetta, LOICZ Core Project Office, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg, Texel, Netherlands. Fax: (+31) 2220 69430, e-mail: Pernetta@nioz.nl

24-26 September, Vancouver, BC, Canada
IGBP Officers Meeting

Autumn, Tokyo, Japan

JGOFS Data Management Task Team. Dr. Roy Lowry, British Oceanographic Data Centre, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside L43 7RA, UK. Tel: (+44-516) 538 633; Fax: (+44-516) 536 269; Dr. Toshiro Saino, Ocean Research Institute, University of Tokyo, 1-15-1 Minamidai, Nakano-ku, Tokyo 164, Japan. E-mail: T.Saino (Omnet)

3-5 October, Durham, New Hampshire, USA
BAHC/LOICZ Workshop on Delivery of Terrestrial Material to Freshwater and Coastal Ecosystems.

12-14 October, Victoria, BC, Canada
JGOFS Scientific Steering Committee

October, Potsdam, Germany
GCTE Functional Types Symposium

26-28 October, Paris, France
IGBP-DIS Standing Committee

31 October-1 November, Stockholm, Sweden
3rd Core Project Officers Meeting

2-4 November, Stockholm, Sweden
BAHC-IGAC-GCTE Task Team Meeting: Planning of Siberian Transect/Land Surface Experiment

7-10 November
Third meeting of the START Regional Committee for Northern Africa (NAFCOM)

14-16 November, Salvador, Brazil
GCTE Cassava Network Inauguration

14-17 November, Sapporo, Japan
International Symposium on Global Fluxes of Carbon and its Related Substances in the Coastal Sea-Ocean-Atmosphere System, including LOICZ Focus 1 Workshop on Coastal Modelling. Shizuo Tsunogai, Faculty of Fisheries, Hokkaido University, Hakodate 041, Japan. Fax: (+81-138) 43 5015, Tel: (+81-138) 40 8808

14-18 November, India
START Regional Committee for South Asia (SASCOM) Planning Workshop on Climate Variability and its Implications, in conjunction with GCTE and CLIVAR (WCRP)

21-22 November, Nepal
Second Meeting of the START Regional Committee for South Asia (SASCOM)

23-25 November, Kathmandu, Nepal
BAHC-GCTE-SASCOM Workshop on Global Change and Mountainous Regions

12-15 December, Canberra, Australia
9th Meeting of the Scientific Committee for the IGBP

December, Fort Collins, Colorado, USA
GCTE Soil Organic Matter Committee Business Meeting

December, Ivory Coast
START Workshop on Measurements of Trace Chemical Fluxes, with IGAC-DEBITS and MEDIAS-France.

IGBP Meetings, 1995

January, Nairobi, Kenya
START Workshop on Modelling Climate Systems, with GAIM and MEDIAS-France

March, Venezuela
IGAC Scientific Steering Committee

20-24 March, Bangkok, Thailand
GCTE Rice Network Planning Workshop

27-31 March, Reading, UK
GCTE Wheat Network Experimentation and Modelling Workshop

April/May, Qingdao, China
LOICZ Scientific Steering Committee

April/May, South East Asia
LOICZ Open Science Meeting. John Pernetta, LOICZ Core Project Office, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg, Texel, The Netherlands. Tel: (+31) 2220 6904, Fax: (+31) 2220 69430, E-mail: Pernetta@nioz.nl

20-24 May, Bangkok, Thailand
GCTE Rice Network Model Intercomparison

27-31 May, Reading, UK
GCTE Wheat Network Experimental Data Synthesis

6-12 August, Tampere, Finland
GCTE Session at International Union of Forestry Research Organisations XX World Congress

20 October, Beijing, China
10th Meeting of the SC-IGBP

21-22 October, Beijing, China
ICSU Global Change Forum

23-27 October, Beijing, China
SAC IV: Fourth Scientific Advisory Council for the IGBP

28 October, Beijing, China
10th Meeting of the SC-IGBP (continued)

ACRONYMS	
BAHC	Biospheric Aspects of the Hydrological Cycle
GAIM	Global Analysis, Interpretation and Modelling
GCTE	Global Change and Terrestrial Ecosystems
IGAC	International Global Atmospheric Chemistry Project
IGBP-DIS	IGBP Data and Information System
JGOFS	Joint Global Ocean Flux Study
LOICZ	Land Ocean Interactions in the Coastal Zone
LUEC	Land Use/Cover Change
PAGES	Past Global Changes
SARCS	Southeast Asia Regional Committee for START
START	Global Change System for Analysis, Research and Training

SAC IV

Beijing, China

23-27 October, 1995

The Fourth Meeting of the Scientific Advisory Council for the IGBP will be hosted by the Chinese IGBP Committee in Beijing. On the two preceding days, 21-22 October, ICSU will hold its Global Change Forum.

Publications

IGBP Report No. 28

The IGBP in Action: The Work Plan 1994-1998 (1994). 151 pp.

This Report provides an overview of the global change research to be carried out under the aegis of the International Geosphere-Biosphere Programme over the next five years. It represents a follow-up to IGBP Report No. 12 (1990) that described the basic structure of the global change research programme, the scientific rationale for its component Core Projects and proposals for their development. In Report 28 the IGBP Core Projects and Framework Activities present their aims and work programme in an up-to-date synthesis of their science, operational and implementation plans.

IGBP Report No. 29

Africa and Global Change/L'Afrique et le changement global (1994). 55/55 pp.

The Global Change System for Analysis, Research and Training (START) and IGBP organized a conference in Niamey in November 1992 to address the urgent issues of global environmental change in Africa, and lay the foundation for integrating the region and regional scientists into IGBP action. The report presents summaries of the plenary meetings, the workshops, and the conclusions. The English and the French text are under the same cover.

Directory 1994

International Geosphere-Biosphere Programme. Committee Members, Project Offices. 156 pp.

The first edition of the directory of IGBP committee members and Core Project Offices was printed in a limited edition. It will be available in June 1994 on an anonymous FTP account, accessible through Internet, from the IGBP-DIS Office in Paris. Further details regarding how to access will be given in the next Newsletter.

Core Project publications

GCTE

Global Change and Terrestrial Ecosystems Report No. 1. GCTE Core Research: 1993 Annual Report. Canberra: GCTE Core Project Office, 135 pp. *A comprehensive description of all the research being carried out in the GCTE science plan, with an outline of activities and tasks, and names and addresses of project leaders. Request from R. Foster, GCTE Core Project Office, CSIRO, Division of Wildlife & Ecology, PO Box 84, Lyneham ACT 2602, Australia. (+61-6) 241 2362*

JGOFS

JGOFS Report No. 12. Report of the Second Meeting of the JGOFS North Atlantic Planning Group, Warnemünde, April, 1993. 38 pp.

JGOFS Report No. 13. Reports of JGOFS Meetings held in Carqueiranne, France, September 1993. (1994). Scientific Steering Committee, JGOFS Southern Ocean Planning Group, Measurement of the Parameters of Photosynthesis. 68 pp.

JGOFS Report No. 14. Biogeochemical Ocean-Atmosphere Transfers (1994). A paper for JGOFS and IGAC by Ronald Prinn, Peter Liss and Patrick Buat-Ménard.

Request from: Elizabeth Gross, Executive Director, Scientific Committee on Oceanic Research, Department of Earth and Planetary Sciences, The Johns Hopkins University, Baltimore, MD 21218, USA. Fax: (+1-410) 516 4019, E-mail: E.Gross.SCOR (Omnet)

IGBP-DIS Working Papers

- No. 1. A Special Meeting on AVHRR Data Preprocessing and Compositing Methods, edited by Philippe Teillet (1992). 16 pp.
- No. 2. Requirements for Terrestrial Biospheric Data for IGBP Core Projects, edited by S. I. Rasool (1992). 24 pp, appendixes
- No. 3. The Global 1 km AVHRR Data Set. Further recommendations, by John Townshend (1992). 8 pp.
- No. 4. IGBP-DIS Strategy for Implementation, edited by Phillip Williamson and S. I. Rasool (1992). 18 pp.
- No. 5. The CEOS Cal/Val Working Group Meeting, edited by Phillip Teillet (1992). 18 pp.
- No. 6. Simple user Manual for the Global Change Master Directory, edited by Ludovic Andres and Anne O'Donnell (1992). 30 pp.
- No. 7. IGBP-DIS/GCTE Global Soils Data Base Workshop, edited by John Ingram (1993). 34 pp.
- No. 8. Monitoring and Modelling Terrestrial Net and Gross Primary Production, edited by S. D. Prince, C. O. Justice, and B. Moore III (1994). 56 pp. (Joint IGBP-DIS-GAIM Working Paper No. 1)

Request from IGBP-DIS Office, Université de Paris VI, 4 place Jussieu, Tour 26, 4ème étage, Boite 97, F-75252 Paris Cedex 05, France. Fax: (+33-1) 44 27 61 71

ICSU

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India

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Global Change Research

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Announcement:

The START International Secretariat has launched a call for CVs for the position of Scientific Coordinator for the Northern African Region (NAFCOM). Contact the International START Secretariat, 1825 K Street, Northwest, Washington DC 20006, USA. Tel: (+1-202) 457 5840, Fax: (+1-202) 457 5859, Internet: start@ciesin.org (Internet). Applications must be received by 30 June.

Edited by Suzanne Nash
 Newsletter requests and change of address information should be sent to:
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 The Royal Swedish Academy
 of Sciences
 Box 50005
 S-104 05 Stockholm, Sweden
 Tel: (+46-8) 16 64 48
 Fax: (+46-8) 16 64 05

LOICZ Project Scientist

The Project Office of the Land-Ocean Interactions in the Coastal Zone (LOICZ) Core Project of the International Geosphere Biosphere Programme (IGBP) is seeking to appoint a Project Scientist for a period of three years initially. The successful applicant will be employed by the Netherlands Institute for Sea Research located on the island of Texel, the Netherlands, and work under the direction and guidance of the International Scientific Steering Committee and the Core Project Manager. Duties will include responsibility for the development of a global typology of coastal systems based on spatially referenced (including remotely sensed) data, in the implementation of the LOICZ Research activities, and for the compilation of global syntheses of environmental data for use by participants in the LOICZ Research.

The successful applicant will have a PhD in the natural sciences and experience of data management and the use of Geographic Information Systems and Arc-Info software. They must be prepared to travel overseas and should be fluent in English. A knowledge of Dutch and other languages would be an advantage.

Applications should be received by 27 May, and should be addressed to:

Dr. John C. Pernetta, LOICZ Core Project Manager, Netherlands Institute (NIOZ), P.O. Box 59, 1790 AB Den Burg - Texel, The Netherlands. Phone +31-2220-69403 Facsimile +31-2220-69430.

