

# GLOBAL CHANGE NEWSLETTER

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

## New IGBP Core Project on Land-Ocean Interactions

Land-Ocean Interactions in the Coastal Zone (LOICZ) is now an established Core Project of the IGBP. After an eighteen-month planning phase, details of the LOICZ scientific agenda have now been defined – addressing the role of coastal systems in global biogeochemical cycles, their interactions with climate, and the sustainable use of their living resources under conditions of global change.

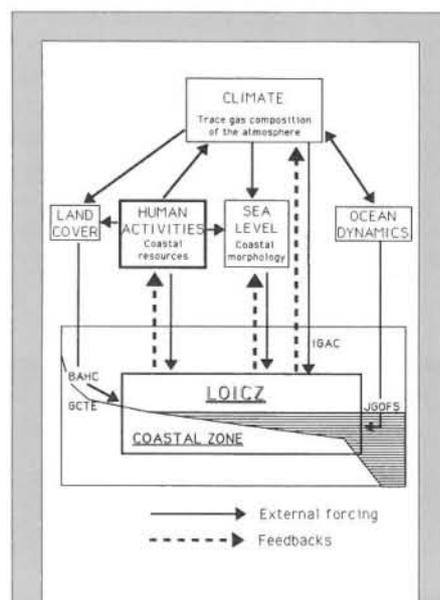
The draft LOICZ Science Plan was approved by the IGBP Scientific Committee at its meeting in Durham, New Hampshire, USA, 30 September–2 October 1992. After minor revisions, this document has now been prepared for publication; it will be discussed at the IGBP Scientific Advisory Council meeting (SAC III) in Ensenada, Mexico in January 1993, and will subsequently be distributed as an IGBP Report.

The goals of LOICZ are:

- To determine at global and regional scales the fluxes of materials between land, sea and atmosphere through the coastal zone;

the capacity of coastal systems to transform and store particulate and dissolved matter; and the effects of changes in external forcing conditions on the structure and functioning of coastal ecosystems

- To determine how changes in land use, climate, sea level and human activities in the coastal zone alter the flux and retention of particulate matter, and affect coastal morphodynamics
- To determine how changes in coastal systems, including responses to varying terrestrial and oceanic matter and nutrients, will affect the global carbon cycle and trace gas composition of the atmosphere
- To assess how the responses of coastal systems to global change will affect the habitation and usage by humans of coastal environments, and to develop further the scientific and socio-economic bases for the integrated management of the coastal environment.



*Effects of global change on the coastal zone, and of changes in the coastal zone on the global environment.*

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The structure of the LOICZ project is based on four research foci, corresponding to these goals, and each including a number of specific activities (see Box). Because of the many links and interactions addressed by LOICZ, implementation of the project will require close collaboration – not only within IGBP itself, but also with other coastal research initiatives at the national and regional scale, aspects of the Human Dimensions of Global Environmental Change Programme (HDP), the World Climate Research Programme (WCRP) and relevant UN activities.

It is expected that the LOICZ Core Project Office will be based in The Netherlands, with the support of the Dutch government. The chair of the LOICZ Planning Committee, Dr Patrick Holligan (Plymouth Marine Laboratory, UK), has accepted the invitation of the IGBP Scientific Committee to guide the project's further development and implementation – as chair of the LOICZ Scientific Steering Committee.

In addition to the discussions on LOICZ at SAC III, there will be the opportunity for wider consultations and review of the project's research and plans for its implementation at a LOICZ Open Meeting, to be held in Raleigh, North Carolina, 18-21 May 1993.

## LOICZ Foci and Activities

### Focus 1: The effects of changes in external forcing or boundary conditions on the fluxes of materials within coastal systems

#### Activities:

- 1.1 Catchment basin dynamics and delivery
- 1.2 Atmospheric inputs to the coastal zone
- 1.3 Exchanges of energy and matter at the shelf-ocean boundary
- 1.4 Factors influencing the mass balance of materials in coastal systems
- 1.5 Reconstructions of past changes in the coastal zone
- 1.6 Development of coupled land-estuarine-ocean models for coastal systems

### Focus 2: Biogeomorphology and sea level rise

#### Activities:

- 2.1 Role of ecosystems in determining coastal geomorphology
- 2.2 Biogeomorphological responses to changes in land use, climate and human activities in the coastal zone
- 2.3 Prediction of coastal geomorphology for different scenarios of relative sea level change

### Focus 3: Carbon fluxes and trace gas emissions

#### Activities:

- 3.1 Cycling of organic matter within coastal ecosystems
- 3.2 Estimation of net fluxes of  $N_2O$  and  $CH_4$  in the coastal zone
- 3.3 Estimation of global coastal emissions of DMS

### Focus 4: Economic and social impacts of global changes on coastal systems

#### Activities:

- 4.1 Evolution of coastal systems under different scenarios of global change
- 4.2 Effects of changes to coastal systems on social and economic activities
- 4.3 Development of improved strategies for the management of coastal resources

## Land-Use/Cover Change Core Project Planning Committee Established

The Scientific Committee of the IGBP and the Standing Committee of the Human Dimensions of Global Environmental Change Programme (HDP) recently decided to establish a Core Project Planning Committee (CPPC) to develop a detailed science plan for a joint IGBP-HDP project on land-use/cover change. The establishment of the CPPC was recommended by an ad-hoc working group that was chaired by geographer B.L. Turner II (Clark University, USA) and included members nominated by both programmes.

The working group concluded that understanding the past and future impacts of changes in land cover is central to the study of global environmental change and its human driving forces and impacts, including hydrology, the climate system, biogeochemical cycling, ecological complexity, and land degradation and its

impacts for agriculture and human settlement. It also pointed out that it will be impossible to make projections of future states of land cover without knowledge of the factors that determine land use and drive land-use change. Because land use is determined by demographic factors such as population size or density, technology, level of affluence, political structures and economic factors such as systems of exchange, attitudes and values, a programme seeking to develop projections about land use and the future states of land cover will require interdisciplinary research spanning the natural and social sciences.

In a report submitted to both IGBP and HDP, the working group drew up a preliminary set of research questions and proposes the next steps that need to be taken in order to finalize a scientific programme that addresses the human caus-

es of global land-cover change and assesses its importance for global environmental change more comprehensively. The plan outlined by the working group calls for the development of a classification system to categorize land cover changes according to their socio-economic driving forces. Selected case studies will provide detailed contexts in which to fine-tune this classification of socio-economic "situations" and land-cover changes. The knowledge gained regarding the human determinants of land use and the driving forces of land-cover change will be integrated into a global land use and land-cover change model. The model will be developed to link to other global models central to the study of global environmental change.

The report will soon be released as a joint IGBP-HDP report. Drafts were reviewed by the IGBP Scientific Commit-

tee in March and September 1992, and by the HDP Standing Committee in October.

In addition to establishing the CPPC, the IGBP Scientific Committee HDP Standing Committee decided to hold an open scientific meeting at which interest-

ed members of the international research community will have an opportunity to review the science plan developed by the CPPC. Assuming approval of the proposed plans by the IGBP and the HDP, a Joint Scientific Steering Committee for the

project will be formed to carry out the scientific plan and begin pilot projects.

*For further information, contact Richard H. Moss, Programme Officer, IGBP Secretariat, Stockholm.*

## Global Analysis, Interpretation, and Modelling

Berrien Moore III, Chair, GAIM Task Force

The Earth system can be viewed as being composed of two interacting subsystems, the physical-climate subsystem and the biogeochemical subsystem, linked together by the global hydrological cycle and by subsystem state variables such as greenhouse gas concentrations, surface roughness, and albedo.

This observation about the composition of the Earth system is at the heart of the Action Plan 1993-1995 of the newly established IGBP Task Force on Global Analysis, Interpretation, and Modelling (GAIM), that will soon be published. By exploiting the conceptual break-down of the Earth system into two coupled subsystems, an attack upon issues of global change can be formulated. Central to this attack is to realize, test, evaluate, and apply a suite of models of and associated data sets for the global biogeochemical subsystem which would be comparable in prognostic dynamics to the current models of the global physical-climate subsystem, the general circulation models (GCMs).

The challenge to the GAIM Task Force is to initiate activities that will lead to the rapid development and application of a suite of global biogeochemical models. These global biogeochemical models would, in time, be linked, partly through the hydrological coupling, to general circulation models, thereby, providing models of the Earth system.

This challenge was recognized early in the IGBP development: "A modelling project for the IGBP should primarily consider chemical and biological processes and their interplay with physical processes. This kind of model development constitutes the core of the IGBP." Report No. 12 (1990); pp. 8-1.7.

Understanding the nature of the biogeochemical system, how it is being changed, and how it is linked to the physical-climate system represents a fundamental goal of the IGBP. This understanding bears directly on key scientific

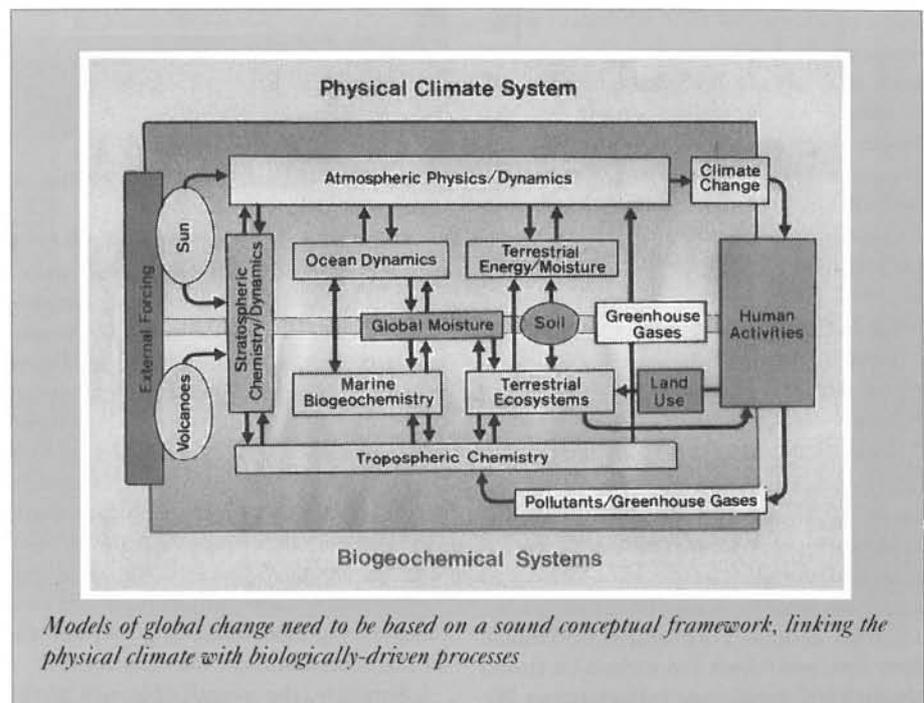
questions concerning the co-evolution of different components of the Earth System, as well as on the most pressing environmental questions of our time. Present understanding of these issues is very incomplete; the attack on the problem will require extensive interdisciplinary collaboration and will rely upon the achievements of all of the IGBP Core Projects. This attack will employ a hierarchy of models; it will include interdisciplinary problem analysis and the synthesis, interpretation, and application of global-scale data sets, especially those obtained by continuous monitoring from space.

GAIM will emphasize activities designed to expand the development, testing, and analyses of integrative data sets and models of those aspects of the Earth system where the IGBP program has the scientific lead, and it will work in collaboration on aspects of the Earth system where the World Climate Research Program

(WCRP) has the lead. GAIM will work with IGBP Core Projects to identify appropriate component models, to assist in integrating these into coupled models, and to test and apply these coupled models. This integration, testing, and analysis of coupled models will generate specific requirements for data: for initialization, forcing, and validation. Development of these data sets will be coordinated through IGBP-DIS.

Given the broad purpose of GAIM, the organization will depart from a Core Project structure and adopt a Task Force structure in which a major portion of the modelling work will be conducted by the Task Force and the modelling experiments will be revised and reviewed yearly. The planning agenda will be focused on timely results that exploit the evolutionary character of global modelling today.

Initial emphasis will be placed on global biogeochemical cycles and on the im-



pacts of ecosystem change on land surface properties, regulating the surface energy budget and hydrology. During the first phase, the focal biogeochemical cycle will be the carbon cycle, including its interaction with aspects of the nitrogen cycle. Coupled analyses will be initiated of feedbacks between dynamic biogeochemistry and climate, mediated by greenhouse gas concentrations, and of climate-ecosystem interactions, mediated by the hydrological cycle.

### Three themes: Analysis, Interpretation and Modelling

The analysis programme will consist initially of a series of short (2-3 day) workshops focused on open scientific issues that limit progress on developing models and on deepening our understanding of global biogeochemical cycles, and how these cycles and the associated key subsystems may change in response to climate change. Many of these workshops will be conducted jointly with other IGBP Core Projects and with IGBP-DIS. Topics are:

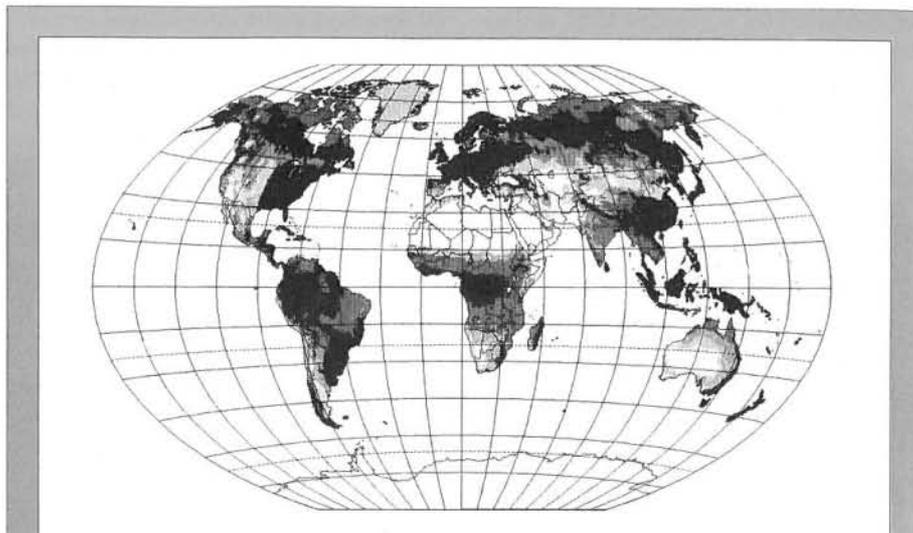
- Global terrestrial primary production: models and observations
- Soil data and Earth system modelling
- The extent and type of biomass burning
- The extent and type of wetlands globally

The interpretation theme will be implemented partly through workshops and partly through study teams (that will develop from workshops). This theme will focus on clarifying specific scientific issues within the IPCC process. For example, how much, how fast, and where can carbon be stored through reforestation and afforestation. We have already seen the utility of ad hoc scientific assessments of key IPCC issues (e.g., the meeting on iron fertilization of marine primary production). The GAIM interpretation theme will enhance these efforts and provide a vehicle for rapid and informal scientific mini-assessments.

The initial modelling component of GAIM is framed by two broad, linked scientific questions:

- What are the characteristic dynamics and controls on the global carbon cycle: how has this cycle been perturbed; what is its linkage to other biogeochemical cycles, and how might it evolve in the future?
- What are the linkages between climate and vegetation; and what are the effects of these linkages in a changing climate?

These questions will be addressed by initiating models programmes in three temporal frames: a contemporary time frame, covering the period 1980-2000; a fossil fuel era time frame, dealing with the period of roughly 1700-present; and a palaeo time



*Dynamic vegetation models will be used by GAIM to simulate the interactions between terrestrial ecosystems and climate*

frame, modelling the period of 18,000 years ago to the present.

An overall objective of the initial focus on the global carbon cycle is to develop a consistent and comprehensive framework within which to diagnose, intercompare, validate, and document existing and future comprehensive models of the global carbon cycle. This framework can be considered as a pilot project which may be used to evaluate models of other biogeochemical cycles besides carbon. In the palaeorecord the focus will be on methane; in the fossil fuel era on methane and the terrestrial component of carbon dioxide; in the contemporary period modelling will address all the components of the carbon cycle.

Similarly, the overall objective of the

initial focus upon the linkage between climate and vegetation is to establish the basis for linking global biogeochemical models to general circulation models. Two periods will be studied. The first is a temporal frame when the external driving conditions, and hence the climate, were different; the second is the contemporary period where existing data sets and field programmes are the most extensive.

*The GAIM Task Force is chaired by Berrien Moore III, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, USA. The Task Force Office is located at the University of New Hampshire.*

The goal of GAIM is to analyze the coupled dynamics of the Earth system, using as tools both data and models. In order to reach this goal, the GAIM Task Force has established the following specific objectives:

- To develop a strategy for the rapid development, evaluation, and application of comprehensive prognostic models of the global biogeochemical subsystem which could eventually be linked with models of the physical-climate subsystem.
- To propose, promote, and facilitate experiments with existing models or by linking subcomponent models, especially those associated with IGBP Core Projects and with WCRP efforts. Such experiments would be focused upon resolving interface issues and questions associated with developing an understanding of the prognostic behaviour of key processes.
- To conduct focused workshops on key scientific issues facing the development of global biogeochemical models and the coupling of these models to general circulation models.
- To assist the IPCC process by providing timely studies that focus upon clarifying important unresolved scientific issues associated with the changing biogeochemical cycles of the planet and upon the role of the biosphere in the physical-climate subsystem, particularly its role in the global hydrological cycle.
- To advise the IGBP Scientific Committee on progress in developing comprehensive global biogeochemical models and to maintain scientific liaison with the WCRP Steering Group on Global Climate Modelling.

## Meeting IGBP Data Needs

The IGBP Data and Information System is now developing rapidly. It is therefore timely to provide a brief review of its progress and direction. Details are also given below on four closely-related initiatives: access arrangements for the International Directory Network; recent releases of global change databases; new World Data Centres supporting IGBP; and the Data and Information System of the Human Dimensions of Global Environmental Change Programme.

### What

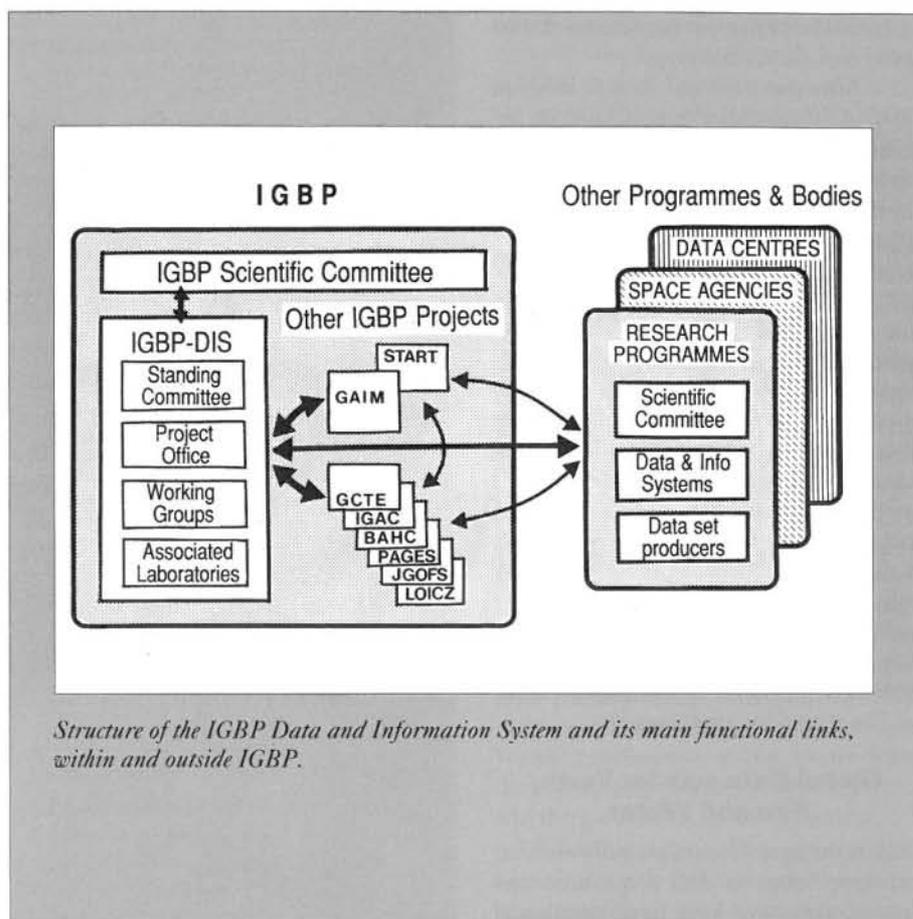
### IGBP-DIS Does

#### Rationale and Strategy

Data provide the currency of global change science. Data acquisition and processing, management and safeguarding, dissemination and exchange, and application to advance understanding, are the basic transactions of the International Geosphere-Biosphere Programme. Taking good care of data, to ensure their quality and value, is therefore of critical importance not only for the success of IGBP Core Projects, but also for IGBP's overall goals: interactive models of the Earth's biogeochemical system, that provide insights on future global change.

Early recognition of the data dependence of IGBP, at all levels and phases, led to the establishment of the IGBP Data and Information System (IGBP-DIS) as a cross-cutting activity. IGBP-DIS has responsibility both for developing effective data management within the programme, and for facilitating access to global data sets collected by other research groups and agencies, particularly those obtained through remote sensing. The following issues have to date been of particular importance in defining the evolving role of IGBP-DIS:

- The lack of many crucial environmental data sets required by IGBP Core Projects and by the IGBP Global Analysis, Interpretation and Modelling (GAIM) Task Force. There is a need both for new global data sets and for existing global data sets in new forms, with emphasis on spatially-referenced information, at fine resolution.



Structure of the IGBP Data and Information System and its main functional links, within and outside IGBP.

- The very large amounts of raw data that will be provided by Earth observation satellites planned for the late 1990s. The magnitude of that information – equivalent to the content of several university libraries per day – requires a radically new approach to data processing and their subsequent manipulation.
- The need for long-term data sets to detect significant global changes in environmentally important variables. Such data sets have different spatial and temporal characteristics from those required for developing or testing process-oriented models.
- The increasingly integrated nature of the physical, biological and socio-economic aspects of global change research, requiring close cooperation between different programmes and projects, and greater exchange of data from diverse sources.

The interactions between IGBP-DIS and other components of IGBP will vary in intensity and character as they develop

together through time. To date, much IGBP-DIS effort has been directed at determining future data needs for land-based studies, and how such needs can best be met – especially where data sets already exist, but are either not readily available or not in a suitable form to meet Core Project requirements. Subsequently, as fieldwork implementation proceeds, IGBP-DIS will be more closely involved in overseeing and reviewing data processing and management activities; in the exchange and supply of data sets between Core Projects; and as acting as a data broker for modellers, particularly within GAIM. To fulfil those roles, several basic data handling issues must be addressed and resolved, such as quality assessment, spatial referencing systems and exchange formats.

IGBP-DIS is not directly responsible for observational activities, such as the initial acquisition of global data-sets (whether by satellites or from surface-based observations), nor in the administration of data archives. These tasks are best carried

out by the specialist projects, organisations and agencies that already exist, with their own expertise and resources. Nevertheless, IGBP-DIS has an important role as a catalyst, promoting the flow of data, and their careful management and application – in order to obtain maximum scientific benefit from the actions of data collection and data storage.

Whilst the principal beneficiaries of IGBP-DIS are IGBP researchers, its activities are also advantageous to non-IGBP bodies. Specifically, through the interpretative role of IGBP-DIS (e.g. in algorithm development for remotely sensed data); the conceptual framework it provides (enabling data sets to be prioritised and quality control procedures established); and its close links to IGBP's international structure (giving wide geographic coverage, through liaison with global change research groups in over 50 countries). Furthermore, IGBP's use of very large data sets provides additional justification for their original collection; assists in defining the scientific rationale for future observational programmes and data archiving activities; and results in 'added value' products that contribute to policy-making (e.g. through the Intergovernmental Panel on Climate Change).

### Global Data sets for Earth, Fire and Water

During the past 20 years, globally-consistent approaches to data acquisition and data management have been developed by the meteorological and oceanographic research communities. However, standard protocols are lacking for data handling by terrestrial ecologists and others concerned with the interactions of biology, physics and chemistry at the land surface. An initial priority for IGBP-DIS was therefore to assist the IGBP projects on Global Change and Terrestrial Ecosystems (GCTE), Biospheric Aspects of the Hydrological Cycle (BAHC) and International Global Atmospheric Chemistry (IGAC) in defining – and helping to meet – their data needs related to land surface properties.

That process was initiated by an IGBP-DIS Workshop on terrestrial data requirements, held in Toulouse, June 1991, and by the proposal of the IGBP-DIS Land Cover Working Group for a new, high resolution global data set for land applications (IGBP Report No. 20; also see Global Change Newsletter No. 8, December 1991). There has since been considerable progress on many fronts; an outline of developments in two areas follows.

Firstly, weekly compilation of global

## The objectives and activities of the IGBP Data and Information System

The overall goal of IGBP-DIS is to improve the supply and management of data and information that will facilitate the attainment of IGBP's scientific agenda.

### Focus 1 Data Set Development

**Aim:** To promote the development of global data sets relevant to the scientific needs of IGBP Core Projects.

*Specific objectives include the assessment of the data needs of the Core Projects (with emphasis on the requirements that cannot be directly met by their own research); determination of the feasibility of obtaining the required information from non-IGBP sources, especially satellite observations and other spatially-referenced data sets; and processing or other preparation of high priority data sets that do not already exist in a useable form.*

Current activities:

- Development of a '1 km' database from satellite sensors
- Creation of global vegetation (land cover/land use) databases
- Estimation of land surface temperature from satellite sensors
- Estimation of areal extent and characteristics of global wetlands, from remote sensing and other sources
- Determination of terrestrial primary production by remote sensing and other sources
- Development of a global biomass burning database
- Development of a global soils database

### Focus 2 Data Dissemination

**Aim:** To facilitate the exchange of data between Core Projects, the acquisition of data from other sources, and the wide distribution of IGBP data sets.

*Specific objectives include the provision of advice to Core Projects on appropriate protocols for handling raw, derived and inferred data, with emphasis on distribution and transfer procedures (including development of guidelines for convenient access to global change data sets); and assistance in the establishment of network facilities to improve the efficiency of regional and global data exchange within IGBP, and between IGBP and other organizations.*

Current activities:

- Setting up of data exchange formats for data set transfers between Core Projects
- Establishment of regional and global networks for IGBP data exchange

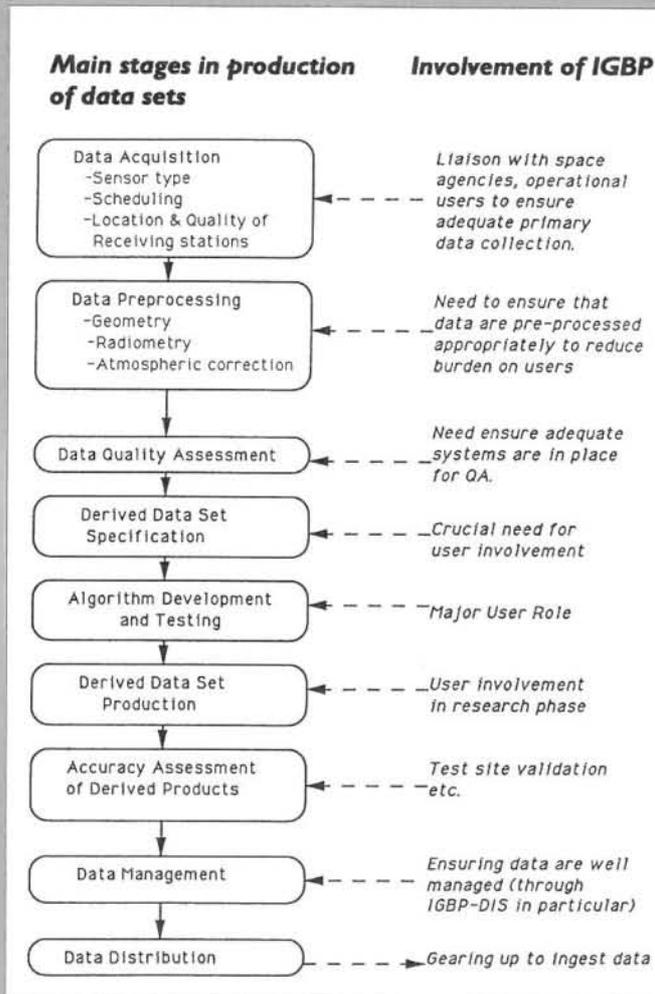
### Focus 3 Data Coordination in an International Context

**Aim:** To contribute to the overall development of international and inter-agency data and information systems to support global change science.

*Specific objectives include ensuring that data that are relevant to IGBP interests are collected and made available on suitable space and time scales, and with adequate continuity and quality, to meet IGBP needs (to be achieved through collaboration with space agencies and other organizations); assessment of the character of existing environmental data bases and Geographical Information Systems, including the user interface; and providing information to IGBP scientists on their content, quality and accessibility.*

Current activities:

- Participation in relevant international planning activities
- Contribution to production of data directories and other meta-data sets
- Facilitation of access to important information systems and data bases



*IGBP-DIS involvement in the processing and management of remotely-sensed data*

1km Advanced Very High Resolution Radiometer (AVHRR) products started in April 1992, at the US Geological Survey/Earth Resources Observing Satellite data centre, Sioux Falls, USA. European, Australian and Chinese space agencies are collaborating, and a CD-Rom containing the first year's results will be issued in 1993. The Land Cover Working Group will use those products to create a new global database of land vegetation (land cover and land use), and work is now underway on improving the methods for obtaining a satellite-derived vegetation classification. Preliminary results, presented at the World Forest Watch Conference in Sao Paulo, May 1992, suggested that assessments of deforestation/ reforestation rates in tropical regions required major reappraisal.

Secondly, the preparation of a new global soils database was initiated at a well-attended workshop, held in Silsoe, UK in October 1992 (jointly with GCTE). Soils are of great importance in determining terrestrial carbon storage and the emission of greenhouse gases to the atmosphere; they also influence heat exchange, and provide a key link and buffer system for the hydrological cycle. IGBP projects require the best possible global maps of soil characteristics, such as texture and organic matter content, affecting these processes. A modelling approach is now being developed to meet that need, combining existing information on soil classification with soil property relationships, and structured to accommodate additional observations. Whilst the new maps will not improve the quality of soils knowledge

in any specific locality, they will make the quality of soils information globally more uniform – and hence much more useful for global biogeochemical modelling.

In addition, work is continuing on improving estimates of land surface temperature from AVHRR and other satellites; on the development of a global data set for biomass burning (jointly with IGAC and GAIM); and on the estimation of the global extent of wetlands (jointly with GAIM).

### **International Liaison**

IGBP-DIS provides the link between IGBP and the Committee on Earth Observation Satellites (CEOS), an international association of agencies with interests in the collection, validation and dissemination of space data relevant to global change. CEOS has been informed of IGBP's specific needs for high resolution imagery from Spot, Landsat and ERS-1, and it is anticipated that such data will be made available to the IGBP community at minimal cost. CEOS support is also expected for the continuation, with potential IGBP involvement, of five working groups set up by the Space Agency Forum on the International Space Year (SAFISY), on: global land cover change; the World Forest Watch; productivity of the global ocean; the global satellite image mapping project; and the global change encyclopedia.

As well as collaborating with the space agencies, IGBP-DIS has developed close working relationships with other research organizations and programmes with complementary interests to IGBP. For example, IGBP-DIS is participating in the development of the Global Climate Observing System (GCOS), of the World Meteorological Organization, the Intergovernmental Oceanographic Commission, the UN Environment Programme and the International Council of Scientific Unions. GCOS is being designed to provide long-term monitoring of both the physical and biogeochemical aspects of the global climate system: data that are needed by IGBP, but are beyond its own resources to provide.

Aspects of IGBP-DIS's role in facilitating access to global data sets, and its links with the ICSU World Data Centre system, are described in the articles that follow.

*For further information, contact Ichtiague Rasool, Chairman of the IGBP-DIS Standing Committee, IGBP-DIS Office, Université de Paris VI, Tour 26, 4 Place Jussieu, F-75230 Paris 05, France; Fax: (+33-1) 44 27 61 71.*

## How to use the International Directory Network

One of the important aspects of the IGBP effort is the intercomparison of data sets to shed new light on the problems of global environmental change. To do this requires knowledge of what data sets are available and useful for such research. An early action by the IGBP-DIS Standing Committee has been to assist in providing such a data-locating directory, through the use of the existing International Directory Network (IDN), coordinated by the Committee on Earth Observation Satellites. **The readers of this article are requested to test the IDN and provide feedback on its strengths and weaknesses.**

The IDN consists of directory nodes, accessible through computer networks or dial-in lines, at several sites around the world which provide a brief characterization of, and point to, useful worldwide data of potential interest to the Earth and space science researchers, including the IGBP community. The directory nodes describe data sets as a whole, and they sometimes provide the opportunity to be automatically connected to other information systems which describe in detail the elements of the data sets. These information systems can also include the capabilities of browsing the data, ordering the data, and even receiving the data directly through a network.

Several of the IDN directory nodes advertise their services to the general community and make these services available at no cost. No account, password, or training is required to use them. For example, within the United States, the NASA National Space Science Data Center (NSSDC) operates the American node of the IDN at Goddard Space Flight Center in Greenbelt, Maryland. This node is committed to having as complete a copy of all available directory information in the IDN as possible and making this information widely available to the community. There are also European and Asian nodes in Italy and Japan having the same commitment.

The directories presently have nearly 1000 entries describing data in Earth science disciplines. There are, of course, many other data sets of potential interest to the Earth and space science communities throughout the world. If you know of such data sets which are available for use and are not presently described in the directory,

we invite your assistance in entering information about them into the directory. It is a relatively simple process to describe the data set according to the IDN standard "Directory Interchange Format" (DIF). Once a data set is described by a DIF file the file can be passed around the world and automatically loaded into most of the nodes.

The DIF file contains brief overview information (the equivalent of 2-3 typewritten pages) including such items as a descriptive title and summary/abstract; contact information for the archive or center where the data are stored, as well as persons technically knowledgeable about the data; type and amount of media on which the data are stored; citations for descriptive references or publications; and relevant

keywords. All of this information and more is displayable in the directory entry. Supplementary information is also available about important spacecraft, sensors, data archives, and major data gathering projects.

An even more important feature is that many other data information systems are described which are freely available over the network. When the user is reading a data information system description for which a network connection is available, a LINK command is offered. Invoking this command automatically connects the user to the other information system. When the user disconnects from the other system he is back in the directory at the place from which the connection was initiated. These connections are also offered when the user

Access information for the American, Asian and European IDN nodes is given below. Your use of these directories, and comments about their usability and information content, are vital to improving the system. Use the COMMENTS command in the directory or contact Dr James Thieman with your comments and for further information on access methods from other networks, eg SPAN, OMNET, DIRECT DIAL, etc.: via NCF::THIEMAN on NSI/DECnet; THIEMAN@128.183.36.23 on INTERNET; Tel (+1-301) 286 9790; or Fax (+1-301) 286 4952.

### American IDN nodes access:

**Via NSI/DECnet (SPAN):**  
\$ SET HOST NSSDCA  
USERNAME: NSSDC

**Via INTERNET:**  
TELNET 128.183.36.23  
USERNAME: NSSDC

**Via OMNET: GOTO NSSDC**  
**by DIAL-IN LINES:**  
Set to 8 bits, no parity, 1 stop bit  
Dial 301 286 9000  
CONNECT 1200 (or 2400 or 300)  
Enter several carriage returns  
ENTER NUMBER  
MD  
CALLING 55201 (or 55202)  
CALL COMPLETE  
Enter several carriage returns  
USERNAME: NSSDC

### Japanese IDN node access

**Via NSI/DECnet (SPAN):**  
\$ SET HOST 41950  
USERNAME: NASDADIR

**Via INTERNET:**  
TELNET 133.56.72.1  
USERNAME: NASDADIR

**By DIAL-IN LINES:**  
Set to 8 bits, no parity, 1 stop bit  
XON/OFF  
Dial 81 492 94 6400  
(0492-96-6400 in Japan)  
1200 - 9600 bps (DEC Kanji)  
USERNAME: NASDADIR

**Via PACKET EXCHANGE NETOWRK:**  
DDX-P, Venus-P  
DTE Number 44014437216  
(4437216 in Japan)  
USERNAME: NASDADIR

### European IDN node address

**Via NSI/DECnet (SPAN):**  
\$ SET HOST 29628 (or SET HOST EPOCAT)  
USERNAME: ESAPID

**Via INTERNET**  
TELNET 192.106.252.160  
USERNAME: ESAPID

**Via DIRECT DIAL**  
Set to 8 bits, no parity, 1 stop bit  
Dial (+39) 6 9417335

**Via ESA Information Retrieval Services (IRS)**  
File 21 of ESA Quest. (No links possible within Quest; Help available at ESRIN (+39 6 94180300). Remote systems not available to users who access the ESA PID via Quest.

Most ESA member states users can also access the ESA PID by calling within their country (at local charge) the following number:

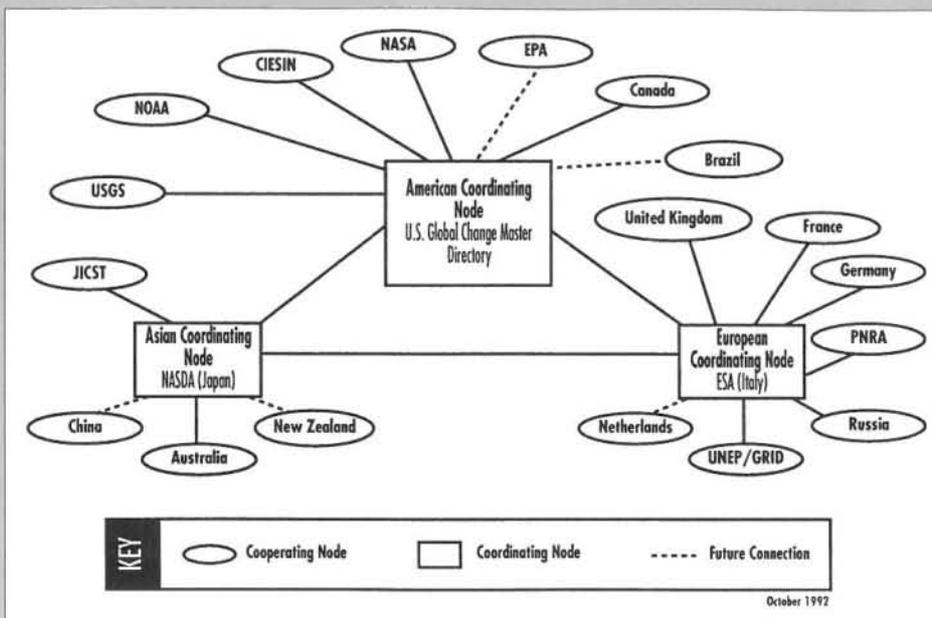
Austria	DATEX-P	(+232) 26181080 61
Belgium	DCS	(+206) 2210443 61
Canada	DATAPAK	(+3020) 85801458 61
Denmark	DATAPAK	(+238) 301063841 61
Finland	DATAPAK	(+244) 204076 61
France	TRANSPAC	(+2080) 175000394 61

*Note: when using the prefix, the leading 1 is dropped*

Germany	DATEX-P	(+262) 45050369 061
Ireland	EIRPAC	(+2724) 36059222 61
Italy	ITAPAC	(+222) 265 00147 61
	DDN	111005306009
	ESPAC	299020030001

*Note: via the Packet Switch Public Data Networks, these numbers are the NUA of the ESA PID*

NL	DN-1	(+204) 1290176 61
Norway	DATAPAC	(+2422) 110627 61
Spain	IBERPAC	(+2145) 214062321 61
Sweden	DATAPAC	(+2403) 710416 61
UK	PSS	(+234) 219201156 61



*The International Directory Network, coordinated by the Committee for Earth Observation Satellites (CEOS). CIESIN, Consortium for International Earth Science Information Network; EPA, Environmental Protection Agency; ESA, European Space Agency; JICST, Japanese Information Centre of Science and Technology; NASA, National Aeronautics and Space Administration; NASDA, National Space Development Agency; NOAA, National Oceanic and Atmospheric Administration; UNEP/GRID, Global Resources Information Database of the United Nations Environment Programme; USGS, United States Geological Survey.*

is reading about a data set which is associated with the remote data system.

The IDN Directory content will soon be available, after a prototype testing period, for distribution on floppy diskettes suitable for installing on IBM personal computers or IBM clones. The LINKs are, of course, not available in the PC-based version.

In summary, the IDN offers a directory capability which is a good starting point for IGBP-DIS. It is a system which is operational and can be used now. By consulting one of the International Directory Network nodes, important data sets can be identified. These, in many cases, lead to information systems which have more detailed information – and sometimes the possibility of ordering or even acquiring the data over the network. The IGBP-DIS Standing Committee invites your participation in testing this system and providing the necessary feedback which will determine its future evolution. For the successful development of this system, it is also critical that information on new IGBP global data sets is included in the IDN directory. Thank you in advance for your help and involvement.

*Report by James R. Thieman, National Space Science Data Center, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA.*

*The user manual for the Global Change Master Directory (IDN) has just been published as IGBP-DIS Working Paper No. 7. A copy can be obtained by writing to I. Rasool (see address in the preceding article).*

Selected Information systems which have one or more Earth science data sets and which have LINKs presently available. Over 70 LINKs are available in all of the Earth and space science disciplines and more are being added all the time.

<i>System acronym</i>	<i>System full name</i>
ARIN	Aerospace Research Information Network
CCRS	Canada Centre for Remote Sensing
DALI	CNES-SPOT IMAGE Catalogue
EOC	Earth Observation Center, Japan
EROS	Earth Resources Observation Systems Data Center
ESA EARTH IMAGES	ESA Earthnet online catalogue (formerly LEDA)
ESA EPO	European Space Agency Earthnet Programme Office
ESIS	European Space Information System
GISS	Goddard Institute for Space Studies
IRIS	Incorporated Research Institutions for Seismology
IRPS	Image Retrieval and Processing System
NCDC	National Climatic Data Center
NCDS	NASA Climate Data System
NOAA-SEL	NOAA Space Environment Laboratory
NSF	NSF Science and Technology Information System
NSSDC	National Space Science Data Center
OCEANIC	Ocean Network Information Center
PLDS	Pilot Land Data System
PNRA	Italian Programme for Antarctic Research, South-Pole Directory
RESTEC	Remote Sensing Technology Center of Japan
SDCS	SAR Data Catalog System
SDDAS	SwRI's Data Display and Archival System
SMRSS	Surveys, Mapping and Remote Sensing Sector
UA-GEODATA CENTER	University of Alaska Fairbanks/GeoData Center
UARS	Upper Atmosphere Research Satellite Central Data Handling Facility
URI AVHRR ARCHIVE	University of Rhode Island AVHRR Archive

## Global Change Databases on Compact Disks and Diskettes

The first phase of the Global Change DataBase (GCDB) programme has recently been completed by the World Data Center-A, Boulder Centers, and the US National Geophysical Data Center. The GCDB is an integrated database of global environmental data that is highly relevant to IGBP. To data users, it offers an increased level of integration, scientific peer review, and documentation. To producers of regional or global data sets, it offers enhanced distribution, use, and visibility for their data. This is a brief report on the design and current state of development of the GCDB, and describes the database products currently available.

The National Geophysical Data Center (NGDC) of the US National Oceanic and Atmospheric Administration (NOAA) is involved in the preparation of databases as part of its work to integrate global and regional scientific data. Currently, a main driving force in NOAA is its Climate and Global Change Program. The GCDB is designed to help meet the need of NOAA and the wider scientific community for data that characterize the global environment, and to describe and quantify possible changes in that environment.

The GCDB was originally developed as part of the initial planning for the IGBP Data and Information System. A pilot project resulted in an integrated digital database for Africa. This database was used in 1989 and 1990 for two workshops in Africa (sponsored by the United Nations Institute for Training and Research and UNEP) and is presently one of three products on global change available from the National Geophysical Data Center.

With the cooperation and guidance of a large number of laboratories and individual scientists, NGDC has pursued the integration of global and environmental data sets into databases readily usable on a variety of scientific Geographic Information Systems. Guidance is also provided on adapting the databases to other software, such as statistics packages and database management systems.

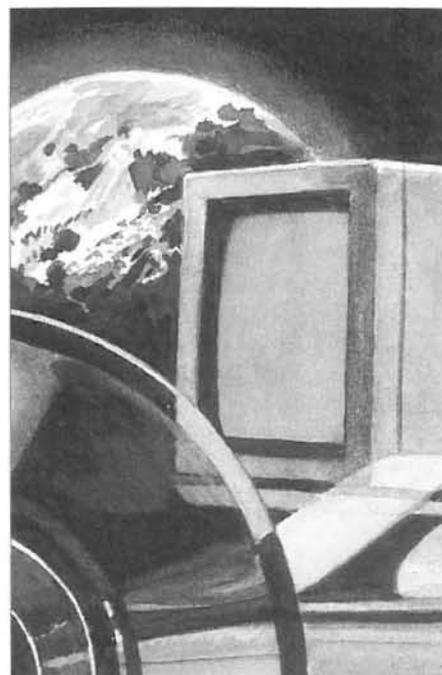
The aims of the Global Change Database programme are:

- to work with original creators of environmental data sets around the world, complementing their scientific expertise with NGDC's capabilities in data integration and access

- to increase the usefulness of individual data sets through integration, including improved quality control and documentation of data, improved organisation of the data on CD-ROMs or other appropriate media, and addition of software to improve accessibility of the data, for multivariate analysis and education
- to offer a method for the peer-review and dissemination of scientific data, akin to traditional methods of paper publications, thereby helping scientists to receive peer-reviewed publication credit for their data
- to go beyond traditional publication by providing a user support mechanism, somewhat similar to that provided for software
- to offer feedback to authors of data sets, to stimulate enhancements of (and additional research with) such data:

Global Change Database products are used operationally in the Geographic Resources Analysis Support System (GRASS), a powerful, environmentally-oriented and inexpensive Geographic Information System (GIS) developed for UNIX work stations and available to anyone. The databases can also be used within IDRISI (named after a 12th century geographer and scientist), a low-cost GIS developed for DOS by Clark University in Massachusetts. IDRISI has particular strengths as an educational tool: the software manual and sample data include a good general primer in GIS, as well as self-training in IDRISI itself, and is used by UNEP for training classes. In addition, instructions available from NGDC show how to use the databases in several other GISs.

International cooperation has been of great importance in developing the Global Change Database. As an example, about 200 copies of Beta Test version of the Global Ecosystems Database (see below) were circulated to reviewers in several countries during 1991 and 1992, in cooperation with the US Environmental Protection Agency. About 35 substantial written reviews were returned to NGDC, together with several less formal reviews. This information allowed NGDC to improve the design and presentation of the database. The reviews were compiled to become a valuable part of the documentation for the database. Such a review procedure makes up for gaps in expertise at NGDC, and for any cultural or scientific bias that might be found in early editions of the database. Since there may still be incomplete representation of all scientific communities in the current version of the database, NGDC would like to hear from anyone with relevant data, and to receive



users' comments on the design and execution of the database.

The Global Change Database programme has the following materials for distribution:

**Global Change Educational Diskette: Pilot Project for Africa** (developed in collaboration with the IGBP). This is on diskette, and includes:

*Data:* Selected data on ecosystems, vegetation, climate, topography, soils and other data for Africa. Vector data for coastlines and other features are also provided, primarily for geographic reference. The data sets are largely experimental, rather than final, perfect data. They are provided to enable the scientific community to use and enhance the data, and to understand their possibilities and limits. The database is on six diskettes of compressed data, occupying about 20 megabytes of space if all materials are used at once (but it is possible to use portions of the data if hard disk space is lacking). Another 12 diskettes of supplemental data are provided.

*Documentation:* Over 300 pages have been produced to explain methods of production and use of the data.

*Manual of Exercises:* A 150 page document supports the training courses developed for the IGBP and the United Nations Institute for Training and Research (UNITAR). The original exercise manual is extended to make it useful for training in schools and universities and for practising professionals. It includes workshop exercises, highlighting applications in the environmental and social sciences.

**Global Change Database, Volume 1: Global Ecosystems Database.** On CD-ROM. This database contains raster gridded map layers registered to a common latitude-longitude base. Parameters have been chosen for their potential use in integrated studies of the global environment. The CD-ROM includes selected data on the global environment, such as ecosystems, land use, wetlands, vegetation (including satellite-derived vegetation index), climate, topography and soils, seasonal albedo, methane emissions, and vector base map data such as coastlines. These data are on a range of compatible grids, from 2 degrees to 2 minutes. About 320 pages of hard copy documentation are provided. Additional documentation is on the CD-ROM.

**Global Change Database, Volume 2: Experimental Calibrated Global Vegetation. Index from NOAA's AVHRR.** On CD-ROM. A Normalized Difference Vegetation Index (NDVI), presented in two data versions: biweekly data (covering April 1985 – December 1991), and monthly data (covering April 1985 – December 1990). NDVI data are an indication of the vigour of vegetative processes, such as chlorophyll production. They have been used to analyze associations between climate and vegetation, and have helped predict future shortfalls in agricultural production due to drought, among other applications.

Except for the Pilot Project for Africa, the data in the GCDB are currently global in coverage. Some databases for significant regions are currently being considered, probably to be distributed on similar series of CD-ROMs. Additional global data are currently being processed through integration and quality control procedures. Periodic updates and enhancements to the data are anticipated. IGBP participants are strongly encouraged to report any errors in the data, so that NGDC can work with creators of the data to incorporate these corrections. You are also invited to contribute data sets that you would like to offer for others to use. The GCDB should be regarded as a pioneering attempt to digitally describe the global environment. Do not be concerned if your data set is not perfect: internal review and the external peer review process will help decide the value of the data sets, and will probably be able to provide ideas for enhancing new data sets.

In summary, the Global Change Database programme encourages collaboration and data exchange with anyone involved in developing global or large-

scale regional data sets. If you have no appropriate data to exchange, the GCDB data, software, and documentation are available for the cost of reproduction.

*Report by David A. Hastings, World Data Centre-A. For further information, and the databases themselves, contact: World Data Centre-A, Boulder Center, NOAA National Geophysical Center (E/JGC1), 325 Broadway, Boulder, Colorado 80303, USA. Fax: (+1-303) 497 65 13, Telex: 592811 noaa masc bdr; Internet: info@mail.ngdc.noaa.gov.*

## New World Data Centres in the ICSU System

The ICSU World Data Centres Panel has recently accepted the proposal by WDC-A (USA) to add to the system three new centres that will support IGBP activities: **World Data Centre-A for Atmospheric Trace Gases**, maintained by Oak Ridge National Laboratory (US Dept of Energy), Oak Ridge, Tennessee, and operated in association with the Carbon Dioxide Information and Analysis Centre (CDIAC). Examples of data now held, in digital as well as published formats, include: time series of atmospheric carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and ozone; emissions of carbon dioxide, by country; carbon stored in ecosystems; carbon-14 activities in the Indian Ocean and the Southern Ocean. CDIAC works closely with individual scientists to prepare their data for use in the public domain; for example, by assisting with documentation and quality assessment. For further details, contact Dr Paul Kanciruk, CDIAC, ORNL, Oak Ridge, TN 37831-6335, USA. Fax: (+1) 615 574 4665; e-mail: CDIAC (Omnet), or cdpornl.gov.

**World Data Centre-A for Remotely-sensed Land Data**, operated by the US Geological Survey in association with the Earth Resources Observing Satellite (EROS) Data Centre, Sioux Falls, South Dakota. Materials available from this WDC include digital and photographic images [e.g., Landsat MSS and Advanced Very High Resolution Radiometer (AVHRR), plus some aircraft data] of the Earth's land surface plus extensive metadata. The EROS Data Centre is actively involved in the IGBP-DIS project to collect globally NOAA's AVHRR full-resolution data (nominally 1x1 km) and process the observations (for quality, calibration, cloud

screening, etc.), to derive full-resolution global digital images of vegetation index. For further details contact W. Draeger, USGS/EDC, Sioux Falls, SD 57198, USA. Fax: (+1) 605 594 6589; e-mail: eros.data centre (Omnet) or erosa.cr.usgs.gov.

**World Data Centre-A for Palaeoclimatology**, established by the NOAA National Geophysical Data Centre, Boulder, Colorado. This centre is closely tied with the IGBP Past Global Changes project (PAGES), and will be responsible for data recommended by PAGES, as well as palaeoclimate data on broader time scales arising from other ICSU projects and programmes. This WDC works closely with scientists to help prepare their data for use in the public domain. Many data sets are in digital format. For further details, contact Bruce Bauer, WDC-A Palaeoclimate Data Coordinator, NGDC, E/JGC, NOAA, 325 Broadway, Boulder, CO 80303, USA. Fax: (+1) 303 497 6513; e-mail: babngdc1.ngdc.noaa.gov.

Further discussions are underway in the ICSU WDC Panel and some of the World Data Centre components for establishing additional data centres needed for IGBP data. For a general review of the role and structure of the ICSU World Data Centre system, see Ruttnerberg (1992) *Eos*, 17 November; vol 73, no 46, pp 494-5.

*Report by Stan Ruttnerberg, Member of IGBP-DIS Standing Committee and Chairman, ICSU World Data Centres Panel.*

## HDP-DIS

The Human Dimensions of Global Environmental Change Programme (HDP) recently announced plans to establish a Data and Information System (HDP-DIS) to meet the needs of the human dimensions research community. The plans were presented at the programme's Second Scientific Symposium on the Human Dimensions of Global Environmental Change: Creating the Data Base, held in Paris at the French Ministry for Research and Space and at UNESCO's Headquarters at Place Fontenoy, from 30 November to 2 December, 1992.

The plan to establish an operational HDP-DIS is the culmination of the 1991-92 HDP Work Programme, which gave priority to surveying the data needs for research on the human dimensions of global environmental change, recording the data that are already available, and identifying the data that are needed.

During 1991-92, working groups were appointed and assessed data needs in three areas. The report of the Working Group on Survey Research Data, Dynamics of Societal Learning about Global Environmental Change, was published in late 1991 (HDP Report No. 2). The Working Group on Population Data published its report, Population Data and Global Environmental Data (HDP Report No. 3) in early 1992. The Working Group on Economic Data has just completed its report, Economic Data and the Human Dimensions of Global Environmental Change: Creating a Data Support Process for an Evolving Long-Term Research Programme (HDP Report No. 4, 1992).

The Consortium for International

Earth Science Information Network (CIESIN), which provided support for the activities of the HDP data working groups, will become the operating agency of HDP-DIS. A memorandum of understanding released at the Second HDP Scientific Symposium calls for CIESIN to establish and operate an information network and system that will provide access to data relevant to research on the human dimensions of global environmental change. Many of these data are already compiled by a variety of national and international agencies. The HDP-DIS will provide information about the availability and location of data, facilitate access to data, and provide assistance to researchers faced with the difficult problems of relating data with

different spatial and temporal resolution. Scientific direction for HDP-DIS will be provided by user groups of researchers working within the HDP framework. The first meeting of these user groups will take place in April 1993, in Graz, Austria, during the CIESIN-sponsored 25th International Symposium on Remote Sensing and Global Environmental Change.

*For further information, contact Ric Cicone, Director of Information and Technology, CIESIN, 1968 Green Road, PO Box 134003, Ann Arbor, MI 48113, USA. Phone (+1-517) 797 2700, Fax (+1-517) 797 2622. E-mail: cicone@ciesin.org*

## European Community Research on Global Change

COMMISSION OF THE EUROPEAN COMMUNITIES

DIRECTORATE-GENERAL FOR SCIENCE, RESEARCH AND DEVELOPMENT

*Pierre Mathy*

*European Community global change research activities span science and technology for environmental protection, climatology and natural hazards, marine science, and environmental research and development. They provide for monitoring, data base building, laboratories, funding, and collaboration with other global change research programmes.*

### Contribution to Global Change Research

Among European Community research programmes that address global change are STEP (Science and Technology for Environmental Protection), EPOCH (European Programme On Climatology and Natural Hazards) and MAST (Marine Science and Technology), names already familiar in environmental research.

The new European Community Research and Development Programme in the Field of the Environment (1991-1994) has a large global change component. The general objectives are to contribute to understanding the processes governing environmental change and to assess the impact of human activities. Community participation concentrates on problems



which will have an impact on environmental policy and in areas where the Community is best placed to ensure European coordination in the framework of large international programmes while taking account of national ones.

The part of this programme that deals specifically with global change cover seven topics: i) natural climatic change; ii) climate change from anthropogenic forcing; iii) climate change impacts; iv) stratospheric ozone; v) tropospheric physics and chemistry; vi) biogeochemical cycles; and vii)

ecosystem dynamics. The socio-economic aspects of environmental change are addressed in other parts of the programme.

The Joint Research Centre (JRC) of the Commission of the European Community at Ispra (Varese, Italy) is also involved in research on global change. The JRC contribution mainly considers modelling and air pollution transport; air chemistry, (biogenic and anthropogenic emissions); biosphere-atmosphere interaction; and related application of remote sensing on the interactions between land and ocean surface and climate. Emphasis is placed on strong cooperation with laboratories and institutes in the Member States and at an international level.

The global change component of the MAST programme on marine science and technology, concurrently run with the environmental programmes, addresses: a) circulation and exchange of water masses, b) biogeochemical cycles and fluxes, and c) process studies in biology, geology and chemistry.

Several countries, members of the European Free Trade Association (EFTA), participate in many EC research projects within the framework of these programmes.

## Interactions between EC programmes and International Research Programmes

### Definition and Implementation

The identification of research needs through scientific joint actions led the EC to consider global change as a major component of its Research and Development Programmes in the Field of Environment. Parallel initiatives undertaken within the framework of international research programmes on global change explain the similarity of topics and the commonality of interest between the EC programmes and the international ones. For obvious reasons (geographical scales; different environmental policies and regional requirements), there is no strict correlation between the EC programme and international programmes. Nonetheless, the EC programmes contribute directly to reaching the scientific objectives of the international global change research programmes by supporting appropriate research projects.

Thus, many EC research projects on climate, biogeochemical cycles, ecosystem dynamics, tropospheric and stratospheric physics and chemistry, and marine environment, *de facto*, contribute substantially. The work at the EC Joint Research Centre in Italy that reinforces these programmes are the studies on: gas-particle interactions; the chemical fate of biogenic and anthropogenic emissions and the build-up of several gases in the troposphere; the deposition/emission exchanges of substances from different vegetation types and their contribution in Mediterranean areas to the formation of tropospheric ozone; the application of remote sensing techniques to the monitoring of the marine environment and to the processes related to large scale changes in terrestrial ecosystems.

### Funding agencies

In view of the importance and size of global change research in Europe, and the need for coordination in order to yield the highest possible return from the large amount of funds which will be committed, the EC decided in consultation with European national funding agencies to consider ways for using more efficiently and jointly large research facilities and experimental installations (airborne and spatial instrumentation, data information and data handling centres, etc.).

The EC is also concerned with gathering and validating relevant data towards their integration and the development of models. Ensuring proper coordination be-

tween the EC and national programmes is crucial to assuring a maximum use of resources. Finally, special attention is given to the support of research and training in developing countries. The Commission of the EC is currently proposing to its Member States modalities to set up a Europe-Africa Network for Global Change research which could meet this requirement.

Furthermore, the European Community is a participant in the International Group of Funding Agencies (IGFA).

## Cooperation

Several initiatives have been taken or are under consideration in order to improve the effectiveness of EC research, and to better coordinate national efforts and links to international programmes.

### Climate research

In several research areas EC projects have assembled most relevant European laboratories in coordinated efforts, notably in palaeoclimatology; climate modelling; the global carbon cycle; sea-level changes; large-scale field experiments on land surface transfer processes (HAPEX and EFERDA) under the Core Project Biospheric Aspects of the Hydrological Cycle (BAHC), Mediterranean desertification and CO<sub>2</sub> impacts on forests in the Core Project on Global Change and Terrestrial Ecosystems (GCTE).

This structure of large thematic projects



## CEC support for European IGAC Project Office

A European Project Office for the IGBP International Global Atmospheric Chemistry project (IGAC) is now operational at the CEC Joint Research Centre, Ispra site (Italy). Its purpose is to stimulate, facilitate and coordinate European participation in IGAC - for both member and non-member countries of the European Community - and to promote links with other relevant CEC activities. Close liaison will be maintained with the global IGAC programme, and the international Project Office (at MIT, Cambridge, USA).

The European IGAC Project Office is guided by a Steering Group that includes all European members of the IGAC Scientific Steering Committee and the European convenors of IGAC foci. At its first meeting, held in December in Brussels, the Steering Group approved supplementary support for four IGAC workshops and planning meetings to be held in 1993. The longer-term aim is to develop EC research programmes that will contribute to IGAC; however, their funding would need to be through established EC mechanisms.

For further information, contact Dr Stan Cieslik, CEC Environment Institute, JRC, 21020 Ispra (Varese), Italy; fax (+ 39) 332 78 57 04.

was established under the EPOCH Programme, and continues as coordinated groups of projects under the current programme. Presently the EC is considering which initiatives could be taken for the next programme (scheduled to begin in 1995) in particular in view of a strengthening of the European infrastructure for climate research.

### Concerted actions

The objectives of EC Concerted Actions are i) to identify gaps in knowledge and ii) to indicate ways how to fill in these gaps through appropriate research projects.

The EC proposed to associate European scientists involved in GCTE in its Concerted Action on Ecosystems. This participation is expected to develop a close cooperation between the EC and GCTE. This could lead to the identification of common research requirements, the development of research projects and the organisation of scientific meetings of common interest, as well as to a better use of research instrumentation.

Similarly, contacts have been established between the EC Concerted Action on physico-chemical changes in the atmosphere and European scientists involved in the International Global Atmospheric Chemistry Project (IGAC) to investigate the possibility of developing research projects of common interest within the framework of a formal European IGAC Project Office which has been established at the Joint Research Centre in Ispra (Italy), [see box].

### Marine Science

The fundamental aim of the MAST programme is to improve our understanding of processes in the sea and of their variability. Research projects of broad relevance to global change issues have been initiated on such subjects as: biogeochemical fluxes at the ocean/sediment interface and in coastal seas, the control of plankton dynamics, deep-sea and coastal ecosystems, circulation of water masses in the Mediterranean.

Projects will be launched in 1993 on i)

sea ice/ocean interaction on the carbon cycle in the North Atlantic; ii) deep-sea hydrothermalism on the Mid-Atlantic ridge (Azores triple junction) iii) fluxes and exchanges across the Northeast Atlantic shelf edge and in several areas of the Mediterranean.

### Centre for Earth Observation

A Centre for Earth Observation has been proposed as a joint undertaking between the EC and the European Space Agency in close cooperation with the Member States. The main objective of this Centre is to

provide an efficient decentralised network for the full exploitation of Earth Observation Data, including those obtained by spaceborne sensors. The work would help to provide adequate and timely information on the state of the environment as needed, for example, by the European Environment Agency. The feasibility study headed by the Joint Research Centre is ongoing, with possible implementation in 1993-1994. This initiative would contribute to the overall objectives of the IGBP Data and Information System.

## Membership of the Scientific Committee for the IGBP

**T**he Scientific Committee for the IGBP is the directing and policy making body for the International Geosphere-Biosphere Programme. The responsibilities of the Scientific Committee are to develop specific plans for the Programme, to guide its implementation and to publicize and ensure that adequate use is made of its results. The Scientific Committee also promotes the coordination of the national, regional and international activities that constitute the Programme.

The Scientific Committee is composed of up to 15 members with up to 5 Officers, appointed by the ICSU Executive Board, who serve in their personal capacity. The term is normally three years, renewable once. The Officers of the SC-IGBP are: the Chairman, the Past-Chairman (ex-officio), up to three Vice-Chairmen and the Treasurer.

In addition to the ICSU appointed members, the Chairmen of the IGBP Scientific Steering Committees, Standing Committees and Task Forces, the Joint Scientific Committee for the World Climate Research Programme and the ISSC Standing Committee for the Human Dimensions of Global Environmental Change Programme (HDP) as well as a designated representative of ICSU Advisory Committee for the Environment are full members of the SC-IGBP.

### Members leaving

The second term for two of the founding members ended in October 1992, and the second term for two others will end in January 1993 after the Third Scientific

Advisory Council for the IGBP. We wish to thank warmly those who have served the IGBP with energy and dedication during the last six years.

**Bert Bolin** (Vice-Chairman), is a former Professor of Meteorology at the University of Stockholm, Sweden, and Director of the International Meteorological Institute in Stockholm. He is presently Chairman of the Intergovernmental Panel on Climate Change (IPCC). His research is in the fields of dynamical meteorology numerical weather forecasting, atmospheric chemistry, and biogeochemistry.

Professor Bolin was one of the earliest leaders of the IGBP endeavour with his chairmanship of the ad hoc planning committee which studied the prospects for an IGBP during 1984-6. At the Berne 1986 General Assembly, his committee recommended that ICSU move ahead and establish the programme. His willingness to commit his time and energy to the tasks of the initial Special Committee and its successor in 1990, the Scientific Committee, ensured that senior and seasoned leadership were available to guide the development of the programme at critical stages. The availability of a host for the secretariat was of paramount importance in launching the IGBP with minimal start-up difficulties, political and otherwise. Bert facilitated the Swedish government commitment that made this possible.

**Marie-Lise Chanin** (Member) is Director of the Department of Middle Atmosphere at the Service d'Aéronomie of the French National Centre of Scientific Re-

search, and member of the French Académie des Sciences. Dr. Chanin was first appointed by ICSU to the IGBP Special Committee in 1987, and re-appointed in 1990 to the Scientific Committee. Her background in the physical dynamics of the upper and middle atmosphere, and solar induced atmospheric variability, provided a valuable viewpoint to the scientific planning of IGBP. She was a dynamic member of the coordinating panel on Terrestrial Biosphere-Atmospheric Chemistry Interactions, and then leader of the research proposal on Stratosphere-Troposphere Interactions and the Biosphere. The major elements of this project are now being implemented, under her leadership, in the WCRP project Stratospheric Processes and their Role in Climate (SPARC). Fortunately for the IGBP, that means that collaboration with Dr. Chanin will continue.

**Jack Eddy** (Vice-Chairman), has research interests in the field of global change that include solar physics, the history of solar behaviour and of climate, and archaeoastronomy. Dr. Eddy also brought continuity and wise perspective to the planning and implementation process of the IGBP. He chaired a United States National Research Council committee that was charged to follow up on recommendations made in a 1983 report that first envisaged an international geosphere-biosphere programme. During 1984-5 the committee produced the National Research Council Report "Global Change in the Geosphere-Biosphere, Initial Priorities for an IGBP". His extraordinary success in generating con-

sensus among representatives of all the earth science disciplines augured well for the development of a truly interdisciplinary programme. He was appointed to the Special Committee for the IGBP in 1987, and to the Scientific Committee in 1990.

As a physical scientist with strong credentials in solar physics, he also brought unique perspective and credibility to the planning process. Dr. Eddy's commitment of time, as well as special resources through the UCAR Office for Interdisciplinary Earth Sciences in Boulder, Colorado, USA, were critical in the development of both the Past Global Changes project and the Bellagio report that launched the global change System for Analysis, Research and Training (START).

Vladimir Kotlyakov (Member), geographer and glaciologist at the Russian Academy of Sciences, is President of the International Commission on Snow and Ice (IAHS/IUGG). His research covers the present-day and past environment in polar and high mountain regions, and the problems of the interaction of society and nature. With his considerable experience in ice palaeorecords, he was first appointed by ICSU to serve on the Executive Board of the IGBP Special Committee in 1987, and served a second term on the new Scientific Committee in 1990. His interest in global change records of all types and periods, serious commitment to coordinated efforts with social scientists, and broad scientific background, provided sound guidance and advice during the planning of IGBP projects.

### New Members



**Margaret Leinen**, University of Rhode Island, Kingston, Rhode Island, USA. Professor Leinen is Vice Provost for Marine Programs and Dean of the Graduate School of Oceanography; her specialisation is in palaeoceanography, with research in ocean

sedimentary records, especially the North Pacific. She first joined the Steering Committee of the US Joint Global Ocean Flux Study (JGOFS) in 1987, and is a member of the international JGOFS Scientific Steering Committee since 1991.



**Stephan Kempe**, Institute for Biochemistry and Ocean Chemistry, University of Hamburg, Germany. Dr. Kempe is Assistant Professor at the University of Hamburg, and lecturer for physical geology and biogeochemistry; his research projects include biogeochemistry of the ocean, the chemical evolution of the ocean, stromatolite formation, rivers, lakes and carbonate chemistry. Dr. Kempe was a member of the Planning Committee for Land-Ocean Interactions in the Coastal Zone project, 1991-1992.



**Bernard Tinker**, formerly Director of Terrestrial and Freshwater Sciences, Natural Environment Research Council, Swindon, UK. Dr. Tinker's research interests cover plant nutrition and root function, particularly for tropical crops and trees; the role of mycorrhizal fungi in nutrient fluxes; and responses of agricultural systems to global change. Dr. Tinker is a member of the Scientific Steering Committee for Global Change and Terrestrial Ecosystems since 1990, where he heads Focus 3, Global Change Impact on Agricultural and Forestry.

## Composition of the Scientific Committee for the IGBP

*A full listing follows of the SC-IGBP membership at the end of January 1993*

### Members appointed by ICSU

**James J. McCarthy** (Chairman), Harvard University, Cambridge, Massachusetts, USA. Professor of Biological Oceanography, Director of the Museum of Comparative Zoology, Harvard University. Research interests include nutrient cycles in the sea, and processes that regulate marine production.

**Robert W. Stewart** (Vice Chairman), Victoria, BC, Canada. Professor of Physics and Oceanography. Research interests include physical oceanography, underwater acoustics, turbulence (ocean and atmospheric), boundary layer meteorology, air-sea interaction, and sea-level variation.

**Shizuo Tsunogai** (Vice Chairman), Hokkaido University, Hakodate, Japan. Professor of Analytical Chemistry, Department of Chemistry, Faculty of Fisheries. Research interests include cycles of chemical substances in the atmosphere, the sea and the sea floor, and biogeochemical studies on the atmosphere-marine system.

**Peter S. Liss** (Treasurer), University of East Anglia, Norwich, UK. Professor in the School of Environmental Sciences. Specialisation in environmental chemistry, with research in the field of ocean/atmosphere chemistry, in particular air-sea gas exchange.

**Congbin Fu** (Member), Academia Sinica, Beijing, China. Professor of Meteorology, Director of the Climate Research Laboratory at the Institute of Atmospheric Physics. Research in the fields of physical and dynamic climatology, climate change, air-sea interaction and climate-vegetation interaction.

**Stephen Kempe** (Member, see New Members).

**Margaret Leinen** (Member, see New Members)

**Jerry M. Melillo** (Member), Marine Biological Laboratory, Woods Hole, MA, USA. Co-director of The Ecosystems Center. Principal Investigator of research projects in boreal, temperate and tropical ecosystems. Research fields include biogeochemistry and ecological modelling.

**Eric O. Odada** (Member), University of Nairobi, Kenya. Professor at the College of

Biological and Physical Sciences, Department of Geology; leader of the International Decade of East African Lakes (IDEAL) project. Marine geochemist, with special interest in past climate change in lacustrine and oceanic environments.

**W. Richard Peltier** (Member), University of Toronto, Ontario, Canada. Professor at the Department of Physics; research in geophysical fluid dynamics on problems involving nonlinear hydrodynamic waves and wave/mean-flow interaction in the atmosphere and oceans, and the dynamics and evolution of the planetary interior and surface, especially mantle convection and palaeoclimatic change.

**José Sarukhán** (Member), National Autonomous University of Mexico, D. F., México. Rector of the University; tropical plant ecologist with emphasis in population and ecosystem approaches, particularly biogeochemical cycles in tropical deciduous forest and the impact of land use patterns.

**Suresh K. Sinha** (Member), Indian Agricultural Research Institute, New Delhi India. Professor of Eminence at the Water Technology Center; plant physiologist with research interests on the impact of climate change on agriculture, drought resistance in crops, plant biochemistry, physiological genetics, physiological and biochemical basis of yield.

**Bernard Tinker** (Member, see New Members).

#### Members chairing IGBP and other related committees

**Hans-Jürgen Bolle**, Free University Berlin, Germany. Chair, Scientific Steering Committee, Biospheric Aspects of the Hydrological Cycle (BAHC), Professor of Meteorology at the Meteorological Institute; research in the application of remote sensing data for climate research.

**Genady Golubev**, Chair, Standing Committee for the Global Change System for Analysis, Research and Training (START), Assistant Director, Conservation Programmes, The World Conservation Union, Gland, Switzerland. Geographer, hydrologist; research on global environmental problems and water resources assessment and management.

**Patrick Holligan**, Chair, Scientific Steering Committee for Land-Ocean Interactions in the Coastal Zone (LOICZ), Natural Environmental Research Council, Plymouth Marine Laboratory, UK. Research interests in marine biogeochemistry and ecology include phytoplankton carbonate production, the sulphur cycle and the application of remote sensing to

studies of plankton distributions.

**Harold K. Jacobson**, Chair, Human Dimensions of Global Environmental Change Programme (HDP) of the International Social Science Council. Professor of Political Science and Director, Centre for Political Studies, Institute for Social Research, University of Michigan, USA. Research on international institutions, especially the national implementation of international environmental accords.

**J.W. Maurits la Rivière**, Convener, ICSU Advisory Council on the Environment (ACE). Secretary General of the International Council of Scientific Unions. Professor Emeritus of Environmental Microbiology at the University of Delft, Netherlands, and specialist in environmental engineering, biogeochemical cycles, microbial metabolism and ecology, and biological waste treatment and utilization.

**Gordon A. McBean**, Chair, Joint Scientific Committee for the WCRP. University of British Columbia, Vancouver, BC, Canada. Professor of Atmospheric Science and Head, Department of Oceanography. Research on atmosphere-ocean interaction, role of storms in climate, and oceanic heat and water balances.

**Berrien Moore III**, Chair, Task Force on Global Analysis, Interpretation and Modelling. University of New Hampshire, USA. Professor of systems research at the Institute for the Study of Earth Oceans and Space. Mathematician; with advanced research in modelling of the global carbon cycle and the role of the ocean as a sink for CO<sub>2</sub>.

**Hans Oeschger**, Chair, Scientific Steering Committee on Past Global Changes (PAGES). Institute of Physics, University of Berne, Switzerland. Professor of Phys-

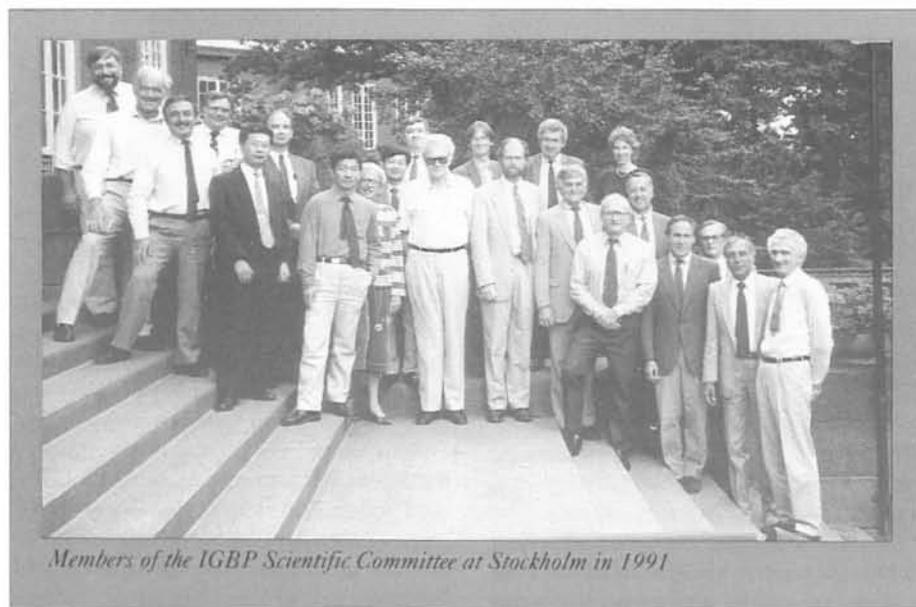
ics at the Institute and Director of the Department of Nuclear Geophysics and Principal Investigator of glaciology research projects in Greenland and Antarctica. Research on Earth system studies include radioisotope analyses, natural system modelling.

**Trevor Platt**, Chair, Scientific Steering Committee for the Joint Ocean Global Ocean Flux project (JGOFS). Biological Oceanography, Biological Sciences Branch, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada. Research on marine production processes, especially the factors controlling photosynthesis and its synoptic measurement by remote sensing.

**Ronald G. Prinn**, Chair, Scientific Steering Committee for the International Global Atmospheric Chemistry Project (IGAC). Massachusetts Institute of Technology, USA. Professor of Meteorology and Director, MIT Center for Global Change Science. Research includes the chemistry and physics of the atmosphere, and its chemical evolution.

**S. Ichtaque Rasool**, Chair, Standing Committee on Data and Information Systems (DIS). University of Paris VI, France. Chief Scientist for Global Studies, NASA. Research on thermal structures of planetary atmospheres, and the development of data interpretation techniques for satellite sensors.

**Brian H. Walker**, Chair, Scientific Steering Committee for Global Change and Terrestrial Ecosystems (GCTE). Commonwealth Scientific and Industrial Research Organization (CSIRO), Canberra, Australia. Chief of the Division of Wildlife and Ecology; ecologist with particular research interest in the dynamics of tropical savannas.



Members of the IGBP Scientific Committee at Stockholm in 1991

## Core Project Activities

### GCTE reviews proposals



The Scientific Steering Committee of the Global Change and Terrestrial Ecosystems (SSC-GCTE) project accepted ten proposals for Core Research at its meeting in Bayreuth, Germany, on October 22-14th. With the operational plan as a

guideline, research groups in several countries have submitted proposals addressing the various GCTE Activities and Tasks. The SSC assessed the proposals on their relevance to the Core Project goals. Many of the projects are already funded by national services while others were accepted subject to funding.

Several projects were identified as contributions to GCTE's second category of research, Regional/National. Although these projects don't directly address the objectives of the GCTE Operational Plan, they are nevertheless important in providing the critical link between the global-scale Core Research and the national and regional scales which are of concern to individual countries and regions. Procedures for dealing with national research contributions to GCTE will be developed further in future meetings.

The SSC noted the progress in the implementation of GCTE research Foci 1, 2 and 3. Plans for Focus 4, Global Change and Ecological Complexity, will be presented during SAC-III in Ensenada, Mexico.

GCTE has strong links with many of other the other IGBP Core Projects. It was considered vital to strengthen these links in order to foster integration and avoid overlap. At present the resources for this type of work are too limited. The relation with the proposed Core Project on Land Use Land Cover Change will be of particular importance.

The output of GCTE research should mainly be published in leading international science journals with proper recognition of the relation to GCTE. The output of GCTE research meetings will be published in established report series and special editions of journals. The SSC decided to hold the first GCTE scientific conference in May 1994.

As a result of a major international meeting in July 1992 on terrestrial monitoring, GCTE has been asked to take the lead in

the definition of the scientific requirements for the Global Terrestrial Observing System (GTOS). UNEP, UNESCO, FAO and WMO participate in the Task Force that has been established for this purpose. GTOS will contribute the terrestrial component of the Global Climate Observing System.

### IGBP-DIS meets with GCTE

The Standing Committee for the IGBP Data and Information System will have its future meetings at the sites of the different Core Projects of the IGBP. This decision was taken after a productive meeting at the GCTE Core Project Office in Canberra Australia. Both the Chair of GCTE, Brian Walker, and the head of the Core Project Office, Will Steffen, participated in most of the meeting. It offered an excellent opportunity to focus on the data needs of GCTE. The SC-DIS considers the strengthening of the links with the Core Projects to be of great importance, if it is to fulfil its task to assist the Core Projects in defining their data needs.

The progress of the different projects of IGBP-DIS was reviewed. A first 1 km Global AVHRR data set is now available for a single day. Ultimately it should develop into an operational system. A working group will be set up to define the requirements for soil data. At the meeting of the Committee on Earth Observation Satellites in London it was decided that IGBP-DIS would be invited to propose a pilot project for using earth observation data for global change research, for which the high resolution data would be made available at lowest possible cost. With a view to streamline data acquisition, a workshop will be convened addressing the coordination of research site selection for GCTE, BAHC, IGAC and LOICZ.

The SC-DIS will offer its assistance to START in the creation of the data part of the regional networks. Considerable time was spent on the discussion of strategic concerns, including the role of IGBP-DIS, but also considering the whole gamut of data and information activities within IGBP. Many of the latter will inevitably be carried out within the Core Projects themselves, as well as within GAIM and START. The outcome of this discussion will be presented at the SAC-III meeting in Ensenada, Mexico.

### BAHC Scientific Symposium

Around 100 meteorologists, hydrologists and ecologists attended the first Open Meeting and Scientific Symposium of the IGBP project on Biospheric Aspects of the Hydrological Cycle (BAHC). The



meeting was held at Météo-France Conference Centre, Toulouse, on November 16-18th; it was preceded by three Workshops (held jointly with UNEP) and followed by the 4th meeting of the BAHC Scientific Steering Committee.

The programme for the Scientific Symposium covered the full range of interactions between terrestrial ecosystems, the water cycle and energy fluxes. Over 40 papers were presented in plenary sessions, giving recent results and ideas for further research on such topics as the estimation of soil moisture and evapotranspiration by remote sensing; the effect of land surface features on near-ground air flow; the dynamic links between water, carbon, nutrient and trace gas cycling; and the development of models to determine evaporation at GCM grid-scales. The Chairman of the BAHC SSC, Hans-Jürgen Bolle, gave an overview of the project, and its main components were outlined by the four Focus Leaders (Steven Running, Jean-Claude André, Chris Field and Brad Bass).

Discussion sessions addressed the following themes in the context of the draft Operational Plan for BAHC:

- Process studies and advances in SVAT (soil-vegetation-atmosphere transport) modelling at the patch scale
- Complex BAHC-related national and regional research projects and programmes
- Meso- to macroscale hydrological studies and modelling
- Achievements and requirements in estimating areal evapotranspiration
- Down-scaling of climate information.

The various components of the Toulouse meeting were considered to be very constructive in the further development of BAHC and its implementation. The first BAHC Newsletter will be issued early in 1993, and will include further information on the results achieved and activities planned.

## Announcements

### Head of IUCN Social Policy Programme

Founded in 1948, IUCN – The World Conservation Union, brings together States, government agencies and non-governmental organizations in a unique world partnership: 650 members, spread across 120 countries.

The IUCN seeks a Head for its Social Policy Programme to lead a small team working on the integration of conceptual, operational and policy implications of demographic, social group, economic, community participation and ethical aspects of conservation into IUCN programmes. The successful applicant should possess broad experience in field and policy work, have demonstrated leadership qualities, have worked in an organization in a catalytic role, and have considerable exposure to disciplines besides her/his own. She/he should be a skilled negotiator and communicator with experience in working with governments, inter-governmental agencies, non-governmental organisations and local communities in culturally diverse settings. A candidate with a working knowledge of English, French and Spanish will be preferred.

The Head will be responsible to the Assistant Director General for Conservation Programmes. Responsibilities include:

- Coordinate all aspects of IUCN's Social Policy Programme.
- Liaison with IUCN regional offices and other IUCN programmes.
- Identify, develop, monitor and evaluate new field projects and activities to better integrate social sciences into IUCN regional and thematic programmes.
- Supervise IUCN social science field staff and consultants.
- Maintain a dialogue with IUCN's governmental and non-governmental members on social policy issues.
- Develop and communicate IUCN's policies and positions on social policy issues.
- Provide advice to governments and development assistance agencies on global and local social policy issues.
- Prepare material for publication, including technical reviews of publications and reports.

The Head of the Social Policy Programmes will be based at IUCN Headquarters in Gland, Switzerland, with time spent in IUCN regional offices and field operations.

To apply, please send your curriculum vitae as soon as possible to the head of Personnel, IUCN, rue Mauverney 28, CH-Gland, Switzerland. Fax: (+41-22) 999 0010.

### International Antarctic Centre

The International Centre for Antarctic Information and Research (ICAIR) at Canterbury (New Zealand) is now spaciouly housed in the new International Antarctic Centre. A manager has been appointed, and a computer network with geographic information system and image processing facilities is being installed.

ICAIR is an independent, non-profit organisation under the auspices of the Royal Society of New Zealand. One of its objectives is the servicing of scientific and environmental information needs, as indicated



in the Madrid Protocol on Environmental Protection of the Antarctic, through the application of appropriate information technology. The ICAIR mission is:

To develop and operate a Centre of acknowledged international leadership in the collection, coordination, utilisation and dissemination of scientific and environmental digital information on Antarctica and the Southern Ocean;

To facilitate the exchange and analysis of data related to Antarctica's role in global processes;

To contribute to the development of soundly based principles for environmental management and planning in Antarctica;

To foster research using the information and resources of the Centre.

Immediate objectives are to develop a spatially referenced environmental database for the Ross Sea region of Antarctica that will serve as a useful baseline against which to monitor and assess change, but it is hoped in the longer term to extend these to other areas of the continent. The Director, Dr. Steven Smith, anticipates that global change researchers in New Zealand and elsewhere will take advantage of the data bases for their own work (via Internet links). ICAIR's emphasis at present lies in the development of an Antarctic science directory system for New Zealand, the US and Italy whose Antarctic programmes are already making use of the facilities. ICAIR is also involved in the development of computer data bases to assist in the logistical aspects of moving science teams to and from the ice. And while in Christchurch, they may tap into ICAIR's resources.

For further information about ICAIR contact: Dr. Steven Smith, Manager, ICAIR, PO Box 14 199, Christchurch, New Zealand. Tel: (+64-3) 358 4450, Fax: (+64-3) 358 4489, E-mail: [ssmith@icair.iac.org.nz](mailto:ssmith@icair.iac.org.nz).

### Information Unit on Climate Change

UNEP, in consultation with the World Meteorological Organization, has established the Information Unit on Climate Change (IUCC) in Geneva. The Unit's mandate is to make the findings of climate change researchers more accessible to both decision-makers and the general public. The Unit helps governments to meet their commitment expressed in the new Framework Convention on Climate Change to improve national information and training programmes. The first step has been to produce a series of climate change fact sheets as well as several videos. Both are being translated into French, Spanish, Portuguese and Arabic. The IUCC has a film database and a video library, with over 75 films on climate change and related issues. A dossier on Climate Change provides specialized information services for high-level decision makers on the critical issue of Climate Change. (UNEP, IUCC, Geneva, 1992). The Fact Sheets give basic information under three headings: the causes of climate change, the impacts of climate change, and the international response to climate change.

Videos, in VHS-NTSC, PAL, SECAM. A/V Section (UNEP, IUCC, Geneva, 1992):

- BIOS, 3 1/2 min. (music background)
- Newsclips, 39 min. (without sound)
- What is the Greenhouse Effect, 12 min. (in English, French, Spanish and Arabic).

Contact: Michael Williams, IUCC Media Specialist, or Michèle Millet, A/V Section, UNEP/IUCC, Palais des Nations, CH-1211 Geneva 10, Switzerland, Tel: (+41-22) 789 40 62; Fax: (+41-22) 789 40 73.

## Publications

**HDP Report 4. Economic Data and the Human Dimensions of Global Environmental Change:** Creating a Data Support Process for an Evolving Long Term Research Program (1992) Gary Yohe and Kathleen Segerson (eds). Paris: Human Dimensions of Global Environmental Change Programme (HDP) of the International Social Science Council. 71 pp.

**Preliminary Guidelines for Assessing Impacts of Climate Change** (1992). T. R. Carter, M. L. Parry, S. Nishioka and H. Harasawa (eds). Environmental Change Unit (UK) and Center for Global Environmental Research (Japan) for Working Group II of the Intergovernmental Panel on Climate Change. Oxford: Environmental Change Unit, 28 pp.

## IGBP Meetings in 1993

### 19-22 January, Charlottesville, Virginia, USA

GCTE Focus 2 Workshop: Use of Functional Types in the Modelling of Global Change. Prof. Herman H. Shugart, Department of Environmental Sciences, University of Virginia, Clark Hall, Charlottesville, VA 22903 USA, Tel: (+1-804) 924 7642, Fax: (+1-804) 982 2137

### 24 January, Ensenada, BC, Mexico

ICSU Global Change Forum on Earth System Science

### 25-26 January, Charlottesville, Virginia, USA

UNEP/GCTE Workshop: Towards a Universal Classification Scheme for Global Mapping and Monitoring of Vegetation. Dr. Beatrice Murray, UNEP-HEM, Global Environmental Monitoring System, Ingolstädter Landstrasse 1, D 8042 Neuherberg bei München, Germany

### 25-29 January, Ensenada, B.C., Mexico

SAC III: Third Meeting of the Scientific Advisory Council for the IGBP including a Scientific Symposium and the third meeting of representatives of National Committees for the IGBP

### 30 January, Ensenada, B.C., Mexico

Scientific Committee for the IGBP

### 28-31 March, Taxco, Mexico

HDP-IGBP/START Inter American Regional Workshop on Global Environmental Change in Latin America: Collaborative Research in the Social and Natural Sciences

### 17 April, Eilat, Israel

IGAC Council

### 18-22 April, Eilat, Israel

IGAC Scientific Symposium. IGAC Core Project Office, Bldg 54-1312, MIT, Cambridge, MA 02139, USA. Tel: (+1-617) 253 4902; Telex: 921473 mitcam; Fax: (+1-617) 253 0354; e-mail: R.Prinn (Omnet)

### 27-29 April, Warnemünde, Germany

JGOFS North Atlantic Planning Group Workshop

### 17-20 May, Raleigh, North Carolina, USA

Open meeting on the IGBP Core Project Land Ocean Interactions in the Coastal Zone (LOICZ). Dr. P. M. Holligan, Plymouth Marine Laboratory, West Hoe, Plymouth PL1 3DH, UK. Tel: (+44-752) 222 772, Fax: (+44-752) 670 637

### June, Brazil

BAHC Focus 2, with GCTE and Unesco, planning meeting for the Amazon Experiment

### 14-16 June, Plymouth, UK

JGOFS - Intergovernmental Oceanographic Commission CO<sub>2</sub> Advisory Panel

### 23-27 August, Oppdal, Norway

Anticipated Effects of Global Change on the Structure and Function of Terrestrial and Arctic Ecosystems: an International Conference. Jarle I. Holten, Coordinator, GCTE Tundra Boreal Office, Norwegian Institute for Nature Research, Tungasletta 2, N-7004 Trondheim, Norway. Tel: (+47-7) 58 05 00, Fax: (+47-7) 91 54 33

### 3-6 September, Yokohama, Japan

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

### October, Asilomar, California, USA

Developing GCTE Transects and Study Areas for Biogeochemical Research and Ecosystem Dynamics Modelling. Dr. George Koch, Department of Biological Sciences, Stanford University, Stanford, CA 94305, USA. Tel: (+1-415) 723 1179, Fax: (+1-415) 723 9253, E-mail: gwksu@leland.stanford.edu

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# Reducing Uncertainties in Global Change

SCIENTIFIC SYMPOSIUM AT SAC III:  
THIRD SCIENTIFIC ADVISORY COUNCIL FOR THE IGBP  
ENSENADA, B. C., MEXICO, 25 – 29 JANUARY 1993

The sessions are arranged jointly with the World Climate Research Programme (WCRP) and the Human Dimensions of Global Environmental Change Programme (HDP). The emphasis is on the progress already made in IGBP, WCRP and HDP; the results that can be expected in the next few years; and the interactions between these programmes and others, particularly within ICSU.

Presentations to be given at the Symposium include:

Global change models – a biogeochemical perspective  
*Berrien Moore*

Global change models – a physical perspective  
*Gordon McBean*

Can changes in regional climate be predicted?  
*Jagdish Shukla*

The interactive atmosphere  
*Ronald Prinn*

How critical are clouds to climate change?  
*Thomas Vonder Haar*

Interannual variability in ocean-atmosphere coupling  
*Antonio Moura*

The role of oceans in global warming and interdecadal variability of climate  
*Syukuro Manabe*

Biogeochemical interactions in the Equatorial Pacific  
*Richard Barber*

Direct responses of terrestrial ecosystems to changes in atmospheric composition  
*Harold Mooney*

Large scale responses of natural and managed ecosystems to global change  
*Brian Walker*

Human forcing of land cover change  
*Billie Turner*

Land surface features and the water cycle  
*Steve Running*

Large scale experimental and modelling studies of hydrological processes  
*Jim Shuttleworth*

Palaeo-perspectives  
*Claude Lorius & Alayne Street-Perott*

Global Change Research in Latin America  
*Federico Garcia-Brum, Alvaro Brenes, José Sarukhan & Ruben Lara Lara*

Interactions and collaboration across the social and natural sciences  
*Roberta Miller*

Science and policy making  
*Bert Bolin*

A Panel Discussion will address the issues: Are the global change research programmes sufficiently focused on the issues of greatest uncertainty? In what timeframe can sizeable contributions be expected to answer the questions that are asked by society? What should be done to further improve and accelerate their progress?

*The papers will be published in the IGBP Report Series*

Global Change NewsLetter  
Editor: *Suzanne Nash*  
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