

GLOBAL CHANGE NEWS LETTER

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GLOBAL
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CHANGE

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Science for Environmental Sustainability

Highlights from
IGBP's 4th Congress
Cape Town, South Africa

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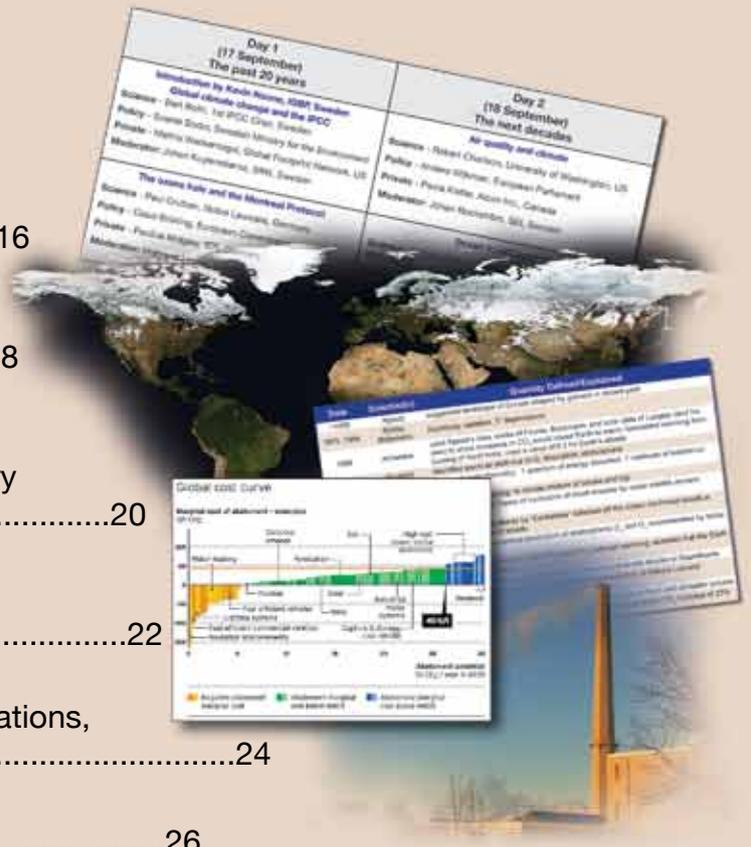
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IGBP's New Executive Director Outlines Future Directions

Editor's note:

Dr. Sybil Seitzinger began her term as IGBP's new executive director on 1 September 2008. Her areas of expertise include biogeochemistry, nutrient dynamics, and land/atmosphere/ocean interactions. Prior to IGBP, Sybil was director of the Rutgers/NOAA Cooperative Education and Marine Research Program at Rutgers University and has been a visiting professor at Rutgers' Institute of Marine and Coastal Sciences since 1994.

This is an exciting time for IGBP. Events over the past year are pointing towards new directions for the Programme, as the need for, and interest in, the findings of IGBP science continue to increase, including among policy makers. IGBP has a long tradition of science-policy interaction, as is evident through its key involvement with international environmental assessment bodies such as the Intergovernmental Panel on Climate Change (IPCC) and the Millennium Ecosystem Assessment (MA). Those activities were augmented in September 2007 with IGBP's 20th Anniversary Symposium on Earth System Science and Society, which encouraged dialogue between major stakeholders in the policy, private and science sectors to address political and societal questions related to global environmental change (see related articles starting on page 16).

In May 2008, IGBP held its 4th Congress in Cape Town, South Africa, under the theme "Sustainable Livelihoods in a Changing Earth System." South Africa was an excellent venue to help strengthen IGBP's research and networking on development issues crucial for developing countries all around the world. The Congress focussed on many issues of direct relevance to civil society and the policy community, and helped IGBP identify ways to better contribute towards developing sustainable pathways for mitigation, innovation and adaptation. Articles summarising key aspects of the Congress begin on page 4.

IGBP intends to continue its brand of policy-relevant, Earth system science, and is poised to refine its programme to better meet the needs of its stakeholders. The recent review of IGBP by a high level panel of scientists appointed by ICSU provides very positive messages for IGBP, including acknowledgment of IGBP's importance to international policy and assessments. Among some of the recommendations, the ICSU review noted the need for IGBP to sharpen its strategic vision, to prioritize its science activities, and to continue to reach out to policy makers. The review will be published in early 2009.

These events are all helping us to chart the next phase of IGBP.

As the incoming Executive Director my goals are many. But top of this list are to lead the development of a Strategic Vision and Prioritisation Process for IGBP activities; maximise the scientific, policy and practice impacts of IGBP-related science; and secure a stable funding base. Promoting the science that our Core Projects are doing is an integral component of all the above. A new, major activity for IGBP will be a synthesis effort in which we will engage a wide range of stakeholders including scientists, policy makers, and the public, with a goal of not only advancing fundamental understanding of the Earth System but also providing the science to underpin key international assessments (e.g., IPCC, MEA, others) and policy decisions.

Clearly, IGBP has a full research and outreach agenda over the coming years. We will continue to steer the programme towards policy relevant directions, with a focus on top research priorities. We invite all members of our community—from scientists, to policy makers, to the general public—to help us reach our goals. For it is only through the full participation of all of our stakeholders that we will be able to address effectively the challenges of global change.



A handwritten signature in blue ink that reads "Sybil P. Seitzinger".

Africa, with its rich diversity of peoples and natural environments, requires using the best of both indigenous and global knowledge to create pathways to a sustainable future.

In Search of Sustainable African Pathways

O.P. Dube and B. Scholes

Many analyses agree that Africa is particularly vulnerable to certain aspects of global environmental change (GEC), partly because of its already-high exposure to extreme droughts, heat, tropical storms, food insecurity and dreaded diseases, but also because its persistently low developmental state limits the response options by both individuals and nations. Science is being challenged more than ever to re-assess its role in the development

of Africa and to find innovative and effective ways to transcend the poverty that has engulfed the continent since the mid 19th Century [3].

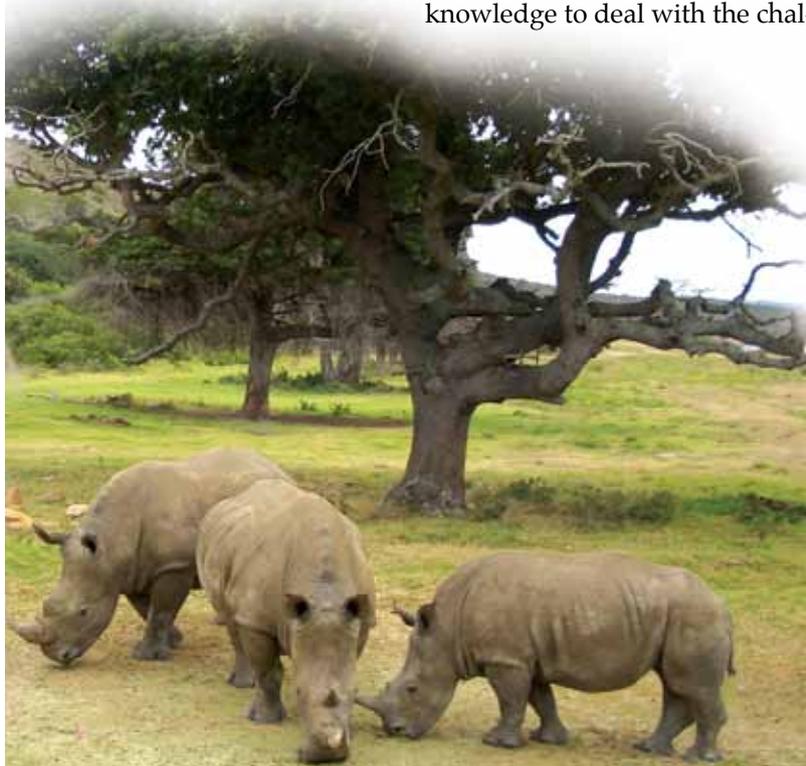
Science and Africa: Where did we lose the way?

Africa is not intrinsically a scientific 'dark continent'. Since time immemorial Africans have developed indigenous knowledge to deal with the chal-

lenges of their environment [1]. Many of these discoveries and innovations have found their way, usually unacknowledged, into 'western' knowledge and products. While that is so, Africa has never been considered an equal partner in the evolution of science. Instead, organised science and the education system have often contributed to the undermining of African indigenous knowledge. In its place, western science has promoted solutions not resilient to African realities. Examples include discouraging locally adapted crop and livestock varieties in favour of input-demanding mono-cropping, imposing sedentary ranching in highly variable dry lands, and fire suppression in systems that thrive on fire. The result is that science in general, and externally-driven science in particular, does not enjoy automatic acceptance and status by African people and their leaders. At the same time, it is increasingly appreciated that the ability to assimilate, master, adapt and develop knowledge and technology is one of the essential elements in breaking out of the poverty trap in which Africa currently finds itself. The novel challenges of global environmental change (GEC) only intensify this need. A research agenda aimed at reducing vulnerability to GEC in Africa should be aligned with poverty reduction with a focus on the sustainable use of the environment.

Research in Africa, not on Africa

This note calls for re-thinking the way in which we bring science



to bear in support of sustainable development in Africa.

An African GEC research program needs to be Africa-led.

This not only improves the chance that it is sustained and has practical outcomes, but is a prerequisite for its developmental objectives. This often means that well-meaning scientists from elsewhere in the world need to consciously stand back and play a supportive role. The ICSU Regional Office of Africa and the African Network for Earth System Science (AfricanNESS) are evidence of this emerging leadership role. Examples of good practice at a project level are the SAFARI 2000 experiment [4] and the ESSP GECAFS southern African programme [2].

Close engagement between African scientists, institutions and agendas with their global counterparts remains essential.

African science is not different in its nature from any other science, only in its circumstances. The GEC issues demand a coordinated approach. But this engagement needs to graduate from its prevalent 'dependence-assistance' mindset to one of partnership based on mutual respect. For the foreseeable future African researchers will not have the budgets, equipment and numbers enjoyed by northern counterparts, but they bring their time (undervalued because it is denominated in local currencies), experience, datasets and observations, keen insights into local processes, and intellects second to none. The true currency of science is knowledge, not dollars. Collaboration must consist of more than a few lines about 'capacity development' in the proposal, and cheap local labour. It means co-development and co-ownership of the intellectual substance of the project.

An aspect of international collaboration that has been neglected in the past is the so called 'south-south' axis, between African countries and other developing countries with similar challenges.

Research initiatives such as the UNEP/GEF/START/TWAS Assessment of Impacts of and Adaptation to Climate Change (AIACC) project have successfully fostered such linkages.

Lack of critical mass in many disciplines, and general weakness in science-supporting institutions, can best be overcome by African scientists organising themselves regionally rather than nationally.

This will require a conscious effort to abandon a lot of nationalistic baggage, both among scientists and politicians.

African GEC research has the opportunity from the outset to be highly integrated.

Firstly, science is not seen as something separate from society, but as part of a collective striving. Secondly, few African researchers have the luxury of narrow specialisation, so they are often intrinsically less discipline-bound and reductionists than northern researchers. For Africa the division between 'development research' and 'GEC research' is spurious and harmful.

Sustainable African pathways require a two-way linkage between science and policy: science should influence policy, but development policies must also shape the science.

To nurture such interdependent linkages, African science must be responsive to the needs of policymakers and other stakeholders, and must work hard to be heard and understood. The science-policy linkages should extend to global assessments such as the Millennium Ecosystem Assessment and the IPCC,

where currently African knowledge has limited input.

Science can only help lay a foundation for sustainable development under a stable and favorable political environment. African society as a whole has a responsibility to facilitate the development of science within the continent, including making it a welcoming place for scientific partners from the rest of the world.

GEC challenges are an opportunity to re-evaluate the role of science in the development of Africa. The goal of science in Africa should be to build resilient social-ecological systems that support sustainable development. Systems that are adapted to the African environment should form the basis of this resilience, and that means they must be built using the best of both indigenous and global knowledge.

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AfricanNESS Science Plan and Implementation Strategy Completed

The African Network of Earth System Science (AfricanNESS) science plan and implementation strategy was completed and officially launched at the IGBP Congress in Cape Town in May 2008. The plan, which is available for download from the IGBP and ESSP web sites, serves as a road map for global environmental change research in Africa. Its purpose is:

“to describe the areas of global environmental change research that are of particular importance and interest for Africa, to describe the basic research needed to support cogent decisions about adaptation and mitigation, and to provide reasonable options for the support structure needed to facilitate and implement the research.”

A Strategy for Global Environmental Change Research in Africa



Science Plan and Implementation Strategy

To download the science plan pdf go to: www.igbp.net/page.php?pid=412

The science plan was prepared in wide consultation with African global environmental change (GEC) researchers, and also with the international research community outside Africa. It reflects the collective views of this research community as to the needs and special interest areas for African GEC research. The plan is stratified into three levels of increasing detail; the intention is to clearly describe the large-scale issues of particular importance for Africa, outline the kinds of international, multidisciplinary research approaches necessary to approach these issues, give examples of specific questions and projects that could be part of an African GEC research initiative, and finally to propose a mechanism through which these initiatives could be realised. This mechanism is called AfricanNESS: the African Network for Earth System Science.

AfricanNESS concentrates on four top-level issues that are the focus of concern with respect to global environmental change and its impacts in Africa:

- Food and nutritional security, including crops, wild-gathered resources, livestock resources and fisheries;
- Water resources, particularly in the water-limited, sub-humid, semi-arid and arid regions;
- Health, especially in relation to the biodiversity-linked, environmentally mediated and vector-borne diseases that are responsible for the high disease burden in Africa; and
- Ecosystem integrity, on which the persistence of biodiversity and the delivery of ecosystem services depends.

These focal issues find expression, for instance, in the Millen-

AfricanNESS thematic clusters (blue text) and research elements

| | | | |
|--|--|---|--|
| <p>Rainfall Variability Distribution Processes Land-surface feedbacks Rainfall in GCMs</p> | <p>Land Cover Degradation Fragmentation Fires Biodiversity loss Water resources Wetlands</p> | <p>Livelihoods Fisheries Pastoralism Crop farming Vulnerable people and places</p> | <p>Cities Flooding Sea-level rise Pollution Water resources Infrastructure</p> |
| <p>Diseases & Pests Environmental and emergent Advanced bioclimatic modelling</p> | <p>Africa and the Earth System Carbon cycle Dust aerosols Water cycle Ocean-land interaction Palaeoclimate Biogeochemistry Regional climate modelling</p> | <p>Integrated Development Energy Transportation Air quality Scenarios Governance</p> | <p>Marine Ecosystems and coral reefs Biodiversity and food resources Large-scale circulations</p> |

nium Development Goals.

The researchable topics in such broad themes are unavoidably many and interconnected. To achieve a degree of focus and clarity, they have been arranged in the AfricanNESS science plan into eight thematic clusters. The elements of such clusters typically interact strongly among themselves, and so are best treated in a coordinated fashion. There are also connections between clusters, so one element may have relevance in several themes, although for conciseness it is described only in one. The thematic clusters are deliberately not aligned with traditional disciplinary boundaries.

To further organise and prioritise the research topics in this African global change research strategy, the science plan applies the following seven principles:

1. Favour a limited number of multi-year coordinated research programmes over a large number of short-term, independent projects;
2. Promote inter-disciplinary, multi-institutional and regional research;
3. Develop science-policy-practice interfaces;
4. Build lasting human and institutional capacity;
5. Ensure that the products of scientific research are credible, salient and legitimate;
6. Contribute to the global research agenda from an African perspective;
7. Recognise and develop indigenous knowledge and capacity.

The resulting themes represent the intersection of the information needed to support development of favourable

research opportunities, and the research capabilities desired in Africa. The objective is to develop the capacity, within Africa, to anticipate and adapt to global change and to adopt a development path that is locally and globally sustainable.

Finally, the science plan proposes a structure and mechanism by which these themes and elements can be approached, and gives an estimate of the level of support needed to make AfricanNESS into a functional research network for Africa. A working group was established during a scoping meeting held at the Congress. It is chaired by Professor Isabelle Niang, Cheikh Anta Diop University, Senegal, and has been charged to come up with concrete suggestions for establishing a support structure for AfricanNESS.



Cape Town Declaration

Editor's note: The following is a summary of the Cape Town Declaration that resulted from the Congress. To read the full text online, go to: www.igbp.kva.se/page.php?pid=415.

The global environmental changes brought on by human activities have already and will continue to have significant, planetary-scale consequences. The thousands of concerned scientists who make up the Earth System Science Partnership emphasise the seriousness of the impending global environmental crisis, and the urgency of collective action to ameliorate it.

- There is a real risk that the climate of the earth will, as a result of human influences on natural processes, exceed the limits for human security and wellbeing in many parts of the world. The inertia of the earth system, including society, requires immediate and concerted actions to build resilience and adaptive capacity to the changes we anticipate.
- While there is a solid body of well-founded science available to diagnose the causes of global environmental trends, their likely consequences, and potential solutions, there still remains much to be done. Never before has there been such a need for well-integrated science of, and action for, the environment.
- Increasingly realistic estimates of the value of the services that ecosystems deliver, and recognition that these services have no substitutes, argue for more robust and sustainable development pathways to be identified and pursued.

The participants of the Fourth IGBP Congress, "Sustainable Livelihoods in a Changing Earth System", commit to work together to pursue science that will aid us in achieving sustainable development of our common, global resources. We commit

- To build upon the successes we have had of constructing a scientific infrastructure that brings together scientists from many nations, disciplines and backgrounds, from across the natural and social sciences;
- That we use this human and intellectual capital to build the next level of scientific infrastructure that is necessary to understand and predict the behavior of coupled human-environmental systems;
- That the framework for this scientific infrastructure be built around the ideas of sustainability and ethical global stewardship of the Earth System;
- That we challenge ourselves with using the understanding that we develop about these coupled systems as the scientific basis for assessments and communication of the options, risks, vulnerabilities and possibilities for future sustainable development of our planet.

Only together can we achieve these goals, and by working together each of us can contribute to making a positive impact on global sustainable development.



IGBP Congresses provide an opportunity for the programme's projects to hold working group sessions on forward-looking, scientific interaction on cross-cutting themes to encourage cross-project interactions. This article summarises the results of working group sessions held in Cape Town.

IGBP Science at the Cape Town Congress: Some Idiosyncratic Reflections

M. Stafford Smith

In a moment of lapsed attention, I somehow agreed to the task of presenting a short summary of the recent IGBP Congress's 20 working group sessions on the day after the groups met. Since these were mostly run as 6 parallel symposia, getting a serious overview was a challenge. I was assisted by many of the session chairs and a few other roving commentators to whom I am grateful. The following, though, is very much a summary of my impressions as presented at the plenary on 9 May.

There was, as ever, outstanding science, some interesting surprises, and evidence of a remarkable amount of hard work around the world. In such a wealth of insights it is invidious to pick anything out, but a few topics that particularly caught my attention included:

- The identification of the emerging potential for upland forest areas to act as a methane source;
- The mapping of anthropogenic N in the oceans, published soon after the meeting as Duce *et al.* [1], highlighting the extent of yet another aspect of non-climate-based global environmental change that we are wreaking on the planet;
- The evolving successes in untangling the complexity of some marine foodwebs, where it often seems to me that despite all the sampling difficulties, marine ecologists are if anything ahead of their terrestrial counterparts in understanding how species interactions may be affected by climate change;
- The progress being made on the analysis of complex social-ecological systems, though especially at a local scale;
- A neat summary update on what is transpiring with the Arctic (with of course some great [and poignant] polar bear pictures) presaging the rapid changes which have been occurring this year and showing that palaeo-data really does confirm the powerful "multiplier effect" on arctic summer temperatures compared to global means;
- In the vein of finding rich insights at the boundaries among disciplines, interesting work building new links between marine and urban environments;
- A growing understanding of how the geographies of production and of consumption are increasingly de-coupled, with food miles moving embedded water, nitrogen and phos-

phorus around the world, introducing the novel idea of needing to tighten our belts on our "nitrogen waistline."

The working group sessions contained other highlights: a great session focussed on young African scientists; new proposals on issues such as biofuels, a global nitrogen model, and systems analyses of air pollution; as well as due recognition for the part played by IGBP scientists in the IPCC's Nobel Prize and other excellent evidence of impacts.

Beyond these and many other specific highlights, however, I was struck by a growing trend. My attention was drawn to it by a somewhat plaintive question in one of the sessions I sat in on. The questioner asked how those present were going to be able to move towards large scale implementation of proposed solutions because "policy decisions are out of our hands as scientists." It struck me as a curiously fatalistic view given that we'd had several South African national and Cape Province provincial politicians address the Congress with active admiration and evident awareness of what their local scientists were doing. Clearly it is not



Mark Stafford Smith

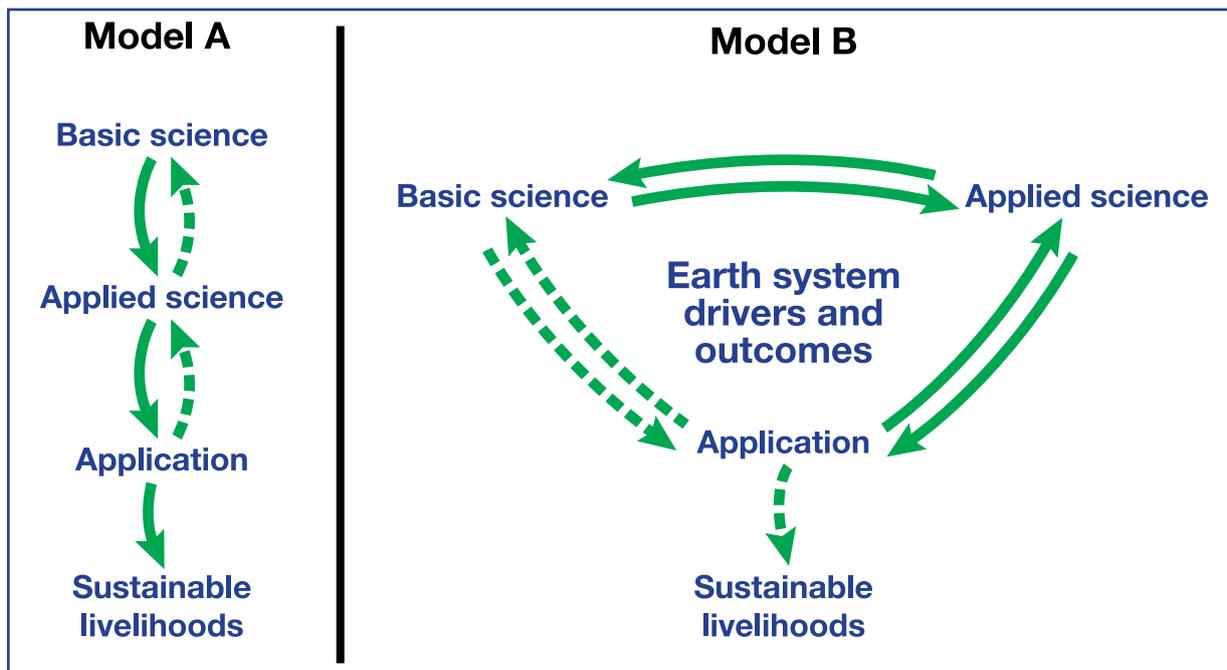


Fig.1. Alternative models of the links between basic science, applied science and application.

impossible to interact effectively with the machinery of government, in some countries at least (I'd come from a recent change in government in Australia perhaps with similar optimism that may be borne of being a small country!). It seemed to me to go to the heart of the role of IGBP in what I'd term the "global innovation system."

For a long time we have assumed a linear chain of scientific transfer in our global change science, where the basic research feeds into applied research which contributes to applications and ultimately sustainable livelihoods in a changing earth system; the feedbacks along the chain to help set the priorities for our research are weak and inefficient in this model (Fig.1(a)). We need to move more to a model where basic science, applied science and application all interact with each other more directly and powerfully (Fig.1(b)). There are then more immediate opportunities for science to influence policy and management, and for science to be influenced more

by the needs of those end-users. Notwithstanding the plaintive question noted above, I was struck that there was an increasing amount of IGBP science taking place more within this type of model, where fascinating science could be done under an applied aegis, and basic research could still be strongly oriented towards societal needs. The food systems work occurring under GECAFS and much work on the global water system, as well as the marine research mentioned above seem to me to be but a few of the many examples of this trend.

I believe that, to cite a Congress participant, "the time is ripe to bridge GEC science with the global development community," to target our work better to adapting to change, and theirs to understanding the feedbacks. This does not mean everyone has to do it all the time (very undesirable!). But everyone has to respect and be interested in the links.

Indeed, a final impressive observation I made at the plenary is that, if one looks at

the tipping points outlined in Lenton *et al.* [2], the Congress reported progress on considering almost all of them, an excellent sign that we are doing work that is highly relevant to society, although the issues facing us are so severe that we cannot ever rest on our laurels.

Mark Stafford Smith,
Vice Chair, IGBP Scientific Committee,
and Science Director,
Climate Adaptation Flagship,
CSIRO, Australia

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To facilitate dialogue between national and international global change research, IGBP has 75 National Committees (NCs) that play an essential role in IGBP's scientific planning and implementation.

IGBP Strengthens Links with its National Committees

J. M.F. de Morais

A major event at the IGBP Congress in Cape Town was a two-day National Committee (NC) meeting hosted by the South African NC. Delegates from 95 countries attended the NC meeting, including 27 who were sponsored by IGBP through generous funding obtained from several national agencies.

The meeting provided an excellent opportunity to enhance the role and structure of NCs, to improve IGBP's international and regional networks and to learn how best to develop integrative projects, data sharing and science-policy initiatives. Another goal was to improve the NCs' links with IGBP, the other global environmental change programmes and ESSP. IGBP Officers, several SSC members and IGBP Secretariat staff attended the meeting as well, showing their support for a stronger communication with and involvement of NCs.

As discussions at the meeting progressed, a clearer picture of the varied nature of NCs emerged. Some NCs address only IGBP issues, while others integrate the full range of global change science; a few national committees are very well linked to IGBP activities, while others have been disconnected (e.g., the Americas have only a few active and effective National Committees).

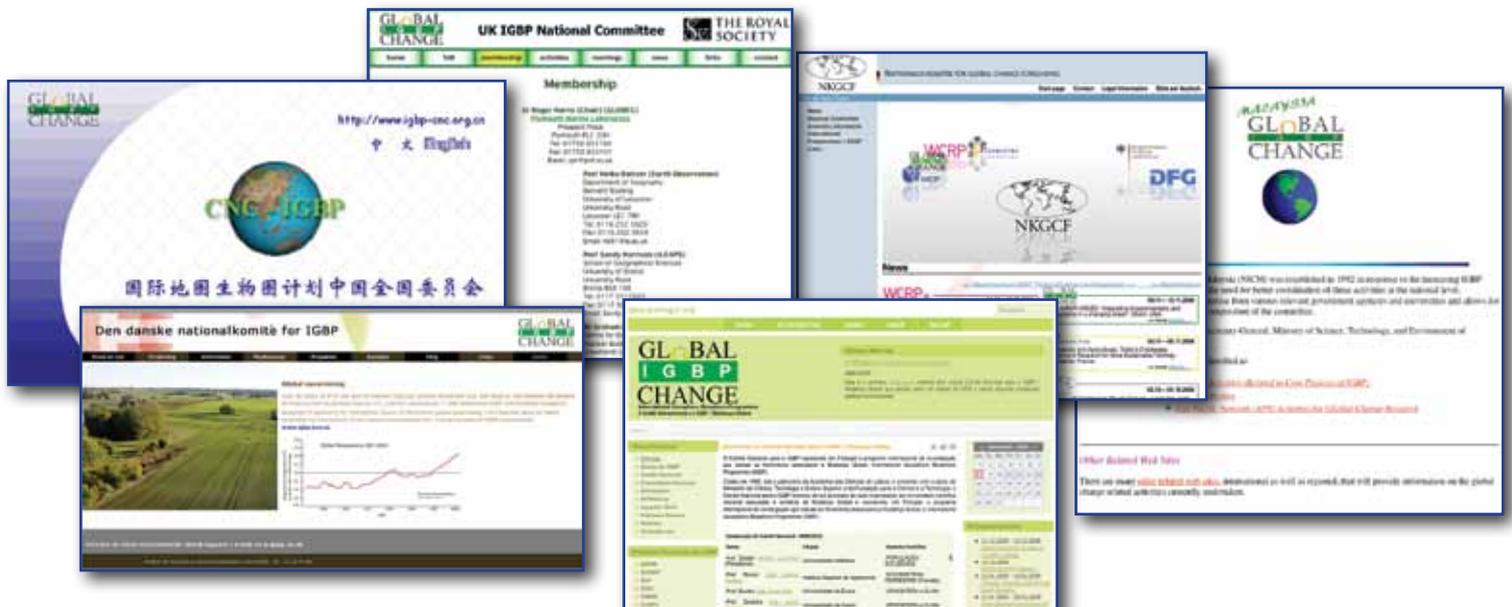
The delegates endorsed the establishment of clear guidelines for NCs and advised on a few strategic options, namely:

Higher involvement and efficient information and governance structures:

1. An increasing level of ownership across the programme, namely between Scientific Steering Committees (SSC) and NCs, promoting the need for IGBP SSC members to become NC representa-

tives and to annually report to their NCs on their SSC activities; active NC input into nominations for IGBP committee membership was also proposed, as well as the IGBP Secretariat taking a more active role in developing NCs;

2. Closer involvement by NCs in promoting data access and data sharing regionally and globally. In the case of Latin America, NC representatives stressed the need to link global change science initiatives to scientific and policy agendas related to greenhouse gas emissions, agricultural development, bioenergy, hydrology, sea level rise and food security. The IGBP Regional Office in Brazil has a central role in helping to enhance the activities and effectiveness of NCs in Latin America, and a meeting (27-28 November 2008, San José dos Campos) has set the stage to better enhance links between IGBP and global change research and networks in the region;
3. An improvement on a two-way communication and information exchange: in the last few years there has been an increase of national and regional NC meetings (e.g. Iberia, Central



Europe) requiring information exchange with the IGBP Secretariat on the outcomes of these meetings and ongoing national activities, fundraising, shared online membership databases, guidelines and time plans, training, etc;

Appropriate synergism across the programme and beyond:

1. The need for a clear regional focus on solutions-oriented research and linkages to policy and practice, such as research on impact, adapta-

tion and mitigation issues, through established global change networking initiatives such as the AfricanNESS, the Inter-America Institute (IAI) and the Asia-Pacific Network (APN) regions;

2. The need for better co-ordination of new and broader regional action plans, particularly among European NCs, where there is an ongoing effort to facilitate supranational, integrative global change research projects. To this effect, IGBP National Committees recently met in Lisbon (13-14

November 2008) to launch an “Alliance of European Global Change Research Committees”; a follow-up meeting is already scheduled for 12-13 February 2009 in Vienna or Zurich.

3. The need to move rapidly toward a more trans-disciplinary organisation, including social aspects, and stronger interaction with policy makers and other stakeholders.

João M.F. de Morais
Deputy Director, Social Sciences
 IGBP

During the NC meeting, participants broke out into regional groups and identified particular activities and topics important to their regions:



Africa

- AfricanNESS
- Capacity-enabling environment
- Food security, nutrition and health in Africa
- Rural-urban relationships
- Translation of key outputs into major languages

Asia/Pacific

- Development of an Asia/Pacific collaborative Earth system model
- Regional collaboration for downscaling Earth system model output to smaller scales
- Regional collaboration to address food and water security
- Planning for the consequences of alternate energy sources

Europe (including Russia)

- An improved relationship between IGBP and the policy sector
- Initiate research programmes to ensure sustainable land management
- Increased support and regional collaboration within Europe and outside (Africa)
- Coordinated action for global change with the EU
- The free availability and comparability of data
- Development of a European group following the African example

The Americas

- Promote discussions within the scientific community (natural and social scientists) and between the scientific community and government agencies
- Promote access and data sharing for the global change scientific community at a regional level
- Large-Scale Biosphere Atmosphere Experiment in Amazonia (LBA II), greenhouse gas emissions, agricultural development and biofuels, hydrology, sea level rise and food security, integrated hazard and disaster programs, developing sustainable livelihoods and understanding climate variability.

3rd GLOBEC Open Science Meeting



Victoria, BC, Canada
22-26 June 2009

This conference will culminate the integration and synthesis activities of the international GLOBEC programme by providing a new mechanistic understanding of the functioning of the marine ecosystem, in order to develop predictive capabilities and propose a framework for the management of marine ecosystems in the era of global change.

Symposium scope

The conference will comprise workshops/theme sessions, plenary and poster sessions. The first two days will be devoted to topical workshops proposed by the GLOBEC community. Three days of plenary sessions will follow, along these themes:

- GLOBEC achievements
- Ecosystem structure, function and forcing
- Ecosystem observation, modelling and prediction
- Ecosystem approach to management
- Marine ecosystem science: into the future

Convenors

Ian Perry (Fisheries & Oceans, Canada)
Eileen Hofmann (Old Dominion University, USA)
Manuel Barange (GLOBEC IPO, UK)

Invited speakers

| | |
|----------------------------|---------------------------|
| Roger Harris (UK) | John Steele (USA) |
| Eileen Hofmann (USA) | Svein Sundby (Norway) |
| Coleen Moloney (S. Africa) | Yasuhiro Yamanaka (Japan) |
| Ian Perry (Canada) | |

Scientific Steering Committee

| | |
|-----------------------|-------------------------|
| J. Alheit (Germany) | A. Jarre (South Africa) |
| H. Batchelder (USA) | S. Lluch-Cota (Mexico) |
| K. Brander (Denmark) | O. Maury (France) |
| W. Broadgate (Sweden) | Y. Sakurai (Japan) |
| D. Checkley (USA) | S. Sundby (Norway) |
| D. Haidvogel (USA) | Q. Tang (China) |
| J. Hall (New Zealand) | E. Urban (USA) |
| R. Harris (UK) | F. Werner (USA) |
| G. Hunt (USA) | |

Key dates

15 January 2009 Abstract submission deadline
15 January 2009 Financial support application deadline
28 February 2009 Abstract acceptance notification
30 March 2009 Early registration deadline*
22-26 June 2009 Symposium
31 July 2009 Manuscript submission deadline

*Please note that numbers are limited and it may be necessary to close registration once our maximum numbers have been reached.

Registration

Registration and abstract submission are available from <http://www.globec.org>.

Financial support

Limited financial support is available for scientists from developing countries and for early career scientists worldwide. See the GLOBEC website for further details.

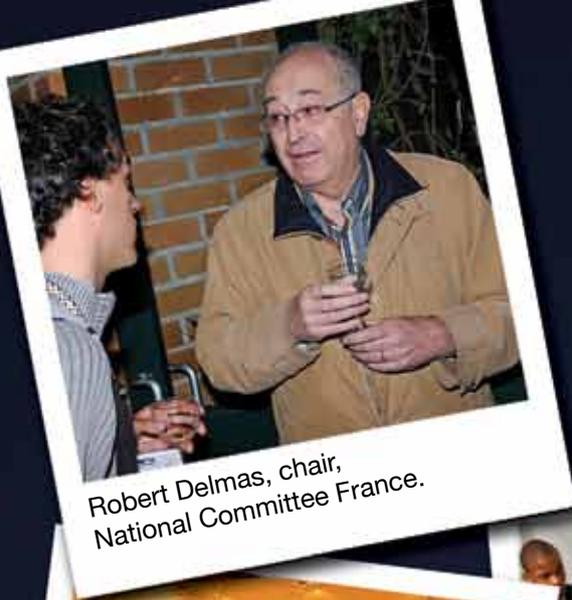
Output

Symposium proceedings will be published as a special volume in an international peer reviewed journal.

Authors will be offered the opportunity to make their posters and presentations available through the symposium website.

Venue

The conference will be held at the Victoria Conference Centre, B.C., Canada. For further information visit: <http://www.victoriaconference.com>



Robert Delmas, chair, National Committee France.



Congress social event, Kirstenbosch Botanical Gardens.



Mary Scholes, IG Marjorie Pyoos, S ment of Science



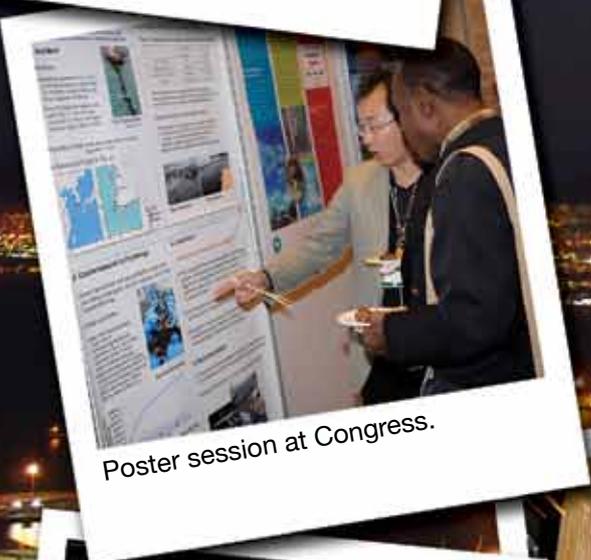
Attendees at a plenary session of the Congress.



School children from Cape Town participated in hands-on science at the Congress.



Lee Berger, University of Witwaters



Poster session at Congress.



Guy Midgley, chair of the Local Organising Committee.



Lou Brown, National Science F.



Carlos Nobre, IGBP chair, and Anette Reenberg, chair of the Global Land Project.



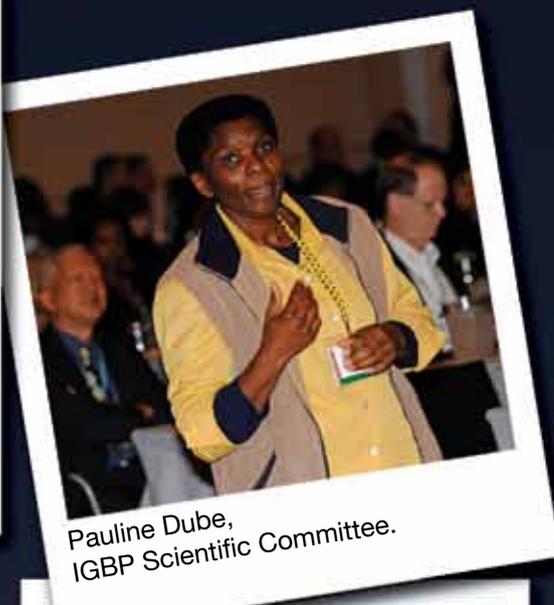
South African performers at Congress social event.



Congress



IGBP Ambassador, and South Africa Department of Science and Technology.



Pauline Dube, IGBP Scientific Committee.



Boaventura Cuamba, National Committee Mozambique.



and.



South African musicians performed at Congress social event.



Dr. Deborah Roberts, Ethekweni Municipality, South Africa.



Foundation.



Isabelle Niang, chair, AfricanNESS working group.



Myanna Lahsen, IGBP Regional Support Office, Brazil, and Mark Stafford Smith, IGBP vice chair.



Russian science poster contest winners Alexey Rezepkin and Anastasiya Revokotova with Olga Solomina, IGBP vice chair.

GLOBAL CHANGE
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IGBP

2008 in pictures



IGBP's 20th Anniversary Symposium

With its strong base of Earth system research built over two decades, IGBP stands poised to provide the policy-relevant science results needed for a sustainable future.

IGBP Celebrates 20 Years of Earth System Science

K. Noone

IGBP has a bold and inspiring vision: *"To provide scientific knowledge to improve the sustainability of the living Earth."* Achieving global sustainability demands answers to many critical questions: What will be the nature of changes in the Earth system over the next decades? What are the implications of these changes for humankind? What type and scale of management responses – from prevention and adaptation to more proactive geo-engineering approaches – can be safely pursued with the current scientific knowledge base? How must science itself change to tackle the challenges that lie ahead? How can an innovative and integrative Earth system science be built? The interactions between the likely accelerating changes to the Earth system over the coming decades and the growing needs of a rapidly expanding human population give a sense of urgency to realising the goals of Earth system science and global sustainability.

IGBP was created two decades ago at a time when little understanding existed of how the

Earth worked as a system, how the different component parts were connected, or even about the fundamental importance of the various component parts of the Earth system. Feedback mechanisms were not always understood, nor were the dynamics controlling the Earth system as a whole. Herbert Friedman, in the introduction to the report *"Toward an International Geosphere-Biosphere Program: A Study of Global Change"* (NRC, 1986) called for a *"bold, 'holistic' venture in organized research – the study of whole systems of interdisci-*

plinary science in an effort to understand global changes in the terrestrial environment and its living systems." IGBP really did represent a bold step along the path of interdisciplinary scientific research.

In the following two decades, the focus of IGBP evolved into what is now expressed in the current IGBP vision statement. IGBP continues to evolve, and we are realising that in addition to the process-level discovery science that IGBP has so successfully facilitated, we also are increasingly called upon to develop a kind of *applied* Earth system science – science that takes fundamental understanding about how the Earth system functions, and applies this knowledge to support decisions about issues of societal relevance. Engaging stakeholders is a necessary component of this new enterprise for IGBP.

Stakeholder engagement was a central theme of IGBP's two-day 20th Anniversary symposium, titled *"Earth System Science and Society,"* held at the Royal Swedish Academy of Sciences in Stockholm on 17 to 18 September 2007.



Kevin Noone

The intent was to take a number of issues – both past and future – where significant interaction between the scientific, political and private sectors was, is or will be necessary.

The general format of the sessions was designed to encourage and facilitate dialogue between representatives from the different sectors. The purpose of the discussions was to analyse the relationship between the different communities for the different issues, and to determine the reasons why some issues were successfully resolved and others remain on the scientific and political agenda. This format stimulated a good deal of interaction and information exchange between the different groups – something often missing at many forums that attempt to gather these different communities.

The first day of the symposium was mainly a retrospective one, looking at issues of 1) Global climate change and the IPCC; 2) The ozone hole and the Montreal Protocol; 3) Land use change in the tropics; and 4) Iron fertilization of the oceans. The second day was a more forward-looking one, concentrating on present and horizon issues. The topics of the second day were 1) Air quality and climate; 2) Ocean acidification; 3) Consequences of renewable energy; and 4) Adaptation and sustainable development.

Close to 80 participants from more than 15 countries participated in the symposium, with roughly 40% from the scientific sector and the rest divided evenly between the political and private sectors. A special note of thanks goes to our intrepid moderators, who were extraordinarily adept

at stimulating productive and lively discussions.

The success of the symposium leaves IGBP with a very imposing challenge: how do we build a long-lasting forum for a dialogue between these sectors on issues of global environmental change? The symposium was an excellent step in establishing this dialogue, but a substantial effort will be needed to nurture and expand the contacts between sectors. We will need to learn new ways of interaction, and become proficient with methods of discourse that may be currently unfamiliar to us. This is a significant challenge, but one that I believe IGBP needs to take on in order for us to achieve our vision.

Kevin Noone,
Former Executive Director, IGBP

| Day 1 (17 September) The past 20 years | Day 2 (18 September) The next decades |
|---|---|
| <p>Introduction by Kevin Noone, IGBP, Sweden Global climate change and the IPCC</p> <p>Science - Bert Bolin, 1st IPCC Chair, Sweden Policy - Svante Bodin, Swedish Ministry for the Environment Private - Mathis Wackernagel, Global Footprint Network, US Moderator: Johan Kuylenstierna, SIWI, Sweden</p> | <p>Air quality and climate</p> <p>Science - Robert Charlson, University of Washington, US Policy - Anders Wijkman, European Parliament Private - Paola Kistler, Alcan Inc., Canada Moderator: Johan Rockström, SEI, Sweden</p> |
| <p>The ozone hole and the Montreal Protocol</p> <p>Science - Paul Crutzen, Nobel Laureate, Germany Policy - Claus Brüning, European Commission Private - Pauline Midgley, IER, Germany Moderator: Margaret Leinen, Climos, US</p> | <p>Ocean acidification</p> <p>Science - Victoria Fabry, California State University San Marcos, US Policy - Carol Turley, Plymouth Marine Laboratory, UK Private - Tore Torp, Statoil, Norway Moderator: Margaret Leinen, Climos, US</p> |
| <p>Land use change in the tropics</p> <p>Science - Carlos Nobre, IGBP Chair, Brazil Policy - Syaiful Anwar, Ministry of Forestry, Indonesia Private - Ildo Sauer, Petrobras, Brazil Moderator: Johan Rockström, SEI, Sweden</p> | <p>Consequences of renewable energy</p> <p>Science - Kevin Noone, IGBP Policy - Michael Wood, US Ambassador Private - Arne Mogren, Vattenfall AB, Sweden Moderator: Johan Kuylenstierna, SIWI, Sweden</p> |
| <p>Iron fertilisation of the oceans</p> <p>Science - Peter Liss, University of East Anglia, UK Policy - John Cullen, Dalhousie University, Canada Private - Margaret Leinen, Climos, US Moderator: Berrien Moore III, University of New Hampshire, US</p> | <p>Adaptation and sustainable development</p> <p>Science - Johan Rockström, SEI, Sweden Policy - Göran Holmqvist, Sida Private - Sara Farley, World Bank, US Moderator: Berrien Moore III, University of New Hampshire, US</p> |

Sessions, presenters and moderators for the IGBP 20th Anniversary Symposium.

Development research and implementation efforts can no longer omit global environmental change, and global change research needs to move fully into social- ecological research endeavours. This article makes a case for integration of global environmental change and development research, and suggests several entry-points for success, within “joint” conceptual frameworks of resilience, vulnerability, adaptation and sustainability science.

Development in the Planetary Phase of Sustainability

J. Rockström



The planet is subject to a quadruple squeeze generating social-ecological pressures of an unprecedented nature. First, anthropogenic climate change is already at a mean temperature increase of 0.7 degrees C, causing major social impacts, such as eroded livelihoods among poor farming communities due to shifts in rainfall patterns. Humanity is furthermore committed to a warming of almost 2 degrees C, and greenhouse gas emissions so far continue unabated. We can no longer exclude crossing thresh-

olds that trigger positive feedbacks and result in accelerated warming.

The second squeeze is the degradation of ecosystem functions and services, which have reached such amplitude over the past 50 years that the aggregate of local effects qualify as global environmental change, e.g., degradation of agricultural land, loss of biodiversity and deforestation [1]. The interactions between the climate and ecosystem squeeze is the source of the growing “fat tail” concern of low-probability high-impact

climate catastrophes [2]. Ecosystem response to climate change is the origin of positive climate feedbacks, which in turn will determine whether a doubling of greenhouse gas concentration in the atmosphere will cause in the order of 3 degrees C (high probability) or > 6 degrees C (low but “fat tailed” probabilities) temperature increase.

The third and fourth squeezes are the two flip sides of the human coin. Affluence in the “old” consumer societies of the OECD and the emerging and rapidly growing Asian economies generate the third squeeze: unsustainable footprints, causing continued and increased pressure on the planet. Finally the fourth squeeze—hunger among 850 million people, absolute poverty among 1 billion people, with actual poverty affecting almost 3 billion people, and continued rapid population growth with 3 billion new world citizens expected by 2050 (essentially all in developing countries)—calls for urgent action to secure energy and resource access, and essentially creates a historic and moral responsibility to open more environmental space for the poorest half of the world’s citizens (the right to development argument is strong and, unfortunately, nothing has created so much social wealth in such a short time as fossil fuels).

The quadruple squeeze interacts across scales and fundamentally changes the global development agenda. Climate change, when hitting socially (due to poverty) and ecologically (due to ecosystem degradation) vulnerable communities may lead to social tipping points resulting in major transformations. Recently (March 13th 2008), Javier Solana, the EU Foreign Policy coordinator, warned of the risk of millions of



Picture credit: J. Lokrantz/Azote



Picture credit: Reto Stockli, NASA Earth Observatory

environmental migrants within a decade, with climate change as one of the major drivers. It is difficult to put full evidence (yet) behind the following statement, but indicators across all four squeeze factors suggest that global environment change is undermining the ability to attain the UN Millennium Development Goals (MDG).

Neither science nor policy has been able to fully understand, much less internalise, the implications of the globalisation of the environment on the development agenda. Inter- and trans-disciplinary science is required to fully understand the interacting and non-linear impacts of social and ecological drivers of global change. But above all, major efforts are required to build resilience to unavoidable change over the coming decades. These changes affect profoundly the development agenda for poor countries in the world. Eco- and social systems must be geared not only to deliver human wellbeing under predictable and stable conditions, but also build the ability to deal with periods of abrupt change.

Attaining development goals in the face of global environmental change will not only require major innovations in institutions and management, but most likely also in partnership constellations. Global change research must “downscale” both in terms of advancing the understanding on drivers and impacts at the regional scale, and in terms of research collaboration with science focussed on finding system solutions on the ground. This research continuum, from global to local scales, needs to be carried out in close collaboration with policy and governance institutions, as well as local communities. A priority focus should be to internalise global environment change with development cooperation agencies and governments (departments and ministries) in developing countries. Increasingly, the private sector realises the importance to engage as a partner in building resilience in the face of global environment change. Aggravated water scarcity, increased frequency of extreme climate events, sea

level rise, and shifts in ecosystem service provision pose a major market risk for businesses across the world. At the same time, business can be an important part of the solution, as a provider of sustainable practice, innovations and scalability. Novel partner constellations have to be explored with clout and determination. There is no doubt that humanity is in a new and unprecedented situation. Thinking globally and acting locally are not enough anymore. Today, thinking and acting have to occur across all scales.

Johan Rockström

*Stockholm Resilience Centre and
Stockholm Environment Institute*

References

1. Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Wellbeing: Synthesis*. Island Press, Washington, D.C.
2. Weitzman, M., 2008. On modeling and interpreting the economics of catastrophic climate change. www.economics.harvard.edu/faculty/weitzman/files/modeling.pdf

Continuing developments in all branches of science and technology have been followed by refinements in understanding climate and air quality. Integration of an increasingly complete understanding of the Earth system, of climate, and of the chemical composition of the atmosphere has progressed, but it has largely been by chance occurrence. However, basic or reductionist science by itself cannot ever produce the needed integrated understanding of global systems. This article suggests ways to achieve an integrative approach, while maintaining critical reductionist activities.



Air Quality and Climate Change: The Fundamental Discoveries of Chemistry and Radiative Transfer

R. J. Charlson

The early history of science was deeply involved with the study of the Earth, its atmosphere, and its climate. Ancient scientists considered the elements to be air, earth, fire, and water. The earliest scientists focussed on the Earth's environment. Aristotle, e.g., wrote "Meteorologica," describing his theories of Earth sciences. Da Vinci became convinced that air was two substances and not an element. Thus the roots of basic physical science involved studies of the atmosphere.

Early scientists studied not only the chemical composition of the atmosphere and its physical properties, but explored its optical properties as well. The following tables summarise key works.

Conclusions and Philosophical Perspectives

The basic sciences of chemistry and physics were built on studies of Earth's atmosphere, its composition, and its physical properties. Many overlapping scientific issues lock together research on air quality and climate forcing, e.g., it is the same sulfate-based aerosol

pollution that causes radiative forcing and acid rain, is suspected of harmful health effects, reduces visibility and causes haze in polluted regions, and nucleates cloud droplets, thus modifying clouds. All of the properties and processes yielding anthropogenic pollutants are simply exaggerations of natural processes; therefore, it is necessary to study the natural *as well as* the pollutants' processes.

Continual refinement in both air quality and climate research was spurred by fundamental discoveries of thermodynamics, the physics of heat transfer, spectroscopy, chemistry, and meteorology. These developments were largely chance occurrences inspired by a few leading and adventurous scientists, e.g., Arrhenius. Integration of an increasingly complete understanding of the Earth system, of climate, and of the chemical composition of the atmosphere has progressed, but it has depended upon the developments in basic science *before* the applied science activity could make progress.

Alone, basic science has never addressed issues of air

quality or the effects of human activity on climate. Reductionist science, which takes very complex systems and divides them up into smaller and smaller understandable pieces, typically stops with explaining the scientific features of a piece of the puzzle; it doesn't put the puzzle back together again. *Reductionist science seldom achieves integrative results.*

Even though reductionist science alone can't provide solutions, it is absolutely essential for integration to succeed. We must follow the example of interdisciplinary and free-thinking individuals such as Arrhenius, who went beyond his own field of chemistry into thermodynamics, the spectroscopy of gases, and even the geology community, demonstrating his ability to synthesize and integrate his own perspectives on what was important.

If the goal is an integrative approach, what might be some of the prerequisites for achieving it?

- Training in Earth systems science that includes bridges among Earth sciences, chemistry, physics, biology, and biogeochemistry (BGC), as well as internationally coordinated, focussed BGC research.
- BGC measurements and modelling must be coordinated, allowing data from one issue to be useful to another.
- The participation of industry in climate research and in the IPCC process is also very important for reasons of quality assurance, objectivity in interpreting data and models, and balancing industrial pragmatism with environmental idealism.

In order to focus on truly global

scientific questions, interdisciplinary coordination of observations and modelling is vital and appropriate. The ultimate goal

of global, integrative scientific progress will not be achieved if the big questions are not addressed.

Robert J. Charlson
*Department of Atmospheric
 Sciences and Chemistry,
 University of Washington, Seattle*

Table 1. Early history of science

| Date | Scientist | Quantity Defined/Explained |
|---------|------------|--|
| 1674 | Boyle | relative humidity, pressure |
| ~1750 | various | standardisation of thermometers |
| 1772 | Rutherford | nitrogen |
| 1774-86 | Priestley | oxygen, photosynthesis |
| 1778 | Lavoisier | reactions of oxygen |
| 1783 | Franklin | regional scale climate effects in Europe of dust plume from Icelandic volcano Laki |
| 1816 | various | global scale climate effects of SH eruption of Tambora (Indonesia); NH's "year without a summer" |
| 1827 | Fourier | identified "greenhouse effect" |
| 1839 | Schönbein | ozone (O ₃) via sparking of air, connection to lightning |
| 1861 | Tyndall | infrared spectrum of water, carbon dioxide (CO ₂) |
| 1869 | Mendeleev | periodic table, based on studies of air, water, aqueous solutions of common elements |
| 1870 | Kelvin | vapor pressure of water over convex surfaces of droplets is higher than over flat surfaces, implying small particles are required to form cloud droplets |
| 1880 | Hartley | spectra of O ₃ , including ultraviolet, connection to solar radiation UV cutoff |

Table 2. Earth's temperature, ozone and photochemistry, chemical climatology, and radiative forcing

| Date | Scientist(s) | Quantity Defined/Explained |
|------------|-------------------------------------|--|
| ~1880 | Agazzi | suggested landscape of Europe shaped by glaciers in distant past |
| 1879, 1884 | Stefan, Boltzmann | blackbody radiation, T ⁴ dependence |
| 1896 | Arrhenius | used Agazzi's idea, works of Fourier, Boltzmann, and solar data of Langley (and his own) to show increases in CO ₂ would cause Earth to warm; forecasted warming from burning of fossil fuels; used a value of 0.3 for Earth's albedo |
| ~1880 | Rayleigh | identified warm air aloft due to O ₃ absorption, stratosphere |
| ~1900 | Stark, Einstein | 1 st law of photochemistry: 1 quantum of energy absorbed, 1 molecule of substance reacts |
| 1905 | des Voeux | coined the term "smog" to denote mixture of smoke and fog |
| 1921-1936 | Köhler | physical/chemical theory of nucleation of cloud droplets by water soluble aerosol particles |
| 1928, 1948 | Danjon, Fritz | measured global albedo by "Earthshine" reflected off the moon; confirmed clouds a controlling factor of albedo |
| 1930 | Chapman | theory for photochemical production of stratospheric O ₃ , but O ₃ overestimated by factor of 2 |
| 1938 | Callendar | used CO ₂ concentration data to forecast CO ₂ -induced warming; asserted that the Earth had already warmed |
| 1955 | Rosby, Egner | "chemical climatology" measurements; precursor to acid rain studies in Scandinavia |
| 1960 | Keeling | showed steady increase of CO ₂ from direct measurements at Mauna Loa and Antarctica |
| 1963 | Junge | recognized nucleation scavenging as a dominant source of cloud and rainwater solutes |
| 1965 | Revelle, et al. | confirmed global warming from expected CO ₂ increase; forecast CO ₂ increase of 25% by 2000 |
| 1969 | Crutzen | proposed catalytic reduction of stratospheric O ₃ by NO, resolving Chapman's overestimation |
| 1970 | Lamb | established "Dust Veil Index" as a climate forcing indicator |
| 1975 | Junge | described separate direct and indirect effects of aerosols on climate |
| 1980s | various | other greenhouse gases besides CO ₂ : methane (CH ₄) and nitrous oxide (N ₂ O) |
| 1982 | Charlson, Rodhe | showed natural acidity of rainwater primarily from naturally occurring sulfur compounds (e.g., DMS) and not from acidity of carbonic acid (CO ₂) |
| 1985-1990 | Ramanathan, Dickinson, and Cicerone | use of "forcing" as an index of climate change |
| 1990 | Charlson, et al. | quantification of aerosol-induced radiative forcing |
| 1995 | Crutzen, Molina, Rowland | Nobel Prize for chemistry for work on the stratospheric O ₃ problem |
| 2007 | IPCC | albedo of aerosols and clouds pose largest uncertainties in quantifying man-made radiative forcing |

Today's emissions must be significantly reduced at the same time as the global economy and the world's population are growing, posing significant political, economic and security challenges worldwide.



Climate Change Can Be Curbed – Will It Happen?

A. Mogren

Can climate change be slowed down? If nothing is done, total annual greenhouse gas emissions will increase from 40 billion tonnes of carbon dioxide (CO₂) equivalents in 2002 to 58 billion tonnes in 2030. In 1990 the emission level, calculated in the same way, was approximately 35 billion tonnes.

If global warming is to be limited to 2 degrees C with a reasonable degree of certainty, the sustainable concentration of greenhouse gases in the atmosphere should be limited to a level of 450 parts per million. The annual emissions in 2030 must be restricted to 31 billion tonnes, or in other words there must be a decrease of 27 billion tonnes.

Our observations indicate that this is fully possible. Over two thirds of the measures can be achieved with available solutions. A significant proportion – 25% – appears possible to introduce at costs that are insignificant or negative, provided that suitable control measures are applied. No one technique or solution can solve the problem, but the sum of all options makes the necessary changes viable. (fig. 1) The measures are largely linked with new building or major investments, which shows that there is no conflict between continued economic growth and increased climate efficiency – quite the opposite in fact.

Beyond 2030, new technology can have significantly

greater effects. An estimate of one possible trend from 2030 to 2070 shows that the power sector in the long term could be entirely free from emissions and that the quantity of emissions from other sectors could be substantially limited despite continued vigorous economic development and population growth on a global scale.

How is the transformation to be brought about? We must put prices on emissions and in this way use the power for change that is offered by the market. The total cost of this transformation depends primarily on how it is introduced. Sudden changes that give shock effects in the economy and late measures in the form of emergency braking will prove to be expensive. Sustainable and long-term measures can reduce the total costs to very low levels.

The climate challenge is basically political. The countries of the world must agree on binding emission restrictions. If this is to be possible, the restrictions will have to be designed so that they do not constitute obstacles to development and do not create an economic shock for any one country. At the same



Photo credit: NOAA Photo Library

Global cost curve

Marginal cost of abatement - examples

€/t CO₂

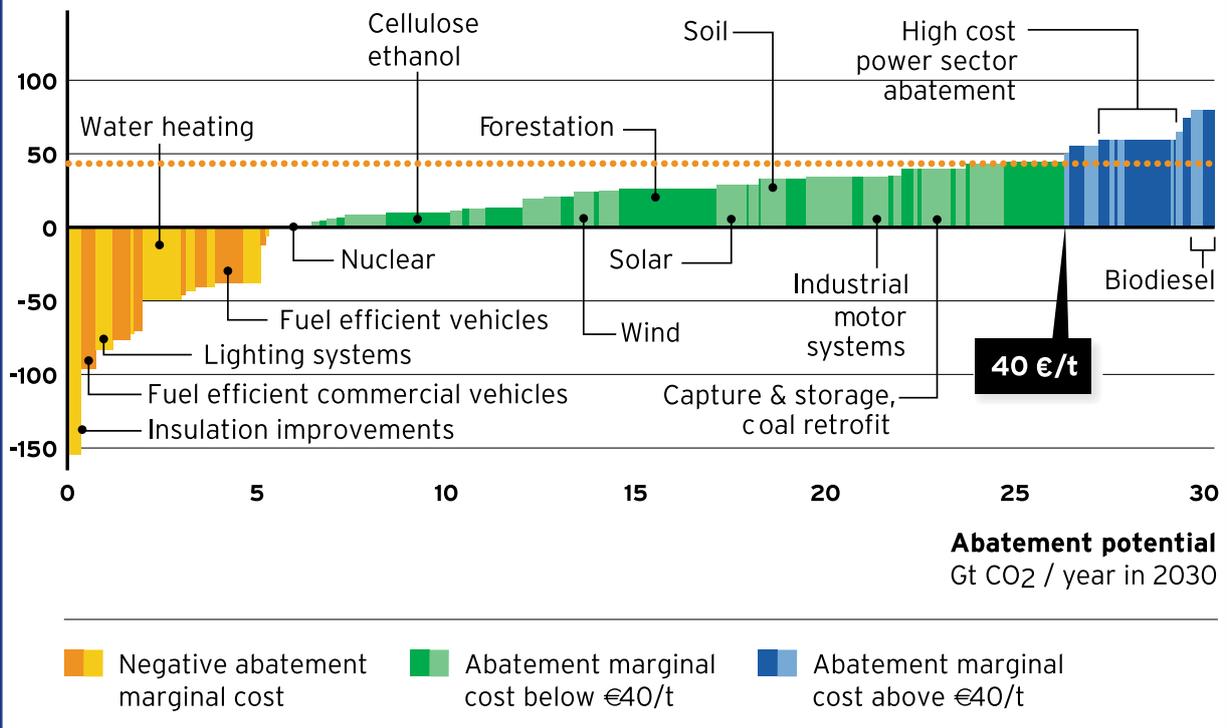


Figure 1. Cost comparisons for reducing emissions.

time, the effects on the power of international competition must be reasonable and acceptable for all parties concerned. According to the calculations we have made, this is fully possible but, of course, makes major demands on the ability of the international community to co-operate. Unless the world's leaders manage to handle the challenge in time by steering the markets in the right direction, the cost of the damage caused will increase and significantly more draconian measures will in time become necessary.

In the long term, there is a threat that the ultimate instrument of politics, armed conflict, will have to be used.

The challenge is also one of an economic and security policy nature. It is on this foundation that the give and take to build up global understanding must

be based. The foundation must consist of a common acceptance of responsibility and joint commitment. The mapping that has been made of potential measures shows clearly that it is not possible to meet the threats

on the climate through measures in certain regions or sectors. The entire global economy must be transformed.

Arne Mogren
Vattenfall AB

Background

A report entitled "Curbing Climate Change – an outline of a framework leading to a low carbon emitting society" that was published by Vattenfall in 2006, analyses developments during the period up until 2100. Unless vigorous measures are taken in global consensus, the emissions will increase dramatically, to levels far above those at which the effects can be handled in a reasonable way.

In co-operation with McKinsey, Vattenfall has analysed the possibilities of reducing greenhouse gases globally up until 2030. We have focussed on identifying concrete measures. The analysis covers the entire world economy. The results, which are available at www.vattenfall.com/climatemap, are striking. There are major opportunities for real emission restrictions in relation to the development that is likely to take place if no efforts are made.

In developing new regulatory approaches for air pollutant emissions, policy makers should be giving much more consideration to the drivers of the emissions—societal needs—and the corresponding consumption of goods and services.



Air Quality and Climate: Sustainable Allocations, Extended Responsibilities

P. Kistler

While regulation of air pollutant emissions established in the past decades in the West have been quite effective in driving reductions of local and regional air pollution levels, it is apparent that for global problems like climate change the impact of national legislation has not yet made significant progress. Impact on air quality and climate, as well as other environmental effects, which are caused by our economic activities, are ultimately driven by consumption. Until now regulations mostly address emission sources. National regulations are focussed on reducing emissions at the source, which means that they address emission sources only within their geographical country boundaries, and responsibility for air quality problems are allocated directly to the owner of the emission source. The nations signing the Kyoto Protocol agreed on emissions levels, based on the responsibility and the allocation of national emissions according to the amount of greenhouse gases emitted in a specific country.

Air pollutant emissions are linked to a process and, therefore, it is straightforward to allocate them to the emission sources. Sulphur dioxide emissions are emitted mostly in fuel combustion processes, as in

power stations using coal with high sulphur content. This means that when regulating sulphur dioxide emissions, the owner of the power station is obliged to reduce the emission. As science analysed the impacts caused by the emissions, it became clear that there is no straightforward link between geographical location of the source and the geographical location of the impacts. There are many other factors, or preconditions, than geographical location and the amount of emission that influence the impacts.

But ultimately, air pollution and air emissions are linked to needs, e.g., to the production and use of food, shelter, mobility, and consumer goods. The sum of needs—the consumption of goods and services—is the driver for air emissions. In more recent

years the influence of consumption as a driver of environmental effects has been acknowledged repeatedly and triggered the development of integrated product policies. These policies have led to a more innovative new generation of environmental policies. The European Integrated Product Policy (IPP) seeks to minimise the impacts by looking at all phases of a product's life-cycle and taking action where it is most effective. The life-cycle of a product is often long and complicated. It covers all the areas from the extraction of natural resources, through their design, manufacture, assembly, marketing, distribution, sale and use, as well as to their eventual disposal as waste. At the same time it also involves many different actors such as designers, industry, marketers, retailers and consumers. IPP attempts to stimulate each part of these individual phases to improve their environmental performance. With so many different products and actors there is no single, simple policy measure. Instead a whole variety of tools—both voluntary and mandatory—has been put in place. These include measures such as economic instruments, substance bans, voluntary agreements, environmental labelling and product design guidelines.



A plume resulting from the burning of coal.

Product policies drive the efficiency of products, but don't address the overall sum of the effects of consumption. The gains in reducing the impacts of single products have been outweighed by the increase in numbers of the product used. As citizens we are starting to see the effect of the product-related measures and beginning to have incentives to use less polluting products and services. However, citizens of a given country may still not take total responsibility for the life cycle emissions which are caused by their collective needs. With choices of a certain product (or prod-

ucts), consumers influence the entire supply chain. Many of the impacts caused along this chain are not internalised into the prices paid for goods, but have to be borne by other countries. For example, the greenhouse gas emissions of the aluminum sector are allocated to the countries that produce aluminum and not to the country in which the aluminum product is consumed. The logical next step would be to extend the responsibility of these emissions to the consumers who drive the need for aluminum products. This would mean shifting from an extended producer responsibil-

ity to an extended consumer responsibility. From a regulatory perspective this could mean that we would take ownership of the emissions and impacts caused by the total consumption of goods and services of the inhabitants of a country. From a scientific perspective, research is needed to fully enable such a way of thinking. Only if we accept this way of looking at impacts can we further strive to develop methodologies to help us in this endeavour.

Paola Kistler
Alcan Engineered Products

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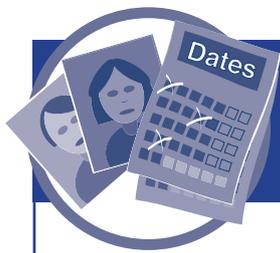
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The Swedish Research Council



IGBP also thanks the following companies for their in-kind support:

The Nobelmuseum
Täby Park Hotel
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People

Emily Brévière, who joined SOLAS in 2005 as project officer, started her new post as executive officer of the SOLAS IPO in August 2008. She succeeds Jeff Hare, who has returned to the University of Colorado. Emily returns to SOLAS after an 11-month secondment to the IGBP Secretariat where she acted as deputy director, Natural Sciences, during Wendy Broadgate's maternity leave.



Doug Wallace took the helm as SOLAS's chair in January 2008, replacing Peter Liss. He is professor of Marine Chemistry at the Leibniz-Institute for Marine Sciences in Kiel, Germany and works on the exchange of gases between the atmosphere and ocean. He has been involved with SOLAS for many years, having organised the first Open Science Conference in 2000 and served on the project's international Scientific Steering Committee from 2001-2006. He has been an active member of the JGOFS SSC, was chair of the SCOR/IOC CO₂ Panel and was involved in the development of IMBER.



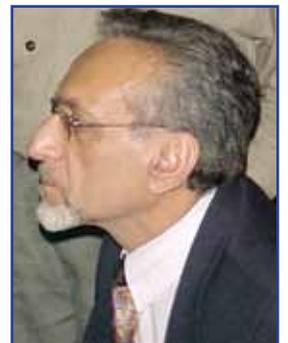
Ian Perry (Fisheries & Oceans Canada, Pacific Biological Station, Nanaimo, British Columbia, Canada) succeeded Cisco Werner as chair of GLOBEC in January 2008. Ian is a fisheries oceanographer with extensive experience of ecosystem approaches to marine management and inter-disciplinary scientific collaborations. He was the GLOBEC SSC vice-chair since from 1997 to 2002 and has been co-leader of GLOBEC's Working Group on the Human Dimensions of Marine Ecosystem Change since 2001. He has strong links with the North Pacific Marine Science Organisation (PICES) and was chair of their Science Board from 2001-2004.



At the start of 2008, **Heinz Wanner** was appointed co-chair of PAGES. Heinz works at the University of Bern on palaeoclimate reconstructions and diagnostics at different time scales between the last few hundred years and the Holocene. Heinz is the acting president of the Oeschger Centre for Climate Change Research. Julie Brigham-Grette will finish her co-chair appointment at the end of 2008 and will be replaced in 2009 by Bette Otto-Bliesner.



Dr. Hassan Virji has been appointed as director of START. Hassan spent time as the associate program director at the Climate Dynamics Program of the US National Science Foundation before becoming deputy executive director of the International Geosphere-Biosphere Programme (IGBP). He joined START in 1992 as Deputy Director. www.start.org/index.html.



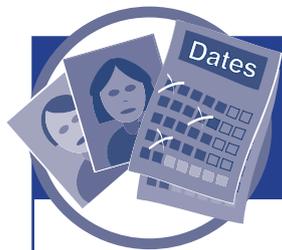
New Leaders for ICSU

Professor Yuan Tseh Lee, a Nobel Prize-winning chemist from China: Taipei has been elected as the future president of the International Council for Science (ICSU). He will take up the appointment in April 2010 and will succeed the current ICSU president, Catherine Bréchnignac, in October 2011.



Professor Deliang Chen has been appointed as ICSU's new executive director. He will take up the appointment on 1 February 2009, following the retirement of Professor Thomas Rosswall.





Meetings

SCOR/IOC/IGBP/IAEA 2nd Symposium on the Ocean in a High CO₂ World

In October 2008, 216 experts from 32 countries met in Monaco to discuss ocean acidification and its consequences for ocean ecosystems and society. The meeting highlighted the measurable effects of ocean acidification, the vulnerability of coastal and polar regions as well as the little known effects on whole ecosystems. A number of publications are being produced as a result of the Symposium, including a special issue of Biogeosciences, a Research Priorities Report and a summary for policymakers. Website: <http://ioc3.unesco.org/oanet/HighCO2World.html>

Planet future meeting sees hope and opportunity

IGBP's Fast Track Initiative, "The Planet in 2050", held a summit of high profile experts from 22 countries in October 2008 in Lund, Sweden. Attendees confirmed that climate change, water and food scarcity, energy security and dangerous pollution were problems that were urgent and happening faster than expected across all aspects of the Earth system. The comments and vision papers of the participants may be read at: <http://www.theplanet2050.org/>. The overall objective of "The Planet in 2050" is to analyse and describe what the Earth might be like in 2050 based on expert knowledge from a wide range of disciplines. The project plans to publish a book based on the results of the Lund summit.

IGBP National Committees hold Regional Meetings

Using the opportunity of the 2008 IGBP Officers meeting in Egypt, the local IGBP National Committee chaired by Prof. M. Saber hosted a 2-day Symposium at the Academy of Scientific Research and Technology in Cairo on 'Sustainable Water and Land Management in Semi-Arid Regions' in Middle-East North Africa (MENA) countries. Participants included young Egyptian scholars, environmental scientists and policy advisors from the region and beyond, as well as global experts. Online information about the event is available at: www.igbp.net/page.php?pid=435

The IGBP Regional Office in Brazil held a meeting at INPE in São Jose dos Campos, Brazil in November 2008 titled "Global Change Science in Latin America: The Role of IGBP and National Committees." The meeting united a subset of Latin American leaders in global change science and IGBP National Committee members to discuss how IGBP can help to strengthen global change science in Latin America.

IGBP's National Committee in Portugal, in collaboration with the German National Committee for Global Change Research, hosted a meeting of European National Committee representatives (including Russia) in Lisbon in November 2008 to discuss the establishment of a European platform for global change research committees. The European Alliance of Global Change Research will promote and support supranational European global change science, covering all aspects from basic to applied research, in collaboration with African colleagues.

Products

IGBP Annual Report 2007

IGBP's Annual Report 2007 is now available for download from the IGBP website. This year's report has been redesigned in content and layout to appeal to a broader audience of policy makers and potential funders as well as the global environmental change science community. URL: www.igbp.net/page.php?pid=217

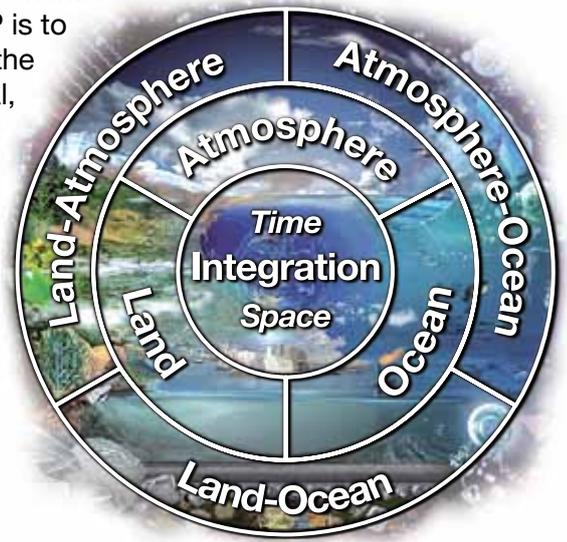


Global Carbon Budget Launched

The Global Carbon Project launched a new Global Carbon Budget on 25 September 2008, a key to understanding the balance of carbon added to the atmosphere, the underpinning of human induced climate change. The growth rate of emissions has continued to speed up, with atmospheric CO₂ concentrations reaching 383 parts per million in 2007. www.globalcarbonproject.org/carbontrends/index.htm

The International Geosphere-Biosphere Programme

IGBP is an international scientific research programme built on inter-disciplinarity, networking and integration. The vision of IGBP is to provide scientific knowledge to improve the sustainability of the living Earth. IGBP studies the interactions between biological, chemical and physical processes and human systems, and collaborates with other programmes to develop and impart the understanding necessary to respond to global change. IGBP research is organised around the compartments of the Earth System, the interfaces between these compartments, and integration across these compartments and through time.

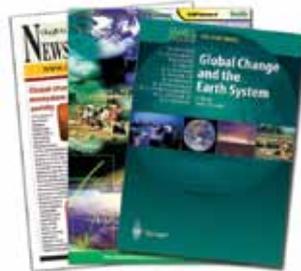


IGBP helps to

- develop common international frameworks for collaborative research based on agreed agendas
- form research networks to tackle focused scientific questions and promote standard methods
- guide and facilitate construction of global databases
- undertake model inter-comparisons
- facilitate efficient resource allocation
- undertake analysis, synthesis and integration of broad Earth System themes

IGBP produces

- data, models, research tools
- refereed scientific literature, often as special journal editions, books, or overview and synthesis papers
- syntheses of new understanding on Earth System Science and global sustainability
- policy-relevant information in easily accessible formats



Earth System Science



IGBP works in close collaboration with the International Human Dimensions Programme on Global Environmental Change (IHDP), the World Climate Research Programme (WCRP), and DIVERSITAS, an international programme of biodiversity science. These four international programmes have formed the Earth System Science Partnership (ESSP). The International Council for Science (ICSU) is the common scientific sponsor of the four international global change programmes.

Participate

IGBP welcomes participation in its activities – especially programme or project open meetings (see meetings list on website). To find out more about IGBP and its research networks and integration activities, or to become involved, visit our website (www.igbp.net) or those of our projects, or contact an International Project Office or one of our 74 National Committees.

Contributions

The Global Change NewsLetter primarily publishes articles reporting science undertaken within the extensive IGBP network. However, articles reporting interesting and relevant science undertaken outside the network may also be published. **Science Features** should balance solid scientific content with appeal to a broad global change research and policy readership. **Discussion Forum** articles should stimulate debate and so may be more provocative. Articles should be between 800 and 1500 words in length, and be accompanied by two or three figures or photographs. Articles submitted for publication are reviewed before acceptance for publication. Items for the **IGBP Network News** may include letters to the editor, short announcements such as new relevant web sites or collaborative ventures, and meeting or field campaign reports. These items should not exceed 250 words.

Photographs should be provided as TIFF or high resolution JPG files; minimum of 300 dpi. Other

images (graphs, diagrams, maps and logos) should be provided as vector-based EPS files to allow editorial improvements at the IGBP Secretariat. All figures should be original and unpublished, or be accompanied by written permission for re-use from the original publishers.

The Global Change NewsLetter is published quarterly. The deadline for contributions is two weeks before the start of the month of publication. Contributions should be emailed to the editor.



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