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GLOBAL CHANGE IGBP

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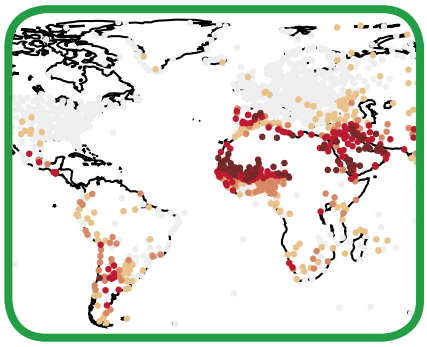
Wind-blown Dust and Dirt



Mineral dust is an important component of the atmospheric aerosol loading. Sandy Harrison describes how atmospheric dust affects regional climates by altering the balance of incoming and outgoing radiation, influencing cloud properties, and affecting atmospheric chemical processes. Read why the regional and global climate implications of dust loadings are currently very unclear.

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Discussion Forum: Light Pollution

Light pollution continues to increase around the globe. What are the ecological implications of this and are there global consequences to consider? Turn to the Discussion Forum to find out.

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The SOLAS Air-Sea Gas Experiment

In March/April this year New Zealand SOLAS successfully coordinated a month-long voyage in sub-Antarctic waters measuring air-sea exchanges of CO_2 and dimethylsulphide in the difficult high wind conditions of the "Roaring Forties". Read about the initial analyses of results and their possible implications.

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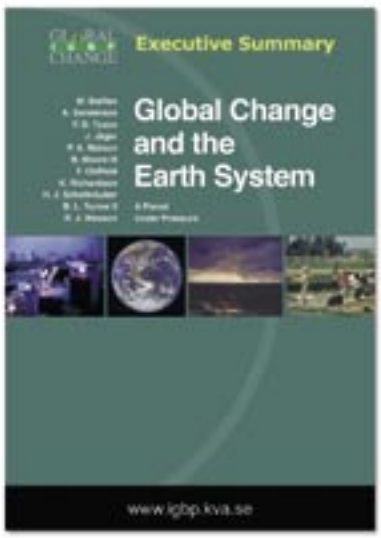
Synthesis Book Executive Summary



A 40 page Executive Summary of the recent IGBP Synthesis Book – *Global Change and the Earth System: A Planet Under Pressure* – is now available for free download from the IGBP website. See book advertisement for details.

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Guest Editorial

A Funding Agency Perspective

Twelve years ago I was at sea as part of the JGOFS Equatorial Pacific project. Five years ago I was an Officer of the IGBP Scientific Committee. Now I find myself in a US federal agency that provides funds to projects of IGBP (as well as to IGBP itself and its sister programmes) and that participates in the International Group of Funding Agencies for Global Change Research. My experience in both the global change science community and the funding agency community, is that that the motivations, the criteria for making decisions, and the evolving directions are very similar in both worlds.

Colleagues in funding agencies in the US and around the world share the passion of the science community to emphasise science, first and foremost, and so we fund the highest quality science. However, I know of no funding agency that has sufficient funds to support all of the *highest* quality research that is proposed – let alone the science that is very good, but not of the highest rank. This is an extremely frustrating reality.

Both the science community and the funding community are forced to set priorities that leave much important, high quality research undone. Individual scientists make decisions about which of the many fascinating avenues to pursue based on judgments of scientific importance and based on personal interests. Funding agencies are much the same: they prioritise according to the scientific importance ascribed to a project by their review mechanisms *and* by their overall missions. Global change research is funded by different types of government entities with different review mechanisms and missions. They include research agencies or councils that look for the most challenging and important science topics, and environmental or resource agencies that look for the science most likely to advance the understanding in areas relevant to their environmental or resource management.

Both the IGBP science community and government funding agencies are in the midst of an important evolution in problem definition. The IGBP science community has highlighted the need for integration and an Earth System approach, *in addition to* sub-system studies. Funding agencies are equally excited and challenged by this development. The IGBP science community has emphasised that challenging Earth System studies require new approaches – sometimes even new conceptual tools and techniques. Funding agencies work with resource managers who emphasise that the problems they face exist within systems, and that they must understand the system to identify solutions that do not generate unanticipated consequences.

Finally, both the global change science community and funding agencies face a challenge for the next decade. The former face the challenge of actually studying *systems*, and doing so without ignoring or starving sub-system science. Funding agencies face the challenge of working in bureaucratic *systems* with dispersed authority. We want to gain skill in transferring scientific results to other researchers with specific applied problems, to government agencies charged with resource management and policy making, and to international organisations that are building capacity around the world. And we want to do this without overburdening the small, but essential, basic research community.

The perspectives of the global change science community and the funding agency community may thus be different, but I believe that in each case the basic values, motivations and external pressures are very similar. For these reasons I am optimistic: we will have to make difficult choices, but I believe they will result in research that has the greatest potential transform science and inform policy.

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Contents

Dust, Land-use and Climate Change

S.Harrison

Mineral dust is an important component of the atmospheric aerosol loading, with 1-2 Pg of dust eroded by the wind from bare soils and lofted into the atmosphere every year. Atmospheric dust affects regional climates by altering the balance of incoming and outgoing radiation, influencing cloud properties and affecting atmospheric chemical processes. The net climatic impact could be large, but it is currently very unclear whether dust will produce warmer or colder conditions at a regional scale, and unclear how regional changes will affect the global climate.

Part of the uncertainty is due to the different effects atmospheric dust can have on the climate, depending on the colour, size and mineralogy of the dust, the height of the dust clouds in the atmosphere, and the nature of the surface (dark or light) over which the dust clouds occur. However, part of the uncertainty also stems from our limited ability to answer questions such as: (i) what proportion of the modern dust load is natural? (ii) how have changes in human activities affected dust emissions in past decades? and (iii) how might human activities affect atmospheric dust loadings in the future? Conventional wisdom, enshrined in the last report of the Intergovernmental Panel on Climate Change [1], suggests that about half of the dust in the atmosphere is derived from human activities – primarily agriculture and deforestation, but also road-building and construction activities. However, this estimate was based on a small number of modelling studies that found it impossible to reproduce observed dust loadings by considering natural dust sources alone.

Recent work has shed new light on the relative importance of natural and human atmospheric dust sources. A recent paper [2] analysed a new compilation of dust-storm observations [3] (Figure 1a) to show that the frequency of dust storms in cropped and grazed lands was somewhat higher than in areas of natural vegetation with comparable climate and vegetation cover. The dust-storm data were then used to calibrate a dust-source model so that it reproduced observed dust emissions in areas of natural vegetation. The differences between the model predictions and observations in cropped and grazed areas were used to estimate the extent to which land-use practices contributed to dust erosion. Dust from cropped and grazed lands was found to contribute less than a tenth of the total dust in the atmosphere today (Figure 1b, 1c). Using different estimates of the extent of cropped and grazed land, or different sources of the meteorological data to drive the dust model, has very little effect on the overall estimate: the anthropogenic component of the current total atmospheric dust loading is small compared to the natural component. Thus, although dust emissions from agricultural soils may have a significant impact locally, they are not of great importance for the global radiation budget.

The implications of this finding for the future were simulated [2] using two different climate models forced by changes in greenhouse-gas concentrations (from the IPCC IS92a scenario), and different scenarios about how land-use might change in the future [e.g. 4,5]. The analyses of potential changes in dust emissions showed that the effect of climate changes, rather than changes in land-use, will be more important in determining the effects of atmospheric dust on regional climates.

The new estimates of how much of the dust in the atmosphere is due to human activities will require a re-assessment of our understanding of the dust cycle. At one level, they suggest that the scope for reducing the negative effects of atmospheric dust on urban

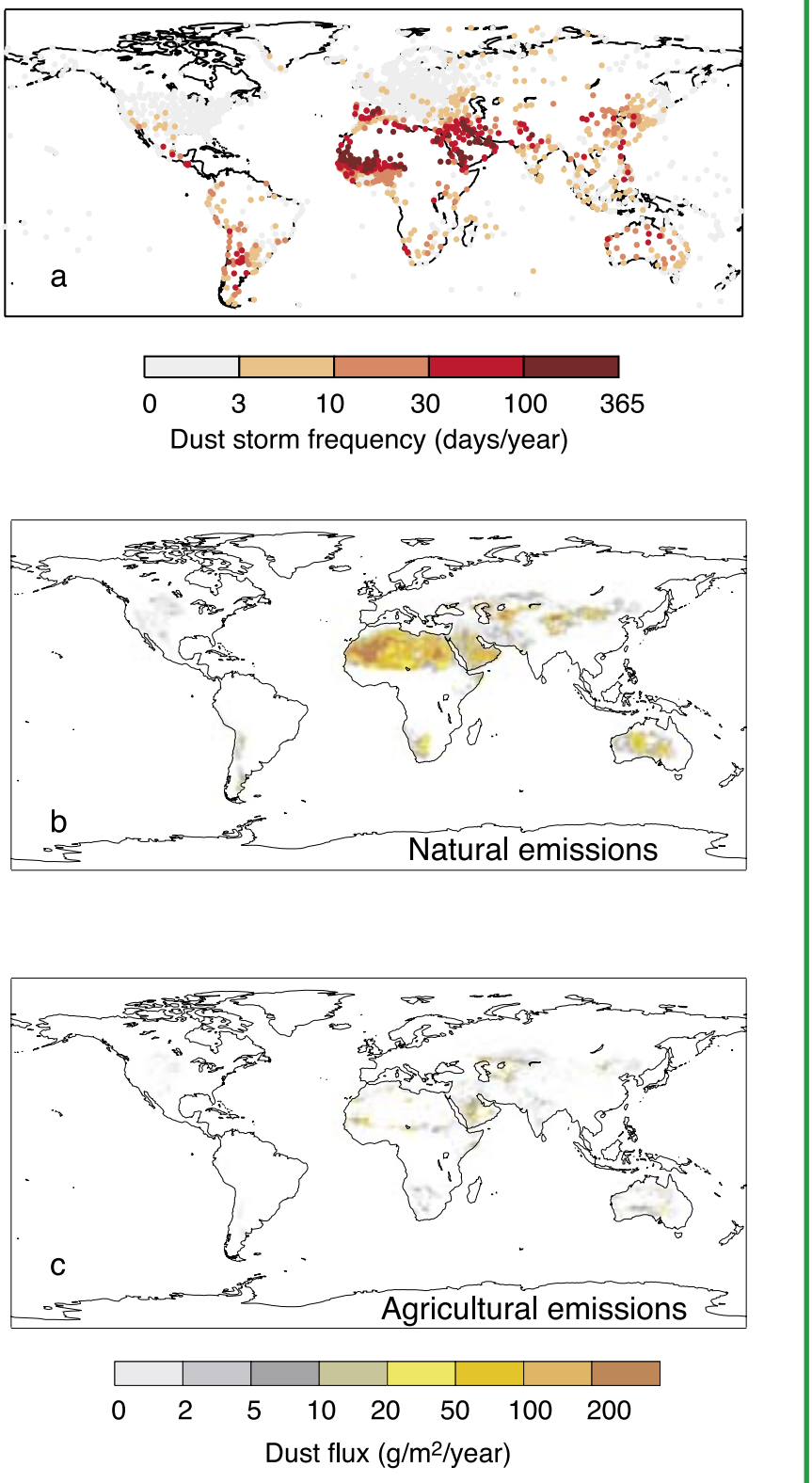

Figure 1. Dust storm frequency (a) [from 3] and estimated emissions, averaged for the years 1983-1992, from natural (b) and agricultural soils (c), [after 2].

climates and human health, for example through afforestation, are limited. At another level, they suggest that better estimates of the impacts of dust on regional and global climate will require more sophisticated models of the dust cycle, incorporating for example, the way in which vegetation growth controls dust emissions.

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The Environment and Sustainable Local Development in Coastal Areas

N. Lourenço and M. Jorge

Between 1998 and 2002 a multi-national research project – *Measuring, monitoring and managing sustainability: the coastal dimension* – was funded by the International Cooperation with Developing Countries programme of the European Commission. The project analysed interactions between social and environmental issues to better understand the impact of socio-economic drivers on ecosystems, focussing on issues of importance to sustainable coastal development planning and management. This included a consideration of stakeholder-sensitive instruments to support coastal policy-making.

The collaboration involved the Energy and Resources Institute (India), the National Institute of Oceanography (India), Goa University (India), the Universidade Nova de Lisboa (Portugal), the Laboratório Nacional de Engenharia Civil (Portugal), the Instituto Cartografic de Catalunya (Spain), and the Universita Degli Studi di Trieste (Italy).

The study analysed land-use change and sustainability in the coastal regions of India in terms of both societal pressures and the nature of coastal ecosystems. Regions were identified where socio-economic and biophysical problems led to coastal vulnerability, and indicators of both the pressure and state of vulnerability were defined for all coastal regions. The indicators were used to classify 66 coastal districts of the west and east coasts, and to identify the most vulnerable districts. The three most vulnerable regions were also found to be representative of the major forces responsible for change in coastal areas: tourism in north Goa, industry and urbanization in Thane (near Mumbai), and intensive agriculture and aquaculture in east Godavari.

Detailed socio-economic and ecosystem health investigations in north Goa, Thane and east Godavari identified the key variables affecting coastal resources in the context of the above drivers, and assessed the nature and extent of the demands that societal drivers place on coastal resources under present and alternative growth strategies. In north Goa, beach and coastal vegetation degradation, land form changes, and surface water quality degradation have stemmed from land-use and land cover change and groundwater use. In east Godavari, deterioration of the quality of groundwaters, coastal and fresh surface waters has accompanied mangrove swamp conversion and rising groundwater levels, while in Thane, polluted coastal and groundwaters are associated with changes in land-use and land cover.

Comparative analysis across locations and drivers [1] suggested that while well managed tourism could improve vegetation cover and biodiversity (in spite of the disappearance of some beach vegetation near Goa), industrial expansion degrades vegetation. In Thane, where plant biomass is declining and vegetation cover is becoming fragmented, Normalized Difference Vegetation Index (NDVI) analyses showed that although agricultural expansion has had significant negative impacts, it has increased plant diversity. Plant diversity has declined however near villages

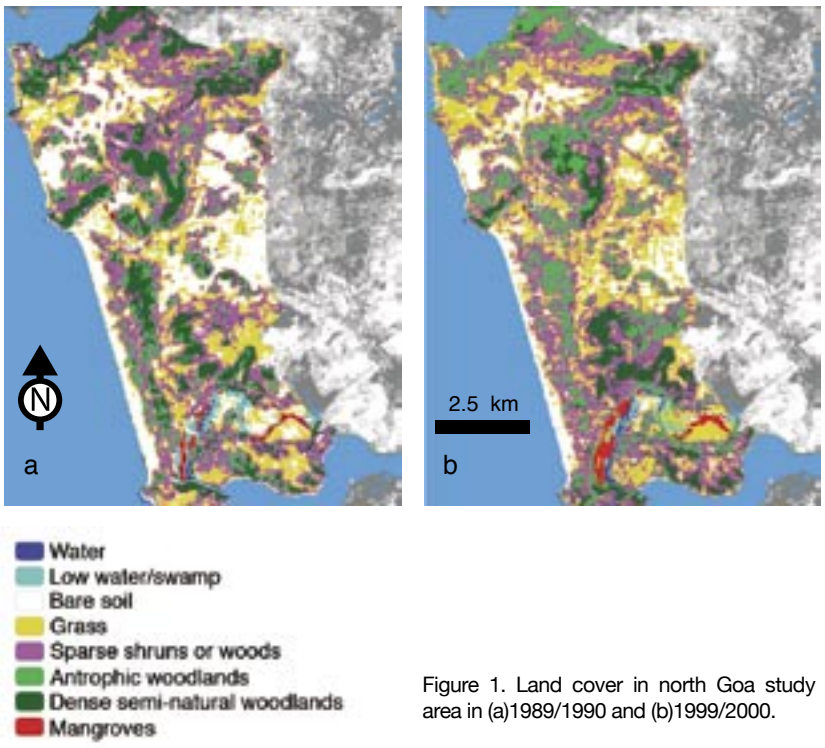

Figure 1. Land cover in north Goa study area in (a)1989/1990 and (b)1999/2000.

Figure 2. A five star hotel next to the shoreline in Fort Aguada beach in the north Goa study area.

Figure 3. A view of Calangute with the seasonal shacks build on the beach in the north Goa study area.

in east Godavari, and mangrove forest area has been reduced due to expansion of shrimp breeding ponds and paddy fields. Sustained development soon leads to water demands, sewage loads and levels of fertiliser and pesticide use that exceed the impact resistance or assimilative capacity of the environment. These thresholds depend on the nature and health of the ecosystem, and hence ecosystem health must be understood before the environmental impacts of future development can be adequately assessed. The relationships between development pressures and environmental responses are often non-linear and mediated by intermediate pressure-driver relationships.

From the case studies a framework for integrated analyses of the social and ecological aspects of coastal development emerged, and tools and approaches to improve sustainable ecosystem management were developed. Examples include a new method for delineating groundwater well-head protection areas, optimisation models to help manage growing water demand, and a coastal groundwater management policy based on optimisation and protection zoning. Three types of tools were developed for decision-makers: visualisation tools, spatial analysis tools and advanced modelling tools. The visualisation tools help consider the study area from different perspectives, define the main biophysical characteristics, highlight direct cause-effect relationships and establish the basis for condition assessments. The spatial analysis tools enable exploration of the spatial and attribute relationships between datasets, while the advanced modelling tools use mathematical and raster modelling to undertake multi-criteria analyses.

An important output of the project is the book *Coastal Tourism, Environment, and Sustainable Local Development* [2], which deals with the results related to tourism impacts. The book details the research analyses and results, and describes the decision tools developed in the project to measure, monitor, and manage coastal tourism development along sustainable paths. Sustainability – a concept that was central to project approach – is highlighted in the book. Sustainability requires an understanding of the complex relationships between society and nature, and so demands an integrated, interdisciplinary approach. While there are different ways to achieve sustainable development, all must consider the interactions between social and ecological systems, and this is reflected in the integration of natural and social sciences in the book.

The book is organised in three parts: (i) *Tourism Drivers and Coastal Ecosystems*, (ii) *Linking*

Social and Ecological Systems, and (iii) *Designing New Approaches to Managing Coastal Tourism*. Part I focuses on the tourism dynamic of the Goa study area. The analysis highlights the spatial dimension of tourism and its importance as the driving force of social, economic and environmental change. Increasing tourist numbers and tourism infrastructure appear to drive local population movement and behaviour, land-use and land cover change, and the patterns of natural resource consumption.

A typology of tourism destinations was used to differentiate the patterns of natural resource consumption that stem from differences in tourist accommodation infrastructure. Analysis of 1989/1990 and 1999/2000 land cover (Figure 1) showed that while the NDVI increased in the study area, the diversity of species has decreased due to loss of the original vegetation. Coastal vegetation has increased in tourism locations due to the desire for an attractive environment (Figure 2), and tourism-related activities have had a strong impact on forest-related activities, and on traditional activities including salt extraction, agriculture and aquaculture. Land reclamation is increasingly common, broadening the coastal tourism belt eastward towards the hinterland. The natural flow of tidal waters and estuaries has been adversely affected, and shore widths have diminished where sand dunes have been razed for tourism development (Figure 3). Water quality data show that sewage effluent is causing high levels of bacterial contamination in rivers and creeks. However, coastal waters are not polluted suggesting efficient biotransformation by heterotrophic bacterial communities.

Part II of the book develops the links between social and ecological systems, and the assessed ecosystem changes. The tourism-related environmental changes are used to identify models and build projections to 2021. Alternative development scenarios are presented with discussion of the potential ecosystem implications. Scenario land cover projections were simulated in a geographic information system. Part III of the book discusses different approaches to sustainable coastal tourism management. New methods are presented and discussed, and a variety of indicators and instruments to support decision-making are compared.

The final discussion considers the political framework required to support sustainable tourism. The EU experience and the outputs from the collaborative research described above suggest that coastal management policy (formulation and implementation) should include a range of creative approaches, with development and its impacts continuously monitored and managed. Participatory development is recommended, wherein local communities are active in guiding development and sharing in the benefits. This points towards decentralised coastal management in India, within broad enabling frameworks, and with regular consultative workshops. To adopt this approach would require the creation of institutions to promote the approach, the building of trust amongst stakeholders, the establishment of equity in information flows, new ways to address tourism needs and impacts, the building of social capital to enable a participatory approach and a strengthening of local governance. Specific measures to enable a participatory approach to development include establishment of state tourism boards with strong representation from key stakeholders, regional and local councils to expedite decision-making and improve transparency, and multi-stakeholder advisory committees to address tourism-related environmental, governance and social issues.

The book *Coastal Tourism, Environment, and Sustainable Local Development* is likely to be of interest to coastal planners, tourism professionals, researchers and all those with an interest in sustainability science. The book can be ordered from The Energy and Resources Institute (www.teriin.org). This research comes under the umbrella of International Cooperation Programme of the European Union, and contributes to the LUCC project of IGBP.

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Surface Ocean - Lower Atmosphere Activities in New Zealand: The SAGE Experiment

M.Harvey J.Hall and D.Ho

The G of the SAGE logo is the path of the RV Tangaroa as it followed a tracer-labelled patch around an eddy.

In the last two years New Zealand SOLAS activity concentrated on planning the multidisciplinary SOLAS Air-Sea Gas Experiment (SAGE). SAGE recently came to fruition with a month long voyage in March/April 2004 in sub-Antarctic waters at 47°S to the east of New Zealand (Figure 1). A major focus of SAGE is expressed as "Focus 2" of the recently published SOLAS Science Plan and Implementation Strategy [1] – "Exchange processes at the air-sea interface…." the objective of which is *"to develop a quantitative understanding of the processes responsible for air-sea exchange of mass, momentum and energy to permit accurate calculation of regional and global gas and aerosol fluxes."*

Understanding the processes regulating gas exchange in sub-Antarctic waters is vital because of the potential importance of this region as a net sink of atmospheric CO_2, and because of the high average windiness of the "Roaring Forties". The uncertainty in our knowledge of the processes and efficiency of gas exchange is greatest for very windy conditions (above 15 m s^{-1}, Figure 2), since making measurements in the open ocean under such conditions is logistically difficult.

In developing the objectives for SAGE, three key decisions were made. Firstly, the importance of the enhanced gradients and fluxes of CO_2 and dimethylsulfide that are associated with phytoplankton blooms, led to the decision to stimulate a bloom by iron fertilisation. Secondly, a lagrangian patch/dual-tracer experimental framework was chosen for following key physical, chemical and biological processes within a labelled patch of water. Thirdly, the decision was made to compare methods of gas exchange measurement; in particular, to compare the dual tracer approach at the tens of kilometres scale to micrometeorological measurements at the sub-kilometre scale.

The questions posed by SOLAS demand the development of complex experiments which combine atmospheric and oceanographic aspects. Conducting such experiments in arduous Southern Ocean conditions is a major operational challenge that was well managed in SAGE by an experienced sea-going team. The large international research group that was assembled to implement SAGE came from several participating organisations [2]. The research was conducted from the multipurpose Research Vessel Tan-

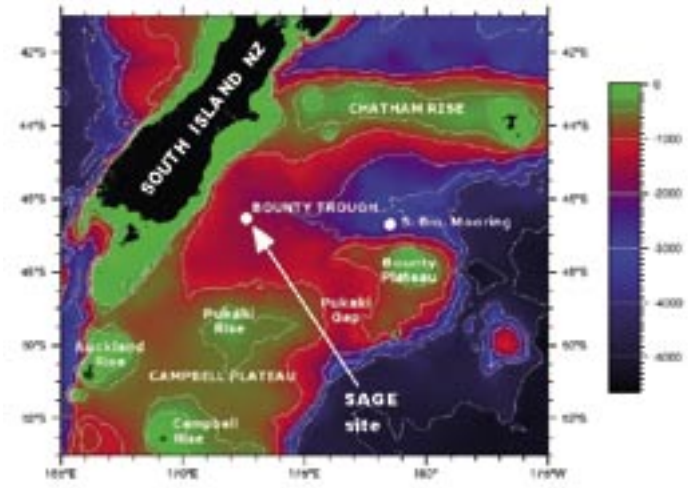

Figure 1. Location of the SAGE experiment in the context of bathymetry to the south-east of New Zealand.

Figure 3. RV Tangaroa from the rigid hull inflatable vessel used to deploy autonomous profiling samplers.

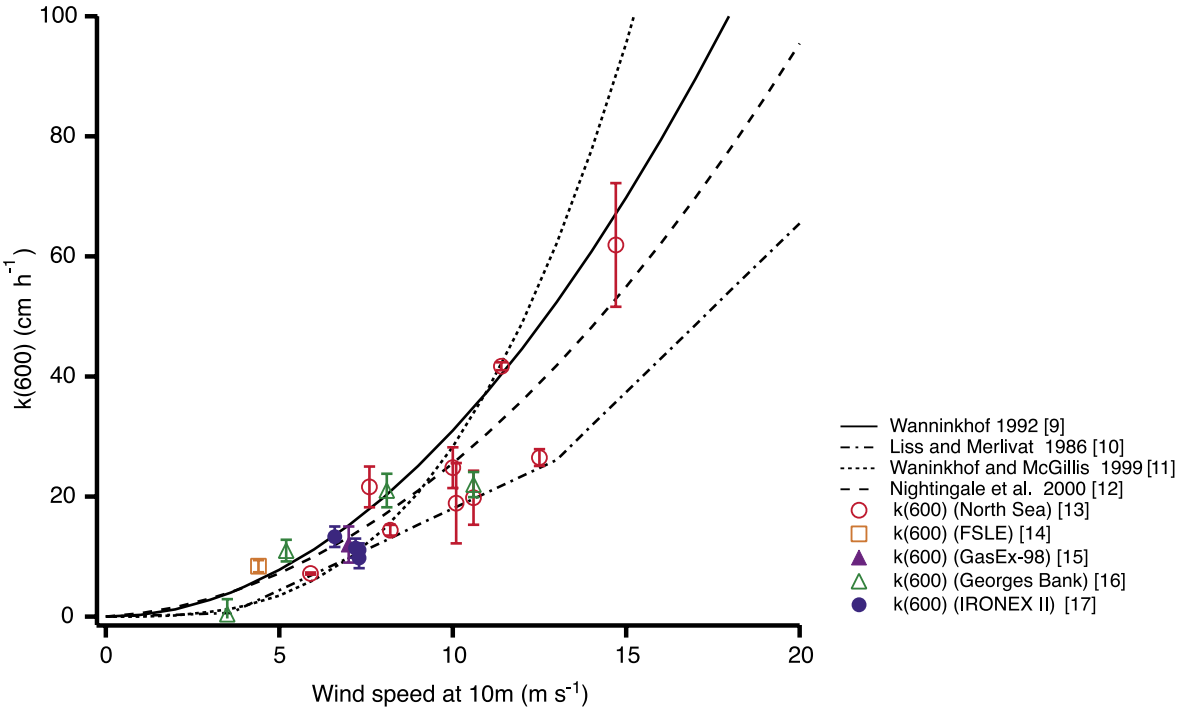

Figure 2. Dual-tracer experiment derived transfer velocity values (solid symbols = open ocean locations; open symbols = coastal and shelf locations) compared to various parameterisations.

garoa of the New Zealand National Institute of Water and Atmospheric Research [3] (Figure 3), with 29 scientists and 14 crew onboard. Details of the experimental plan can be found on the SAGE website [4].

An important aspect of air-sea exchange that will be advanced by the SAGE voyage came from the opportunity for concurrent measurements of dual-tracer gas exchange, surface radiometry and wave properties at the upper end of the wind speed range. These measurements were taken during the high wind speed, stormy conditions encountered during the SAGE voyage (Figures 4 and 5), with some of these measurements being above the previous maximum wind speed of 15 m s^{-1}.

Sometimes, unexpected experimental results prove to be the most exciting. In SAGE, the phytoplankton population response to iron fertilisation was unexpectedly slow and limited. Chlorophyll concentration in the surface water of the fertilised patch only doubled

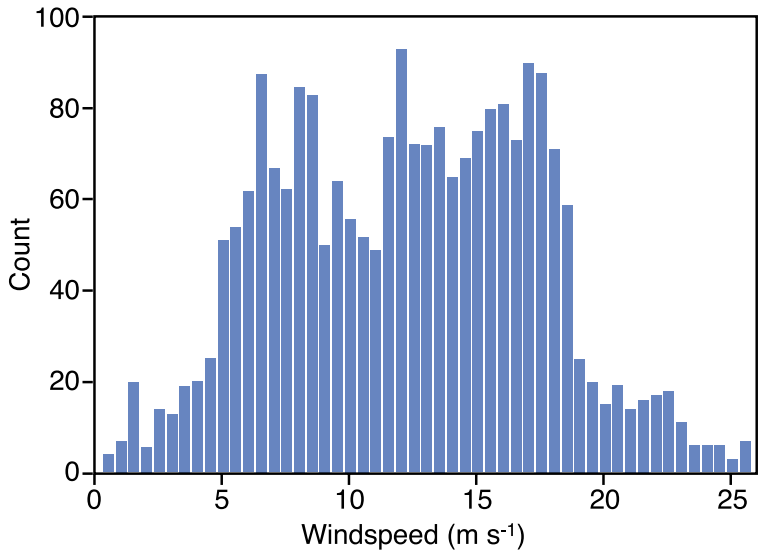

Figure 4. Distribution of wind speeds during the dual-tracer experiment.

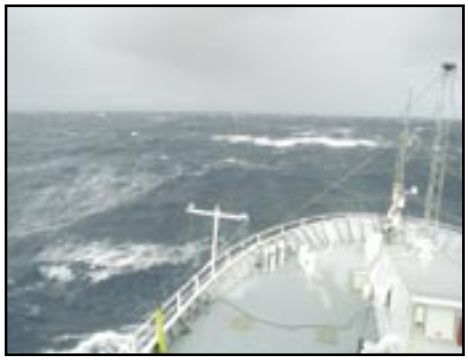

Figure 5. Strong winds from the bow of RV Tangaroa.

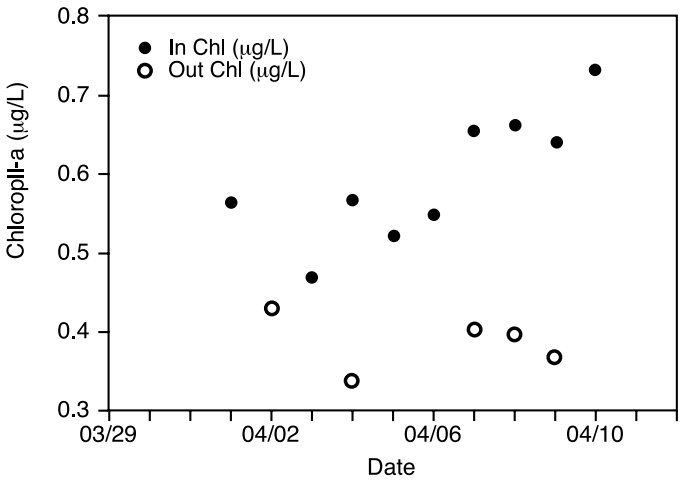

Figure 6. Surface water chlorophyll-a values inside (In) and outside (Out) the iron enriched patch over the final ten day period ending 16 days after the initial iron addition.

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in the last ten days of the experiment (Figure 6) – a very modest response compared with previous fertilisation experiments [5-8]. Understanding why the phytoplankton response was so slow and limited was a major focus of the on-board experimentation, and continues to be explored in the post voyage analyses. The findings of these and other analyses will be reported at a SAGE workshop which is planned for early 2005.

Acknowledgements

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The proliferation of numerical models developed for exploring aspects of global change in the Earth System and its various inter-connected compartments, has led to efforts to compare the results of different models applied to the same problem.

Model Inter-comparison Projects

The key to a successful model inter-comparison is to identify a specific task – such as predicting atmospheric tracer transport or calculating ocean surface carbon fluxes, and to then apply multiple models, with different formulations and different underlying assumptions, to this task. By comparing the results, underlying assumptions and process can be explored to provide insights that would not emerge from consideration of the models in isolation. The power of this approach has led to a raft of model inter-comparison projects (MIPs) in Earth System science.

A standardised set of input parameter values is essential for successful inter-comparison; if different parameter values are used in the different models, the results merely reflect these inputs rather than the model formulations. Likewise, the models in a MIP need a common set of output variables to allow a meaningful comparison. Problems that could arise from scaling and resolution issues, boundary conditions and model scope in space and time, can be avoided by establishing the MIP protocol *a priori*, and then adjusting model inputs and outputs – without altering model assumptions and formulations – to enable meaningful comparison.

As the Earth System becomes increasingly quantified by more comprehensive observations and better sub-system process understanding, it is reasonable to expect that numerical models will become increasingly robust, and that inter-comparisons will become increasingly powerful in Earth System analysis. This diagnostic power is emerging from an increased ability to isolate the processes responsible for differences in model output.

At the 2002 joint meeting of GAIM and the WCRP Working Group on Coupled Modelling it was recognised that many MIPs were in progress, and that these would benefit from sharing methods, protocols and results. Lessons have been learned in the process of conducting each of the MIPs, and it is therefore timely to examine and compare current MIPs and learn from these. This informal "model inter-comparison inter-comparison" should help modellers learn from past efforts and thus guide future endeavours. A MIPs compilation for open consultation was proposed at the 2002 meeting and has been initiated (Table 1). This could be viewed as a first step towards building a "toolbox" of model inter-comparison techniques, that would help future MIPs avoid protocol standardisation pitfalls, experiment with approaches from other disciplines, and better assess any apparently baffling inter-comparison results. Construction of this "toolbox" remains a goal for the international global change research community, and one which would help address the operational Earth System Questions posed by GAIM [1].

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Title	Description	Further Information
Asian-Australian Monsoon Atmospheric GCM IP	Inter-comparisons of intra-seasonal oscillation, monsoon dynamics and hydrology, atmosphere-ocean interaction, and global heat budget at the top of atmosphere and the surface in atmospheric GCMs.	climate.snu.ac.kr/clivar/index.htm
Atmospheric Model IP	Standard experimental protocol for global atmospheric GCMs. Provides a community-based infrastructure in support of climate model diagnosis, validation, inter-comparison, documentation and data access.	www-pcmdi.llnl.gov/amip/
Arctic Ocean Model IP	International effort to identify systematic errors in Arctic Ocean models under realistic forcing. Goals include examination of the ability of Arctic Ocean models to simulate variability on seasonal to inter-annual scales, and an improved understanding of model behaviour.	Andrey Proshutinsky Aproshutinsky@whoiu.edu
Arctic Regional Climate Model IP	International inter-comparison of Arctic regional model simulations, organised by GEWEX Cloud System Studies Working Group on Polar Clouds and the Arctic Climate System Study Numerical Experimentation Group.	Judy Curry curryja@eas.gatech.edu
Carbon-Cycle Model Linkage Project	Multi-research group study of the role of the terrestrial biosphere in the Earth System using Terrestrial Biosphere models.	www.ifm.uni-kiel.de/fb/fb1/me/research/Projekte/SIMIP/simip.html
Coupled Model IP	Comparing simulations from coupled global climate models with components describing atmosphere, ocean, sea ice and land surface.	www-pcmdi.llnl.gov/cmip/
Coupled Carbon-Cycle Climate Model IP	Comparing and analysing the feedbacks between the carbon cycle and climate under external climate forcing.	www.c4mip.cnrs-gif.fr/background.html
International Climate of the 20th Century Project	Seeking to impose the observed atmospheric forcing functions of the last century on state-of-the-art atmospheric GCMs to determine the extent to which seasonal to decadal variations are reproducible, and provide a validation of these atmospheric GCMs.	www.iges.org/c20c
Potsdam DGVM IP	Illustrating possible ecosystem responses to rising atmospheric CO_2 and climate change using six DGVMs that explicitly represent the interactions of ecosystem carbon and water exchanges with vegetation dynamics.	Wolfgang.Cramer@pik-potsdam.de
Dynamo		Claus Boening cboening@ifm.uni-kiel.de
Ecosystem Model-Data Intercomparison	Comparing model estimates of terrestrial carbon fluxes to estimates from ground-based measurements, and improving the understanding of environmental controls on carbon allocation.	gaim.unh.edu/Structure/Intercomparison/EMDI/
ENSO IP	Documenting El Niño simulations in coupled ocean-atmosphere models. Outputs from around 20 coupled models have been collected, including regional and global models, coarse and high-resolution models, flux-corrected and freely-running coupled models.	Mojib Latif latif@dkrz.de
GEWEX Cloud System Study (GCSS)	Developing improved cloud system parameterisations for climate models based on improved understanding of the physical processes.	www.gewex.org/gcss.html
Global Land-Atmosphere Coupling Experiment	Seeks to quantify and document the strength of model coupling across a broad range of atmospheric GCMs used in land-atmosphere interaction studies.	glace.gsfc.nasa.gov
Global Land Atmosphere System Study Panel	The land-surface modelling panel of GEWEX. Includes multi-institutional experiments of stand-alone land surface models and coupled land-atmosphere models at local (point, plot and catchment) and large (continental to global) scales.	www.iges.org/

GEWEX Modeling and Prediction Panel		Jan.Polcher@lmd.jussieu.fr
The Global Soil Wetness Project	Ongoing activity of the Global Land-Atmosphere System Study and the International Satellite Land-Surface Climatology Project, that contribute to GEWEX.	www.iges.org/gswp/
IGAC-MIPs		Guy Brasseur brasseur@dkrz.de
Potsdam Net Primary Production Model IP	Comparing 17 global models of terrestrial biogeochemistry with respect to annual and seasonal fluxes of net primary productivity.	Wolfgang.Cramer@pik-potsdam.de
Ocean Carbon-Cycle Model IP	Initiated by IGBP/GAIM in 1995 to foster international collaboration, improve predictive capacity and accelerate development of global-scale, 3D, ocean carbon-cycle models by standardised model evaluation and model inter-comparison.	www.ipsl.jussieu.fr/OCMIP
Ocean Model IP	Assessing the performance of ocean and ice model components used in coupled models to study climate and tracer uptake, so as to assess the quality of the forcing fields and to improve the understanding of the sensitivity of ocean/sea ice models to parameterisations and forcing.	www.clivar.org/organization/wgomd/pomip.htm
Project for Inter-comparison of Land-surface Parameterisation Schemes	Improving continental surface parameterisations, especially hydrological, energy, momentum and carbon exchanges with the atmosphere. Element of the Global Land Atmosphere System Study Panel.	Ann Henderson-Sellers ahssec@ansto.gov.au
Project to Inter-compare Regional Climate Simulations	Community-based inter-comparison of regional models run in climate mode. Consists of a series of collaborative inter-comparison experiments using meso-scale models simulating the climate of North America.	www.pircs.iastate.edu/
Palaeo-climate Model IP		www-pcmdi.llnl.gov/pmip/
Regional Climate Model IP for Asia	Evaluating and improving regional climate model monsoon simulations. Supported by Asia-Pacific Network for Global Change Research.	Congbin Fu fcb@tea.ac.cn
Sea-Ice Model IP	International effort developing improved representation of sea-ice in climate models, using numerical experiments co-ordinated across several institutes in the Arctic Climate System Study of WCRP.	Greg.Flato@ec.gc.ca
Seasonal Prediction Model IP 2	Investigating seasonal predictability in atmospheric GCMs using two experimental protocols and either observed SST, or forecast SST. Ensembles of integrations are used for each season during 1979-2000, differing only in initial conditions.	www-pcmdi.llnl.gov/smip/
Snow Models IP	Comparing snow simulations at four sites (middle elevation temperate, high elevation temperate, eastern US, arctic) in various models.	www.cnrm.meteo.fr/snowmip/
Study of Tropical Oceans in Coupled Models	Identifying strengths and weaknesses of coupled models in tropical ocean regions.	Mike.Davey@metoffice.com Ken Sperber sperber1@llnl.gov
WCRP Transport MIPs	Providing a foundation for establishing the credibility of stratospheric models used in environmental assessments of the ozone response to CFCs, aircraft emissions, and other climate-chemistry interactions.	Michael Prather mprather@uci.edu Daniel Jacob djacob@fas.harvard.edu Phil Rasch pjr@ucar.edu

Table 1. Summary of current MIPs complied by GAIM and the WCRP Working Group on Coupled Modelling. (GCM = general circulation model, DGVM = dynamic global vegetation model). This information, including live links, can be accessed at gaim.unh.edu/Structure/Future/MIPs/.

Discussion Forum

In September, 2003, scientists, lighting experts, medical practitioners, astronomers, and many others met in Ontario for an International Symposium – "The Ecology of the Night" [1]. The conference was inspired by the increasing levels of light pollution (Figure 1), and coincidently followed soon after the massive power failure across eastern North America on the 14th of August, 2003. That night millions of people had their first view of the night sky unaffected by city lights (Figure 2). Symposium presentations dealt with the importance of periodic darkness for the development and function of most plants and animals – including humans. The Symposium introduced the term "scotobiology" (from the Greek scotos, darkness), as the science of biological systems that depend upon darkness to function normally [2].

Scotobiology – the Biology of Darkness

The development of plants, particularly those in temperate zones, varies with season and most plants detect season by the duration of darkness. Hence "short-day" plants actually require long nights, and "long-day" plants require short nights. Short-day plants normally bloom in the autumn when the days shorten. Long nights initiate the onset of flowering, and later, as nights lengthen, the onset of dormancy, which enables plants to withstand the rigours of winter. If short-day/long-night plants are illuminated even briefly during a long night, they detect this as two short "nights". Under continuous night-time light pollution plants respond as if there were no night. In either case flowering and development are compromised. The effects of successive nightly illumination are cumulative, and can seriously affect or prevent the development, flowering and dormancy – and hence survival – of short-day plants.

Birds suffer huge losses due to light pollution. There has been a tremendous increase in the number of brightly illuminated tall infrastructure, including buildings, power pylons, chimneys, telecommunications towers and wind generators. Birds are disoriented by bright lights, and either fly toward them or are unable to see structures behind them – for example, the extent of a building that surrounds illuminated windows. In North America alone, more than one hundred million birds collide with such structures during migration every year, and thousands more die from short-flight collisions on their breeding or wintering grounds [1]. Even those that are not killed in collisions are often caught by the raptors and carnivorous birds that congregate near bright lights. Migration patterns can be affected, as even if birds do not get lost and fail reach their destination, they often fly further and so reduce their chances of survival. Many of the species affected are in serious decline, threatened, or even endangered.

The behaviour of many animals, including mammals, amphibians and insects can be seriously affected by light pollution. The hunting and breeding habits of carnivorous animals can be affected, as can the behaviour of frogs, salamanders, and other nocturnal amphibians. The patterns of activity and social interaction of nocturnal amphibians are effective in low-light conditions, and are extremely susceptible to disruption by artificial illumination. These species can be affected where urban parks and gardens are subject to light pollution.

The effects of light pollution are also considerable at the community and ecosystem level. Disturbance of plant and animal life-cycles within a community affects the survival of otherwise unaffected members. Migratory birds, which are seriously affected by light pollution, are members of two or more far distant communities; factors affecting their survival and behaviour can thus have far reaching ecological impacts. Light pollution from cities and highways

Figure 1. NASA image of Earth's city lights. The brightest areas are the most urbanised, but not necessarily the most populated. The image highlights the tendency for urbanisation along coastlines and transport networks.

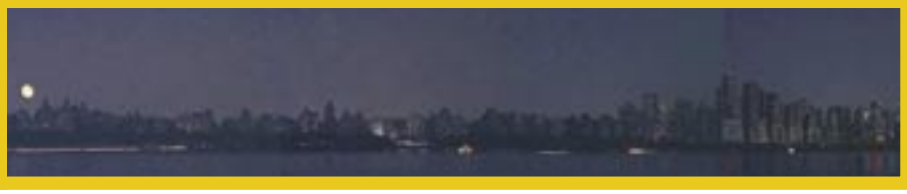

Figure 2. New York City skyline on the 14th August, 2003. The picture shows the moon with Mars to the right of it; the visible lights are from cars, generator-driven lights, flashlights and candles.

is sufficiently widespread to affect very large areas, and the effects on individual organisms can disrupt the population balance and thus the integrity of whole communities.

Human health is more severely affected by light pollution than is generally realised. Human hormone regulation, physiology and behaviour have evolved in a diurnal pattern of night and day. The normal operation of sleep/wake cycles, hormone cycles, the immune system and other biochemical behaviour, depends on the daily alternation of light and dark. For example, the immune system functions more strongly during the day to protect the body against invasion, while antibody production is highest at daytime. At night, the killer cells that attack tumours and established invasions are more active. Night-time light pollution unbalances the different activities of the immune system, to the serious detriment of health, and disrupts circadian hormone cycles with resulting emotional, physical and psychological damage.

Light pollution may become a major ecological and human health issue if we continue to ignore the evidence of its increasing impacts. A hopeful aspect of the problem is that much light pollution is unnecessary and could be easily controlled. The lights on high structures to prevent airplane collisions are of course essential, but their effects may be ameliorated by using specific wavelengths or flashing lights. The light pollution from internal illumination of large buildings could be reduced by curtains, and floodlighting of buildings and statues could be dramatically reduced at the relatively small cost of reduced public prominence. A major reduction of light pollution can be achieved with shaded/focussed street, highway, area and advertising lighting, and this has been done in several locations in Europe and the Americas with gratifying results. Less powerful, downward-focussed street lights can provide adequate lighting without skyward pollution. Finally, reducing light pollution would also lower the environmental impacts associated with electricity generation.

The extent of public interest in this issue is indicated by the many star parties and dark-night media presentations now being held. However, more work in the science of scotobiology is needed to understand the impacts of light pollution, and to promote practical solutions.

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The recent IGBP synthesis *Global Change and the Earth System: A Planet Under Pressure* [1] states: "any complete analysis of the consequences of global change must go well beyond scientific and economic considerations, to fundamental moral and ethical values". In his review, Hans von Storch [2] recommends that for an analysis of the complex history of the cultural, ideological and political foundations of the modern environmental sciences, readers turn to Ludwig Fleck's *Genesis and Development of a Scientific Fact* [3], or Clarence Glacken's *Traces on the Rhodian Shore* [4]. I confess never to having heard of the former, until I read Hans' review. My copy of the latter is 763 pages long, and whilst it is a wonderful book, I believe that there are other, more direct (although perhaps less erudite) routes into the recommended areas of knowledge.

Global Change and the Global Economy

These areas of knowledge are largely the province of the social sciences and the humanities, which deal with the structure and functioning of human societies. Before exploring this statement further, I wish to sound a note of warning: as natural scientists, we must be careful to avoid uncritical imposition of our typically mechanistic paradigms. These usually emphasise the similarities between human beings and other species: that human societies are ecosystems [5] that 'evolve' solely via Darwinian mechanisms [6], that human behaviour is largely genetically determined [7,8], and the number of people on Earth is the most important factor driving environmental change [9]. Instead, we should learn from the social sciences and humanities about how human societies differ from natural systems, in order to avoid the deterministic arguments from which these disciplines spent much of the late 19th and early 20th century trying to escape [10]. It is surely in the differences between humans and other species, and not the similarities, that the causes of, and hence the solutions to, the problems of global change lie.

Thus, all human societies are part of ecosystems, but they are also more than ecosystems (see below). Similarly, although Darwinian mechanisms apply equally to humans as to other species, human societies do not change via Darwinian mechanisms alone, and the process of change in human societies is not 'evolution' *sensu stricto* – i.e. it is not 'natural' selection', but depends on human choice. Nor is it clear

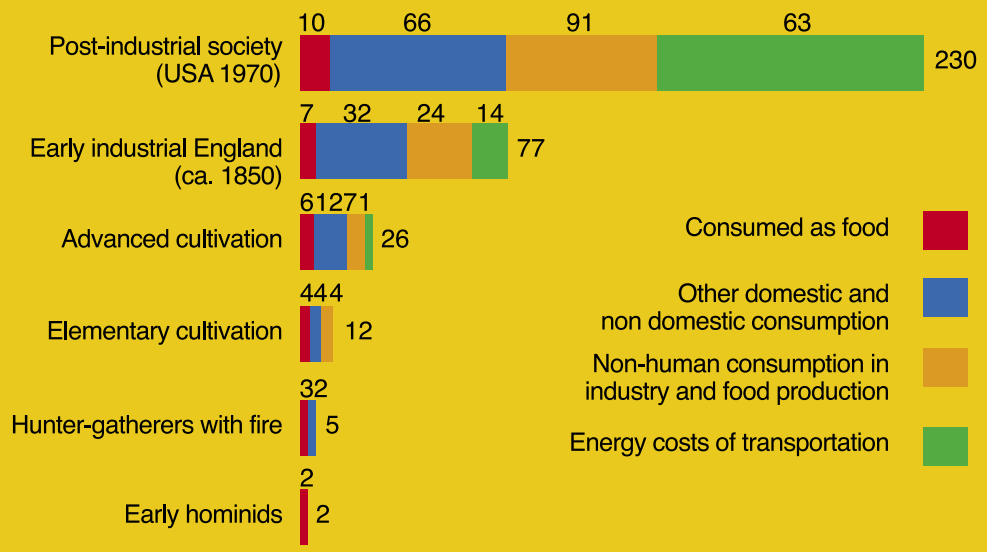

Figure 1. Total (end of bar) and fractional (above bar) energy consumption (10^3 kcal per person per day) for different societies (Adapted from [18]).

that human behaviour is anywhere near as strongly conditioned by genetic inheritance as in other species [11,12]; cultural factors are equally, or even more important. Finally, it is not only the number of people on Earth that drives global change, but also the *per capita* levels of resource consumption.

Humans are distinguished from all other species by their culture [13], including a technology, a language, an art (but not always a science), a store of knowledge, a social organisation, a form of government (a polity), an economy, a religion and/or a philosophy, an ideology, and a set of customs, rules, taboos, norms and institutions. Human societies function as much via the flow of information as of energy and matter; one reason why it is unwise to think of them only as ecosystems *per se*. Whilst other species may possess some of the above, none possess them all.

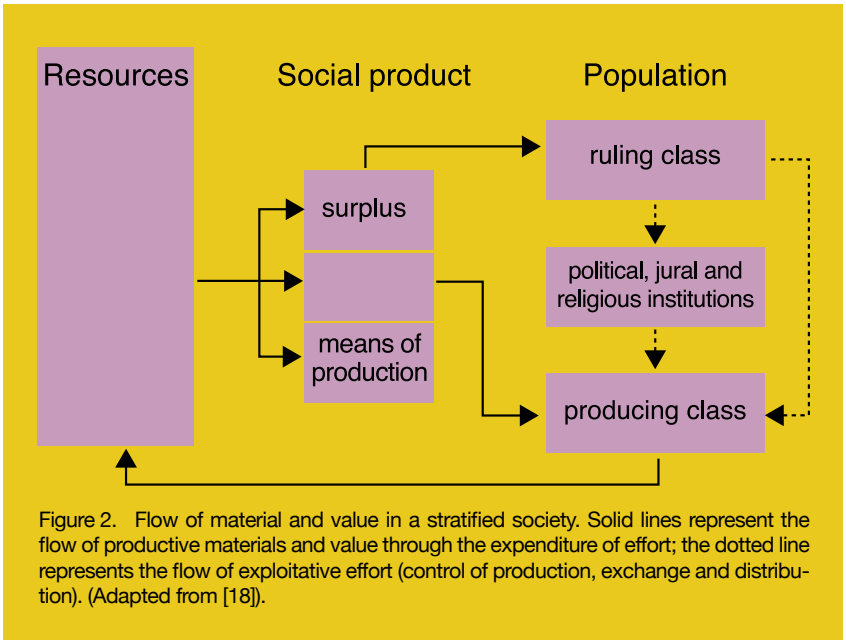

Figure 2. Flow of material and value in a stratified society. Solid lines represent the flow of productive materials and value through the expenditure of effort; the dotted line represents the flow of exploitative effort (control of production, exchange and distribution). (Adapted from [18]).

It is therefore to the social sciences and the humanities that we must turn in order to identify solutions to the problems of global change. Much mainstream sociology, however, and even some environmental sociology, is concerned not with interactions between humans and nature, but with relationships between humans in developed society [15]. Similarly, much modern political science is concerned with the functioning of a single model of government – that of liberal, representative, parliamentary democracy [15]. Modern economics, even environmental economics (or even its offshoot, ecological economics [16]) is often largely concerned not with the value of nature, but with its price, which is a completely different question [17]. In contrast, anthropology, especially its ecological variant cultural (as opposed to social) anthropology [13], which explores the relationships between ecology and economy in human societies, offers natural scientists exactly the kind of information that Steffen *et al*. [1] recommend. To illustrate this point, I offer two examples from the excellent introduction to the subject by Roy Ellen [18].

The first (Figure 1) compares energy consumption under five economic systems: (i) hunting, gathering and collecting (foraging), (ii) elementary (early Neolithic) cultivation (horticulture), (iii) 'advanced' (feudal, peasant) cultivation, (iv) western industrial society, and (v) western post-industrial society. Amounts now consumed as food in developed countries are more or less triple that typical in the Late Pleistocene, although the absolute increase has been fairly small compared those of other uses, owing to relatively inelastic demand for food. Under both foraging and elementary cultivation other domestic and non-domestic consumption was also relatively small (less than or equal to the amount consumed as food), but began to rise under advanced cultivation, as more and more non-food energy was converted (e.g. by craft specialists, and others such as warriors, priests and scribes, who did not directly produce their own food; see Figure 2). In western industrial society, when widespread fossil fuel use began, non-food energy consumption increased to 2.7 times that of advanced cultivation. Now, in western post-industrial society, non-food energy consumption is 5.5 times that of advanced cultivation.

Non-human energy consumption in industry and food production was non-existent under foraging (by definition), and small under Neolithic agriculture, but rose under advanced cultivation, as the number of beasts of burden, and the use of technologies such as water power, increased. However, the largest increases occurred under western industrial and western post-industrial society: by factors of about 3, and 13 respectively. The greatest increases in energy consumption have been those for transportation: from 1 x 10^3 kcal ca^{-1} d^{-1} under advanced agriculture, to 14 and 63 x 10^3 kcal ca^{-1} d^{-1} respectively, under western industrial and western post-industrial society.

Thus, in western industrialised countries, about three times as much energy is consumed on a *per capita* basis as in the western industrial societies of the 19th century, about nine times as much as during pre-industrial, feudal times, and about 17.5 times as much as during the Neolithic. Thus, it is not only the number of people on Earth that has led to the great increases in energy use, but also the expansion of transportation (i.e. of trade), first in the colonial indus-

trial market of the 19th and 20th centuries, and now in a post-industrial, globalised economy.

In pre-Neolithic and early Neolithic societies, trade was largely either in essentials (e.g. salt), or luxuries (e.g. amber, mother of pearl, beads), and almost never in food [19]. During the later Neolithic, trade in raw materials and highly valuable items (such as stone axes) began; but most societies, of necessity, remained self-reliant, especially in food. In feudal societies, trade in food did occur, but it was the quest for luxuries such as silk and spices that led to European voyages of exploration during the late 15th-17th centuries, and the beginnings of the global market [20]. It was establishment of the colonial industrial system, with its emphasis upon resource extraction and commodity production on one continent, industrial production on another, and sale of goods possibly on a third, that led to the initial upsurge in transportation of raw materials, commodities and manufactured goods indicated in Figure 1 [21].

Parallel changes in economy, polity and society of human groups have accompanied these changes in energy consumption (Figure 2), in the form of the flow of materials and of value in stratified societies. Stratified societies are those in which not everyone is engaged in production of food and other commodities, and in which the stock of resources ('land'), is not 'owned' 'free for all' (as in forager society), but is the property of the polity. The polity is usually the ruling family of the chief (in a tribal society), or of the king, emperor, other ruler (in a feudal state), and the associated aristocrats [13]. Here, natural resources are extracted by those engaged in agriculture and extractive industries (the primary sector), and processed into manufactured goods by craft producers (the secondary sector). The means of production is owned either by the polity, or by members of the crafts (e.g. the Guild Masters of medieval Europe). However, in order to support those not directly engaged in production, producers need to generate a surplus, which flows not to them, but to the non-producers; hence the growth in domestic and non-domestic (non-food), and in non-human energy consumption between elementary and advanced cultivation shown in Figure 1.

In unstratified pre-Neolithic and early Neolithic societies, there was no requirement to produce a surplus. Everyone produced their own food (or that of the group), and all production flowed directly back to producers. In industrial and post-industrial society the tertiary (service) and quaternary (service to services) sectors greatly expanded. Ownership of resources and the means of production became increasingly privatised as the economy separated from the economy [20], and then more recently (in many cases), become the property of global corporate entities [21]. One could refine Figure 2 to represent this separation of the economy from the polity, but it illustrates in any case that it is the need to produce a surplus, and nowadays, to transport that surplus around the globe, that is a major cause of the increase in energy consumption.

It is perhaps no coincidence that many place the onset of contemporary global warming in the mid-19th century, which represents not only the ending of the Little Ice Age, but also the expansion of the global colonial industrial market economy [22]. It has recently been suggested however, that anthropogenic global warming associated with increased atmospheric carbon dioxide concentrations, may have begun as early as 6-8000 years ago due to the spread of agriculture [23]. Subsequent decreases in CO_2 concentration and the associated coolings, are attributed to population decreases caused by events such as the Black Death of 14th century Europe [23], although not everyone agrees [24]. A more accurate assessment of the cause and timing of the onset of warming, is that it coincides not with the spread of agriculture *per se*, but, as Ruddiman [23] himself suggests, with development of advanced cultivation employed by highly stratified, extremely hierarchical Bronze Age empires of the Ancient World, in which production of large (agricultural) surpluses, was fundamental to maintenance of political order.

In one sense therefore, I agree with Steffen *et al.* [1] when they call for us to look beyond science and economics for the causes of, and solutions to global change. However, in another sense, I disagree, in that it is by the extraction of raw materials, their industrial processing to make manufactured goods, and their transportation around the planet in a global market, that we intervene most critically in ecosystems and in biogeochemical cycles, and hence cause the greatest change. Some thirty years ago, when scientists began thinking about 'environmental' problems, many thought that ecology was the most important subject in environmental science [25]. I now believe that it is economics, especially the difference between the economics of egalitarian groups, which are truly sustainable, and those of stratified societies, which depend heavily upon production and distribution of a surplus, including our own. These are basically, positive feedback systems; hence their inherent tendency to cause environmental damage.

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New Roles and Faces

Will Steffen finishes as Executive Director of the IGBP Secretariat on 30 June 2004, after a little over six years in the job. Will's reflections on his time as Director can be found in his Guest Editorial in the March 2004 NewsLetter (No. 57). The Chair of the SC-IGBP and the IGBP Officers have appointed Will to an unsalaried position of Chief Scientist for IGBP for a term of two years, primarily to help the Programme in its efforts to synthesise knowledge and to define new scientific challenges. Will is now based in Canberra, Australia, working for the Australian Government in the Bureau of Rural Sciences. We thank Will for his vision and leadership during his years as Executive Director, wish him well in his new endeavours and look forward to his constructive input to IGBP in his new role.
E-mail: will.steffen@brs.gov.au

Other Staff Changes at the IGBP Secretariat

Anna Dalin, who was introduced in NewsLetter 56, recently finished her time at the IGBP Secretariat. Anna assisted with several communications tasks including the public launch of the IGBP synthesis book *Global Change and the Earth System: A Planet Under Pressure*, and the development of a strategy for enhanced involvement of National Committees in the IGBP community. Thanks Anna.

Sofia Rogers, the IGBP webmaster, is now working full-time at the Secretariat again, after nearly two years of part-time work while on study leave.

IGBP and Related Global Change Meetings

A more extensive meetings list is held on the IGBP web site at www.igbp.kva.se

SPACC Workshop: On the Economics of Small Pelagics and Climate Change

13-15 September, Portsmouth, UK

Contact: http://www.pml.ac.uk/globec/structure/regional/spacc/economics/workshop.htm

Regional Workshop on Human Dimensions on Global Environmental Change Research

13-15 September, Richards Bay, South Africa

Contact: hectorchikoore@yahoo.com

ICES Annual Science Meeting

22-25 September, Vigo, Spain

Contact: http://www.ices.dk/iceswork/asc/2004/

IAI Institute on Urbanisation and Global Environmental Change in Latin America

27 September-08 October, Mexico City, Mexico

Contact: http://www.institutes.iai.int/2004UGEC.htm

International Workshop on Significant Scientific Research on Global Environmental Change in Central and Eastern Europe

06-08 October, Sinaia, Romania

Contact: geoinst@rnc.ro

10th Wengen Workshops on Global Change Research

06-09 October, Wengen, Switzerland

Contact: http://www.unifr.ch/geoscience/geographie/EVENTS/Wengen/04/Wengen2004.html

1st SOLAS Open Science Conference

13-16 October, Halifax, Nova Scotia, Canada

Contact: Daniela Turk, solas@dal.ca

4th International Colloquium on LUCC

15-16 October, Beijing, China

Contact: Zhang Yili, zhangyl@igsnrr.ac.cn

6th International Symposium on Plant Responses to Air Pollution and Global Change

19-22 October, Ibaraki, Japan

Contact: http://apgc2004.en.a.u-tokyo.ac.jp/

IHDP-IAI Global Environmental Change Institute on Globalisation and Food Systems

24 October-06 November, Nicoya, Costa Rica

Contact: http://www.ihdp.org

Joint International Workshop: Integrated Assessment of the Land System:

28-30 October, Amsterdam, The Netherlands

Contact: Kasper Kok, kasper.kok@wur.nl

5th International Conference "Asian Megacities and Sustainability"

10-12 November, Tokyo, Japan

Contact: Kiyoshi Kurokawa, kurokawa@is.icc.u-tokai.ac.jp

European Conference on Coastal Zone Research: an ELOISE Approach

15-18 November, Portoroz, Slovenia

Contact: http://www2.nilu.no/eloise/

2nd China-Japan-Korea Joint GLOBEC Symposium

27-29 November, Hangzhou, China

Contact: Ling Tong, tongling@ysfri.ac.cn

Conference on the Human Dimensions of Global Environmental Change

03-04 December, Berlin, Germany

Contact: http://www.fu-berlin.de/ffu/akumwelt/bc2004/index.htm

AGU Fall Meeeting

13-17 December, San Francisco, USA

Contact: http://www.agu.org/meetings/fm04/

2005

International Conference on Integrated Assessment of Water Resources and Global Change: A North-South Analysis

23-25 February, Bonn, Germany

Contact: http://www.zef.de/watershed2005

PAGES/DEKLIM Conference: The climate of the next millennia in the perspective of abrupt climate change during the late pleistocene

07-10 March, Mainz, Germany

Contacts: Saskia Rudert, rudert@uni-mainz.de, http://www.uni-mainz.de/FB/Geo/Geologie/sedi/en/index.html

7th IAHS Scientific Assembly

03-09 April, Foz do Iguacu, Brazil

Contact: http://www.acquacon.com.br

IAMAS Symposium

2-11 August, Beijing, China

Contact: http://web.lasg.ac.cn/IAMAS2005/program.htm

2nd PAGES Open Science Meeting

10-12 August, Beijing, China

Contact: http://www.pages2005.org

7th International CO_2 Conference

26-30 September, Boulder, CO, USA

Contact: pep.canadell@csiro.au

6th Open Meeting of the Global Environmental Change Research Community

09-13 October, Bonn, Germany

Contact: mullin.ihdp@uni-bonn.de, http://www.ihdp.org

1st DIVERSITAS International Conference on Biodiversity. Integrating biodiversity science for human well-being

09-12 November, Oaxaca, Mexico

Contact: http://www.diversitas-osc1.org

International Conference on

Integrated Assessment of Water Resources and Global Change: A North-South Analysis

Bonn, Germany
23-25 February 2005

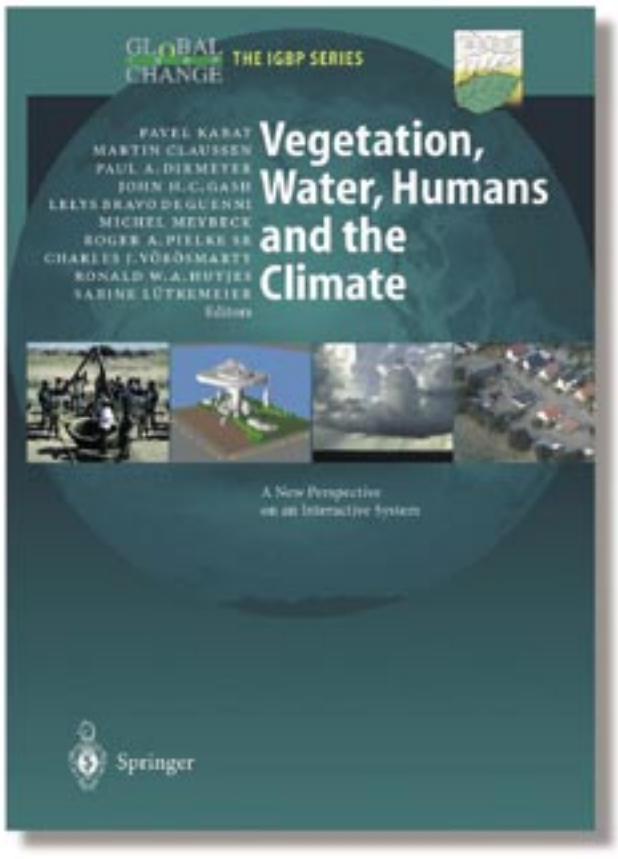
Objective and themes of the conference

The main objective of the conference is to analyse the global change challenges that are encountered in the integrated assessment and management of water resources in large river basins. By bringing together scientists and managers from North and South, it is expected that international research efforts concerning water related issues will be translated into more practical methods and coherent approaches.

At the conference, the following themes will be addressed explicitly:

* **Water resources data**
* **Stakeholders perspectives**
* **Scaling**
* **Integration**
* **Water science and policy**
* **Summary of international water programs**

www.zef.de/watershed2005



Vegetation, Water, Humans and the Climate

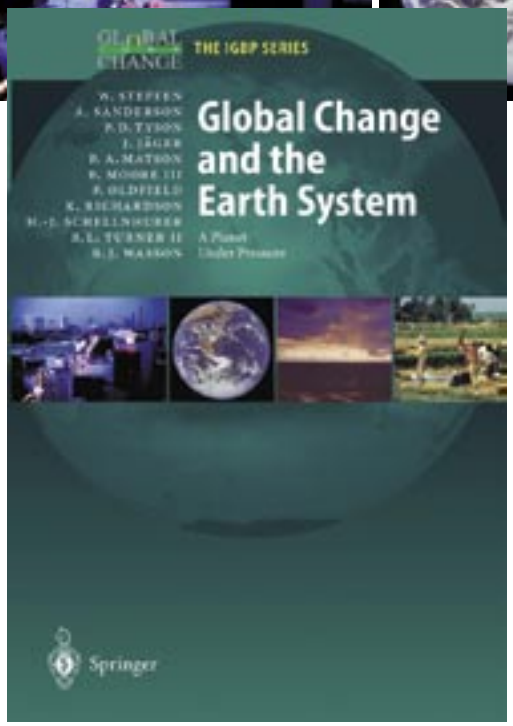
P Kabat, M Claussen, PA Dirmeyer, JHC Gash, LB de Guenni, M Meybeck, RA Pielke Sr, CJ Vörösmarty, RWA Hutjes and S Lütkemeier

ISBN: 3-540-42400-8 (129.95 Euro)

The BAHC Synthesis book is now available from Springer. To order on-line follow the links from the IGBP home page to 'Products' and 'Book Series'. This 550+ page summarises over a decade of research of the *Biospheric Aspects of the Hydrologic Cycle* (BAHC) project of IGBP. It also encompasses relevant related research especially many of the findings of the *Global Energy and Water Cycle Experiment* (GEWEX) project of WCRP.

The book describes the interactions between the terrestrial biosphere and the atmosphere via the hydrological cycle, and their interactions with human activities. Measurements from field experiments are complemented by modelling studies simulating flows and transport in rivers, coupled land-cover and climate, and Earth System processes. The impact of humans on river basins, environmental vulnerability, and methods for assessing the risks associated with global change are discussed.

Our Changing Planet



Global Change and the Earth System: A Planet Under Pressure

W Steffen, A Sanderson, PD Tyson, J Jäger, A Matson, B Moore III, F Oldfield, K Richardson, H.J. Schellnhuber, BL Turner II, RJ Wasson (Eds.)

ISBN: 3-540-40800-2 (99.95 Euro)

This book presents our current understanding of the Earth's environment as a single, integrated system, and is based on a decade of IGBP and related research. It explores the functioning of the Earth System before humans, and the ways in which human activities have grown to cause changes that reverberate through the System.

You can also download a 40 page Executive Summary from the IGBP website. For hardcopies please contact the IGBP Secretariat (charlotte@igbp.kva.se)

Springer

GLOBAL CHANGE IGBP

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a SOLAS open science conference

2004

International Council for Science Scientific Committee on Oceanic Research | GLOBAL CHANGE IGBP | WCRP | CACGP

solas

surface ocean - lower atmosphere study

science

13-16 october 2004
halifax, nova scotia
canada

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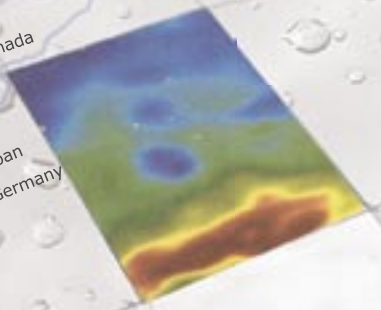


Abstract deadline June 15th 2004

email Daniela Turk: solas@dal.ca

www.solas-int.org

Pin Board

The Pin Board is a place for short announcements and letters to the Editor. Announcements may range from new websites, research centres, collaborative programmes, policy initiatives or political decisions of relevance to global change. Letters to the Editor should not exceed 200 words and should be accompanied by name and contact details.

Executive Director, IGBP Secretariat

Professor Kevin Noone from the Department of Meteorology at Stockholm University, Sweden, has been appointed as the new Executive Director of IGBP. Kevin will commence with IGBP on 1 September 2004 and will be fully introduced in the September issue of the Global Change NewsLetter.

Desert Research Award

Congratulations to Ashok Singhvi – member of the PAGES SSC, and Senior Professor at the Physical Research Laboratory in Ahmedabad, India, for being awarded the Farouk El-Baz Award for Desert Research. The award was established in 1999 by the Geological Society of America Foundation and is bestowed annually by the Quaternary Geology and Geomorphology Division of the GSA for an outstanding body of work in the field of warm (i.e. not polar) desert research.

New National Committee for the Netherlands

In April 2004 the Netherlands IGBP/WCRP Committee and the Netherlands IHDP Committee of the Royal Netherlands Academy of Arts and Sciences merged to form the Netherlands Global Change Committee. The merger aims to promote scientific interaction between social and natural research on global environmental change. The new Committee will: (i) assist in the further development of the international global change research programmes, (ii) inform Dutch scientists and scholars about these programmes, (iii) stimulate Dutch researchers and research institutes to participate in these programmes, (iv) organise interdisciplinary workshops which create new relationships between these programmes, (v) participate in international planning meetings, and (vi) outline possible Dutch contributions to, or new research issues for, these programmes.

Global Change on the Big Screen

Twentieth Century Fox has released its latest disaster movie – The Day After Tomorrow – built around a scenario of extreme, abrupt climate change. Presenting an American-centric view of science, politics and the world, this is the third time director Roland Emmerich has destroyed New York. Although clearly intended as mainstream entertainment, the film has attracted comments and reviews in Nature and Science, and positive and negative comments from scientists around the world, both within and beyond the IGBP community. See for example, a perspective from Stefan Rahmstorf at the Potsdam Institute: http://www.pik-potsdam.de/~stefan/tdat_review.html.

For better or worse, the movie has increased current media attention on the issue of climate change, and prividesan opportunity to present what we do know about the risks associated with current and likely future global change.

Learning to Change Our World

At the invitation of the Swedish Government, IGBP presented the science of global change at "Learning to Change Our World" – an international consultation on education and sustainability held in early May in Gothenburg, Sweden (www.learning2004.se).

The consultation was part of the Swedish Government's commitment to sustainability promised at the World Summit on Sustainable Development in Johannesburg in 2002, and was intended to break new ground in the field of education for sustainable development.

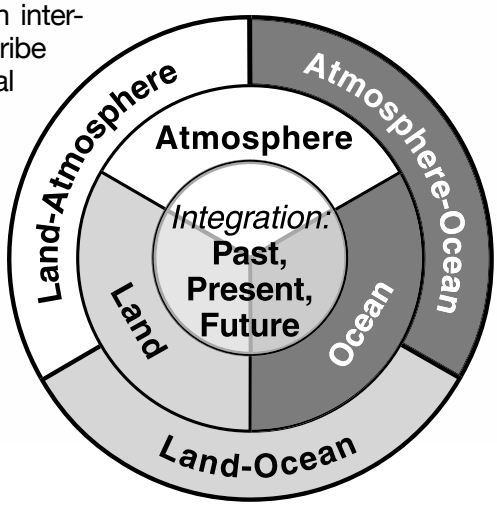
The three-day event was opened by Swedish Prime Minister, Göran Persson. IGBP Executive Director, Will Steffen, gave a plenary talk alongside ministers of education, environment and foreign affairs and a broadcast address from UN Secretary General, Kofi Annan.

EMIC Inter-comparison Projects

An IGBP-GAIM-BAHC workshop in 1999 reviewed Earth System modelling, concluding that a hierarchy of model complexity should be used, with Earth System models of intermediate complexity (EMICs) playing a central role. As EMICs became increasingly used in palaeoclimate simulations and climate sensitivity studies, the desire to assess EMIC robustness grew. While multiple inter-comparison projects were underway for comprehensive models (see Integration article this issue), none had been initiated for EMICs. A series of workshops was therefore launched in 2000 to address this issue, with co-sponsorship from GAIM, EGS (European Geophysical Society) and its successor EGU (European Geosciences Union). The initial workshop reviewed and tabulated the spectrum of EMICs in use (see www.pik-potsdam.de/emics). At subsequent workshops experiments were defined including comparative analyses of current climate simulations, equilibrium and transient responses to CO_2 doubling, biogeophysical effects of historical land cover changes, and the stability of the Atlantic Thermohaline Circulation. Experiments on glacial cycle dynamics are in progress. The results of these EMICs inter-comparison projects have been, or are close to being, submitted for publication; they will be summarised in a forthcoming NewsLetter. [Martin.Claussen@pik-potsdam.de]

The International Geosphere-Biosphere Programme

IGBP is an international scientific research programme built on interdisciplinarity, networking and integration. IGBP aims to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth System, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions. It delivers scientific knowledge to help human societies develop in harmony with Earth's environment. 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 an Earth System Science Partnership. 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.kva.se) or those of our projects, or contact an International Project Office or one of our 78 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 Pin Board may include letters to the Editor, short announcements such as new relevant web sites or collaborative ventures, and meeting or field campaign reports. Pin Board items should not exceed 250 words.

Photographs should be provided .tiff 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 – March, June, September and December. 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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The current and past issues of the Global Change NewsLetter are available for download from www.igbp.kva.se. Requests for reproduction of articles appearing in the NewsLetter should be emailed to the Editor. Changes to address information for receipt of the NewsLetter should be emailed to charlotte@igbp.kva.se. The IGBP Report Series is published in annex to the Global Change NewsLetter.

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