IGFA/Belmont Forum Fall Meeting 2010
The Pavilion Conference Centre, BMW Pavilion, V & A Waterfront
Cape Town, South Africa

INTERNATIONAL GROUP OF FUNDING AGENCIES FOR GLOBAL CHANGE RESEARCH

IGFA/Belmont Forum Fall Meeting 2010
The Pavilion Conference Centre, BMW Pavilion, V & A Waterfront
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16:00 – 18:00 **Meeting with Executive Directors of Global Change Programmes to discuss issues related to funding**

16:00-16:15- Introduction of the session (Maria and Lou)

16:15-16:30- ICSU provides the overarching context of the ICSU Visioning Process (Deliang Chen)

16:30-16:40 WCRP- Ghassem Asrar

16:40-16:50 IGBP- Sybil Seitzinger

16:50-17:00 IHDP- Anantha Duraiappah

17:00-17:10 DIVERSITAS- Anne-Helene Prieur-Richard

17:10-17:20 ESSP- Martin Rice

17:20-17:30 START- Hassan Virji

17:30-18:00 Open Discussion and next steps (moderated by Maria and Lou)

GEC Programmes & ESSP
Report to IGFA (2010)

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Executive Summary

Introduction

The four global-environmental-change (GEC) research programmes (DIVERSITAS, IGBP, IHDP and WCRP) and their Earth System Science Partnership (ESSP) have contributed substantially to improving the understanding of the planet. This work has highlighted, for example, the many ways in which humans have influenced Earth's climate, the delivery of ecosystem services and biogeochemical cycles, and how such changes in turn are affecting societies. But the changes themselves continue unabated, posing many challenges that necessitate the production of new knowledge aimed at new, more effective solutions. Our sponsors and funders – the International Council for Science (ICSU) and the International Group of Funding Agencies (IGFA) – are clearly attuned to the challenges that lie ahead, as evidenced from the processes leading up to the ICSU visioning and Belmont Challenge.

The GEC programmes and the ESSP have been actively involved in the visioning process, and have also provided inputs to the Belmont process. We are addressing various aspects of the ICSU/Belmont challenges already, as is clear from the information presented in our individual reports and from our summary below. We look forward to continuing our engagement with IGFA and ICSU and other international organizations and to moving forward together to respond to the challenges ahead.

We have been working together on a number of common goals/objectives and pursuing innovative integrative approaches to achieve them. We will continue to explore synergies to confront the challenges that lie ahead. One example of our joint efforts is the engagement of the producers and users of GEC information in defining the priorities for our future activities, and gaining their confidence in our ability to deliver the needed information in a timely and useful manner. Towards this goal, we are organizing two major and complimentary open science conferences in 2011 in Denver, Colorado and 2012 in London. These conferences will synthesize recent accomplishments and build, for example, on the outcome of the World Climate Conference-3. They will result in research priorities and plans, and will focus on innovative solutions on spatial and temporal scales relevant to policy makers. They will also provide a discussion platform how to best organize our activities in an integrated and coordinated way to achieve these plans.

We will continue to engage in focused and disciplinary research, which we believe is essential to answer some of the unresolved scientific questions that underpin major policy divisions. But we are also very committed to the next generation of integrated and transdisciplinary research[1] that will ensure greater and more effective uptake of the scientific knowledge that we generate, by those who need it. The funding required by GEC programmes for coordination and integration is significantly greater than what is available today, but when compared with the total investment in the actual research funding, it is still a small fraction. Recognizing the past and present benefits gained from your investments and a much greater potential that exists for such benefits in the future, we urge you to consider some additional investments in this regard instead of re-direction

[1] ESSP, for example, is planning a joint activity with ISSC and ICSU to define 'good practices' for research integration and transdisciplinary projects along numerous dimensions (e.g. scientific, international, structural and user-oriented).

of the current base funding for the programmes to these new and emerging priorities. We will work closely with you and demonstrate the efficiencies that can be gained by building on or re-prioritizing some of the existing activities as much as possible, however, wholesale change in some programmes will result in loss of capabilities and networks of experts that programmes have developed over the past three decades and serving as a foundation for today's GEC knowledge delivery. We will not be able to develop and deliver the scientific and technical knowledge required for future integrative grand challenges without this solid disciplinary foundation. We know that you are aware of this need, and anticipate that the future funding decisions will reflect this awareness.

Here we summarise programme highlights, new science findings, capacity building and outreach activities and finances of the GEC programmes and the ESSP. We hope this summary, in addition to our more detailed reports, serves to underscore our core strengths, our efforts to work across spatial scales and regions, and our commitment to work together to confront the challenges facing society today.

Activity Highlights

Both the ICSU and Belmont challenges address many common themes. We illustrate how our recent research and activities support ICSU's five Grand Challenges in global sustainability research, which encompass the themes discussed in the Belmont Challenge. In particular, we highlight those aspects of our work that are integrative by involving not only two or more GEC programmes but also other international players (e.g. CGIAR/ESSP collaborative research programme CCAFS, and the earth observation and monitoring programmes, systems and organisations). Note that these, as well as the highlights in our individual reports, are only snapshots of the research and activities our programmes undertake. In addition, both the Belmont and ICSU visioning processes attest to an emerging prominence of social-science research (including the humanities). There is an urgent call to mobilise the wider social sciences communities to engage more directly with global environmental change problems and issues. IHDP together with ISSC and UNESCO are presently undertaking a global survey to explore ways and means to include these communities in framing and engaging proactively in investigating global change issues and challenges.

We strongly realise that we need to co-design our research and frame the more integrative questions right at the outset. This differs for the common goals/objectives from those of programme specific questions and then bringing together the necessary means to address the grand challenges. Some of this work has already started (for example, the insights generated by ESSP joint projects, described below) but we acknowledge that greater coordination and integration across the various programmes will be the norm in the way forward.

The ESSP's Global Carbon Project, for example, publishes an annual global carbon budget and explains the observed trends. This has become a critical conduit of data and insights relevant to current discussions on the size of the human perturbation and the magnitude of climate change. The budget draws on some of the research done by the GEC programmes. Also the DIVERSITAS freshwaterBIODIVERSITY project and the ESSP's Global Water System Project have recently published a review article in *Nature* entitled 'Global Threats to Human Water Security and River Biodiversity'. This study is the first to account for the simultaneous effects of

pollution, dam building, agricultural run-off, the conversion of wetlands and the introduction of exotic species on the health of the world's rivers. The paper highlights that these stressors threaten rivers that serve 80 percent of the world's population, around 5 billion people. They also endanger the biodiversity of 65 percent of the world's river habitats and put thousands of aquatic wildlife species at risk.

GECAFS, in collaboration with partners from the GEC and development communities, has completed a major synthesis of the current state of knowledge and thinking on the relationships between GEC and food security. The synthesis reviews new thinking that has emerged over the last decade, analyses research methods for stakeholder engagement and for undertaking studies at the regional level, and looks forward by reviewing a number of emerging 'hot topics' in the food security-GEC debate, which will help set new agendas for the research and donor communities at large. GECAFS resulted in the CGIAR/ESSP collaborative research programme on climate change and food security.

An international team of scientists coordinated an effort led by core projects of WCRP and IGBP to develop a new approach to greenhouse-gas emissions scenarios now known as Representational Concentration Pathways (RCP). The work resulted in the publication in *Nature* of a new set of emissions pathways, which consider multiple economic and developmental trajectories and resulting insignificant improvements to previous IPCC scenarios. The climate modelling projections based on these RCPs are in final stage of production and will be soon available for analysis and publication through the CMIP5 portals world-wide in support of the Fifth Assessment Report.

WCRP and START are promoting education, training and development of experts through the regional analysis of climate projections and predictions from seasonal, decadal to centennial timescales. START, WCRP and network partner organizations in Africa and Asia are working on promoting research-policy dialogues through a series of regional activities in order to integrate climate-change adaptation in development planning in these regions. The expected outcome of this project is a series of regional assessments that can benefit both the IPCC assessment and other adaptation and development planning activities in the regions under study.

IGBP has initiated its second synthesis, which includes topics such as geoengineering, nitrogen and climate, and the needs of the least developed countries. The synthesis aims to involve a variety of stakeholders, right at the outset, including scientists, policymakers and industry. Many of the topics have been developed in consultation with the IPCC. Topic leaders are being encouraged to involve experts from the other GEC programmes. This has received strong positive responses. For example, IHDP, ESSP and WCRP have been involved in the topic on least developed countries, and IHDP and WCRP have provided feedback on the topic on geoengineering.

The Global Land Project, jointly sponsored by IHDP and IGBP, has recently published a report analysing the recent trend of land acquisition in Africa by foreign entities to grow food or biofuel crops. In light of the considerable but scattered and often informal nature of the quantitative information pertaining to such deals, the report aims to scrutinize and triangulate such

information. In doing so, the report hopes to provide more accurate insight into the magnitude of this emerging pressure on land in Africa.

DIVERSITAS, NASA (USA) and EBONE (EC) are leading the establishment of the biodiversity arm of GEOSS, called GEO BON. Over 100 governments and organizations (i.e. the GEO BON community of practice) will be involved. DIVERSITAS is developing some of the basic science needed to fill key knowledge gaps, particularly on genetic diversity and ecosystem services, where new observation methods need to be designed and implemented.

DIVERSITAS and IHDP have been instrumental at representing the scientific community in the negotiations on IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services). The two programmes have placed much emphasis on the development of this new initiative, which will be key in informing responses to the loss of biodiversity and ecosystem services and depend on the success of GEO BON.

Governance is a critical element in managing global environmental change. IHDP's Earth System Governance project (ESG) presents a social science framing across various themes such as water, food, and carbon—ESSP joint projects – as integrated parts of its research agenda. Hence, cutting-edge research on GEC governance presents a perfect candidate to pursue an integrated research agenda to address, inter alia, Challenge 4 of the ICSU visioning process.

Contributions to fostering science-policy links

The GEC programmes and the ESSP put considerable emphasis on ensuring that the knowledge we generate will benefit society. An effective way of doing this is by interacting closely with policy makers. The success of recent initiatives is exemplified by the now annual updates of GEC science at the UNFCCC-SBSTA plenary meetings, by the frequent contributions of GEC researchers to international science-policy assessments (e.g. IPCC) and by the development of targeted policy briefs together with UNESCO and SCOPE, and by achievements described in the above section and our individual reports. Also the long-term collaboration between DIVERSITAS and the Convention on Biological Diversity (CBD) has been extremely successful. We contributed with a set of biodiversity scenarios to CBD's Global Biodiversity Outlook 3 and participating in designing the 2020 biodiversity targets and indicators, and monitoring systems (Mace *et al*. COSUST, Perrings *et al.* Science). These results received a lot of press during the 2010 International Year of Biodiversity.

Funding

As mentioned earlier, addressing the ICSU and Belmont challenges will require pursuing an ambitious agenda that focuses on working together to develop an effective integrative and transdisciplinary research approach to find and explore acceptable and successful solutions. Fundamental changes in the way the programmes operate and conduct their research and other activities are expected. Naturally, the funding needs are also likely to be substantial and cover both the actual research and the international research infrastructure, coordinated by the GEC programmes, ESSP and others. The required funds will likely go beyond the core/glue money that has been so generously provided by the funding agencies to develop the ICSU and Belmont challenges.

Core/Glue Money Anticipated (2010 & 2011)

	2010	**2011**
DIVERSITAS	0.6	0.6
IGBP	1.2	1.3
IHDP	0.7	0.8
WCRP	1.8	1.8
ESSP	0.2	0.2
START*	0.6	0.7
Total (Euros)	€ 5.1 million	€ 5.4 million

*original budget in USD converted into Euros using UN exchange rate ($1 = € 0.787 wef 1 September 2010)

We thank IGFA for its continued support to the GEC research programmes and their ESSP and START.

DIVERSITAS

1. Introduction

- A full annual report 2009-10 can be found on the homepage of the DIVERSITAS web site, and was made available to IGFA Members: http://www.diversitas-international.org/
- e-newsletters: http://www.diversitas-international.org/?page=pub_diversitas
- The report below provides highlights from 2009-10, and main orientations of the programme in the years to come.

1.1 DIVERSITAS' mission and organization

DIVERSITAS is the global change programme dedicated to biodiversity science. DIVERSITAS is one of the four partners of the Earth System Science Partnership (ESSP). DIVERSITAS has been established by ICSU, IUBS, SCOPE and UNESCO. DIVERSITAS published its science plan and implementation strategy in 2002 and is currently working on its new strategic plan. The Scientific Committee (SC) of DIVERSITAS is currently chaired by Prof. Harold Mooney (Stanford University, USA) since January 2008 (Annex 1). The SC-DIVERSITAS meets annually since its first meeting in 2002 and its Executive Committee twice a year – at least - by teleconference.

DIVERSITAS has an international secretariat hosted since May 2007 by the French National Museum of Natural History (MNHN) in Paris, and formerly hosted by ICSU. Some of the Project and Cross-cutting Networks have international project offices. DIVERSITAS also has National Committees.

The missions of DIVERSITAS are to:

- Promote an integrative biodiversity science, linking biological, ecological and social disciplines in an effort to produce socially relevant new knowledge;
- Provide the scientific basis for the conservation and sustainable use of biodiversity; and
- Draw out the implications for policies for conservation and sustainable use of biodiversity.

DIVERSITAS is composed of four Core Projects, and five Cross-cutting Networks.

DIVERSITAS Core Projects encourage global investigation of four key aspects of biodiversity research:

- **bioGENESIS**: To provide an evolutionary framework for biodiversity science
- **bioDISCOVERY**: To monitor biodiversity changes and understand the causes of these changes
- **ecoSERVICES**: To study the consequences of biodiversity changes for ecosystem functioning and for the delivery of ecosystem services
- **bioSUSTAINABILITY**: To guide policy and decision making that supports the conservation and sustainable use of global biodiversity

DIVERSITAS Cross-cutting Networks focus on specific ecosystems or issues:

- **Global Mountain Biodiversity Assessment (GMBA)**: To explore and explain the great biological richness of the world's mountains
- **agroBIODIVERSITY**: To provide a common framework for biodiversity science within agricultural landscapes
- **freshwaterBIODIVERSITY**: To provide a common framework for freshwater biodiversity assessment
- **ecoHEALTH**: To explore and understand the relationships between biodiversity and infectious diseases emergence
- **Global Invasive Species Programme (GISP)**: To conserve biodiversity and sustain human livelihoods by minimizing the spread and impact of invasive alien species

1.2 Added value of DIVERSITAS

DIVERSITAS adds value to national research programs, by performing the following tasks.

DIVERSITAS:
- Provides common international frameworks for collaborative research
- Performs scientific syntheses
- Builds scientific networks
- Organizes workshops & conferences
- Promotes standardized methods
- Guides and facilitates the development of global databases
- Builds an important link with policy makers

2. Activities in 2009-2010

The scientific landscape in relation to global problems is increasingly organizing itself into four interconnected spheres: scientific research, observations, scientific assessments and policy making. DIVERSITAS is located within the research sphere, and is increasingly called upon to provide a scientific contribution to the three other spheres. The report follows this outline and provides DIVERSITAS highlights and plans for research and for scientific contribution to observations, assessments and policy making.

2.1 Scientific research: Improving knowledge on biodiversity

- Improving predictions of climate change impact on biodiversity

While there is general agreement that human activities have modified and will continue to modify biodiversity, the development of reliable model-based predictions of the consequences of biodiversity change remains problematic due to incomplete knowledge of existing biodiversity and of its response to single drivers and due to the complex interactions driving biodiversity change. The long term objective is to improve our capacity to predict future biodiversity change at the landscape, regional and global scales, and to evaluate the implications of such change, building on the work done by the Millennium Assessment. In 2009, the TRY (Refining plant functional classifications for earth system modelling) and BBS (Advanced prediction of Biome Boundary Shifts in regional and global dynamic vegetation models) initiatives joined forces to improve modelling of biodiversity complexity to contribute to understanding how vegetation and

ecosystems respond to global change. The joint workshop, held in October 2009 in Cape Town, South Africa, focussed on 1) Improving regional and global models of vegetation dynamics and ecosystem function and 2) Expanding and developing applications for the TRY global plant functional trait database. The plant trait database is being used in a first phase for developing and parameterizing regional and global vegetation models, and its use will be expanded later to other areas of ecology and biogeography. A document detailing the TRY Intellectual Property Guidelines was prepared and is available on www.try-db.org

bioGENESIS, in close collaboration, is working on the evolutionary consequences of climate change on biodiversity, and, especially on the relationships between speciation, the evolution of adaptive traits, and patterns of geographical distribution. To address this challenge, bioDISCOVERY and bioGENESIS organized a joined workshop on *"Eco-evolutionary approaches to understanding and predicting the response of species and ecosystems to climate change"* in Paris, France, August 2009. The workshop aimed at 1) creating an international network of scientists working on bridging the gaps between evolutionary, molecular and functional ecology with the specific goal of contributing to the development or improvement of models that account for both evolutionary and functional processes; and 2) providing training for young scientists interested in the new and rapidly expanding field of eco-evolutionary research.

Deliverables
-Earth system models parameterized with global plant trait data base
-Global change effects on plant distributions in improved earth system models benchmarked with paleo data, historical data and experiments
-New international network on rapid evolution to climate change.

- Developing tools to manage for ecosystem services

Despite many efforts at all levels, the 2010 biodiversity targets have not been met. Countries have started in the context of the Convention on Biological Diversity to negotiate new biodiversity targets for 2020 as well as indicators to measure progress against these targets. DIVERSITAS in 2009 and 2010 offered a number of contributions to inform this negotiation: Mace et al. (2010, COSUST) represents part of the DIVERSITAS contributions. bioSUSTAINABILITY and ecoSERVICES are co-leading a DIVERSITAS-UNEP project on "Targets and Indicators – an ecosystem service lens". A policy paper by Perrings et al. will be published soon in Science (Science, in press, October 2010). Additional scientific papers are in preparation and results of this project will be presented at CBD-COP10 in Nagoya (side event on 21st October).

bioSUSTAINABILITY's two co-chairs, S Polasky and T Elmqvist are involved as authors and contributors to the scientific volume of the TEEB (The Economics of Ecosystems and Biodiversity) project and T Elmqvist is leading Chapter 2 "Biodiversity, ecosystems and ecosystem services", to be officially launched at CBD-COP10 in Nagoya, Japan.

Deliverables
-Scientific papers on targets and indicators for ecosystem services
-A DIVERSITAS-UNEP policy paper on indicators for ecosystem services for CBD-COP10.

- Understanding and predicting links between biodiversity changes and human health

Interest in the link between biodiversity and health is developing rapidly. Some data suggest a potential protective nature of biodiversity for human health (Lyme disease), while others suggest

an opposite role of biodiversity as a provider of new zoonotic diseases agents. The debate over how we deal with new zoonotic diseases is likely to grow as a conservation issue and raise the question of conflicts between biodiversity conservation and public health. The main goal of ecoHEALTH of DIVERSITAS is to use case studies to predict emergence of zoonotic disease; to solve conflicts between biodiversity conservation and public health (trade-off and cost-benefit analyses) and to provide information and management strategies to policy makers. During 2009-2010, ecoHEALTH set up some groups working on specific issues related to biodiversity and infectious diseases.

The DIVERSITAS ecoHEALTH Economics of Emerging Diseases project (DEEED): The objective of DEEED is to provide a bio-economic modelling framework to evaluate the risk posed by Emerging Infectious Diseases (EIDs) from wildlife in trade. This includes formulation of the underlying model describing the transport of infected wildlife to new destinations, deriving the distribution of the net present value for evaluating the underlying economics, and providing a risk management strategy for making decisions. This project organised two meetings (July 2009 and June 2010, New-York, USA) to develop the conceptual framework as well as the model. The group is currently collecting data from several studied diseases to test this model. Some preliminary results were presented at the DIVERSITAS OSC2 (October 2009, Cape Town, S-Africa). A paper was published in *Science* (Smith *et al.* 2009) and another one is in preparation.

DIVERSITAS ecoHEALTH Biodiversity and Emerging Diseases (DEBED): This project is based on studies which have shown that the properties of local species-rich communities would protect against invaders and pathogens. The so-called dilution effect' theory may represent a "flag" for research on biodiversity and ecosystem services. Alternatively, papers have shown that at broad spatial scales, increased biodiversity is linked to increasing risk of zoonotic diseases in people (disease from wildlife). There is a need to develop causal inference in emerging disease ecology, in which the dilution effect phenomenon is part of something more complex: What are the main ecological drivers of emerging infectious diseases (before any consideration on the possibility of a dilution effect)? What does the dilution effect phenomenon mirror exactly? This group met for the first time on 17-18 August 2010 in London, UK, and defined a research agenda on this topic and activities to be carried by this group in the coming 3 years.

Deliverable
-Scientific and science-policy papers on a bio-economic modelling framework to evaluate the risk posed by EIDs from wildlife in trade
-Publication of research agenda on biodiversity and infectious diseases

- <u>Providing an evolutionary context to global change research</u>

The most important product for 2009 was the publication of the bioGENESIS Science Plan, along with an overview paper (and "call to arms") for the journal *Evolution* (Andrew *et al.* 2010). In 2009-10, bioGENESIS sponsored workshops and symposia to draw attention to its scientific agenda in circles where it has previously been poorly known. In addition, bioGENESIS is involved in the following longer-time activities:

GEO Biodiversity Observation Network (GEO BON): D Faith and T Yahara co-chair the Working Group "Genetic/Phylogenetic Diversity" and lead the development of this section of the GEO BON implementation plan, launched on International Day of Biodiversity 2010 (22 May 2010; see below). This group is developing short-term deliverables such as using niche based

models using generalized dissimilarity modelling (GDM) based on data available via GBIF as a "Biodiversity Lens approach" to further understand and interpret observational data.

Eco-evolutionary approaches to climate change: see above the section "Improving predictions of climate change impact on biodiversity"

Capacity building: bioGENESIS co-organised, with the Universidad Nacional Autónoma de México, a student training courses "Latin-American workshop on phylogenetics and molecular evolution" (22 June- 3 July 2009, Guernavaca, Mexico).

Deliverables
-Development and test of measures of genetic/phylogenetic diversity to understand the distribution and conservation status of biodiversity
-Understand rapid evolution in response to drivers of biodiversity change and integrate this knowledge into predictive models.

- Building geo-referenced biological databases for understanding biodiversity

GMBA, in cooperation with the Global Biodiversity Information Facility (GBIF), released on 10th May 2010, the Mountain Biodiversity Portal (www.mountainbiodiversity.org). The portal allows exploring GBIFs biodiversity archive data for mountain regions, from region to globe, or by mountain life zones (such as the treeless alpine zone). The data can be used by scientists or managers to assess patterns and trends or parameterise models to make predictions about future changes in mountain biodiversity.

To encourage dataholders to share their mountain biodiversity data, and to improve data quality, GMBA held a hands-on training workshops on "Open Access to, and documentation of, Mountain Biodiversity Data" in Kunming, China, 29-30 July 2009. Another training course in Kathmandu with GBIF and the International Centre for Integrated Mountain Development (ICIMOD) took place 14-18 June 2010. GMBA facilitated the online delivery and use of the Himalayan Upland Plant Database ("HUP", by B. Dickore and collaborators, Herbarium of Munich) available via GBIF (164'360 records of ca. 5562 species). GMBA also started a project with Georgia (Ilia State University, Tbilisi) to provide open access to plant diversity data of the Great Caucasus.

Deliverables
-Geo-referenced archive databases for mountain biodiversity
-Synthesis book: Körner and Spehn "Data mining for global trends in Mountain Biodiversity", CRC press/Taylor and Francis, 2009.
-Contribution of new mountain biodiversity data base to the GEO Biodiversity Observation Network (GEO BON), see below.

2.2 Observations: Leading plans for a global biodiversity observing system, GEO BON

The Group of Earth Observations (GEO; http://earthobservations.org/) has initiated a process to build a GEOSS, designed around nine Societal Benefit Areas (SBAs): disasters, health, energy, water, weather, climate, ecosystems, agriculture and biodiversity.

DIVERSITAS, NASA, and EU-EBONE have accepted the lead in coordinating the early planning stages towards the establishment of this global biodiversity observation system. We call the system and the partners who develop it "GEO-BON", which stands for "Group of Earth

Observations - Biodiversity Observation Network". GEO BON is being built by some 100 governmental and non-governmental organisations.

The vision of GEO BON is for a coordinated, global network that gathers and shares information on biodiversity, provides tools for data integration and analysis, and contributes to improving environmental management and human well-being.

In 2009-10, GEO BON formalised its governance (1st mtg of SC-GEO BON), and progressed in the development of its implementation plan. Eight working groups were appointed to develop the various sections of the GEO BON concept document. They met in Feb 2010 to finalise the implementation plan. GEO BON was presented at a side event at CBD-SBSTTA 14 (13 May 2010, Nairobi). A draft 1.0 of this GEO BON implementation plan was released on 22 May 2010 (International Day of Biodiversity).

Key developments in 2009-10:

Jan 2009	2nd GEO BON interim Steering Committee meeting (Washington)
Jun 2009	1st GEO BON Steering Committee meeting; Chair: B Scholes (Geneva)
Nov 2009	Report by GEO BON at GEO-VI Plenary (Washington)
Feb 2010	3rd International GEO BON workshop (90 ptcpts; Asilomar, California)
May 2010	GEO BON featured at CBD-SBSTTA 14 (side event)
22 May 2010	GEO BON implementation plan released on International Biodiversity Day
Oct 2010	GEO BON featured at CBD-COP10 (side event)
	Parties to the Convention on Biological Diversity (CBD) invited at COP10 to support GEO BON

In addition to organising the events mentioned above, the DIVERSITAS secretariat (A Larigauderie/A-H Prieur-Richard) gave talks or organised GEO BON related events (e.g. EPBRS, Pruhonice, Czech Republic, May 2009; GEO BON symposium at DIVERSITAS OSC2, October 2009; Launch of International Year of Biodiversity, UNESCO Jan 2010; CBD-SBSTTA14, May 2010, Nairobi, Kenya).

Deliverables:
-An agreement among key organizations to build GEO BON
-GEO BON implementation plan version 1.0 (May 2010)

2.3 Scientific assessments: Developing scientific expertise for decision making

- Global Biodiversity Outlook 3 (GBO3)

DIVERSITAS, through its Core Project bioDISCOVERY, in partnership with UNEP-WCMC coordinated a synthesis of scenarios of biodiversity change over the 21st century as mandated by the Secretariat of the Convention on Biological Diversity (CBD), as a major contribution to GBO-3, released in May 2010 at CBD-SBSTTA 14, by the Executive Secretary of the Convention, during a high level segment (GBO-3 was presented by Dr Tom Lovejoy, member of the US National Committee for DIVERSITAS).

The synthesis focused on 21st century biodiversity change as predicted by models, based on experiments and observed trends. A detailed analysis of these scenarios was published as a CBD technical document.

Deliverable

-CBD report 50: Biodiversity scenarios: Projections of 21st century change in biodiversity and associated ecosystem services (GBO-3)
-GBO3 and the CBD report 50 featured at CBD-SBSTTA 14 (side events)
-Scientific articles (in prep)

- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

DIVERSITAS has been leading the scientific community, since 2005, in efforts to establish an "IPCC like mechanism for biodiversity", called IPBES.

During 2009-10 DIVERSITAS continued to be strongly involved, as representative of the scientific community, into the discussions toward the establishment of "IPCC like mechanism for biodiversity", called IPBES, for Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

At the 3rd ad hoc intergovernmental and multistakeholder meeting on an IPBES (7-11 June 2010, Busan, S-Korea), representatives of 85 countries meeting under the auspices of UNEP, recommended the establishment of an Intergovernmental Platform on Biodiversity and Ecosystem Services, IPBES. DIVERSITAS was represented by its chair, H Mooney, and Executive Director, A Larigauderie.

Deliverables:
-Involvement of the international scientific community in the discussions on an IPCC-like mechanism for biodiversity
-Editorial by Mooney and Mace: Biodiversity policy challenges, 2009, Science, 325:1474
-Science-Policy panel on IPBES at DIVERSITAS OSC2, and Cape Town declaration supporting IPBES (Oct 2009; 700 participants)
-CBD-PreCOP10 in Japan (Nagoya, Feb 2010); successful plenary science-policy dialog on IPBES with Japanese Vice-Minister of Environment; 300 participants (DIVERSITAS/Govt of Japan/Secretariat CBD)
-US consultation on IPBES organised by the US National Academy of Sciences, its US National Committee for DIVERSITAS, and the UNEP regional office in North America (27 April 2010, Washington DC)
- Larigauderie and Mooney: IPBES: moving a step closer to an IPCC-like mechanism for biodiversity. 2010, COSUST, 2 (1):1-2
-Side event on IPBES at CBD-SBSTTA14, Nairobi, 14 May 2010 (DIVERSITAS-IUCN-ICSU-IHDP).

2.4 Policy making: Providing scientific expertise to Conventions

- Convention on Biological Diversity (CBD)

Contributing to discussions on biodiversity targets beyond 2010
During the year 2010, Parties to the CBD will evaluate progress against the 2010 biodiversity targets adopted by the Parties to the CBD, and by governments at the World Summit on Sustainable Development in 2002.

The Scientific Committee of DIVERSITAS under the leadership of Georgina Mace (Imperial College, London, UK) produced a position paper entitled "Biodiversity targets after 2010" (Mace *et al.* 2010), analyzing the 2010 targets process, and proposing criteria for a set of achievable second generation (post 2010) targets, to contribute to the post 2010 selection of indicators for biodiversity changes. This paper, together with Mooney and Mace, 2009 (*Science* 325:1474) and Larigauderie, Mace and Mooney, 2010 (*Nature*, 464:160) were formally made available to delegates at SBSTTA 14 and used for statements at SBSTTA 14 (paper UNEP/CBD/SBSTTA/14/10).

Contribution to the Global Biodiversity Outlook-3 of the CBD
DIVERSITAS, in partnership with UNEP-WCMC, was contracted by the Convention on Biological Diversity (CBD) to prepare a synthesis of scenarios of biodiversity change over the 21st century for GBO-3, released by the CBD at its SBSTTA 14 in Nairobi, Kenya (10 May 2010). See section 2.3 "Global Biodiversity Outlook 3" of this report.

Contributing to CBD-SBSTTA 14 (Nairobi, Kenya, 10-21 May 2010)
DIVERSITAS made contributions to discussions at SBSTTA 14 on the programme of work on mountain biodiversity, climate change, GBO-3, the Global Taxonomy Initiative, and the 2020 targets.

DIVERSITAS co-organised four side events:
-GBO-3: Progress towards the 2010 target, future prospects and implications for the post-2010 strategic plan of the CBD (S-CBD, DIVERSITAS, UNEP-WCMC; 11 May).
-GBO-3: Biodiversity futures for the 21st century (S-CBD, DIVERSITAS, UNEP-WCMC; 12 May).
-GEO BON: Building a Global Biodiversity Observing System (GEO, Japan, DIVERSITAS, NASA and EBONE; 13 May).
-Toward an IPBES (DIVERSITAS, IUCN, IHDP, ICSU; 14 May).

Preparing for CBD-COP10: CBD-COP10 preConference (Nagoya, Japan, 21-23 March 2010)
DIVERSITAS co-organised with the Japan Ministry of the Environment, Nagoya University and the Secretariat of the CBD (S-CBD) a CBD-COP10 preConference to contribute to discussions on IPBES, the 2020 targets, and further development of AP-BON (Asia Pacific BON) as part of GEO BON. The meeting which involved an audience of 300 scientists and policy makers from the Asia Pacific region featured a science-policy plenary dialog on IPBES between Mr Tajima, Senior-Vice Minister of the Environment of Japan, and DIVERSITAS scientists. The report of the event was used to prepare statements for SBSTTA 14, and also fed into statements and was presented at COP10 (Nagoya, October 2010).

- Climate Change Convention (UNFCCC)

DIVERSITAS has been invited over the past two years by the SBSTA of the climate change convention (UNFCCC) to participate in annual « Research Dialogues » between Parties to UNFCCC on one hand, and programmes of the ESSP and IPCC on the other hand. ESSP programmes (DIVERSITAS, IGBP, IHDP and WCRP) have been invited to report and dialog with SBSTA delegates on emerging scientific findings, research plans, gaps and priorities.

Deliverables:

-Mooney and Mace, 2009, *Science* 325:1474
-Larigauderie, Mace and Mooney, 2010, *Nature*, 464:160
-Mace *et al*., 2010, *Current Opinion in Environmental Sustainability*, 2:1-6
-CBD report 50: Biodiversity scenarios: Projections of 21st century change in biodiversity and associated ecosystem services (GBO-3)

2.5 DIVERSITAS Second Open Science Conference 2

Following up on the success of the First DIVERSITAS Open Science Conference (9-12 Nov 2005, Oaxaca, Mexico), DIVERSITAS organized its Second Open Science Conference: "Biodiversity and society: understanding connections, adapting to change" held 13-16 October 2009 in Cape Town, South Africa.
This conference attracted an international audience of 700 scientists and policy makers from about 70 countries representing many facets of biodiversity science and policy. About 40 % of these participants came from developing countries, and 30% were young scientists. **This was made possible thanks to the generous support of the conference sponsors and the DIVERSITAS core sponsors, which allowed DIVERSITAS to support 380 participants** (via small grants). The conference received an important exposure in the media.
The main objectives of the DIVERSITAS OSC2 were to

- provide an overview of the latest biodiversity science,
- inform scientists, biodiversity managers and policy makers and promote human well-being and sustainable development
- strengthen biodiversity science by featuring a diversity of topics across countries and disciplines
- support the biodiversity science-policy interface
- strengthen and expand DIVERSITAS networks and forge new ones.

The conference featured a mix of plenary lectures, symposium, oral and poster sessions, presented by invited speakers, as well as scientists selected from a call for abstracts on the three following themes: strengthening biodiversity science, supporting the science – policy interface, and focus on African issues.
New scientific knowledge was presented and a larger DIVERSITAS set of networks emerged as a result of the conference. A stronger base in the Africa region is developing thanks to initial contacts which were made in Cape Town.
Detailed information on the conference and its outputs is available at: http://www.diversitas-international.org/?page=diversitas_osc2

2.6 Key publications 2009-10

- Articles (resulting from DIVERSITAS related activities

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3. Future Activities – 2010 and beyond

3.1 Scientific research: Strengthening biodiversity science

- Improving predictions of climate change impact on biodiversity

Based on the activities of the past years (see above), in 2010-11, the TRY (Refining plant functional classifications for earth system modelling) and BBS (Advanced prediction of Biome Boundary Shifts in regional and global dynamic vegetation models) will continue their joint initiative to improve modelling of biodiversity complexity to contribute to understanding how vegetation and ecosystems respond to global change. A joint workshop will be held in March 2011 in Paris, France, and will focus on the continued development of the global plant trait database and its use in global and regional vegetation models.

In addition a workshop on "Novel modeling approaches to predicting biodiversity response to global change" will be held 6-10 June 2011 (Arrabida Monastery, Portugal) and will focus on developing novel types of models that can be used to project the impacts of global change on biodiversity.

bioGENESIS and bioDISCOVERY will continue working on the evolutionary consequences of climate change on biodiversity, and, especially on the relationships between speciation, the evolution of adaptive traits, and patterns of geographical distribution. A second workshop on "Evolutionary responses to global change" (28-30 August 2010, Kyushu, Japan) focused on the spatial and temporal changes in genetic variability and their relationship to genetic and plastic adaptation to local environment and to changing future environments. A scientific paper focusing on the conceptual framework of this project is in preparation. A third workshop should be organized in 2011.

Deliverables
-Earth system models parameterized with global plant trait data base
-Global change effects on plant distributions in improved earth system models benchmarked with paleo data, historical data and experiments
-New international network on rapid evolution to climate change.

- Developing tools to manage for ecosystem services

bioSUSTAINABILITY, in partnership with the Stockholm Resilience Centre, UNEP, UNESCO, and the Tropical Biology Association, developed during 2009-10 a large proposal entitled "Adaptive governance and management of ecosystem services under scenarios of change", focused on Africa. The overall goal of the proposal is to address the complexity of planning for climate change, degraded ecosystem services and meeting the Millennium Development Goals. bioSUSTAINABILITY will run the project during 2010-13, if successful.

Deliverables
-An international collaborative research project
-An international research agenda on governance for ecosystem services

- Understanding and predicting links between biodiversity changes and human health

During 2010-11, ecoHEALTH will end the first phase of the *DIVERSITAS ecoHEALTH Economics of Emerging Diseases project (DEEED)*: The objective of DEEED is to provide a bio-economic modelling framework to evaluate the risk posed by Emerging Infectious Diseases (EIDs) from wildlife in trade. A meeting is planned in October 2010 (Brown University, USA) to finalise the project and several papers are in preparation. A second phase, focusing on the policy implications of the results of this project is under discussion. Partners such as GISP, Conservation International, and the Convention on Biological Diversity have expressed their interest.

At their first meeting (17-18 Aug 2010, London, UK), *the DIVERSITAS ecoHEALTH Biodiversity and Emerging Diseases (DEBED)* group identified key issues related to the relationship between biodiversity and emergence or outbreaks of infectious diseases. The group is planning to address some of these issues in 2010-2013. A grant proposal to a French NCEAS like mechanism (CESAB) is in preparation.

Deliverable
-Scientific and science-policy papers on a bio-economic modelling framework to evaluate the risk posed by EIDs from wildlife in trade
-Publication of research agenda on biodiversity and emergence and outbreaks of infectious diseases
-Scientific and science-policy papers on the relationship between biodiversity and emergence and outbreaks of infectious diseases

- Providing an evolutionary context to global change research

In 2011, bioGENESIS will continue its work on improving knowledge of the capacity for evolutionary responses to environmental change, which is crucial to making long-range predictions (see above section "Improving predictions of climate change impact on biodiversity").

In addition, bioGENESIS is strongly involved in developing the science for the implementation of the GEO Biodiversity Observation Network (GEO BON), and more especially the Working Group "Genetic/Phylogenetic Diversity" (see below).

Finally, bioGENESIS puts a lot of efforts on capacity building activities related to evolution through:

- Organisation of symposia at conferences in which the field of evolution is under represented (e.g. Association of Tropical Biology and Conservation)
- Organisation of training courses in Latin America and Asia.

Deliverables
-Development and test of measures of genetic/phylogenetic diversity to understand the distribution and conservation status of biodiversity
-Understand rapid evolution in response to drivers of biodiversity change and integrate this knowledge into predictive models
-Publication of a text book on evolution and conservation
-Training curricula in phylogeny

- Building geo-referenced biological databases for understanding biodiversity

In 2010-13, GMBA plans to improve the mountain portal (developed in collaboration with GBIF and released in May 2010), add functionalities and additional layers. In addition, GMBA put a lot of effort in encouraging dataholders to share their mountain biodiversity data, and to improve data quality through capacity building and training activities. This activity will be continued to further encourage mountain biodiversity data holders to make their data available to GBIF. GMBA also plans to do a global assessment/analysis of the GBIF data ("policy relevant profiles") in mountains, for the Convention on Biological Diversity and IPBES – if launched.

Deliverables
-Improved the geo-referenced archive databases for mountain biodiversity
-Open access databases of mountain biodiversity data
-Contribution of new mountain biodiversity data base to the GEO Biodiversity Observation Network (GEO BON), see below
-Assessment/analysis of the GBIF data in mountains

3.2 Observations: Towards a Global Biodiversity Observing System (GEO BON)

As GEO BON develops (implementation plan released in May 2010, see above), DIVERSITAS is moving from an overall coordinator role, to a different type of contribution, which aims at developing a few key scientific contributions toward the implementation of GEO BON and focusing on a few working groups' topics. This includes work with the genetic diversity group (bioGENESIS activity) and the ecosystem services group. Stronger DIVERSITAS involvement in these groups were proposed because they are still anchored in research (as opposed to more operational groups who already have well established methods), and would benefit from the help of DIVERSITAS. In addition, DIVERSITAS will continue working with the other working groups (e.g. terrestrial ecosystems, freshwater ecosystems) as needed.

Deliverables:
-A set of early GEO BON products

3.3 Scientific assessments: Developing scientific expertise for decision making

- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

The First plenary meeting of IPBES, if established, will take place in the second part of 2011, under the auspices of UNEP, hosting the IPBES interim secretariat. DIVERSITAS will continue leading the scientific input into this process, ahead of the first plenary, by starting to develop a number of proposals for the future assessment programme of work of IPBES.

- Global Biodiversity Outlook 4 (GBO-4)

CBD-COP10 will decide in Nagoya (Oct 2010) to perform a 4th report on the status and future trends of biodiversity, for the Global Biodiversity Outlook 4. DIVERSITAS, which contributed to a major part of GBO-3 (see above), plans to receive a mandate from the CBD to contribute to this report.

3.4 Policy making

- Convention on Biological Diversity

DIVERSITAS will continue to work with the CBD on the implementation of its Programme of Work on specific topics (e.g. mountain biodiversity; trade-invasion-health), as it has in the past.

In addition, DIVERSITAS plans to contribute to the work of the AHTEG of the CBD (Ad Hoc Technical Expert Group) on indicators, to refine the development of specific indicators to assess progress against the 2020 Targets, agreed upon by governments in Nagoya (CBD-COP10).

Deliverables:
-Science-policy briefs on key topics such as mountain biodiversity, inland water, invasion-trade-health
-A set of measurable indicators against the 2020 targets.

- Rio+20

20 years after the UN Conference on Environment and Development (UNCED 1992, or "Rio Summit"), the UN General Assembly decided to organize a Conference on Sustainable Development, or Rio+20 Summit, in Rio (UNCSD 2012). ICSU has been officially invited to play a role as organizing partner of the Scientific and Technology Community major group. DIVERSITAS has been invited to make a number of contributions to the ICSU led series of events (e.g. S&T Forum in Rio, position papers, etc.).

4. Financial Report

4.1 2010 Budget

Budgets are expressed in Euros per year.
-The projected income for the core funding of DIVERSITAS in 2010 is expected to be stable or even a bit higher, compared to 2009 (excluding the Second DIVERSITAS Open Science Conference income; Figure 1), and equal to around 1,000,000 € (see Annex 2). However some national contributions for 2010 are still pending: USA (FY11), Germany-DFG, Belgium, Mexico, Slovak Republic, Sweden, Argentina, and one country, Spain has decreased its contribution. The income for 2010 is stable thanks to funds from raised from sources (UNEP, NASA) other than national contributions.

-In 2010, national contributions coming from about 15 sources will represent about 46% of the total DIVERSITAS income (Figure 1), to be compared with 60% in 2009.

-Expenses for 2010 (see Figure 3), balanced with income, are shown in Annex 2, with major breakdowns. Funds are spent on meetings of scientific committees of core projects and cross-cutting networks, scientific meetings (e.g. side events at conventions; participation in GEOSS), workshops, salaries (administrative and scientific), and travel costs for secretariat members and representatives of DIVERSITAS.

Figure 1: DIVERSITAS income 2001-2010

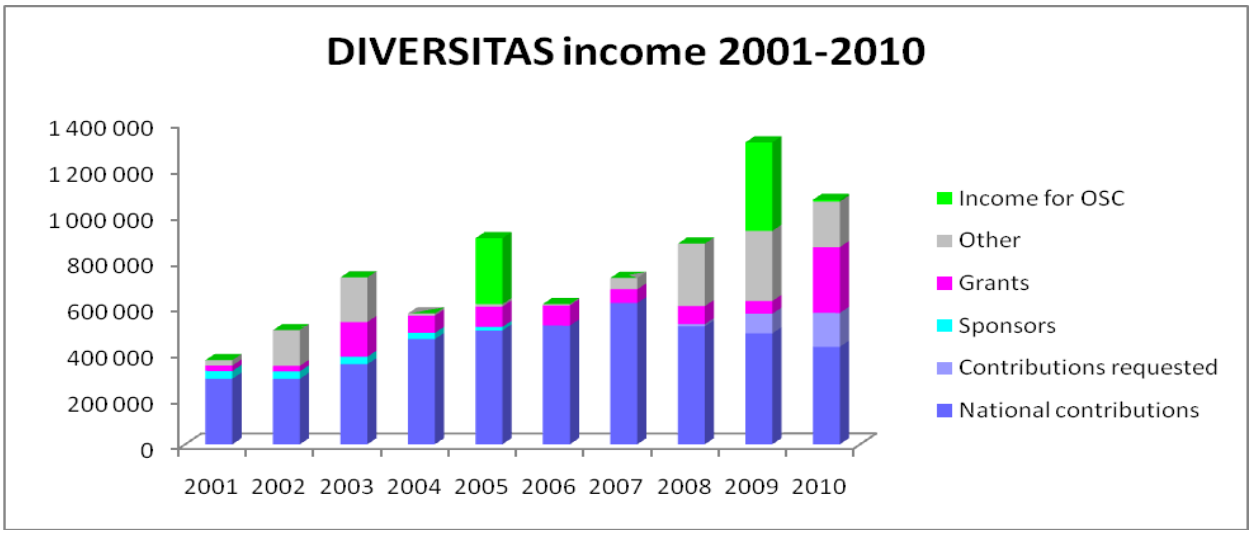


Figure 2: National contribution per country in 2010

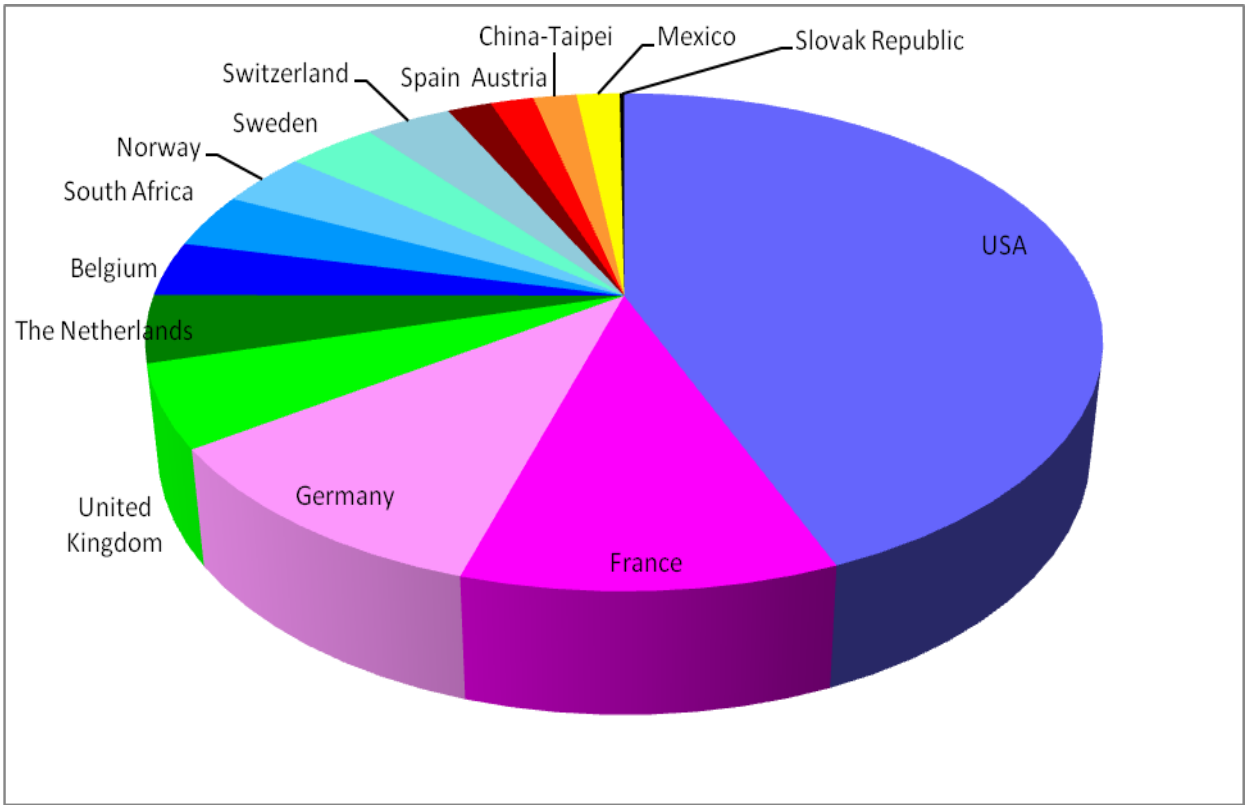
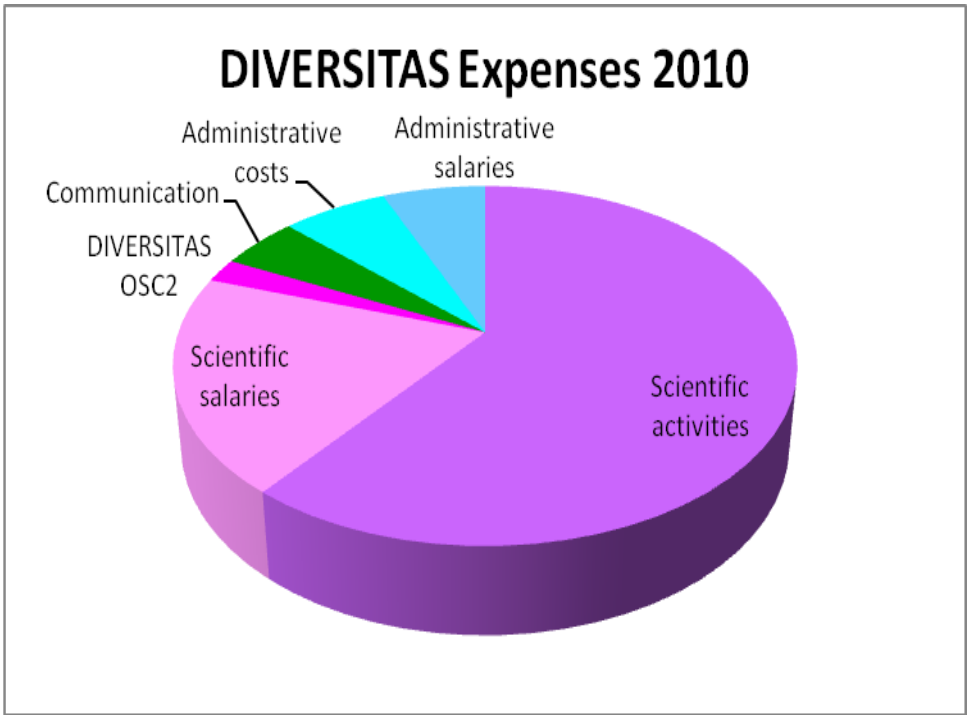


Figure 3: DIVERSITAS expenses 2010



4.2 2011 provisional Budgets – Future Incomes & Expenditures

The provisional budget for 2011 is presented in Annex 3. This is a conservative budget, matched with expected income, allowing DIVERSITAS to progress on the priorities indicated above. The provisional budget for 2012 will be similar to the provisional budget for 2011 (conservative budget) with some funds allocated to implement the new DIVERSITAS strategic plan to be published in 2011 and to hiring a new scientific staff member for the secretariat to respond to the increase demand placed by the community on DIVERSITAS (funds allocated to "other activities").

5. Current and future funding issues

Several problems have been identified for the funding of DIVERSITAS. The SC-DIVERSITAS has addressed these issues not only in the context of IGFA annual meetings but also during the meeting of the DIVERSITAS Full Members (paying countries), which was held on 12 October 2009 back to back with the DIVERSITAS OSC2.

A major issue is the increasing demand placed by the community on DIVERSITAS, without an increase in funding. Important initiatives, both at regional and international level, requesting input from DIVERSITAS have emerged over the past few years. Examples include GEO BON, which is extremely complex and time consuming; IPBES; new scientific challenges such as developing scientifically sound biodiversity indicators related to the new biodiversity targets for 2020; or the Belmont Challenge.

DIVERSITAS is finding it very hard to convince additional countries to become member. There are awkward situations where countries have a well established and active DIVERSITAS national committee and are thus aware of the added value of DIVERSITAS, but do not pay a membership contribution (e.g. China, Japan). Mobilising even small amounts of money for international programmes is increasingly difficult. This is a major issue for IGFA.

Countries are not receptive to very small but regular increases in contributions (1 or 2 percent per year), which have not been applied since 2005.

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International Geosphere-Biosphere Programme (IGBP)

6. Introduction

The International Geosphere-Biosphere Programme (IGBP) is at a landmark stage in its development.

ICSU is currently developing a new vision for global-change research. We are closely involved in this process. The vision states: Over the next decade the global scientific community must take on the challenge of delivering knowledge required to support efforts to achieve sustainable development in the context of global environmental change.

This new vision will enable the global-change programmes to move towards a focus on global sustainability research.

Furthermore, the Belmont group has put forward a challenge to the international research community to develop and deliver knowledge in support of national and international government action to mitigate and adapt to global and regional environmental change with an emphasis on regional hazards.

IGBP has updated its own vision to take account of these new drivers.

IGBP's updated vision is to provide essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change.

The IGBP vision document can be viewed here: http://www.igbp.net/page.php?pid=368

A major international science conference in 2012, Planet under Pressure: New Knowledge towards Solutions, driven by IGBP, and our global-change partners, will provide a platform to launch ICSU's new vision for global sustainability research. The conference will have close links to the 2012 Earth Summit. Key outputs from the conference will include:

- The launch of a new vision for global sustainability research
- Closer links between the natural and social science communities
- A report on new and emerging global-change and sustainability issues
- Outputs from IGBP's second synthesis on issues such as geoengineering and climate adaptation
- Evidence-based estimates of local and national biogeochemical boundaries to ensure global sustainability, ie a coordinated approach to sustainability that crosses scales, from global to regional, national and local.
- High-profile input into the Earth Summit Rio +20
- Development of long-lasting engagement with a wider network of stakeholders at international, regional, national and local levels.

A major scientific input to the conference from IGBP will be the themes of our second synthesis. These policy-relevant themes are mentioned on page 25.

This report provides a brief update on activities and budget information for IGBP during 2009 and 2010, as well as projected budgets for 2011/2012.

7. Activities in 2010 – Highlights

The following highlights demonstrate the world-class nature of IGBP's research portfolio and the relevance of its outputs to national, regional and international policy. This research is cognisant of the priorities laid out in the Belmont Challenge as well as with ICSU's grand challenges for sustainability, which have many similar themes. The ICSU document focuses on sustainability and highlights, for example, the need for meaningful forecasts and effective observation systems. The Belmont Challenge document states that addressing the challenge will require regional and decadal prediction, advanced observing systems, and inclusion of social sciences; and synergy of multiple stressors, including extreme events, for: coastal zones; water cycle and water resources; ecosystem services - food security; carbon cycling; and most vulnerable societies. Several of IGBP's current research priorities align with these areas.

7.1 Programme Highlights

IGBP vision

In view of the ICSU visioning process, IGBP has been updating its own vision to reflect changing priorities and the latest information on the planet's major biogeochemical cycles. Entitled *A vision for integrative global-change research for a sustainable future*, the vision document details how IGBP intends to go about providing essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change. In particular, IGBP will seek deeper understanding of the links and feedbacks between Earth-system processes, and it will take into consideration socio-economic forcings. It will actively promote a new era of inter- and trans-disciplinary research and will work closely with relevant partners to support solutions to societal transformations (www.igbp.net/page.php?pid=368).

IGBP science presented to SBSTA

At the request of the UNFCC Subsidiary Body for Scientific and Technological Advice (SBSTA), recent IGBP research results on climate change were presented at the SBSTA meeting in Bonn on 3 June 2010. This is the third year that IGBP and the other GEC programs have been invited to give presentations and engage in discussions with representatives from the parties to the UNFCCC. This year IGBP also was requested to provide a special update on ocean acidification research, which was presented by Executive Director Sybil Seitzinger. This demonstrates the continued recognition of the importance of IGBP climate-change science and led to the decision by SBSTA last year to invite the global environmental change programs and organizations to "regularly inform SBSTA of developments in research activities relevant to the needs of the Convention, such as on emerging scientific findings, research priorities and research planning, including in response to key uncertainties identified by the IPCC." Following this year's meeting, SBSTA Is requesting even more extensive interaction "Parties not only would

like to see this activity being continued in its present form, but would like to see more: i.e., a workshop to be held in conjunction with SBSTA 34".

IGBP second synthesis
In 2009, IGBP undertook a series of consultations with its main decision-making bodies and partners, and the co-chairs of the IPCC working groups, leading to the identification of several topics in Earth-system science that most require synthesis. The topics cover research under IGBP's core projects, joint projects and beyond. One of the topics, pertaining to the needs of the least developed countries, held its planning workshop in Maputo, Mozambique, from 20-22 September 2010. The workshop discussed various themes such as the role of traditional knowledge systems in global-environmental-change research. Other synthesis groups will hold their workshops in the coming months. See page 26 for a full list of topics.

Observations task force announced
Currently, most observing systems are tied to relatively narrow science or management questions and there are many gaps in *in situ* observations, particularly in areas sensitive to global change, for example the Arctic, Africa, and high elevations. There is a strong drive for a coordinated approach to measurements and networks of measurement sites, rather than networks of research teams. IGBP is putting together a task force on observations, led by David Schimel, chief executive of the US's National Ecological Observatory Network, Washington DC. This task force will develop IGBP recommendations on measurements that are needed (what and where) and the level of funding required to create this network. IGBP also wants to discuss with space agencies how they can become more involved in observations, particularly *in situ* measurements. All IGBP projects, marine, terrestrial, atmospheric, as well as social scientists, and GEO, NASA and ESA will be involved in this process. The initial report is due December 2010.

Call for a global measurement network
Understanding the spatial distribution of atmospheric pollutants and quantifying their climate and air quality effects requires comprehensive ground-based and satellite observations and also models covering ecosystems at regional and global scales. In a paper published last year, scientists from IGBP's iLEAPS project proposed a global network of comprehensive measurement stations and a hierarchy of stations to cover spatial and temporal variations. The network should include stations of i) basic level ii) flux level, and iii) "flag-ship" level. The aim of the basic stations is to provide information for spatial characterization; the number of such stations (~8000) is large to obtain global coverage. The flux stations provide information on fluxes in the ecosystem, and the approximately 400 global stations suggested represent different ecosystems and climates. This number is restricted by the infrastructure and instrumentation required. The"flag-ship" level stations (~20 globally) – limited by the required scientific and technical level – provide information on processes generating the fluxes, develop instrumentation and serve to train scientists and technical staff.

Hari P, Andreae M O, Kabat P and Kulmala M (2009) A comprehensive network for measuring stations to monitor climate change. *Boreal Environment Research* 14: 442-446.

Ecosystem approach to fisheries management
Marine scientists working on IGBP's GLOBEC project have produced a complete ecosystem budget for George's Bank off the northeast coast of the United States. The research suggests

ways to rebuild collapsed cod and haddock stocks in the area, which lies between Cape Cod in Massachusetts and Nova Scotia in Canada. The findings are significant because several key international agreements adopted over the last two decades stress the need for the adoption of ecosystem approaches to fisheries. The scientists say a return to the balance of fish species present on George's Bank in the early 20th century would depend on an increase in the fraction of primary production going to seabed organisms rather than to plankton. GLOBEC is co-sponsored by SCOR and IOC.

Collie J S, Gifford D J and Steele J H (2009) End-to-end foodweb control of fish production on Georges Bank. *ICES Journal of Marine Science* 66: 2223–2232.

Ocean acidification coordination

In August 2009 a SOLAS-IMBER working group on ocean acidification was launched to coordinate ocean acidification research internationally and undertake international synthesis activities in the area. The group held its first meeting in Paris, France on 1-3 December 2009 and identified and prioritised topics for immediate attention, with an indication of proposed deliverables and a plan to achieve them. An example of their activities is a web-based, interactive database of ocean acidification research, to provide a map-based overview of ongoing and past research projects on ocean acidification, in association with Google Earth. The group will also be providing regular updates to the "Guide for best practices on ocean acidification research and data reporting" first published in 2010. http://www.imber.info/C_WG_SubGroup3.html

Large variability in ocean carbon sink

Recent measurements in the North Atlantic Ocean, reported in *Science*, suggest that the capacity of this carbon dioxide sink varies considerably on a decadal timescale. Researchers associated with the CARBOOCEAN project used ship-based measurements to quantify the exchange of carbon dioxide between the atmosphere and the surface of the North Atlantic Ocean. They found that over a substantial region, the yearly flux between 2002 and 2007 – the longest period for which measurements were available – differed by more than a factor of two. This could be due to natural climate variability, but the exact explanation awaits additional work. The CARBOOCEAN project is endorsed by IGBP's SOLAS project.

Watson A J *et al*. (2009) Tracking the Variable North Atlantic Sink for Atmospheric CO2. *Science* 326: 1391-1393.

Governance responses to coastal ecosystem change

The first regional application of methods for assessing the responses of governance systems to coastal ecosystem change has been completed for Latin America with detailed analysis of thirteen sites in eleven countries. The governance baselines assessment has been successfully applied in a diversity of settings, including case studies of marine spatial planning, coastal management programs and multidisciplinary PhD programs sponsored by the NSF IGERT Program at four US universities. The study was conducted by a LOICZ working group that addresses the linkages between governance and science in coastal regions. It contributes to the primary goal of LOICZ, as stated in its Science Plan and Implementation Strategy: "to provide the knowledge, understanding and prediction needed to allow coastal communities to assess, anticipate and respond to the interaction of global change and the local pressures in determining coastal change"

Olsen S B, Page G G and Ochoa E (2009) The Analysis of Governance Responses to Ecosystem Change: A Handbook for Assembling a Baseline. *LOICZ Reports & Studies No. 34*. GKSS Research Center, Geesthacht, 87 pages.

Knowledge-based management of Europe's seas (KnowSeas)
April 2009 witnessed the launch of the LOICZ-affiliated EU-Framework Programme (FP7) project. With the participation of 31 institutions from 15 countries, KnowSeas underpins the EU Marine Strategy Framework Directive and it has one of the highest profiles of any marine policy related project in Europe. The project builds on major findings of the European Lifestyles and Marine Ecosystems ELME project and uses LOICZ's approach on social ecological assessment and modelling. Findings can be found in McQuatters-Gallop *et al*. (2009).

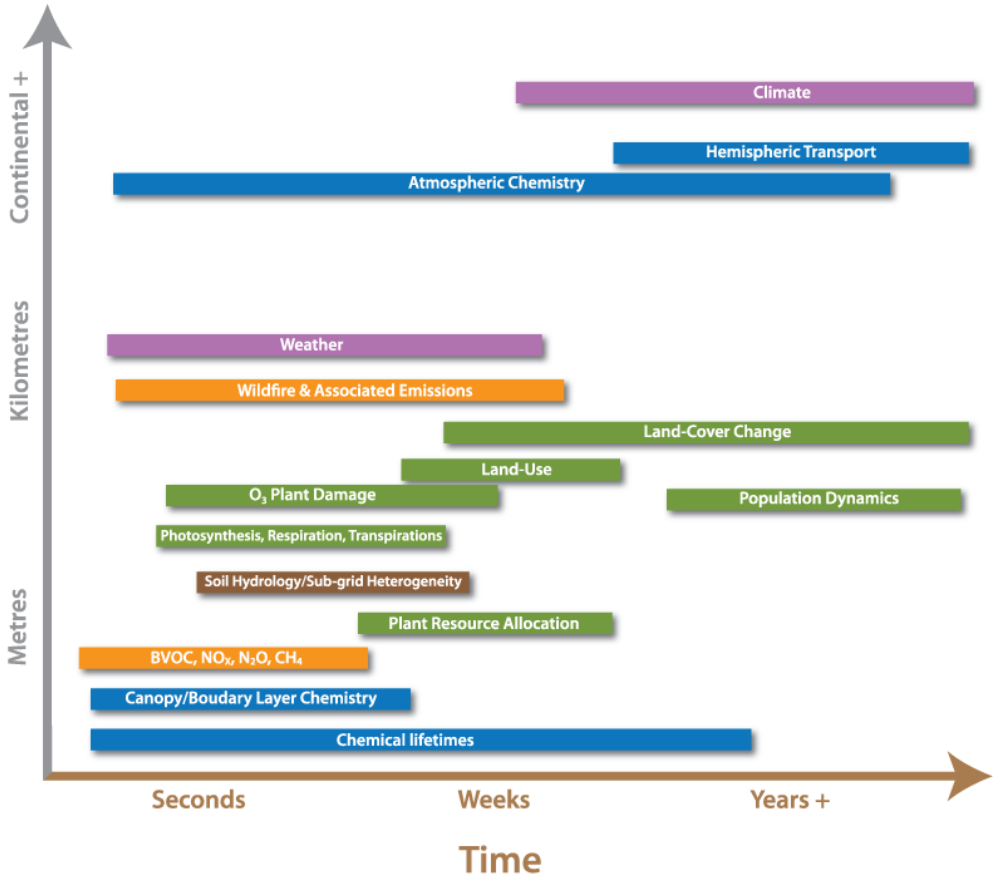
McQuatters-Gollop A *et al*. (2009) How well do ecosystem indicators communicate the effects of anthropogenic eutrophication? *Estuarine, Coastal and Shelf Science* 82 (4): 583-596.

Black carbon sources identified in Asian cities
Diesel vehicles and ships are the main sources of summer-time black carbon – or soot – in Beijing and Shanghai, according to researchers in IGBP's IGAC project. The results provide important constraints on the emissions inventories for these two areas. Policymakers and scientists have suggested that international policies to reduce atmospheric levels of black carbon may be a quick fix to the climate problem. But uncertainties remain as to how black carbon is influencing climate, not least because in some countries black-carbon-emissions inventories are unreliable. This is particularly true in many Asian countries where black-carbon emissions are increasing. In the summer of 2005, lead author Xuehua Zhou measured black carbon and other constituents around Beijing and Shanghai to provide emissions estimates for these urban areas.

Zhou X, Gao J, Wang T, Wu W and Wang W (2009) Measurement of black carbon aerosols near two Chinese megacities and implication for improving emission inventories. *Atmospheric Environment* 43: 3918-3924.

Trace-Gas exchanges between the terrestrial biosphere and atmosphere
Climate models with interactive terrestrial carbon cycles have shown potentially large climate-carbon cycle feedbacks this century. But other trace gases exchanged between terrestrial ecosystems and the atmosphere - methane (CH4), carbon monoxide (CO) and nitrous oxides (NOX), for example – also affect atmospheric chemistry and climate. A study conducted by scientists from IGBP's iLEAPS project reviewed the state of knowledge of important non-CO_2 trace gas exchanges between plants and the atmosphere and how well models (dynamic global vegetation models, DGVM) represent them. It identified key uncertainties for global-scale model applications and suggested a way forward for model integration and evaluation. The review finds that new modelling approaches will yield emission estimates that respond to, for example, changing climate, changing atmospheric CO_2 concentration, nitrogen deposition and changes in land cover/land use in an internally consistent way that takes into account underlying biological process understanding. Eventually, these model approaches can be used for improved biogenic emission estimates in chemistry climate simulations.

Arneth A *et al*. (2010) From biota to chemistry and climate: towards a comprehensive description of trace gas exchange between the biosphere and atmosphere. *Biogeosciences* 7: 121-149.



Land-atmosphere processes occur on many different time and space scales. Green lines: processes associated with plant physiology/land cover; orange lines: trace-gas emissions; brown: surface hydrology/energy balance; blue: chemical transformations and related processes; purple: weather and climate. Modified after Arneth *et al*. (2010).

Bounding the role of black carbon

IGAC in collaboration with the WCRP's project Stratospheric Processes and their Role in Climate (SPARC) is leading an assessment report on the role of black carbon in climate due to be published in 2010. The report will: 1) summarize the state of the science of BC as a climate forcing agent and, specifically, the implications for mitigation decisions. The information will contribute to decisions that allow co-benefits for both climate and air quality/human health. 2) explain widely varying forcing estimates, esp. in the context of IPCC values, thus providing updates to AR4, and input to AR5. 3) present bounded uncertainties for everything especially co-emitted species and cloud changes. 4) hand over usable numbers for mitigation decisions, which will be assured by engaging policymakers from the start.

The lead author list includes: Tami Bond (US), Terje Berntsen (Norwary), Olivier Boucher (France), Ben DeAngelo (US), Sarah Doherty (US), David Fahey (US), Mark Flanner (US), Piers

Forster (UK), Steve Ghan (US), Bernd Kärcher (Germany), Stefan Kinne (Germany), Dorothy Koch (US), Yutaka Kondo (Japan), Ulrike Lohmann (Germany), Patricia Quinn (US), Michael Schulz (France, but now Norway), Marcus Sarofim (US), Chandra Venkataraman (India), Hua Zhang (China), Shiqiu Zhang (China).

Terrestrial ecosystem feedbacks and climate

The terrestrial biosphere – life on land – is a key regulator of climate and atmospheric chemistry. Scientists from the iLEAPS project now report that the effects of terrestrial biogeochemical feedbacks on climate are too important to ignore and could be as important in modulating future climate change as changes to the carbon cycle. Feedbacks include CO_2 fertilization, CO_2 emissions from the biosphere, nitrogen including its limiting effect on CO_2 fertilization, permafrost and carbon in peatlands, methane, ozone and fire. According to this new analysis, the warming associated with these feedbacks could cancel out the cooling effect associated with carbon dioxide fertilization of the biosphere, which has been proposed as a way to mitigate warming. The scientists estimate that by 2100, total positive radiative forcings from feedbacks between the terrestrial biosphere and the atmosphere will reach between 0.9 and 1.5 $Wm^{-2}K^{-1}$.

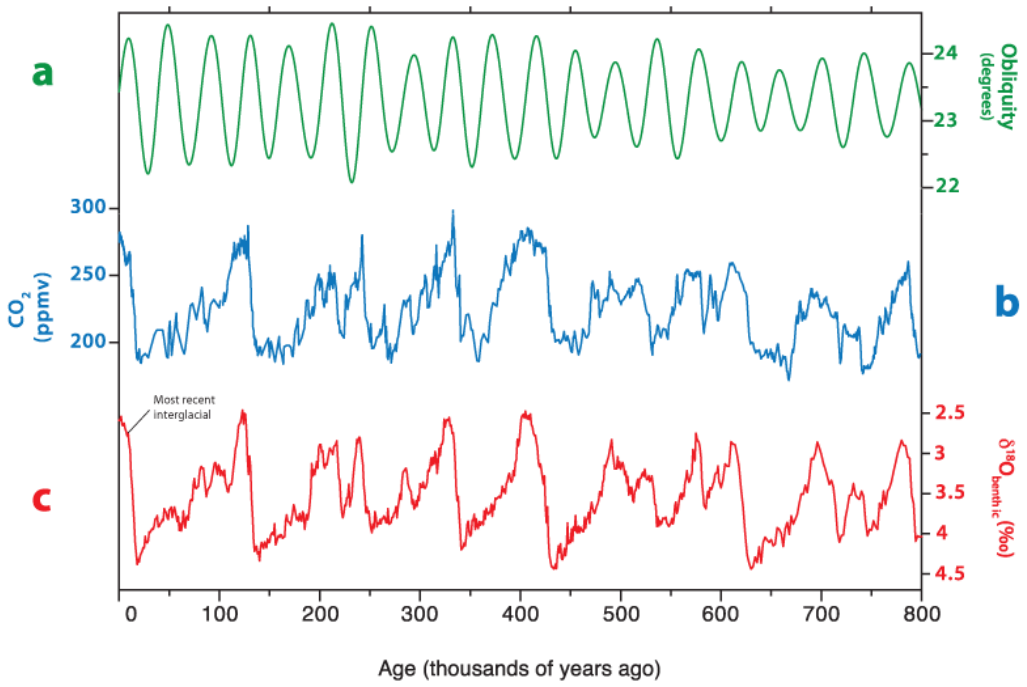
Arnuth *et al.* Terrestrial biogeochemical feedbacks in the climate system. *Nature Geoscience* 3: 525-532.

Interglacial diversity

Earth's climate has gradually cooled over the last three million years. Sea levels have dropped, polar ice sheets expanded. But periodically the long ice ages make way for brief relatively warm periods, or interglacials, like the current period. The appearance of these interglacials is governed by predictable cyclical changes in astronomical variables such as the tilt of Earth's rotational axis. Then why do interglacials vary so much in terms of duration and climate? A team of researchers from IGBP's Past Global Changes (PAGES) project has compiled palaeoclimate data to record characteristics of interglacials over the last 800,000 years.

By examining the long record, the international team has revealed intriguing diversity among interglacials in terms of their intensity, duration and internal variability. The research shows "broad distinctions between warmer interglacials with higher CO2 values and sea-level maxima as high as or higher than today, and cooler interglacials with lower CO2 concentrations and moderate sea level maxima". The researchers also show the possibility that "both intensity and duration of warmth can vary with geographical location and that specific regions respond differently to any global integration." The research directly addresses specific PAGES's research questions: How did the main forcing factors vary in the past? How sensitive was the climate system to these forcings?

Tzedakis P C *et al.* (2009) Interglacial diversity. *Nature Geoscience* 2: 751-755.



The figure shows how three variables – obliquity of the Earth's axis, carbon dioxide levels and oxygen isotope composition – changed during the glacial-interglacial cycles of the past 800 thousand years. Figure courtesy Chronis Tzedakis.

Report on land grab in Africa

IGBP's Global Land Project has published a report analysing the recent trend of land acquisition in Africa by foreign entities to grow food or biofuel crops. In light of the considerable but scattered and often informal nature of the quantitative information pertaining to such deals, the report aims to scrutinize and triangulate such information. In doing so, the report hopes to provide more accurate insight into the magnitude of this emerging pressure on land in Africa. The analysis shows that in ten of the identified recipient countries, the deals represent more than 5% of the current agricultural area – in Uganda more than 14%, in Mozambique more than 21% and in DR Congo more than 48% of the agricultural land. This suggests that at least in certain contexts, the consequences of the land deals on local populations could be substantial, and could include agricultural intensification, forest degradation, displacement of local populations, increasing local food insecurity and increasing poverty

Friis C and Reenberg A (2010) Land grab in Africa: Emerging land system drivers in a teleconnected world. *GLP Report No. 1*. GLP-IPO, Copenhagen.

Global scale patterns of trace gas sources and sinks

Following the successes of the surface ocean CO_2 atlas (SOCAT), SOLAS is producing similar climatological maps of dimethylsulphide (DMS), nitrous oxide and methane. The biogenic trace gas, DMS, is well known for its role in the proposed CLAW hypothesis. The DMS climatology, calculated from the Bates and Johnson DMS database held at NOAA (http://saga.pmel.noaa.gov/dms/), suggest a significant change in estimated global DMS

emissions from the ocean, increasing from ca. 22 to ca. 28 g S yr-1. As these data are used as input to many atmospheric chemistry models they are of considerable importance to the modeling community. Similar efforts are underway for nitrous oxide and methane, with an emphasis on understanding coastal fluxes.

Lana, Bell *et al*. (submitted) An updated climatology of surface dimethylsulphide concentrations and flux to the atmosphere. *Global Biogeochemical Cycles*.
Bange, Bell *et al*. (2009) MEMENTO: A proposal to develop a database of marine nitrous oxide and methane measurements. *Environmental Chemistry* 6: 195-197.

7.2 Key Publications

Below is a selection of scientific publications resulting from IGBP research during 2009 and in some cases 2010. We have chosen to list just ten to fifteen top articles or books in peer-reviewed publications for each core project, but there are many more.

Additionally, the core projects publish science plans marking the path to state-of-the-art and integrative research, reports from workshops, white papers, and regular newsletters. They produce datasets and models for use by the entire scientific community.

IGBP
Gattuso J-P, Orr J, Pantoja S, Pörtner H-O, Riebesell U, Trull T, eds (2009-10) The ocean in a high-CO2 world II. *Biogeosciences* 6/7.

Hood M, Broadgate W, Urban E, and Gaffney O, eds (2009) Ocean Acidification summary for policymakers. Available for download at http://www.igbp.net/page.php?pid=228 (English, French and Spanish versions).

Leemans R, Asrar G, Busalacchi A, Canadell J, Ingram J, Larigauderie A, Mooney H, Nobre C, Patwardhan A, Rice M, Schmidt F, Seitzinger S, Virji H, Vörösmarty C and Young O (2009) Developing a common strategy for integrative global environmental change research and outreach: the Earth System Science Partnership (ESSP) Strategy paper. *Current Opinion in Environmental Sustainability* doi:10.1016/j. cosust.2009.07.013.

Nobre C, De Simone Borma L (2009) 'Tipping points' for the Amazon forest. *Current Opinion in Environmental Sustainability*. Elsevier. doi:10.1016/j.cosust.2009.07.003.

Orr J C, Caldeira K, Fabry V, Gattuso J-P, Haugan P, Lehodey P, Pantoja S, Pörtner H-O, Riebesell U, Trull T, Urban E, Hood M and Broadgate W (2009) Research Priorities for Understanding Ocean Acidification: Summary from the Second Symposium on the Ocean in a High CO2 World. *Oceanography 22* (4): 182-189.

Report series
AIMES (2010) Science Plan and Implementation Strategy. IGBP Report No. 58. IGBP Secretariat, Stockholm. 30pp.

IHOPE (2010) Developing an Integrated History and Future of People on Earth (IHOPE): Research Plan. IGBP Report No. 59. IGBP Secretariat, Stockholm. 40pp.

IMBER (2010) Supplement to the Science Plan and Implementation Strategy, IGBP Report No. 52A. IGBP Secretariat, Stockholm. 36pp.

PAGES (2009) Science Plan and Implementation Strategy. IGBP Report No. 57. IGBP Secretariat, Stockholm. 67pp.

Fast Track Initiatives

Plant Functional Classifications

Kattge J, Knorr W, Raddatz T and Wirth C (2009) Quantifying photosynthetic capacity and nitrogen use efficiency for earth system models. *Global Change Biology* 15: 976-991. Kattge J, Ogle K, Boenisch G, Diaz S, Lavorel S, Madin J, Nadrowski N, Nollert S, Sartor K and Wirth C (in review). A generic structure for plant trait databases. *Methods in Ecology and Evolution.*

Past Ocean Acidification

Ridgwell A and Schmidt D C (2010) Past constraints on the vulnerability of marine calcifiers to massive carbon dioxide release. *Nature Geoscience* 3: 196-200.

Analysis, Integration and Modelling of the Earth System (AIMES)

Harmonization of global land-use scenarios for the period 1500-2100 for IPCC-AR5. *iLEAPS Newsletter* 7: 6-8.

Hibbard K, Kattsov V, Rinke A, Romonovsky V and Verseghy D (2009) Terrestrial permafrost carbon in the changing climate. *iLEAPS Newsletter* 8: 6-9.

Hibbard K A, Janetos A, vanVuuren D P, Pongratz J, Rose S, Betts R, Herold M and Feddema J (in press) Research priorities in land use and land cover change for Earth system and integrated assessment modeling. *Special Issue on land cover for International Journal of Climate.*

Lamarque J-F, Granier C, Bond T, Eyrling V, Heil A, Kainuma M, Lee D, Liousse C, Mieville A, Riahi K, Schultz M, Sith S, Stehfest E, Stevenson D, Thomson A, vanAardenne J and vanVuuren D (2009) Gridded emissions in support of IPCC AR5. *IGAC Newsletter* 41: 12-18.

Moss R, Edmonds J, Hibbard K, Manning M, Rose S K, van Vuuren D P, Carter T R, Emori S, Kainuma M, Kram T, Meehl G A, Mitchell J F B, Nakicenovic N, Riahi K, Smith S J, Stouffer R J, Thomson A M, Weyant J P, Wilbanks T J (2010) The next generation of scenarios for climate change research and assessment. *Nature* 463: 747-756, doi:10.1038/nature08823.

Taylor K E, Stouffer R J and Meehl G A (2008) A Summary of the CMIP5 Experiment Design. https://cmip.llnl.gov/cmip5/docs/Taylor_ CMIP5_dec31.pdf.

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Global Ocean Ecosystem Dynamics (GLOBEC)

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7.3 Outreach & Capacity Building

Outreach

Global Change magazine

IGBP's new magazine aims at conveying the results of the network and its projects to a broad readership that includes scientists, policymakers and the general public. The first issue – focusing on the carbon cycle – was launched to coincide with the climate conference (COP15) in Copenhagen. The subsequent issue, published in June 2010, dealt with a range of topics including emissions scenarios and the science and politics of land in Africa. The overwhelmingly positive feedback received so far suggests that the magazine is proving to be an effective communications and outreach tool.

COP15

At COP15, IGBP organised a full programme of activities. IGBP jointly sponsored two side events: the Global Nitrogen Initiative event with the US State Department and others, and an event on adaptation to climate change with the International Human Dimensions Programme on Global Environmental Change (IHDP). The latter event included presentations on nitrogen and climate, and the recently released 2008 global carbon budget.

Climate-Change Index

At COP15 IGBP also launched its Climate-Change Index, a tool for the public and policymakers. The index, which will be updated every year, combines the four key metrics that help unravel what is happening to the planet: temperature, carbon dioxide levels, seal level and Arctic sea ice. By drawing together the four metrics, the index helps dampen natural variability and reveals the underlying trend.

Global Change Wikipedia entries

In 2009, the Wikipedia entries for IGBP and "global change" were slight, out of date and inaccurate in places. The communications team has updated both sites.

http://en.wikipedia.org/wiki/Global_change
http://en.wikipedia.org/wiki/International_Geosphere-Biosphere_Programme

Vulnerability, Impact and Adaptation (VIA) to Climate Change

Addressing ecosystem and human VIA is receiving increasing attention within IGBP. Considerable research on VIA is being conducted in all IGBP core projects. In November 2009, IGBP and IPCC jointly sponsored a workshop in Brazil on impact, adaptation and vulnerability to climate change in the developing world. The workshop, convened by IGBP Chair, Carlos Nobre, brought together leading researchers from the developing world to discuss research requirements. The workshop, which was funded by NASA and others and organised by IGBP's regional office in Brazil, concluded that much stronger networks of researchers in the southern hemisphere would be "invaluable" to IPCC. Actions on IAV and a research agenda with nine elements were produced.

IGBP Chair Carlos Nobre and IGBP AIMES Executive Officer Kathy Hibbard participated in the international conference on *Climate Adaptation Futures*, 29 June-1 July 2010, Gold Coast, Australia.

World Bank's abcde conference, May 2010

Annual Bank Conference for Development Economics

IGBP Executive Director, Sybil Seitziger spoke at the World Bank's annual conference for development economics. Professor Seitzinger discussed the great acceleration in human output and consumption since 1950 and the impact this consumption has had on the planet's key biogeochemical cycles. The talk was complemented by a discussion on planetary boundaries by Johan Rockström from the Stockholm Resilience Centre.

Translations of the Ocean Acidification Summary for Policymakers
Over 10,000 copies of the English language version of this summary have already been distributed, and in 2010, IGBP and its partners (SCOR and IOC) produced French and Spanish translations (www.ocean-acidification.net)**.** The summary outlines the significance of this rapid oceanic change and calls for a global observation network to monitor the problem and related changes to ecosystems and cycles.

Capacity building

IGBP runs many capacity building workshops each year, aimed at young scientists and promoting interaction among different disciplines. Below are three examples.

Summer school facilitates cross-disciplinary interaction
A summer school on oceans, marine ecosystems and society facing climate change: a multidisciplinary approach was held at IUEM in Brest, France from 23-27 August 2010. The school aimed for interactive exchanges between participants and lecturers from different disciplines to build a conceptual framework that considers the impact of climate change on oceans and enables the transfer of this knowledge to society. The school was one of the activities of IGBP's IMBER project.

PhD course on poverty, vulnerability and adaptation
During March 4-6, 2010, IGBP's Global Land Project contributed to holding a PhD Course entitled "Poverty, vulnerability and adaptation - Rural livelihood and land use responses to global change" in the Department of Geography and Geology, University of Copenhagen.

Supporting the next generation of palaeoscientists
IGBP's PAGES project held its 1st Young Scientists Meeting (YSM) alongside its 3rd Open Science Meeting, to support the next generation of paleoscientists. 90 early-career scientists from 19 countries were selected to attend. The conference proceedings are being compiled for the open-access journal *Institute of Physics Conference Series: Earth and Environmental Science*.

8. Future Activities: 2011 and Beyond

8.1 Programme Highlights

Second synthesis
IGBP's second synthesis is well underway and is fostering considerable collaboration between the global-change programmes and between scientists and policymakers. All topics are expected to hold their workshops in 2011. These workshops will lead to the generation of a wide variety of products including, for example, a report on nitrogen and climate, an assessment of assessments of the relationship between air pollution and climate change, and a review article on the impacts of potential geoengineering schemes, in addition to summaries for policymakers. The products are to be made available ahead of the deadline for consideration for the IPCC AR5. Some of the results will be presented at the Global Change Open Science Conference in 2012.

Synthesis topics

- Geoengineering impacts
- The role of changing nutrient loads in coastal zones and the open ocean in an increased CO_2 world
- Nitrogen and climate
- Earth-system impacts from changes in the cryosphere
- Impact of cryospheric changes on biota and society in the arid Central Asia
- Megacities in the coastal zones
- Global environmental change and sustainable development: the needs of least developed countries
- Role of land cover and land use in modulating climate
- Atmospheric pollution and climate
- Aerosols

Open Science Conference – Planet under pressure: New knowledge towards solutions
This conference, sponsored jointly by ICSU's global environmental change programmes and ESSP, will be held from 26-29 March 2012 in London. The conference will bring together natural and social scientists, policymakers and industry representatives to explore solutions to global change. Nobel laureate Elinor Ostrom is the Chief Scientific Advisor for the conference.

With an aim of attracting 2500 scientists and policymakers, the conference will provide a comprehensive update of the pressure planet Earth is now under. It will discuss solutions, at all scales, to move societies on to a sustainable pathway and provide a platform to launch ICSU's vision for global sustainability research. It will provide scientific leadership for the Earth Summit, Rio +20, also in 2012. The conference will seek to attract 40% attendance from developing countries. http://www.igbp.net/page.php?pid=531

Guiding the direction for the conference is the Belmont Challenge and the International Council for Science's five grand challenges for global sustainability research: observations, forecasting, responses, thresholds and innovation. The conference will also support international assessment processes, for example the Intergovernmental Panel on Climate Change and the new biodiversity assessment, plus the Millennium Development Goals.

Expected outcomes

- The launch of a new vision for global sustainability research
- A report on new and emerging global-change and sustainability issues
- Evidence-based estimates of local and national biogeochemical boundaries to ensure global sustainability, ie a coordinated approach to sustainability that crosses scales, from global to regional, national and local.
- High-profile input into the Earth Summit Rio +20
- Development of long-lasting engagement with a wider network of stakeholders at international, regional, national and local levels.

Responding to the ICSU visioning

IGBP will continue to pay close attention to the progress of the ICSU visioning process and take appropriate action to conform and respond to it. The IGBP vision will be further refined and finalised during the coming year. This will form the basis for planning future research endeavours and community-building efforts.

8.2 Future Plans - Outreach & Capacity Building

Global Change magazine

IGBP will continue to publish two issues of the magazine every year and disseminate it to a wide community.

Climate Index, Global Change Index

The index is to be updated every year and IGBP is currently working on the 2010 edition. In the coming year or two, the index will be expanded to encompass indicators of changes in other Earth-system processes, for example key biogeochemical processes.

New database and website development (launching Fall 2010)

IGBP is undertaking a major revamping of its database so as to be able to segment its core audiences effectively. The website will also be redesigned to create a comprehensive site that brings together all the latest research and discussion on global change research, Earth system science and sustainability issues. More multimedia options and social networking for the global-change community will be explored.

Update IGBP Global acceleration graphs

IGBP's most high-profile and widely-cited product is the IGBP first synthesis in particular the "great acceleration" graphs. IGBP still receives regular requests for these graphs and many people use them in presentations. These are now over ten years old. In 2011, the Nobel Symposium is proposing the launch of an initiative to "bend the curves". The curves in question are the IGBP acceleration graphs. The communications team will update the graphs to 2010, add more parameters and contract a web design company to create an attractive online package of the graphs.

Building links to Swedish sustainability and resilience research communities

Within a few kilometres of the IGBP secretariat are some of the world's leading institutes on global change and sustainability – the Bejer Institute, Stockholm Resilience Centre, Stockholm Environment Institute, Bert Bolin Centre for Climate Change Research, iHOPE, PECS. IGBP is now in discussion with these institutes to investigate links and visions in light of the ICSU grand challenges.

Synthesis and Open Science Conference

The final day of the 2012 Open Science Conference will be devoted to outreach with policy-makers, funding agencies, journalists, NGOs and the public. As mentioned earlier, several synthesis topics are aiming to produce summaries for policymakers, which will be presented and

discussed on this day. The Earth Summit and the UN Global Sustainability Panel are two targets for policy-relevant research developed for the conference.

9. Financing and Budgets

9.1 Financial Report - 2010

The IGBP central budgets for 2009 (final) and 2010 (estimated) are summarised in Table 1. The projected income for 2010 is 1.77 M Euros. The increase from 2009 is primarily due to a few countries paying previous years plus 2010 contributions in 2010. Many countries also increased their contribution in 2010 by the requested 3%. The breakdown in national contributions by country for 2010, including amounts, are detailed in Table 2 and presented graphically in Figure 1.

The European Space Agency (ESA) provides a grant of 160K Euros. This is administered by IGBP but we derive no direct financial support from it for network activities.

Contributions from eight countries account for approximately 80% of the total contributions. Effectively, national contributions support all IGBP core activities.

The major expenditures are funds to support the scientific committees of the IGBP and of our core projects and cross-cutting networks, communications and publications for outreach to the scientific community and decision makers, interactions with our partner programs, and synthesis and integration activities. Expenditures for 2010 by major category are summarised in Figure 2 and detailed in Table 1.

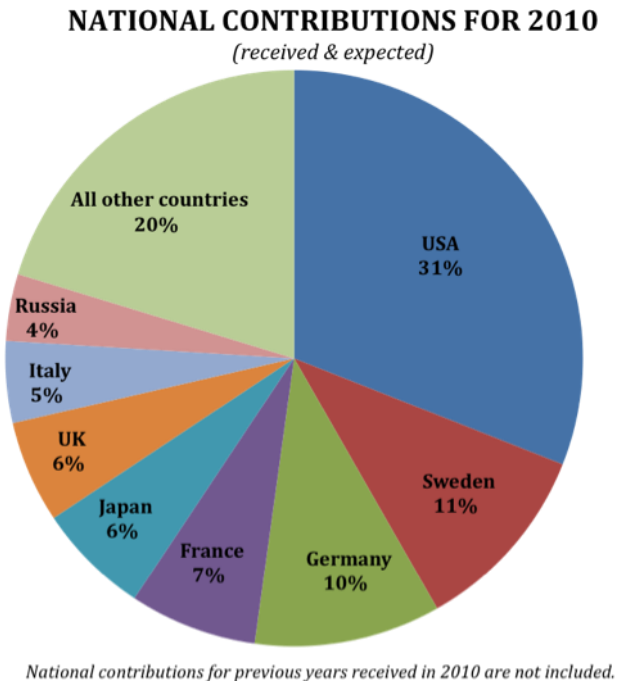

Figure 1

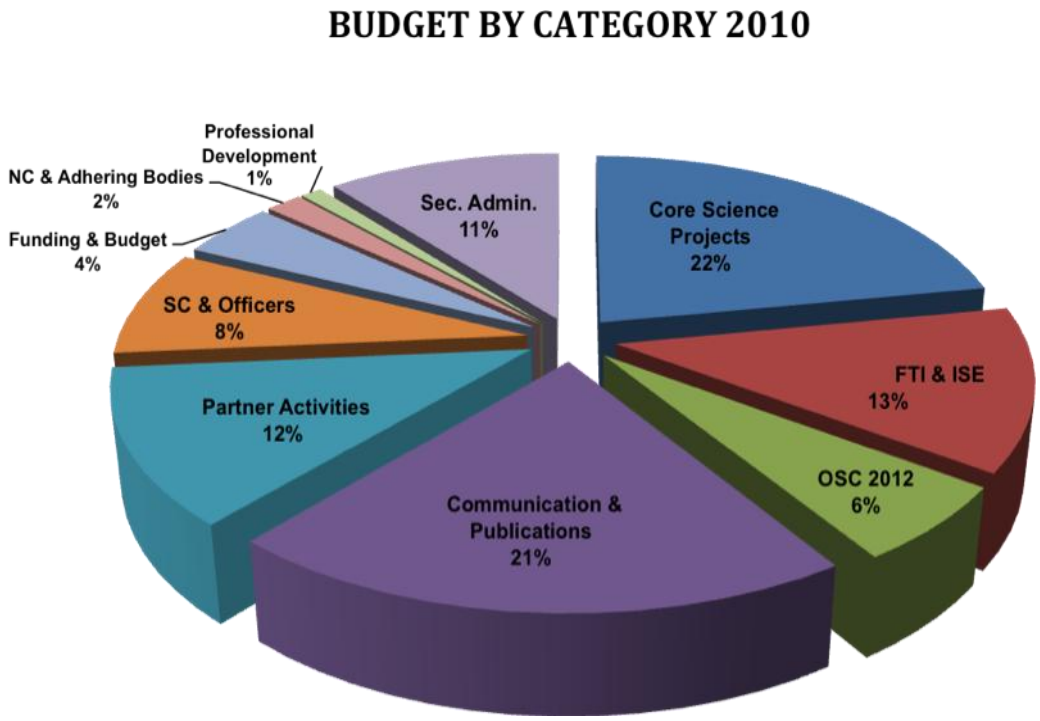

Figure 2

Table 1. **IGBP financial statements 2009 & draft statements 2010-2012**

Projected Income:		**EURO**			
	Network	**2009**	**2010 est.**	**2011 est.**	**2012 est.**
	National Contributions*	1,251,605	1,246,957	1,296,909	1,306,124
	Other Network income	11,931	18,891	0	0
	Allocated from previous year	57,024	174,701	0	0
	Operating Assets from previous year	211,092	325,330	278,075	228,778
	subtotal IGBP Network	**1,531,651**	**1,765,879**	**1,574,984**	**1,534,902**
	Administered Grants	***118,192***	***160,000***	***160,000***	***160,000***
	Total Income	**1,649,842**	**1,925,879**	**1,734,984**	**1,694,902**
Projected Allocations:		**EURO**			
	Subtotal Network Scientific Activities:	**950,200**	**1,345,065**	**1,198,684**	**1,189,346**
	SSC Block Grants	166,483	165,000	165,000	165,000
	SC, Officers and IPO meetings	67,462	55,533	*118,000*	*138,000*
	IGBP /KVA Symposium 2009	2,440	1,284	0	0
	Open Science Conference 2012**	4,132	35,000	10,000	10,000
	IGBP support to GLOBEC	0	13,750	0	0
	IGBP support to IMBER transition	0	8,000	0	0
	Integration & Synthesis	0	50,000	50,000	0
	ESSP Joint projects	30,870	43,932	44,404	44,404
	Fast Track initiatives	0	0	0	0
	Exec. Dir. Discretionary Fund	0	40,000	40,000	40,000
	Salaries incl. social taxes and pension	524,436	652,204	675,292	695,954
	Scientific Liaison travel	68,246	45,101	50,000	50,000
	Publs, Comms & Information	35,932	70,031	*45,988*	*45,988*
	Recruitment	13,782	0	0	0
	Reallocated for indicated year	36,417	165,230	0	0
	Administered Grants	**118,191**	**160,000**	**160,000**	***160,000***

	Administrative Costs	**105,913**	**142,739**	**147,522**	**151,114**
	Loss/Gain due to exchange rate	-24,494	0	0	**0**
	Committed funds to the following year	**174,701**	**0**	**0**	**0**
Operating Assets for the following year		**325,330**	**278,075**	**228,778**	**194,442**
	(excl. Academy reserve)				
	Total Projected Allocations	**1,649,842**	**1,925,879**	**1,734,984**	**1,694,902**

* ***National contribution:*** The national contribution has been adjusted upwards by 3% for each year 2011 & 2012.

** ***Open Science Conference 2012:*** Costs for preparation of the Open Science Conference 2012 will be considerably larger and will require agressive fund raising efforts.

Please note: Estimated costs for 2011 & 2012 are minimum estimates with no room for enhanced activities

Table 2. National contributions received & expected 2010	
(black = received & *red italic=expected*)	
Country	**2010**
Australia	22,030
Austria	10,250
Belgium	16,200
Benin	
Botswana	550
Brazil	*16,395*
Cameron	550
Canada	0
China-Beijing	11,900
China-Taipei	18,350
Colombia	528
Congo	550
Czech. Rep.	5,950
Denmark	9,700
Egypt	1,150
Finland	7,050
France	87,000
Germany	127,225

Greece	0
Hungary	2,250
Iceland	550
India	*5,500*
Indonesia	2,250
Ireland	2,750
Israel	3,250
Italy	55,850
Ivory cost	0
Jamaica	0
Japan	77,037
Jordan	0
Kenya	550
Korea	9,250
Malaysia	1,541
Mexico	0
Morocco	
Netherlands	22,600
New Zeeland	3,250
Norway	24,120
Pakistan	989
Poland (paid less than scale in 2010)	3,245
Portugal	2,750
Romania	550
Russia (paid for remaining part of 2009 & 2010 in 2010)	74,272
Singapore	0
South Africa	6,500
Spain (paid less than scale in 2010)	13,000
Sri Lanka	0
Sweden	130,998
Switzerland	19,350
Thailand	1,105
UK	69,850
USA	377,685
Zimbabwe	538
Total received & *expected* 2010	1,246,957

IPO Budgets

Table 3. Summary of income for the IPO Offices of the Core Projects of IGBP.

IPO budgets 2010					
PROJECT	**Country/Org.**	**USD**	**EURO**	**Staff (position)**	**%**
AIMES	*NSF International Programs (GEO) 2009 figure*	*258,439*	*179,098*	Executive officer	100%
	NCAR (in kind) 2009 figure	*30,511*	*21,144*	Administrative Assistant	25%
	IGBP 2010 + remaining funds from 2009	52,603	36,454		
	***AIMES* TOTAL INCOME**	**341,553**	**236,696**		
GLP	Univ. Of Copenhagen (1 435 000 DKK)	278,641	193,098	Executive officer	100%
	IHDP	17,500	12,128	Administrative officer	75%
	IGBP 2010 + remaining funds from 2009	28,670	19,868		
	***GLP* TOTAL INCOME**	**324,810**	**225,094**		
IGAC				Executive officer	75%
	U.S NASA	89,753	62,199	Administrative officer	50%
	NOAA	90,179	62,494		
	NSF	88,765	61,514		
	European ACCENT (pending)	0			
	Academia Sinica,Taipei	3,608	2,500		
	IGBP 2010 + remaining funds from 2009	57,488	39,839		
	***IGAC* TOTAL INCOME**	**329,792**	**228,546**		
iLEAPS	Univ. of Helsinki, Faculty of Sciences	200,000	138,600	Executive officer	100%

	Finnish Met. Inst.	20,000	13,860	Science officer	100%
	IGBP 2010	39,683	27,500	Science officer	50%
				Project secretary	100%
	***iLEAPS* TOTAL INCOME**	**259,683**	**179,960**		
IMBER	SCOR - NSF (IMBER)	50,000	34,650	Executive Director	100%
	SCOR Carry-over from Previous Year	61,082	42,330	Deputy Executive Director	100%
	University of Western Brittany / IUEM - (office support)	258,597	179,208	Administrative Assistant	100%
	CNRS/IRD/Brittany region (IPO Salaries, expenses)	20,339	14,095		
	IGBP: IMBER/GLOBEC Transition	11,544	8,000		
	IGBP 2010	19,841	13,750		
	IMBER TOTAL INCOME	**421,404**	**292,033**		
LOICZ				Executive Director	100%
	Inst. f. Coastal Research (430´Euro)	620,491	430,000	Senior Science Coordinator	100%
	IHDP	20,000	13,860	Office and Comm. Manager	100%
	IGBP 2010	19,841	13,750	Office and Finance Admin.	60%
	***LOICZ* TOTAL INCOME**	**660,332**	**457,610**	Project manager-Congresses and affiliated Projects (temporary)	50%
PAGES				Executive Director	100%
	Swiss NSF	364,832	252,829	Science Officer	85%
	USA NSF	339,511	235,281	Project Officer	60%
	IGBP 2010	39,683	27,500	Finance	30%

				Manager	
	***PAGES* TOTAL INCOME**	**744,026**	**515,610**	IT Coordinator	50%
SOLAS	UK-Natural Environment Research Council (1 /4 2010- 31/3 2011)	143,834	99,677	Executive Officer	100%
	BMBF (1 Feb 2010- 31 Jan 2011)	144,349	100,034	Project Officer	100%
	IFM-GEOMAR (salary for PO in Kiel)		Unknown		
	SCOR	25,000	17,325		
	IGBP 2010	19,841	13,750		
	***SOLAS* TOTAL INCOME**	**189,190**	**131,109**		

9.2 Future Budgets (2011-2012)

Budgets for 2010-2012 are provisional. They are presented alongside the 2009 budget for easy comparison across time (Table 1). Expenditures are estimated conservatively, to match expected income.
In preparing these future budgets we made the following assumptions. We assumed a 3% increase annually in national contributions. The cost for the SC, Officers and IPO meetings increase for 2011 and 2012 relative to 2009/2010 for the following reason. In 2009 and 2010, Japan and France, respectively, provided significant funding for the IGBP SC meeting. We have conservatively estimated the support from NASA for the 2011 IGBP SC meeting. Salaries increase relative to 2009 because staffing was incomplete until the end of the year, and KVA has significantly increased pension costs. Salary increases of 3% annually are budgeted. Publications/communication budgets increased in 2010 due to the critical need to update our website and database for communication and outreach activities. KVA has substantially increased the charges to IGBP for rent and services thus increasing our administrative costs. Estimated costs for 2011 and 2012 are minimum estimates with no room for enhanced activities.

10. Current and/or Future Programme and/or Funding Issues

There continues to be *an increasing demand* placed by the community on IGBP, *without an increase in funding*. For example, IGBP has now been requested to report twice a year to the UN's Framework Convention on Climate Change, not once a year. We continue to increase our interaction with partner programmes and with decision makers, including enhancing our communication products. To stay within our budget, 1.5 full-time equivalent positions continue to be vacant at the IGBP Secretariat; all long-distance phone calls are with SKYPE; we are using teleconferences and videoconferences to reduce travel costs; and we continue to identify mechanisms to increase our efficiency and reduce expenditures.

We have two major fund raising initiatives in the immediate future: **IGBP's second synthesis and the Open Science Conference in 2012**. We are seeking funding for each of the synthesis topics and have tentatively identified funding for two of them. The Open Science Conference, *Planet under pressure: new knowledge towards solutions*, in 2012 will be held in London. We

have an ambitious target of 1000 of the 2500 participants to come from developing countries and this will take significant funding. The conference will provide an update of the state of the planet and will discuss solutions, at all scales to move societies onto a sustainable pathway. A series of workshops will be designed to prepare results and products for presentation at the conference and also feed into the UN Earth Summit. A substantial effort is required on the part of the IGBP Secretariat to help coordinate and prepare for this conference and the Summit. The budget indicated in Table 1 is simply the amount that can be allocated from the existing IGBP core budget; an aggressive fund raising effort will be needed to support the Secretariat costs, workshop costs, products for presentation at the conference, media, and the policy day, among others.

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International Human Dimensions Programme on Global Environmental Change (IHDP)

11. Introduction

Science and policy approaches to global environmental change (GEC) are currently moving toward identifying responses and solutions that are applicable at different levels and for diverse societal groups. This raises expectations for social science contributions on the role of social structures, norms and behaviors in causing and responding to GEC. Thus, there is an urgent need to mobilize the wider social sciences community to engage more directly with GEC problems and issues.

The International Human Dimensions Programme on Global Environmental Change (IHDP) is well positioned to play a leading role in this process, advancing research on the human dimensions of GEC within the context of the "Belmont Challenge" as well as the wider International Council for Science (ICSU) Visioning Process, calling for a stronger involvement of social sciences. IHDP will continue their engagement with key partners to pursue this goal.

The mission of IHDP is to provide leadership in framing, developing, and integrating social science research on GEC, and to promote the application of its findings. By combining cutting-edge research, capacity development, outreach, and science-policy interaction, IHDP has emerged as an important player in catalyzing new social science research, knowledge and collaboration for advancing the understanding of GEC.

Initiating and managing cutting-edge human dimensions research on GEC is the principal role of IHDP and its Secretariat. In order to fulfill its mandate effectively in a changing research landscape, IHDP has secured a grant from the Packard Foundation to undertake a global survey among the social sciences and humanities community to explore ways and means to bring more extensive and foundational social science inputs within GEC research, and to identify the role of IHDP within this context. The Packard survey, done in collaboration with ISSC and UNESCO, will be carried out in the first half of 2011 by an independent consultancy firm. The results will inform the ICSU Visioning Process and others, and form the basis of future IHDP initiatives.

IHDP supports relatively autonomous core research projects, as well as joint research projects which are conducted under the Earth System Science Partnership (ESSP). To maintain a balanced portfolio of core and joint research projects, IHDP will develop key social science initiatives, such as research foci on behavioral changes or equity, and several integrated research projects working in close collaboration with the other GEC programs. In addition, IHDP plans to incorporate a complementary research component—rapid assessments on emerging issues—which will contribute to a cohesive and adaptive policy-relevant research portfolio of IHDP, and will provide a new mechanism to respond to developments such as the "Belmont Challenge".

Another core element of IHDP's mandate is to broaden and strengthen the network of young social scientists working on the human dimensions of GEC. IHDP works toward this by furthering a comprehensive capacity development strategy, particularly targeting future leaders in

science, policy, and the media, to establish a broad science-policy-public learning process that can increase the shared understanding of complex issue areas of GEC.

IHDP's value added for addressing global needs in both policy and research and serving a diverse clientele as a dialogue facilitator and relationship broker, resides in its convening power to mobilize and catalyze research and dialogue, in its access to intergovernmental processes through its United Nations University affiliation, and in its long-standing experience with multidisciplinary approaches. To further advance the science-policy dialogue, IHDP endeavors to forge new or strengthen existing strategic partnerships; e.g. with the emerging Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and with other ongoing processes such as Rio+20. This will put two core IHDP research agendas at centre stage: Transitions towards a green economy, and the institutional framework for sustainable development.

12. Activities in 2009/10 – Highlights

12.1 Program Highlights 2009-2010

Projects in Synthesis Phase

Three of IHDP's projects are currently within their synthesis stage. The Global Environmental Change and Human Security (GECHS) Project held its synthesis conference in 2009 and is working on its synthesis publications. Overall, the project was able to "change the discourse" in GEC research by putting people into the centre of analysis, e.g. within the context of research on "sustainable adaptation". Additionally, the Industrial Transformation (IHDP-IT) and ESSP joint project on Global Environmental Change and Food Systems (GECAFS) Projects are both in the process of writing their synthesis books and are anticipating future activities within their respective fields. The research agenda of IHDP-IT, for example, rests within the middle of the current debate about a "Green Economy", since it addresses the transitions required to move towards a sustainable economy or society. Hence, it presents a good opportunity for IHDP to showcase the policy relevance of its research.

Earth System Governance Project (ESG)

In April 2009, the Earth System Governance Project finalised and published its Science Plan. The plan will guide the projects actions, as a cross-cutting theme within IHDP Science, throughout the projects ten year lifecycle.

Major Project Conferences

The Earth System Governance Project hosted the 2009 Amsterdam Conference on the Human Dimensions of Global Environmental Change "People, Places, and the Planet". GECHS convened its synthesis conference "Human Security in an Era of Global Change" and both the Urbanization and Global Environmental Change Project (UGEC) and Global Land Project (GLP) are planning back to back Open Science Conferences in Arizona in October 2010.

Former Member of IHDP Scientific Committee wins Nobel Economics Prize

Elinor Ostrom, a former member of the IHDP Scientific Committee, shared the Nobel Prize in Economics. Elinor Ostrom has a long standing relationship with IHDP and has further initiated and participated in various activities over the past five years – including IHDP Open Meetings, International Human Dimensions Workshops, and has made substantive contributions to IHDP's Update Magazine.

New Executive Director

Following Dr. Andreas Rechkemmer's term as Executive Director of the IHDP Secretariat, IHDP's institutional sponsors have appointed Dr. Anantha Kumar Duraiappah to take on the position. Dr. Duraiappah officially began on January 1, 2010.

Policy Dialogue with the Public: The Bonn Dialogues on Global Change

Continuing its series for the third year, IHDP, in conjunction with the United Nations University Institute for Environment and Human Security (UNU-EHS), and the German Committee for Disaster Reduction (DKKV), hosted two Bonn Dialogues on "Energy and Food Security", and "Cities under Climate Threat".

IHDP Communication in New Media

IHDP Communications have widened the scope of their activities to further include the electronic media within its strategy. In the course of 2009, it opened Youtube and Facebook accounts, where interested parties can find information about, and get involved in, IHDP activities. In addition, IHDP's traditional print publications are now electronically distributed; this provides more interactive reading interfaces and the option to subscribe to electronic mailing lists.

12.2 Research Agenda: Program Highlights 2009-2010

(Following each project highlight, two key publications are added. An expanded publication list, though not exhaustive, can be found in chapter 2.3)

Industrial Transformation (IT)

Technological innovations are important but not sufficient for sustainability transitions. IHDP-IT research demonstrates that developing countries do not have to follow traditional, and in many instances unsustainable, development pathways.

IHDP-IT is preparing for its synthesis event in January 2011 "Innovation and Sustainability Transitions in Asia" to be held in Kuala Lumpur, Malaysia. The project has contributed to our understanding of transition processes or systems innovations in socio-technological regimes and has built an international community of researchers throughout its life-span. This research focus of IHDP-IT is unique in the whole GEC research community. Building on earlier findings, the focus of IHDP-IT in 2009/2010 was on "sustainability experiments" (with support of the APN),

initiating research on: i) the development of a conceptual framework for inventorising, classifying and analysing sustainability experiments, (ii) advancing a research strategy for identifying opportunities for and barriers to successful sustainability experiments, and (iii) identifying appropriate governance strategies to support the processes involved in the upscaling of experiments and increasing their impact.

- Berkhout, F., Verbong, G., Wieczorek, A. J., Raven, R., Lebel, L. & Bai, X. 2010. Sustainability experiments in Asia: innovations shaping alternative development pathways? *Environmental Science and Policy*, Special Issue.
- Berkhout, F., Angel, D. & Wieczorek, A.J. 2009. Asian development pathways and sustainable socio- technical regimes. *Technological Forecasting and Social Change*, 76: 218.

Global Environmental Change and Human Security (GECHS)

Climate change is not an environmental problem that can be managed in isolation from larger questions concerning development trajectories and human security concerns. This includes ethical obligations towards others, and to future generations. Placing humans at the center of the analysis, GECHS research has contributed to a shift from a purely risk-based approach to one that takes into account issues of vulnerability, equity, power, justice, and ethics.

Adaptation provides an opportunity to transform society towards sustainability goals; at the same time, adaptation actions can also exacerbate greenhouse gas emissions, increase vulnerability and contribute to a number of development problems. The road to sustainable adaptation starts with the understanding that it is a social process rather than a list of actions and measures that address specific climate change impacts.

GECHS' research was presented at their synthesis conference in June 2010, Oslo, Norway. These overall findings provided the basis, inter alia, for a much stronger focus on the human dimensions in the outline of IPCC's AR 5 and contributed significantly to the development of an IPCC Special Report on "Managing Risk of Extreme Events to Advance Climate Change Adaptation". Currently, GECHS is exploring ways and means for using to project's findings to create positive social change and enhance human security in the context of global environmental change. There are success stories too, that can be showcased. Finally, the current thematic focus of the Belmont Challenge on "most vulnerable societies" should build to a large extent on the GECHS legacy in this respect.

- Matthew, R.O., Barnett, J., McDonald, B. & O'Brien, K.L. 2010. *Global Environmental Change and Human Security*. Cambridge MA: MIT Press.
- O'Brien, K., Lera St. Clair, A. & Kristoffersen, B. 2010. *Climate Change, Ethics and Human Security*. Cambridge: Cambridge University Press.

Urbanization and Global Environmental Change project (UGEC)

UGEC's first highly visible synthesis activities took place during the IHDP Open Meeting 2009 through parallel and special sessions, highlighting the importance of urban areas for the human dimensions of global environmental change. On the theme of cities and climate change in particular, a distinct focus of the UGEC project, UGEC hosted the only session on urbanization

during the Copenhagen Climate Change Congress in 2009. UGEC collaborated with other institutions and participated in their international workshops (such as UCCRN and START), sponsoring, advising and co-organizing events. The participation in the START/East-West Center 'Cities at Risk' workshop, held in Bangkok, Thailand, contributed to region specific research and strengthened the UGEC Asian network.

- Seto, K.C., Sanchez-Rodriguez, R. & Fragkias, M. 2010. The new geography of contemporary urbanization and the environment. *Annual Reviews of Environment and Resources*, 35.
- New York City Panel on Climate Change 2010. *Climate Change Adaptation in New York City: Building a Risk Management Response*. *Annals of the New York Academy of Sciences*, 1196.

Earth System Governance (ESG)

Leading scholars of the Earth System Governance network shape the debate about international environmental governance, a focus of the political process towards the "Rio+20" Conference in 2012. Furthermore, due to the cross-cutting nature of governance in the GEC research landscape, the projects research agenda fits very well within ICSU's Grand Challenges (a near perfect match with challenge 4) and the topics and scales emerging from the Belmont process.

This first year of the Earth System Governance Project's ten-year life cycle has been characterized by a successful and dynamic propagation and further conceptual and methodological development of the concept of earth system governance, accumulating in more than 500 abstracts submitted by colleagues, from more than 64 countries to the 2009 Amsterdam Conference on the Human Dimensions of Global Environmental Change. About 200 paper presentations, and 30 keynote speeches at the conference on 'Earth System Governance. People, Places, and the Planet' presented cutting edge, applied and fundamental research on earth system governance. The conference provided also a venue of an IHDP-wide session on "Governance as a Cross-Cutting Issue of Human Dimensions Research", showcasing governance related work on water, coastal zones, food security, industrial transformation and adaptation to climate change.

- Biermann, Frank., Michele M. Betsill, Joyeeta Gupta, Norichika Kanie, Louis Lebel, Diana Liverman, Heike Schroeder, and Bernd Siebenhüner. 2009. Earth System Governance: People, Places and the Planet. Science and Implementation Plan of the Earth System Governance Project. Earth System Governance Report 1, IHDP Report 20 Bonn, IHDP: The Earth System Governance Project.
- Young, Oran R. 2010. *Institutional Dynamics. Emergent Patterns in International Environmental Governance*. Cambridge, MA: MIT Press.

Global Land Project (GLP)

The overarching research question of GLP is currently how to manage land systems to cope with global change and how to develop sustainable pathways for the future. One of the subsequent questions is whether people benefit from land use transitions vis-à-vis the environmental costs and benefits of such transitions. The current push for REDD under the climate change negotiations provides a case in point for the need to better understand of such transitions.

GLP's scientific activities in 2009 consisted of a series of workshops, organised and co-organised both by the IPO and GLP's Nodal Offices. Topics ranged from a continuation of the Aberdeen Nodal Office workshop series on modelling issues to vegetation dynamics in global drylands, land-use and ecosystems or globalisation and land-use changes and resulted in 4 special issues.

- Milne, E., Aspinall, R. J. & Veldkamp, T.A. 2009. Integrated modeling of natural and social systems in land change science. *Landscape Ecology*, 24(9): 1145-1147.
- Reenberg, A. (Ed.) 2009. LaSyS Workshop 2007: Land system science handling complex series of natural and socio-economic processes. *Journal of Land Use Science*, 4.

Land-Ocean Interactions in the Coastal Zone (LOICZ)

Within its Priority Topic on Coastal Governance, LOICZ developed a version 1.0 of the conceptual governance-baseline assessment and reporting model, being applied by coastal practitioners in Latin America and in West Africa. In 2009, it has further identified "Coastal Hotspots" and future efforts will concentrate on the new research foci: deltas/river-mouth systems; islands; coastal urbanisation / megacities; and the Arctic. The LOICZ and IPO expertise is integrated into international assessments (e.g. GEF's International Waters) and the development of indicators for transboundary water issues.

Coastal regions are part of the 'Belmont' thematic priorities and the integrative nature of LOICZ matches the Grand Challenges identified by the ICSU Visioning Process. Hence, LOICZ has a high potential for further development into an interdisciplinary science, services and communications effort within and beyond the Earth System Science Partnership context. The results of the past 4 years of research will be published as a LOICZ 'mid-term synthesis', focusing on social-ecological systems (e.g. conceptual work on assessment, modelling, and scenario development in social-ecological systems), fluxes and biogeochemistry, and governance challenges in coastal systems.

In September 2000, the first Storm Surges Congress 2010 was held successfully in Hamburg, Germany, and LOICZ has been asked to host it again in 2013. The organisation of the LOICZ Open Science Conference 2011, including a Young LOICZ Forum (September 2011 in Yantai, China) with numerous partners, is in progress. Its focus lies on "synthesis" and new hotspots. LOICZ's mid-term evaluation has been carried out and the last five years of their work has been documented and will likely be published subsequent to the final results being approved and released.

- Syvitski, J.P.M., Kettner, A., Overeem, J.I., Hutton, E.W.H., Hannon, M.T., Brakenridge, R.G., Day, J., Vörösmarty, C, Saito, Y., Giosan, L. & Nicholls, R.J. 2009. Sinking deltas due to human activities. *Nature Geoscience*, 2: 681-686.
- Weichselgartner, J. & Kasperson, R. 2010. Barriers in the science-policy-practice interface: toward a knowledge-action-system in global environmental change research. *Global Environmental Change*, 20 (2): 266-277.

12.3 New and Planned (advanced) Initiatives

Integrated History and Future of People on Earth (IHOPE)

This project was initiated by IGBP (AIMES and PAGES) and its Science Plan was finalized in 2009. It was put forward to the IHDP SC for approval, which was done in late 2009, and IHOPE became a joint IHDP-IGBP core project. Research linked to IHOPE demonstrates that Earth system changes in the past have been strongly associated with changes in the coupled human-environment system. IHOPE therefore argues that society and science needs lessons from the past when conceptualizing and modeling about sustainable futures and unpleasant thresholds. IHOPE supports sharing knowledge and resources from the biophysical and the social sciences and the humanities to address analytical and interpretive issues associated with the coupled human-earth system dynamics. This integration of human history and Earth system history is a timely and important task.

Integrated Risk Governance (IRG-Project)

How can risk governance be improved internationally? This is the main research question of IRG-Project. In order to address this issue, the project focuses on the "entry and exit switches" that mark the beginning and end of emergency situations. Amongst other things, the project plans to investigate conditions that foster short and long-term learning processes in the face of emergencies as well as hindrances to such learning. During the planning process, linkages between IRG-Project and the ICSU Research Programme Integrated Research on Disaster Risk (IRDR) were explored and will be pursued.

IRG-Project submitted its science plan for IHDP approval as a core project in 2010, after the official review process was conducted in 2009. Among first project activities were the commencement of a fruitful and ongoing collaboration with the GSD Project (a European network on complex systems); the completion of a collaborative project on economic risks with the German Ministry for the Environment; and the hosting of the IRG-Project Summer School, held at the Summer Institute for Advanced Study of Disaster and Risk at Beijing's Normal University, China. Besides these activities, IRG-Project further delivered its report on "Catastrophe Governance Case Analysis". This report included the "Chinese Paradigm of Catastrophe Risk Governance", which was based on an analysis of two case studies concerning the 2008 Wenchuan earthquake and South-China freezing rain and snowstorm of that same year.

Knowledge, Learning and Societal Change (KLSC)

In 2009 and 2010, the Scientific Planning Committee developed the central ideas, structure, and guiding questions for the project. A core team produced a draft scientific plan, which is currently being amended for external review in the fourth quarter of 2010 with launch anticipated in the first half of 2011. The scientific focus of this initiative fits perfectly with the new focus on issues of behavioral change and societal learning processes in the ICSU Visioning and the Belmont Challenge contexts. The mission of KLSC is to identify, understand, and enable the effective use of the mechanisms and levers of behavioral and societal change and adaptation that are interlinked with knowledge and learning. KLSC specifically addresses issues that are highly significant in many global change projects, but are not their primary research focus. Thus KLSC

is particularly well positioned to contribute to and benefit from fruitful collaborations with partners within IHDP and beyond.

12.4 Key Publications (a full list can be obtained from the Secretariat)

Journal Articles (selected)

Industrial Transformation

- Angel, D; Rock, MT. 2009. Environmental rationalities and the development state in East Asia: Prospects for a sustainability transition. TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE, p. 229, vol. 76, (2009). Published, 10.1016/j.techfore.2008.01.00.
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- Rock,. M., J. T. Murphy, R. Rasiah, P. van Seters, S. Managi, "A hard slog, not a leapfrog: Globalisation and sustainability transitions in developing Asia", TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE (special Issue), p. , vol. 76(2), (2009). Published.

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Human Security

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- Mortreux, C; Barnett, J, "Climate change, migration and adaptation in Funafuti, Tuvalu. GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS, p. 105,

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Urbanization
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Publications and Specific Programme / Project Publications (selected)

- **GECAFS Synthesis Book**: 'Food Security and Global Environmental Change'. (2010)
- **GECHS Synthesis Book**: 'Climate Change, Ethics and Human Security'. (2010)
- **GLP NEWS**: GLP newsletter, announcing major events to the community and showcasing GLP science in the form of scientific articles. Newsletters issued in: June 2009, and March 2010.
- **IHDP Annual Report 2009**, Bonn, 2010

- **IHDP Update Issue No. 2/2009**: 'Human Security in an Era of Global Change (GECHS Synthesis)' Bonn, June 2009.
- **IHDP Update Issue No. 3/2009**: Governance as a Crosscutting Theme in Human Dimensions Science, Bonn, November 2009.
- **LOICZ Newsletter INPRINT**, on-line at www.loicz.org/products/publication/newsletter/index.html.en
- **LOICZ Reports & Studies No. 34** Olsen, Stephen B.; Glenn G. Page, Emilio Ochoa (2009): The Analysis of Governance Responses to Ecosystem Change - A Handbook for Assembling a Baseline, LOICZ Reports and Studies No. 34, Geesthacht.
- **Project Internal Report**: Coastal Futures (2009): Offshore-Windkraft in der deutschen Nordsee. Oekom Verlag, Munchen.
- **UGEC Viewpoints** Issue 3 03/2010 Integrative Perspectives on Urbanization and Climate Change?; Issue 2 09/2009 Urbanization: A Critical Human Dimension of Global Environmental Change?

12.5 Science-Policy, Outreach and Capacity Building

Science-Policy-Interaction

- Science-policy interaction is a top priority for IHDP in its second decade and will be strengthened further in the coming years.
- The "worlds" of both science and policy need to better know one another, learn to speak each other's languages, benefit from their respective expertise, know each others' priorities and ultimately, encourage each others' endeavours.
- The IHDP Open Meeting 2009 invited numerous actors from both spheres and presented an attractive and well-used platform for dialogue and interaction. Furthermore, IHDP was present at COP 15 of UNFCCC with a very well received exhibition booth, jointly manned with IGBP. A joint side event on "Science, Society and Adaptation" attracted more than 100 people. IHDP is part of the annual Research Dialogue of the SBSTA of UNFCCC and presented particularly research of the two projects in synthesis: GECHS and IHDP-IT.
- Many of IHDP's leading scholars were crucial in the development of the outline for the 5th Assessment Report of IPCC and, more recently, IHDP played a critical role in establishing IPBES.
- Thematically, topics taking centre stage within IHDP, such as sustainable adaptation, sustainability pathways in the context of a 'Green Economy', or the institutional framework of sustainable development are at the core of current international processes. Currently, IHDP is exploring its possible contributions to the 'Rio+20' process, to highlight the role science can play in expediting the implementation of goals and targets in the realm of sustainability.

Public Awareness and Outreach

Several public events were convened in 2009, and IHDP intensified its activities in the area of public awareness and outreach. It continued the above mentioned 'Bonn Dialogues' series that focused in 2009/2010 on issues such as "Migration", trade-offs between "Food and Energy Security" and "Cities under Climate Threat". The IHDP Open Meeting 2009 featured a series of highly attractive public panels and invited students (from schools within the region) as well. The IHDP further set up exhibitions at the 1st World Social Science Forum in May 2009 in Bergen; at COP 15 of UNFCCC in December 2009 (exhibition and side event), as well at UNFCCC SBSTA, and continues its outreach activities with local and international groups visiting the UN Campus in Bonn.

IHDP National Committees

Following extensive reviews concerning the relationships between IHDP and its National Committees (NC's), 2009 and 2010 saw an increase in the strengthening and support offered to their roles within the human dimensions network. A new NC strategy is currently under review and is incorporated into IHDP's Strategic Programme 2011-2013. Concerning communications, the online NC Bulletin began its release in 2009, with future editions being released on a tri-annual basis. The Bulletin includes updates from NC's and important information for the wider IHDP community. The IHDP Scientific Committee meeting in September 2010 reviewed the NC's and discussed pathways for greater inclusion within international policy dialogues (such as IPCC/IPBES, etc.); increased research avenues, particularly given the North-South relationship; and, in general, ways in which NC's can increasingly play a more integrated part within the IHDP community.

13. Future Activities – 2011 and Beyond

13.1 IHDP Strategic Programme 2011-2013: Implementing the IHDP Strategic Plan 2007-2015

The future activities of IHDP are designed to make progress towards the mission of the Programme: "To provide international leadership in framing, developing and integrating social science research on global environmental change and to promote the application of key findings to help address environmental challenges". A comprehensive list of activities is detailed within IHDP's "Strategic Programme 2011-2013." Here we briefly present the highlights of our future plans.

Mobilizing the Social Sciences to engage in framing questions, conducting research, and presenting policy implications regarding Global Environmental Change

The current demand for social science input on drivers and responses to global environmental change challenges the status quo and creates a need for new approaches as well as the better integration of past contributions. IHDP will pursue two combined activities to meet this need:

Identifying Barriers and Opportunities: Global Survey of Social Scientists

With the support of the Packard Foundation, IHDP will be conducting a global survey of social scientists to identify why the social sciences have not been very strong partners in GEC research and associated policy discussions, and what would be required to change this. The Secretariat will work closely with a survey consultant to develop, administer and analyze the results of a survey of a representative global sample of social scientists. This project will be completed in 2011.

Identifying IHDP's Role in Facilitating Broader Engagement by the Social Sciences Research Community in GEC Research

Using the results of the above-mentioned survey, IHDP will analyse the present organisational landscape to assess whether the present structure and processes of IHDP are adequate to meet the growing demands for credible, policy-relevant social science inputs, and if not, to recommend steps to enable IHDP to evolve to meet the changing landscape. It is essential that social scientists be brought in at the ground floor and take a lead role in reframing GEC questions and research goals in order to engage more pro-actively.

Facilitating Interdisciplinary, Multicultural Research Collaborations on the Policy-Relevant Human Dimensions of Global Environmental Change

The challenges posed by GEC cannot be met without strong input from a variety of academic disciplines and cultural perspectives. One key contribution that IHDP is ideally positioned to make is bringing together interdisciplinary research teams from around the world to ask crucial questions, generate reliable scientific findings, and present the policy implications of these findings. All IHDP projects operate under the guidance of the IHDP Strategic Plan 2007-2015 with its focus area of science-policy interaction. Several success stories could be reported in the past, such as the contributions of GECHS in contributing to the development of an IPCC special report on "Managing Risk of Extreme Events to Advance Climate Change Adaptation". For the coming years, the following projects are under consideration to meet this challenge:

Assessment of Social Structures and Values Related to Global Environmental Change

As human society enters the 2000's, we understand many of the physical dimensions of GEC, but less of the social, economic and cultural drivers as well as consequences of these changes. Further, we do not know how to effectively move societies in the direction of sustainable social and economic systems. IHDP will be actively involved in helping to develop a global collaboration of leading social scientists and others to conduct focused research on these questions, with input from the survey mentioned above (3.1.1.1). The goal of this project will be to develop better understandings of the social and cultural dimensions of GEC, to identify policy options associated with these understandings, and to initiate a process for discussing the normative aspects of these topics—i.e. what should be the objectives of any cultural and social change toward sustainability? This latter process must be extraordinarily inclusive if it is to be credible and effective.

Understanding Social Change through Behavioral Experiments

Theoretical and empirical research on social/behavioral change towards the goal of sustainability can be augmented by carefully-planned behavioral experiments. As an auxiliary to the above MAHB project (3.1.2.1), we are considering a series of behavioral experiments, designed to understand concrete mechanisms for altering key behaviors in the face of a rapidly-changing

environment. As with the normative discussion mentioned above, the goals of any such behavior change is a highly sensitive subject, and a highly ethical and inclusive process must be developed to direct the choice of goals and mechanisms for encouraging behavioral change.

Social Dimensions of a Green Economy
The concept of a Green Economy is often discussed or even adopted as a goal by various organizations and constituencies. However, the concept is generally defined in terms of energy efficiency, sustainable resource use, and minimizing environmental impacts. IHDP plans to explore, critically, the human dimensions (social and economic) of such an economy, identifying goals such as equity, inclusiveness, and compatibility with other important social and political values, while addressing one of the core human dimensions research foci: transitions. Research already completed by IHDP-IT will provide one starting point for this, and the "Rio+20 Process" presents the international process that will be targeted.

Inclusive Wealth Report
The Inclusive Wealth Report (IWR) project is a joint initiative of UNEP, UNU-IHDP and World Bank. The project aims at developing the first report on wealth and change in wealth in over 100 countries, with a focus on developing countries. The primary objective of the Inclusive Wealth Report is to supply quantitative information and analysis of the different kinds of wealth of nations: Natural Capital, Produced Capital, Human Capital and Social capital. The way in which nations manage their diverse sort of wealth over time may have crucial implications for a long term sustainable development.

Improving the Policy Impact of Human Dimensions Research

Ongoing and substantive interaction among scientists, decision makers and practitioners is vital to advance both research and the implementation of its recommendations. Policy relevance has to be one of the criteria for pursuing GEC research, and decision makers should be provided with opportunities, as well as capacities, to consult with scientists before making policy choices to ensure that the best available science is considered. Again, due to the cross-cutting nature of the task, activities addressing the interaction of science and policy will be largely developed, supported and implemented by the IHDP Secretariat.

Providing Rapid Assessments on Human and Policy Dimensions of Emerging Global Environmental Change Topics
Time and spatial scales can differ widely for different types of GEC research—and the changes themselves—and often, the changes outpace the response capacities. While core projects will remain a central building block of IHDP Science, the time lag between problems identified by the scientific community and their ability to deliver research findings and policy recommendations, needs alternative modes of response. Rapid assessments of the state of knowledge and policy options on emerging issues can help shorten this time lag by providing the science for appropriate policies to be designed and implemented. Chapter 3.1.2 presents suitable candidates for this research.

Participating in Policy Dialogue and Processes
IHDP will increase its efforts to identify policy implications of all project research findings, and develop strategies for bringing these policy options to the public and relevant decision makers.

We will continue to contribute to IPCC assessments, for example, by providing research results on issues such as equity and adaptation to the Fifth Assessment Report. Major opportunities will also arise from the established Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Two other major opportunities will come up in the coming years: (1) The Earth Summit 2012, or Rio+20 process, will focus on two main subjects on which IHDP has conducted substantive research in the past: a) international environmental governance and b) transitions towards a green economy. Timely retrieval of research results and providing them in formats targeting decision makers is therefore one strategy to enhance the science-policy dialogue. (2) With the target date for achieving the Millennium Development Goals (MDGs) approaching in 2015, it is ever more important to understand whether the goals are on track, and where additional efforts and support are needed. This opens additional prospects for an enhanced science-policy dialogue, and IHDP will develop a strategy to make best use of this opportunity.

Building Future Social Sciences Addressing Human Dimensions of Global Environmental Change

Building the Future Leaders in Human Dimension Science

Training in inter- and multidisciplinary research design gains more and more importance as the focus increasingly shifts towards applicable knowledge and practical, hands-on solutions. Social scientists will have to take into account natural sciences' methodologies, case studies and findings, and vice versa. At the same time, both scientists and policymakers have to determine common ground and find shared forms of communication so as to identify mutually beneficial solutions to emerging environmental challenges. This requires, among others, a move from supply- toward a more demand-driven research, while policymakers have to become more receptive to incorporating science-based solutions into decision making processes and hence, need to be trained as well, for example, by incorporating future decision makers into IHDP capacity development workshops. In this regard, IHDP will aim at formulating a new concept for the International Human Dimension Workshops (IHDW) within the framework of ISSC-led CoDATE initiative, including targeted training modules, a mentoring programme for aspiring leaders, and high-level segments for decision makers.

Social Science Capacities in Developing Countries are Strengthened

IHDP's Programme, implemented by its Secretariat, will contribute to institutional capacity development with a new strategy for its National Committees. National Committees vary in terms of structure, composition, modes of operation, capabilities, and levels of activities. While some committees have identified their key research areas and are carrying out extensive programmes of research, others are in their initial stages. Each National Committee develops its own terms of operation depending on specific needs, priorities and resources. However, the integrative approach of the NKGCF in Germany is indeed a model that will be very useful in setting up new committees or in restructuring established ones. IHDP will explore possibilities for seeding grants to establish such committees; support to developing countries in upgrading, strengthening or establishing national committees; and a survey on opportunities to coordinate national committees in e.g. regional centers of expertise.

Communication and Outreach

IHDP is Recognized by Major International Assessment and Policy Processes as the Key Social Science Partner

IHDP's value added toward addressing global needs in both policy and research resides in its convening power to mobilize and catalyze research and dialogue, its access to intergovernmental processes and its long-standing experience with multidisciplinary approaches, serving a diverse clientele as a dialogue facilitator and matchmaker.

IHDP's input into IPCC is well established and major opportunities will also arise from the newly established Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Pertaining to the policy processes IHDP will aim for, two major opportunities come to pass in the coming years. The Earth Summit 2012, or Rio +20 process, will focus on two main subjects on, which IHDP has conducted substantive research in the past: a) international environmental governance and b) green economy. Timely retrieval of research results and providing them in formats targeting decision makers is therefore one strategy to enhance the science-policy dialogue. Another will be to organize and convene a conference and science-policy symposium on the human dimensions in the Rio+20 process. Targeted policy briefs on key topics as well as side events at central multinational forums will be used to give more prominence to this important field of work within the coming three years.

Enhanced Visibility of IHDP as the Leading Provider of Social Science Research on Global Environmental Change

IHDP will develop a comprehensive communication strategy with particular elements targeting its key constituencies, i.e. the science and policy communities, as well as the media and the public. IHDP has a broad variety of tools and formats at its disposal for reaching out to the different audiences, such as print products (books, journal articles, policy briefs, etc.), and electronic products (IHDP update, its electronic newsletter E-Zine, press releases and its website). Giving these products, which have significantly improved in the past few years already, a distinctive IHDP "brand" will increase recognition and visibility, and opportunities will be explored to establish such an IHDP trademark, for example, within UNU Press, the scholarly publishing division of the UNU.

IHDP Science and Research Results are used in Policymaking and the Scientific Community

Identifying the most relevant external scientific events, policymaking processes and exchange platforms, is of equally high importance for communicating IHDP's research results. This will be paired with determining key brokers and communicators from IHDP's network for the targeted events and fora, so as to maximize its outreach.

Successful communication and outreach also requires good internal information networking. Therefore, an increased use of IHDP's website as a hub for information dissemination, as well as internal communication, will improve interaction among projects and between projects and the Secretariat.

Resource Mobilization

IHDP's Funding is Secured, Expanded and Increasingly Diversified

To achieve the ambitious goals formulated in the programmatic framework for the years 2011 – 2013 and beyond, IHDP needs to increase its existing funding base and explore additional sources, e.g. beyond strictly research-related funding agencies. Raising additional funds and engaging new sponsors, however, is a time-consuming task and requires a solid foundation from which to venture out. The Secretariat will therefore aims to at enlarge its core funding base in the first place, so as to be able to attract and mobilize supplementary project-based resources.

As outlined in the research component areas above, the opportunities are ample, benefiting from new momentum for social sciences on one hand, and, more particularly, in the field of horizon scanning on emerging issues, engagement with broader surveys and assessments of social sciences' contribution to GEC research, or new international processes such as IPBES on other hand. The Secretariat is therefore aiming to substantially increase its project-based resources, provided that its rising institutional funding is leaving room to allocate resources and also focus attention on additional fund-raising. Core funding sources could then be strategically used as leverage to attract further contributions. Given the existing opportunities, the Secretariat strives for a return on investment rate of 50% in the coming years, i.e. it aims at raising half of the amount it receives as institutional contributions as additional project-based funding.

13.2 Supporting Infrastructure Requirements

Through this strategic positioning and by further strengthening its contribution to GEC research, IHDP will continue to produce research results that will be even more targeted, policy-relevant and demand driven. Delivering such outcomes and services provides the basis for the engagement of new partners and broadening the portfolio. Hence, it is necessary to use a stable funding base as leverage for exploring additional opportunities for project-based funding.
A strong core funding base will not only allow the leveraging of substantive sums of additional project-based funding, but will contribute to furthering synergies among IHDP projects, its Secretariat functions, and the international GEC community, and actively responding to emerging issues and research gaps.

Incorporating such demand-driven and project-based research activities also requires adaptation in the Secretariat's structure, in order to be better able to act in response to such demands and to successfully coordinate a portfolio that is at the same time broader and more integrated, with added synergies among the research activities. This coincides with the transitional phase of IHDP having become a member of the UN family through its third institutional sponsor, the UNU, in 2007. The necessary governance reform, started in 2008, already resulted in a leadership transition in 2010 and will be completed within the coming funding cycle.

The IHDP Secretariat will also be restructured taking advantage of the UNU system and the support it gives on financial and administration issues. As a result, while the staffing table of the current funding cycle provides for 12 staff positions at the Secretariat, the proposed re-structuring reduces this number to 10 with much more focus on science and less on administration. Re-focusing staff tasks and responsibilities and moving from a large number of part time staff to a smaller number, highly experienced and motivated staff with longer terms of employment will compensate for such a strong reduction (-33%) and increase efficiency in the delivery of outcomes. UN integration, on the other hand, requires higher expenditures on some of the positions, notably the international ones.

Further core expenditures include the organization of science committee meetings, as well as funds to ensure the functioning of the Secretariat, i.e. for publications, synthesizing science findings from projects for policy, building the capacity of National Committees to undertake social science research, travel to international science events, communication and dissemination activities, and risk management.

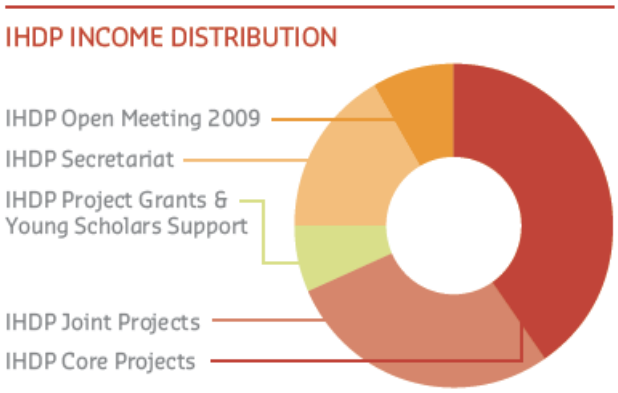
14. Financing and Budgets

14.1 Financial Report – 2009/2010

IHDP Network

IHDP's global research is driven by its core and joint projects and supported by the IHDP Secretariat. Together, the network accounted for an operational budget of 4.6 million USD, with research grants and direct support for the International Project Offices amounting to more than two thirds of the total.

IHDP 2009 – Network budget	In 1,000 USD	
IHDP Core Projects	$1878	40.5%
IHDP Joint Projects	$1300	28.0%
IHDP Project Grants and Young Scholars Support	$307	6.6%
IHDP Secretariat core (w/o IHDP Project Grants)	$770	16.6%
IHDP Open Meeting 2009	$383	8.3%
Total Income FY	**4638.0**	**100.0%**



The IHDP's decentralized 'network of networks' is funded from five main sources, including the direct research grants to the IHDP Core and Joint projects, the in-kind contribution provided by the institutions hosting the International Project Offices, and the core support for the IHDP Secretariat represented in this report. In addition, human dimensions research is supported with numerous singular grants for publications, events, workshops, and conferences convened by the projects or the programme. The most significant resource however is at the same time the hardest to quantify: the intellect, time and institutional support contributed 'for free' by the several

thousand scientists of the IHDP community, ranging from hosting of meetings, to high-level peer-reviews, to reports, to representation, to research results.

Network Income: Project income excluding transfers from IHDP

IHDP core projects	IT	GECHS	ESG	UGEC	LOICZ	GLP
IGBP					$ 14,500.00	$ 14,500.00
External Funds	$ 92,000.00	$ 198,500.00	$ -	$ 331,630.00	$ 13,450.00	$ 13,750.00
In-Kind Donations	$ 92,000.00	$ 67,530.00	$ 47,000.00	$ 75,000.00	$ 430,000.00	$ 192,822.00
Total	**$ 184,000.00**	**$ 266,030.00**	**$ 47,000.00**	**$ 406,630.00**	**$ 457,950.00**	**$ 221,072.00**
					Subtotal Core projects	**$ 1,582,682.00**

ESSP joint projects	GECAFS	GCP	GWSP	GECHH	
ESSP others	$ 21,750.00	$ 21,750.00	$ 21,750.00		
External Funds	$ 155,764.00	$ 475,000.00	$ 333,332.00	$ -	
In-Kind Donations	$ 50,000.00	$ 50,000.00	$ 90,000.00	$ 80,000.00	
Total	**$ 227,514.00**	**$ 546,750.00**	**$ 445,082.00**	**$ 80,000.00**	
				Subtotal ESSP projects	**$ 1,299,346.00**

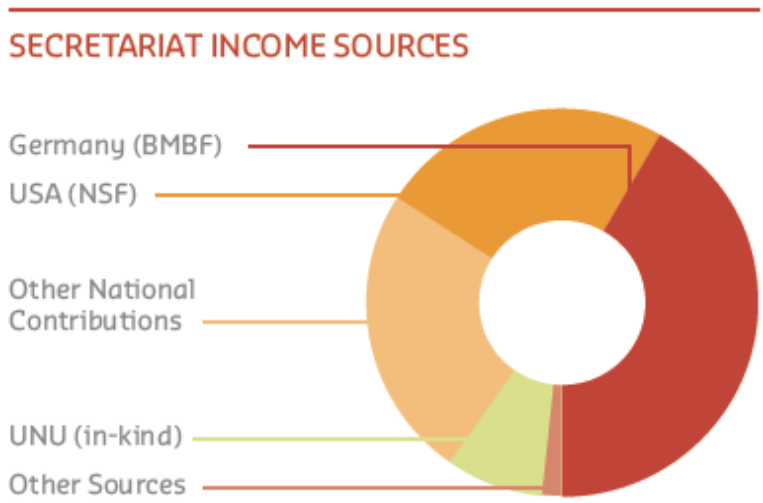
New initiatives	KLSC	IRG
External Funds		$ 295,647.00
In-Kind Donations		
Total	**$ -**	**$ 295,647.00**
		Subtotal new **$ 295,647.00**

Total Network $ 3,177,675.00

(all numbers as provided by the project offices)
Note: IHDP contributes $20,000 to its Core Projects and $10,000 to ESSP Joint Projects

IHDP Secretariat 2009

The IHDP Secretariat recorded a core income of 0.94 million USD (-4%); including the Open Meeting 2009, the total grant and revenue volume administered by the Secretariat stood at 1.46 million USD. As in the previous years, around 20% of the total revenue was directly relayed to the research network through annual project grants and support for young scholars. In general, the current income development marks a shift towards collaborative activities and project-based funding.



IHDP Secretariat Income 2009-2010

IHDP Secretariat Income (in USD)		
	2009	**2010 (estim.)**
Carry over from previous year	$15,393	$22,873
Core Grants	**$621,437**	**$591,537**
Germany	$392,952	$331,537
USA	$228,485	$260,000
National Contributions	**$227,315**	**$247,594**
France	$84,270	$81,633
Norway	$32,365	$32,000
The Netherlands	$26,350	$27,211
Austria	$11,158	$10,884
China (Beijing)	$21,067	$20,408
Switzerland	$11,934	$13,605
Spain	$ 30,120	$6,803
China (Taipei)	$5,000	$5,000
South Africa		$15,000
Finland	$5,050	$5,050
Sweden		$30,000[2]
In-Kind contribution UNU	$78,540	$78,540
Other contributions	$5,000	
Subtotal core budget	**$947,684**	**$940,545**
Project Income	$523,923	**$309,540**
IHDP Open Meeting 2009	$370,573	
Young Scholars Support	$144,970	
UNEP WWR/IPBES		$191,650
Packard Foundation		$94,000
Other Project Income	$8,380	$23,890
Total Income incl. Projects	**$1,471,607**	**$1,250,085**

[2] IHDP was invited to submit a request for funding from Sweden starting as of 2010.

IHDP Secretariat Expenses 2009-2010

IHDP Secretariat; Core Activities		
	Annual cost, in US $	
	2009	**2010 (estim.)**
Science		
Academic Staff	$229,528	$396,000
Academic Activities		
Grants IHDP Core and Joint Projects	$145,000	$120,000
Scientific Projects and Initiatives	$149,018	$186,000
IHDP Governance Meetings	$12,242	$40,000
Meetings and Science-Policy Activities	$29,361	$45,000
Sub-total Science	*$565,148*	*$787,000*
Administration		
Administrative Staff	$165,776	$160,000
Administrative Activities		
General Office Cost and Services	$25,348	$45,000
UN Campus facilities (provided in-kind by UNU)	$78,540	$78,540
Sub-total Administration	*$ 269,664*	*$283,540*
Communications and Outreach		
Communications and Outreach Staff	$75383	$42,000
Communications Activities		
IHDP Update Magazine and Scientific Publications	$13,567	$25,000
IHDP Communications and Outreach	$9,429	$9,000
Sub-total Communications and Outreach	*$98,379*	*$76,000*
Open Meeting 2009		
IHDP Open Meeting 2009	370,573	
Young Scholars Support[3]	144,970	
Sub-total Open Meeting 2009	*$515,543*	
Total Expenses incl. Projects	**$1,448,734**	**$1,146,540**
Projected Carry over	$22,873	$73,545

14.2 Future Budgets for 2011-20124

Integration into the UNU family will support IHDP's links with the international policymaking community, notably the UN, while providing regular networking opportunities with a group of strong policy-relevant research facilities. Although this will result in higher core costs for the IHDP Secretariat, it will at the same time offer added opportunities to attract additional funding through better positioning and higher visibility within the multilateral policy community. It is

[3] Some reporting still to be completed.
[4] IHDP, as a part of UN System, reports its budget biannually.

expected that IHDP Secretariat core funding will leverage project-based funding at a return on investment rate of 50% for the funding period 2011-2012.
This leads to an overall annual budget of US $ 1,770,000. While the IHDP Secretariat expects to receive about US $ 1.2 Million from its main supporting organizations and regular funding sources, it will use this funding base to leverage 50% as additional resources, i.e. about US $ 600,000.

IHDP Annual Budget 2011-2012

IHDP Secretariat Income 2011-2012 (in USD)		
	2011 (estim.)	**2012 (estim.)**
Carry over from previous year	**$73,545**	**$50,000**
Core Grants	**$660,000**	**$660,000**
Germany	$400,000[5]	$400,000
USA	$260,000	$260,000
National Contributions	**$288,000**	**$328,000**
France	$82,000	$82,000
Norway	$32,000	$32,000
The Netherlands	$27,000	$27,000
Austria	$11,000	$11,000
China (Beijing)	$20,000	$20,000
Switzerland	$14,000	$14,000
Spain	$7,000	$7,000
China (Taipei)	$5,000	$5,000
South Africa	$15,000	$15,000
Finland	$5,000	$5,000
Sweden	$30,000	$30,000
New national contributions	$40,000	$80,000
In-Kind contribution UNU	**$50,000**	**$50,000**
Subtotal core budget	**$1,071,545**	**$1,088,000**
Project Income	**$520,000[6]**	**$570,000**
Total Income incl. Projects	**$1,591,545**	**1,658,000**

IHDP Secretariat Expenses 2011-2012 (in USD)		
	2011 (estim.)	2012 (estim.)
Science		
Academic Staff	455,000	470,000
Academic Activities		
Core Projects	150,000	150,000
Joint Projects	75,000	75,000
Science Syntheses	60,000	60,000
Science Committee Meetings	50,000	50,000

[5] Proposal has been submitted to BMBF. Slight increase requested to cover inflation and exchange rate fluctuation.
[6] New potential projects to be secured.

Capacity Development - NC Meetings/Twinning	110,000	110,000
Sub-total Science	**$ 900,000**	**$915,000**
Administration		
Administrative Staff	80,000	82,000
Administrative Activities		
CSU – UN Campus Cost	35,000	35,000
General Office Expenses	25,000	25,000
Risk management	35,000	35,000
Sub-total Administration	**$175,000**	**$177,000**
Communications and Outreach		
Communication Staff	50,000	55,000
Communication Activities		
Publications	40,000	40,000
Travel	50,000	50,000
Communication and dissemination	35,000	35,000
Sub-total Communications and Outreach	**$175,000**	**$180,000**
Total Core Activities	**$1,250,000**	**$1,272,000**
Project activities		
Policy Dialogue	70,000	70,000
Young Scientists Leadership Program	200,000	200,000
Assessments and emerging issues (incl. e.g. Rio+20 & MDG 15)	150,000	200,000
Inclusive wealth report	100,000	100,000
Total Project Activities	**$520,000**	**$570,000**
Total Cost	**$1,770,000**	**$1.842,000**

15.Current and/or Future Programme and/or Funding Issues

IHDP core support is mainly provided by the German Federal Ministry of Education and Research (BMBF), while the remaining funds come from the U.S. National Science Foundation (NSF) and contributions from government donors, such as research councils. However, to achieve the Programme's ambitious goals detailed in its Strategy 2011-2013 (mentioned briefly in this report) and beyond, IHDP needs to increase its existing funding base and explore additional sources, e.g. beyond strictly research-related funding agencies. Three major challenges are reflected in the presented budget estimate for the coming two years:

- The core budget for 2011 presents a shortfall of $178,455 and of $184,000 in 2012. The shortfall arises because of the increase in funding for building social sciences capacity at the national and regional level which was not present in past budgets.
- The requested core income presents not only the basis for sustainable funding for the IHDP, but is also a pre-condition for leveraging project-related funding.
- The Belmont Challenge calls for an even greater effort to build capacity in GEC research at the national/regional level. This is particularly the case within the social sciences. IHDP

has been working in this realm for many years; however, the new strategic approach requests that this now be reflected within the budget of IHDP's core activities.

The IHDP Secretariat will therefore further explore other funding sources such as a broader base of national contributions, private foundations, as well as project based funding for assessments and research based on demand from international processes. Project funding for the Inclusive Wealth Report, contributions to the establishment of an IPBES and similar opportunities, the IHDP Secretariat has already demonstrated its ability in raising such additional contributions.

Raising additional funds and engaging new sponsors, however, is a time-consuming task and requires a solid foundation from which to venture out. The Secretariat will therefore aim at enlarging its core funding base to a critical level in the first place, so as to be able to attract and mobilize supplementary project-based resources.

As outlined in the research component above, the opportunities are ample, benefiting from new momentum for social sciences on one hand, and, more particularly, in the field of horizon scanning on emerging issues, engagement with broader surveys and assessments of social sciences' contribution to GEC research, or new international processes such as IPBES on other hand. The Secretariat is therefore aiming to substantially increase its project-based resources, provided that its rising institutional funding is leaving room to allocate resources and also focus attention on additional fund-raising.

Core funding sources could then be strategically used as leverage to attract further contributions. Given the existing opportunities, the Secretariat strives for a return on investment rate of 50% in the coming years, i.e. it aims at raising half of the amount it receives as institutional contributions as additional project-based funding.

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World Climate Research Programme (WCRP)

16.Executive Summary

WCRP made progress in improving the quality of seasonal forecast by continuing exploring multi-model ensembles tool and developing state-of-the-art data assimilation systems. WCRP promotes research to better understand key processes that are likely to contribute to improved seasonal forecasts, such as the Madden-Julian Oscillation, ENSO and Asian Monsoons. WCRP is actively engaged to improve climate projections with the launch of the Climate Model Intercomparison Project (CMIP5) that provides the framework for climate change modelling research and the basis for the next IPCC Assessment (AR5). As part of the CMIP5, WCRP is exploring the potential of decadal predictions that could provide useful information for developing adaptation strategies. WCRP is coordinating research efforts on improving regional climate predictions through a coordinated regional climate downscaling experiment (CORDEX). CORDEX is generating regional climate projections for many areas of the world with an initial focus on Africa.

WCRP in partnership with the Global Climate Observing System (GCOS) has been advocating for the development of global datasets of Essential Climate Variables (ECVs) and related variables. Such datasets are valuable as a basis for diagnostic studies and particularly for the evaluation of models. WCRP is committed to developing analytical and diagnostic techniques to create and reprocess data records and datasets related to ECVs to enhance their value to the international research community and other users of climate datasets.

WCRP is promoting the development of capacity through the promotion of regional analysis of global simulations from seasonal to centennial timescales and the analysis of regional modeling outputs from CORDEX. WCRP is also working closely with START on promoting research-policy dialogues in order to integrate climate change adaptation in development planning. The project is a collaborative effort between the WMO, UNEP, the IPCC, START, the Universities of Ghana and Dar es Salaam and the Bangladesh Centre for Advanced Studies.

WCRP is entraining as many scientists as possible, especially the early career ones, into its activities. Many of the scientific and technical workshops that WCRP organized during last year offered several travel grants to students and early career scientists. WCRP is planning to reinforce such support in future events. WCRP will continue to pursue its two pronged approaches to capacity building: 1) provide support to scientists from developing countries and 2) build the research community of the future to ensure the transfer of appropriate skills for the development of Earth system science.

WCRP is organizing an Open Science Conference (OSC), with active engagement of the international climate research community to be held in 24-28 October 2011, in Denver, Colorado, USA. More information on the conference can be found at: (http://conference2011.wcrp-climate.org/).

WCRP will continue to deliver the best available state of knowledge on climate variability and change to the decision-makers, in a manner consistent with the challenges and opportunities associated with prediction of weather and climate across all time and space scales. WCRP will focus its activities and partnerships on fulfilling the existing and emerging societal needs which includes climate extremes, sea-level variability and change, drought predictability and prediction, seasonal to multi-decadal predictability of Polar climate.

WCRP will support the implementation of the Global Framework of Climate Services by 1) strengthening and mainstreaming research observations to serve as prototypes for future climate observing systems;2) developing climate prediction systems with lead times from seasons to centuries; 3) ensuring development of reliable high-resolution products needed for climate adaptation and risk management; 4) promoting interdisciplinary research to develop sector applications, tools and tailored information; 5) facilitating flow of user requirements to the research community and climate services sectors through user feedback; 6) improving the availability of highly-skilled talent to undertake climate research, operational prediction, and communication, particularly in the developing regions/countries.

17.Introduction

The reporting period was characterized for WCRP by:

- organising climate research as a part of the global environmental change research, such as coordinated by the ESSP, and in response to the ICSU Visioning, WMO sponsored World Climate Conference-3 and IOC OceanObs'09 initiatives, strengthening the contributions to the Global Sustainability Research and development of 'seamless forecasting systems for weather, climate and other environmental conditions - to serve as a foundation for the emerging Global Framework for Climate Services;
- identifying areas of scientific focus and deliverables of high societal relevance and developing an implementation plan for the near term (2010-2015);
- developing a strategy for the longer term (post-2015);
- continuation of previously existing and, as well, formulation and launch of new, integrating research initiatives in support of the IPCC AR5 and the 2010 WMO/UNEP Scientific Assessment of Ozone Depletion;
- ongoing pan-WCRP efforts aimed at development of scientific activities for enabling prediction of seasonal and decadal climate variations and monsoons, studies of sea level;
- further advances in fundamental climate research undertaken by WCRP core projects and coordinating activities by its Working Groups;
- leadership, coordination and support activities in climate observations, process studies, modelling, and integration of knowledge in assessments and predictions
- education and capacity development initiatives; and
- focus on resource mobilization and financial health of the Programme

18. Activities in 2010 – Highlights

Since the IGFA meeting in 2009, WCRP has continued active support to and promotion of global coordination and integration of climate research, modelling and prediction activities through sponsoring several conferences, workshops, meetings and symposia focused on all aspects of Earth's climate system (i.e. oceans, atmosphere, cryosphere and land-surface). WCRP pursues its research objectives through observations, process-understanding research, modelling and analysis, with an emphasis on practical results of regional and global importance. The central focus of the WCRP Strategic Framework for the years 2005-2015 (http://www.wcrp-climate.org/documents/WCRP_IP_2010_2015.pdf) is to translate achievements in fundamental understanding of climate processes contributing to the variability and change in global and regional climate conditions into a range of information products such as seasonal, regional and decadal climate predictions, projections and assessments of high societal value for a broad range of users. WCRP keeps bringing together scientists from around the world to formulate new research agendas and to leverage scientific know-how between researchers and across disciplines and between developed and less developed countries.

WCRP continues to inform the UNFCCC process making an important contribution to the development of the post-Kyoto regime. WCRP also made great strides in transferring the scientific information and knowledge about the Earth's climate system for policy decisions through the IPCC, the UNFCCC Conference of Parties and its Subsidiary Body for Scientific and Technological Advice (SBSTA). Through the Program for Climate Model Diagnostics and Intercomparisons WCRP provides world-wide access to its climate predictions/projections and research results enabling scientists including ones from developing and least developed nations to assess the potential consequences of climate variability and change on major economic sectors (e.g. food, water, energy, health, etc.), for their country or geographic regions.

As a part of the Earth System Science Partnership, WCRP continues to build on its existing partnerships with other international research programmes such as the International Geosphere-Biosphere Programme (IGBP) on biogeochemical aspects, the International Human Dimensions Programme on Global Environmental Change (IHDP) on social and human dimensions of climate change research, and with the global Change SysTem for Analysis, Research and Training (START) and regional organizations such as the Asian-Pacific Network (APN) and the Inter-American Institute (IAI) on capacity building, education and outreach.

19. Program Highlights

Paving the Way for Future Climate Predictions and Assessments

WCRP has been actively engaged in setting the stage for new and improved climate predictions and projections for a variety of future assessments including the Fifth IPCC Assessment Report (AR5). The WCRP's Working Group on Coupled Modelling (WGCM) has launched the next climate model intercomparison project (CMIP5, http://cmip-pcmdi.llnl.gov/cmip5/) that provides the framework for climate change modelling research for the next five years and the basis for the

next IPCC Assessment (AR5). Over 20 global modeling groups are involved in model experiments in order to evaluate how realistic the models are in simulating the recent past climate and provide projections of future climate change.

CMIP5 models and experiments address two time frames and two sets of science questions on future climate change. The near-term (2005-2030) "decadal prediction" experimental protocol provides an opportunity for the international coordination of research on the mechanisms associated with regional variability of climate and its predictability. Demonstrations of skill of projecting/predicting climate variability and change on decadal and longer timescale would be of great practical value to planners and decision makers. The long-term (to 2100) simulations are performed by climate system models as part of a coupled biophysical-climate and integrated Earth system model assessment approach. The models are using mitigation/adaptation scenarios with implicit policy actions to develop future adaptation, mitigation and risk management strategies. The challenge is to use climate models to quantify time-evolving regional climate changes to which human societies will have to adapt. All CMIP5 results will be available to researchers around the world without any restriction, and the findings of such research will be published in the open and peer reviewed literature for use by decision makers.

Regional climate downscaling

Regional climate predictions were identified in the IPCC AR4 follow-up evaluations as the major area of research needing improvements. In order to foster coordination between regional downscaling efforts around the world, and to assess and understand the sources of uncertainty in regional climate projections, the WCRP Task Force on Regional Climate Downscaling (RCD) (http://wcrp.ipsl.jussieu.fr/SF_RCMTerms.html) launched the Coordinated Regional Climate Downscaling Experiment (CORDEX, http://wcrp.ipsl.jussieu.fr/SF_RCD_CORDEX.html). CORDEX is a framework to look at the regional changes and variability in climate and associated environmental/ecosystems conditions with the evolution of GHGs, aerosols, land use changes, etc, and to generate regional climate projections for many areas of the world with an initial focus on Africa, with spatial resolution not less than 50 km resolution. The ERA-Interim re-analyses will serve as boundary conditions over the period 1989-2007. Global modelling groups are committed to provide the necessary boundary conditions based on the CMIP5 results. More than 12 modelling centers from around the world are participating in CORDEX and several countries have offered to host the data and information resulting from CORDEX, similar to CMIP for global climate model intercomparisons. The project is well underway and is becoming a reference for the community.

In close coordination with the international programmes such as IPCC Working Groups I and II, WCRP has sponsored a series of workshops to facilitate the production of climate information and its use in impacts, adaptation and vulnerability assessments. In June 2010 WCRP organized a regional climate workshop in Lille, France, that was attended by 60 leading international experts. The discussions led to a unifying vision of and approach to developing regional climate research and fostering its interaction with and contribution to the work of IPCC WGI and WGII (http://wcrp.ipsl.jussieu.fr/Workshops/RegionalClimate/index.html).

Assessing the depletion of stratospheric ozone and predicting its recovery

The WCRP's Stratospheric Processes And their Role in Climate (SPARC) Project has achieved outstanding progress in improving chemistry-climate models (CCMs) through process-oriented evaluation. Around 100 scientists have analyzed the output of 18 CCMs for the Phase 2 of the SPARC Chemistry-Climate Model Validation (CCMVal-2). A key aspect of their most recent report (http://www.pa.op.dlr.de/CCMVal/SPARC_CCMValReport/SPARC_CCMValReport.html). is the application of observationally-based performance metrics to quantify the ability of models to reproduce key processes for stratospheric ozone and its impact on climate. It resulted in considerably substantiated projections of stratospheric ozone. The Report is targeted at a variety of users, including the international climate science assessments such as WMO/UNEP Ozone Assessments and the IPCC Assessment Reports. Having been a part of the implementation of the Montreal Protocol since 1989, these assessments help the Parties to reach informed decisions on controls to protect the ozone layer.

Advances in Seasonal to Decadal Prediction

The Climate-system Historical Forecast Project (CHFP) of the WCRP Working Group on Seasonal to Interannual Prediction (WGSIP) is a multi-model and multi-institutional experimental framework (http://www.clivar.org/organization/wgsip/chfp/chfp.php) to bring together the climate change and seasonal prediction communities in producing sub-seasonal to decadal climate predictions The CHFP takes into account the combined effects of anthropogenic influences and natural variability on the observed current climate changes. The main assumption is modeling and predicting a regional climate anomaly requires proper treatment of the effects of sea-surface temperature, sea ice, snow cover, soil wetness, vegetation, stratospheric processes, and atmospheric composition (carbon dioxide, ozone, etc.) in the predictive model. Cooperation between the CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP) and climate researchers associated with the WMO's Regional Climate Outlook Fora (RCOFs) will make sure that CHFP work will be used by communities involved in the practical seasonal prediction. CHFP will also make an attempt to address the difficulties of predicting seasonal monsoon fluctuations.

Decadal predictability is a major focus for WCRP. Many activities are aimed at understanding predictability on decadal time scales. Currently there is little scientific understanding as to whether climate can be predicted up to a few decades in advance with a skill sufficient for practical applications. Recent studies have shown that predictability can be obtained in complex numerical climate models, based on the long-term memory that resides in the ocean. The near-term CMIP5 simulations will feed into the IPCC 5th Assessment and it is expected that the ensemble of decadal predictions will be used in the process to develop adaptation strategies, as many investments on infrastructure and in industry are paid of in decades. The WCRP recognizes the potential of decadal predictions and has organized a series of workshops to address the scientific aspects of generating decadal predictions:

- Workshop on Earth-System Initialization for Decadal Predictions, 4-6 November 2009, De Bilt, the Netherlands http://www.knmi.nl/samenw/easyinit/index.html
- Workshop on Predicting the Climate of the Coming Decades, 11-14 January 2010, Miami, USA http://www.clivar.org/organization/decadal/rsmas_decadal/rsmas_decadal.php

- Workshop on Decadal Variability, Predictability and Prediction: understanding the role of the ocean, 20-23 September 2010, Boulder CO, USA
  http://www.clivar.org/organization/wgomd/decadal/decadal.php

In 2011, WCRP will continue to assess the potential decadal predictability arising from the ocean and stratosphere. Modelling of the role of stratosphere-troposphere coupling for decadal scale predictions will be a subject of research in the context of the DynVar activity and SPARC Gravity-wave initiative. The importance of changes in atmospheric composition (especially ozone depletion and recovery, which has a strong decadal timescale signature), solar variability and volcanic eruptions will be studied as part of the SPARC CCMVal.

Research on El Niño-Southern Oscillation

The WCRP has long recognized the central importance of an improved understanding and predictability of ENSO by encouraging coordinated research in tropical climate variability via its different expert panels and working groups (Pacific, Indian, Seasonal to Interannual Prediction...). Most recently, WCRP has organized a

- workshop on ENSO, Decadal Variability and Climate Change in South America, 12-14 October 2010, Guayaquil Ecuador
  http://www.clivar.org/organization/pacific/meetings/enso/enso_2010.php

Over the past few years, new promising methods have emerged which can improve ENSO simulation, for example by combining ENSO theoretical frameworks and GCM modelling or by using initialized hindcasts and by utilizing the recent wealth of high-quality observations to understand errors and their growth in forecast systems. By focusing on the very key processes affecting ENSO dynamics, these new approaches have a strong potential to accelerate progress and improve representation of ENSO in complex climate models. Not only can these new methods help address the question of how ENSO is changing in a changing climate, but potentially they can also improve reliability of centennial-scale climate projections. The CMIP5, which will feed into the IPCC 5th Assessment, provides a new opportunity to evaluate current research in the process-based evaluation of ENSO in GCMs. These issues will be discussed at a

- workshop on new strategies for evaluating ENSO processes in climate models, 17-19 November 2010, Paris France.

Advancing research on monsoon systems

Through the joint efforts of CLIVAR and GEWEX, WCRP has achieved progress in coordinating the monsoon prediction research in several regions. In Asia, major monsoon research activities and field projects are being planned in China, Japan, India, Korea, and other Asian countries in the timeframe of 2008-2010. WCRP led the integration of these scientific programmes under the Asian Monsoon Years initiative (AMY - 2007-2012; http://www.wcrp-amy.org). AMY implementation includes 24 regional field projects and model integration studies, such as the Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI), to improve understanding and prediction of the Asian monsoon system.

WCRP with partners organized a

- workshop on Modelling Monsoon Intraseasonal Variability in Busan, Korea, on 15-18 June 2010 (http://www.ucar.edu/yotc/documents/mjo/KoreaWkshp.html)

with a focus on modelling and prediction of monsoon intraseasonal variability (ISV). Monsoon variability is dominated by ISV, and accurate prediction of monsoonal features such as onset, duration, and spell-characteristics that manifest themselves in ISV will potentially have wide application in agriculture, water resource management, disease control, etc. However, simulation, much less prediction, of monsoon ISV remains a challenge. The workshop provided an up-to-date assessment of the current capability to predict and simulate monsoon ISV and insights into the problems and issues that need to be addressed to move modelling capability forward.

Active monsoon research is ongoing as well in Americas and Africa through the CLIVAR Variability of the American Monsoon Systems (VAMOS, http://www.clivar.org/organization/vamos/vamos.php) programme, the African Monsoon Multidisciplinary Analysis (AMMA, http://amma-international.org/), and several other initiatives.

Representation of organized tropical convection in GCMs

The realistic representation of tropical convection in our global atmospheric models is a long-standing grand challenge for numerical weather forecasts and global climate predictions. Our lack of fundamental knowledge and practical capabilities in this area leaves us disadvantaged in modeling and predicting prominent phenomena of the tropical atmosphere such as the ITCZ, ENSO, monsoons and their active/break periods, the MJO, subtropical stratus decks, near-surface ocean properties, tropical cyclones, and even the diurnal cycle.

To address this challenge, WCRP and the World Weather Research Programme (WWRP)/The Observing System Research and Predictability Experiment (THORPEX) have initiated a year of coordinated observing, modelling, and forecasting with a focus on organized tropical convection, its prediction, and predictability (Year of Tropical Convection, YOTC http://www.ucar.edu/yotc/). By exploiting the vast amounts of existing and emerging observations, expanding computational resources and the development of new, high-resolution modelling frameworks, YOTC will help to advance diagnosis, modelling, parameterization, and prediction of multi-scale tropical convection and two-way interaction between the tropics and extratropics with an emphasis on the intersection between weather and climate. YOTC activities were initiated during the summer 2008 and will contribute to AMY and the THORPEX Pacific Area Regional Campaign (TPARC), as well as to the United Nations Year of Planet Earth.

Assessing Cloud-Climate Feedbacks

Owing to the strong interaction of clouds with the local energy balance, the atmospheric circulation and the hydrological cycle, biases in the models' representation of clouds and moist processes are also critically problematic for the reliability of climate predictions at regional scales. To improve this situation, the GCSS (GEWEX Cloud System Study) and WGNE (Working Group on Numerical Experimentation) are working on the second phase of the Cloud Feedback Model Intercomparison Project (CFMIP2, http://cfmip.metoffice.com/CFMIP2.html) to combine new observations from field campaigns and satellites with results from theoretical and cloud resolving modelling studies and parameterization developments.

Many resources are now available to observe clouds, such as the A-Train constellation of satellites, long time series of ground-based observations from instrumented sites and many observational campaigns. On the modelling side, cloud-resolving models (CRMs) and large-eddy simulation models (LES) are now run on increasingly large space and time scales, and a new generation of climate models is emerging that uses CRM physics in place of conventional parameterizations, enabling global simulations of the Earth's atmosphere. The close collaboration between GEWEX and WGNE ensures timely transition of these capabilities to the operational meteorological services and direct benefit to the society in managing the risks of high-impact weather-related hazards for saving lives and properties

Assessing Sea-level Variability and change

In 2009 the WCRP and IOC (Intergovernmental Oceanographic Commission of UNESCO) established the WCRP-IOC Task Group on Sea-Level Variability and Change (http://www.wcrp-climate.org/SeaLevel.shtml). The decision was made by the 30th Session of the WCRP Joint Scientific Committee (6-9 April 2009) and it was endorsed by the 25th Assembly of IOC (16-25 June 2009). The Task Group addresses issues relevant to sea-level rise, both its global average and also its variability in space and time. The overall goal of the group is to improve our ability to monitor, explain, predict global and regional sea level and all environmental factors related to it, and use this information for decision making.

For the UNFCCC COP15 (Copenhagen, Denmark, December 2009), WCRP and WMO published an Update on Sea-Level (SL) variability and change (http://www.wcrp-climate.org/documents/sea_level_4page_web_EN-1.pdf). The document reviews recent assessments of contributions to sea-level rise from the loss of mass of glaciers and ice sheets, combined with corrected estimates of the oceans' thermal expansion, resulting in the combined contributions to sea-level change. These derived estimates matched very closely, for the first time, the observed values from the satellites and tide-gages. This was a fundamental achievement demonstrating our capability to explain the observed SL changes at the global scale. It also serves as the foundation for more substantiated assessment of the future SL variability and change, both in time and space. A major challenge is now to assess the impacts of global sea-level variability and change regionally on coastal ecosystems and settlements. This is now a priority area of research for CliC and WCRP, in partnership with other international research programmmes.

As a result of the workshop organized in June 2006 by WCRP and IOC, the book "Understanding Sea-Level Rise and Variability" has been published in August 2010 (http://eu.wiley.com/WileyCDA/WileyTitle/productCd-1444334514.html). The book identifies the major impacts of sea-level rise, presents up-to- date assessments of past sea-level change, thoroughly explores all of the factors contributing to sea-level rise, and explores how sea-level extreme events might change. It identifies what is known in each area and what research and observations are required to reduce the uncertainties in our understanding of sea-level rise so that more reliable future projections can be made. A synthesis of findings provides a concise summary of past, present and future sea-level rise and its impacts on society.

Understanding and characterizing the changes in climate extremes

WCRP research on "Climate Extremes" is focused on the design of an inter-comparison framework through which both observations and climate model representations of extremes and projections of climate can be assessed, and by which changes in climate extremes can be better evaluated. The scope of the considered phenomena includes prolonged drought and cold periods and the intensity of monsoons, the probability of occurrence of short time scale extreme events dependent on mean climate characteristics: tropical cyclones, mid- and high-latitude storms, severe frosts, air pollution extremes and heavy precipitation. In recent years, the occurrence of extreme events as well as the associated damage has increased. The overall aim of this activity is to accelerate progress on the prediction/projection of climate extremes with a focus on developing capabilities and products which facilitate practical applications for stakeholders in regions/sectors around the world.

In partnership with UNESCO, WCRP is hosting a workshop on metrics and methodologies of estimation of extreme climate events in Paris, France, on 27-29 September 2010 (http://www.extremeworkshop.org/). Representatives from fields as diverse as meteorology, statistics and re-insurance will come together to review and assess the existing means of observing and defining extreme climate events and discuss how these can be strengthened. The main objective of the workshop is to develop an optimal strategy to improve our ability to estimate the risk of climate extremes occurring in a changing climate.

Drought has been identified as an important focus of the WCRP extremes activity and a major international workshop is being organized for early 2011 to maximize synergy amongst existing drought research activities worldwide and to identify areas of research that are lacking or need to be strengthened through WCRP Projects and activities.

Research in support to the Global Framework for Climate Services

WCRP scientists played a major role in the success of the World Climate Conference-3 held in Geneva on 31 August – 4 September 2009. The High-level segment of WCC-3 agreed to establish a Global Framework for Climate Services (GFCS) to strengthen production, availability, delivery and application of science-based climate prediction and services. Strengthening of both GCOS and the WCRP were seen as key to a successful GFCS. The JSC, at its most recent session, heard reports from Japan, Canada, France, UK, Germany and USA on their plans for climate services, including current or anticipated requirements from WCRP. In all cases climate research was seen as a key element, although whether it would be carried out within the context of the climate service or as a parallel activity varied from country to country. Development and assessment of the most effective use of multi-model ensembles and provision of climate information at the regional level for risk management and adaptation measures are seen as a key role for WCRP. A WCRP Task Force has been formed to further scope the role of science in support of climate information services.

Main focus of WCRP core projects' activities in 2009 and 2010 and some of their outcomes

WCRP/IASC/SCAR CliC:

- Studies of mass balance of Greenland and Antarctica and detection of total mass loss in Antarctica, prolonged data series for surface melt in Greenland, new assessments of satellite – based mass balance estimation errors from major cryospheric missions)
- Design of the WMO Global Cryosphere Watch concept – to be considered by the WMO Congress in 2011.
- Jointly with Arctic Monitoring and Assessment Programme and International Arctic Science Committee, completion of the first draft of the Snow, Water, Ice and Permafrost in the Arctic (SWIPA) Assessment, which contains the most authoritative, to date, analysis of the state of the Arctic cryosphere and its predictions based on the WCRP CMIP3 datasets.
- Regional activities, in Asia and South America, with a conference "Ice and Climate Change: A View from the South" held in Valdivia, Chile, 1-3 February 2010.
- Summer school on ice-sheet modelling for the 21st century (Portland, USA, August 209)
- Research on in situ observations of Arctic sea ice, release of first comprehensive datasets containing estimates of sea-ice thickness.
- Arctic sea-ice prediction research, analysis of the role of shorter term variability of the atmosphere and ice in the long-range evolution of the Arctic Sea-ice cover, with a WCRP White Paper on the rapid loss of Arctic sea-ice.
- Contribution to polar observing systems, with the Southern Ocean Observing System having been offered for an open review.
- Multiple new datasets (on sea-ice concentration, glacier inventories and numerical descriptions, snow mask, snow cover, snow cover water equivalent from the EuroCryoClim and GlobSnow.
- Formation and initiation of activities of the CliC Working Groups on Arctic and Southern Ocean sea ice.

CLIVAR:

- Coordination of the WCRP activities in the areas of seasonal and decadal prediction, monsoons, climate extremes (the latter two with GEWEX) and conduct of research in all these areas of activity.
- Contribution to the studies of anthropogenic climate change.
- A variety of oceanographic and climate studies in the Atlantic, such as AMMA, PIRATA, Atlantic Meridional Overturning Circulation. Tropical Atlantic Climate Experiment, South Atlantic Meridional Overturning Circulation, Arctic –SubArctic Ocean Fluxes, contribution to CLIMODE.
- Design of Indian Ocean Observing System, together with IOC and GOOS.
- Participation in the Southwest Pacific ocean Circulation and Climate Experiment.
- Continuation of studies on ENSO predictability and prediction.
- Development of the Southern Ocean Observing System.
- Development of ocean reanalyses and their assessment.
- Coordinating Ocean-Ice Reference Experiments.
- A variety of studies of the Madden – Julian Oscillation.

- A variety of activities associated with the Variability of the American Monsoon System Panel (such as MESA, NAME, VOCALS, studies in the domains of seasonal prediction, climate extremes).
- A variety of activities under the Variability of the African Climate System Panel including the Horn of Africa RCM Intercomparison.
- Focussed research on seasonal to interannual prediction with dedicated numerical experiments.
- Decadal and Centennial climate predictions under CMIP5.
- A variety of paleo – climate studies, together with the IGBP Project Pages.
- Development of climate change and variability indexes, together with WMO CCl and JCOMM.
- Research on droughts.

GEWEX:

- Coordination of the WCRP research on monsoons and climate extremes (with CLIVAR) and conduct of research in all these areas of activity.
- Contribution to the studies of anthropogenic climate change.
- Preparation of a major International Scientific Conference on the Global Energy and Water Cycle, August 2009, Melbourne, Australia.
- Preparation of the ESA/GEWEX Water Cycle Project Kickoff Conference, November 2009, Frascati, Italy.
- A series of regional studies under CEOP and other GEWEX activities aimed at developing water and energy cycle data sets of assured quality, with an attempt to resolve a variety of spatial scales in observations and upscale them.
- Studies of climate extremes and water cycle in high elevations.
- Development of new hydrologic and land surface schemes, their testing in practical applications.
- Advanced research on and research – quality satellite observations of clouds, radiation, surface fluxes.
- Studies of predictability associated with water cycle elements.
- Development of high-resolution data assimilation systems for atmospheric and surface processes with focus on water cycle variables.
- Scientific support to the Integrated Global Water Cycle Observations Theme, and to water cycle activities contributing to GEOSS.
- Massive preparation for reprocessing of satellite records for future climate system reanalysis.

SPARC:

- Continuing the WCRP and IGBP activity on Atmospheric Chemistry and Climate focussing on modelling of inert tracers, aerosols, tropospheric ozone and methane chemistry,
- Key contribution, through SPARC's CCMVal and beyond it, to the 2010 WMO/UNEP Scientific Assessment of the stratosphere ozone depletion. Research on the ozone layer recovery and creation of scientific basis of its prediction. Bridging IPCC climate and ozone layer predictions. Studies of the role of halogen chemistry in ozone depletion.

- Scientific assessment of water vapour in the stratosphere, stratospheric aerosols, and trends of temperature in the stratosphere.
- Major contribution to the integration of research on polar climate predictability.
- Contributions to the WCRP research on seasonal prediction, stratospheric subcomponent of the CHFP set of experiments.
- SPARC DynVar studies of the dynamical two-way coupling between the stratospheric and tropospheric circulation using both simplified theoretical and comprehensive atmospheric general circulation models with a focus on stratospheric impact on tropospheric circulation, ocean circulation, the cryosphere, and tropospheric intraseasonal variability.
- Studies of gravity waves and associated dynamical effects in the stratosphere.

Significant WCRP meetings and conferences in 2009

12-14 Jan	12th session of the Working Group on Seasonal to Interannual Prediction (WGSIP), Miami, USA
19-23 Jan	21st session of the GEWEX Scientific Steering Group, Irvine, USA
26-27 Jan	First CliC Workshop on Arctic surface-based sea- ice observations: Integrated protocols and coordinated data acquisition, Tromsø, Norway
11-13 Feb	Workshop on Evaluating and Improving Regional Climate Projections, Toulouse, France
11-13 Feb	CLIVAR- Spain workshop on Climate in Spain: Past, Present and Future, Madrid, Spain
16-18 Feb	Southern Ocean Panel meeting, Sydney, Australia
3-6 Mar	Joint IPCC-WCRP-IGBP Workshop: New Science Directions and Activities relevant to the IPCC AR5, Honolulu, USA
6-9 Apr	Thirtieth session of the Joint Scientific Committee (JSC), College Park, USA
27-29 Apr	Meeting of the Working Group on Ocean Model Development (WGOMD) and Workshop on Ocean meso-scale eddies: representations, parameterizations and observations, Exeter, UK
4-8 May	2nd Lund Regional-scale Climate Modelling Workshop: 21st Century Challenges in Regional-scale Climate Modelling, Lund, Sweden
19-22 May	Sixteenth session of the CLIVAR Scientific Steering Group, Madrid, Spain
2-14 August	Marine Ecosystems and Climate: Modeling and Analysis of Observed Variability, Boulder, USA
21-25 Sept.	OceanObs'09 Ocean Information for Society: Sustaining the Benefits, Realizing the Potential, Venice, Italy
28-30 Sept.	13th session of the Working Group on Coupled Modelling, San Francisco, USA
26-30 Oct.	17th session of the SPARC Scientific Steering Group, Kyoto, Japan
2-6 Nov.	CAS/JSC Working Group on Numerical Experimentation (25th session) and GEWEX Modelling and Prediction Panel (11th session), Offenbach, Germany
4-6 Nov.	CLIVAR Workshop: Earth-System Initialization for Decadal Predictions Workshop, Utrecht, The Netherlands

11-13 Nov.	4th session of the CLIVAR GSOP, Tokyo, Japan

Significant WCRP meetings and conferences in the first part of 2010

31th Session of the WCRP Joint Scientific Committee (Antalya, Turkey, 15-19 February 2010)

WCRP convened its annual Joint Scientific Committee (JSC) in Antalya, Turkey, 15-19 February 2010 (http://www.wcrp-climate.org/jsc31/index.html). The meeting had two main foci: the programme's long-term strategy and the role of WCRP research in the Global Framework for Climate Services (GFCS). The agenda included a joint symposium on the role of Research in Climate Services with the WMO Commission for Climatology (CCl), as a part of the Technical Conference on Changing Climate and Demands for Climate Services for Sustainable Development (http://www.wmo.int/pages/prog/wcp/TechnicalConferenceAntalya.html). The main outcome of the joint symposium is agreed collaboration between climate research and services addressing the urgent needs for regional and national climate prediction systems with lead times from season to decades and longer towards meeting the need for climate information for adaptation and risk management. A joint statement was developed and approved by the participants (http://www.wcrp-climate.org/documents/Resolution_CCl_WCRP_2010.pdf).

Other 2010 meetings are listed in the table below.

11-15 Jan.	CLIVAR Workshop: "Predicting the climate of the coming decades", Miami USA
25-29 Jan.	22nd session of the GEWEX Scientific Steering Group, New Delhi, India
4-9 Feb.	6th session of the CliC Scientific Steering Group, Valdivia, Chile
29-31 March	4th session of the WCRP Observation and Assimilation Panel (WOAP), Hamburg, Germany
13-16 April	11th Science and Review Workshop for the Baseline Surface Radiation Network (BSRN), Queenstown, New Zealand
19-23 April	5th International CLIVAR Climate of the 20th Century workshop (C20C), Beijing, China
17-20 May	17th session of the CLIVAR Scientific Steering Group, Boulder, USA
4-5 June	2nd CliC Arctic Sea Ice Workshop, Tromso, Norway
8-10 June	4th HyMeX Workshop, Bologna, Italy
14-16 June	WCRP workshop on regional climate: Impacts, Adaptation and Vulnerabilities, Lille, Lille
14-18 June	6th Study Conference on BALTEX, Miedzyzdroje, Poland

15-18 June	YOTC Workshop on Modelling Monsoon Intraseasonal Variability, Busan, Korea
18-19 June	10th Session of the CLIVAR AAMP, Busan, Korea
7-9 July	THORPEX Predictability and Dynamical Processes Working Group and WGNE Workshop "Diagnosis of Model Errors", Zurich, Switzerland
12-14 August	International CliC and IACS Conference on Cryospheric Changes and its Influences: Cryospheric Issues in Regional Sustainable Development, Lijiang, China
23-27 Aug.	2nd Pan-GEWEX Meeting, Seattle, USA
20-23 Sept.	CLIVAR WGOMD-GSOP Workshop on Decadal Variability, Predictability, and Prediction: Understanding the Role of the Ocean, Boulder, USA
27-29 Sept.	WCRP-UNESCO (GEWEX/CLIVAR/IHP) Workshop on metrics and methodologies of estimation of extreme climate events, Paris, France
4-6 Oct.	14th session of the Working Group on Coupled Modelling (WGCM), Exeter, UK
6-8 Oct.	WWRP-THORPEX/WCRP Polar Prediction Workshop, Oslo, Norway
6-8 Oct.	CliC/IARC Workshop on Rapid Change in Arctic Sea Ice: Assessing Drivers and Future Trajectories, Fairbanks, USA
12-14 Oct.	International Workshop on ENSO, Decadal Variability and Climate Change in South America, 'Trends, teleconnections and potential impacts´, Guayaquil, Ecuador

20. Communication and Education Activities

WCRP launched a new website (http://www.wcrp-climate.org/) with improved navigation and look. The website regularly features science highlights and programme news. WCRP publishes a quarterly e-zine (http://www.wcrp-climate.org/newsletter.shtml) that reaches about 2000 subscribers. WCRP issues press releases on major topics of climate research relevance in association with WMO media office, and the host institutes for WCRP Projects in Canada, France, Norway, United Kingdom and USA.

All WCRP Projects publish their Newsletters, which regularly highlight the latest scientific challenges and progress:

- Ice and Climate (by CliC), http://www.climate-cryosphere.org/en/disc/newsletters.html
- Exchanges (by CLIVAR), http://www.clivar.org/publications/exchanges/exchanges.php
- GEWEX News, http://www.gewex.org/gewex_nwsltr.html
- SPARC Newsletter. http://www.atmosp.physics.utoronto.ca/SPARC/newsletters.html

WCRP is actively working on engaging the international climate science community and entrain as many scientists as possible, especially the early career ones, into its activities. WCRP recognizes that its success depends on engaging the next generation of scientists as well as increasing the scientific capacity in developing regions and countries.

In the WCRP Implementation Plan 2010-2015, published in August 2009 (full text available at http://wcrp.wmo.int/documents/WCRP_IP.pdf), WCRP puts high priority on providing opportunities to early career scientists and scientists in the developing regions/nations to attend training seminars and participate in WCRP-sponsored scientific and technical meetings, workshops and conferences. Most of these activities are coordinated closely with other education and outreach programmes (START, ESSP, IRI, World Bank, etc.).

WCRP's contributions to the capacity development in many countries are associated with the use of accessible numerical climate projections/predictions in both scientific research as well as analysis in support of decision makers. For example, WCRP is promoting regional analysis of global simulations within the seasonal to interannual prediction project, CHFP, decadal and centennial predictions of CMIP5, analysis of regional modeling outputs within CORDEX, and through the regional panels of CLIVAR and GEWEX Projects (e.g. VAMOS, VACS, AAMP RHPs).

WCRP supported the Training Institute on the use of seasonal Climate Predictions for applications in Latin America that was held in Buenos Aires, Argentina on 2-13 August 2010 (https://iaibr3.iai.int/twiki/bin/view/TIClimatePredictions2010). The Training Institute was hosted by the School of Exact and Natural Sciences of the University of Buenos Aires (FCEN/UBA) in collaboration with the Inter American Institute (IAI) and the International Research Institute for Climate and Society (IRI). The Overall Objective of this training institute was to enhance local and regional capacity on the use of seasonal prediction tailored to user needs in different socioeconomic sectors (agriculture, health, water resources, disaster risk reduction, etc) of Latin America. The course consisted of two weeks of lectures, seminars, discussions and practical exercises. Main topics were: 1) From global to regional seasonal predictions; 2) Translating science into applied knowledge to inform decision making; 3) Use of climate information: Experiences and needs in disaster risk reduction; in the agricultural, water management sector; and the health sector.

Several other summer schools and training courses have been organized in South America by GEWEX Regional Hydroclimate projects and CLIVAR VAMOS:

- The "International Summer School on Land Cover Change and Hydroclimate of the La Plata Basin". Foz do Iguacu, November 2009. http://www7.cptec.inpe.br/conference/index.shtml
- The first CLARIS LPB Introductory Course on Systems Thinking, Systems Practice, Buenos Aires October and December 2009. http://eolo.cima.fcen.uba.ar/~sweb/news2.php?Id=23
- CLARIS LPB Course on APACH quality control web tool, SENAMHI, Lima, Peru, December 2009 http://eolo.cima.fcen.uba.ar/~sweb/news2.php?Id=25

To assist the developing and least-developed countries of the Greater Horn of Africa (GHA) region in undertaking and appropriately using climate projections in their adaptation planning, WCRP, GCOS, WMO, the Nairobi-based IGAD (Inter-Governmental Authority on Development) Climate Prediction and Applications Center (ICPAC) and the World Bank are collaborating to implement a programme of three linked and hand-on training workshops (http://www.wcrp-climate.org/CB_projects_GFDRR.shtml). This project and the workshops will demonstrate the key elements of an effective climate risk management strategy for the region. The overall objectives of the project are to ensure that attention is given by countries in the GHA region to observation and data needs, to demonstrate the use and value of regional models, to provide advice on model limitations, and to improve capabilities across the GHA for using data records and model projections for adaptation planning. The project will demonstrate the application of climate information in particular for the agriculture/food security and water resources sectors. The first workshop was held 19-23 April 2010 in Nairobi, Kenya (http://www.wcrp-climate.org/documents/WB_GFDRR_Wshop1.pdf). The second workshop is scheduled for October 2010.

WCRP is also working closely with START on a project entitled "Understanding the Findings of the IPCC Fourth Assessment Report, Climate Change 2007 - Integrating Climate Change Adaptation and Mitigation in Development Planning". The project Integrating Climate Change Mitigation and Adaptation in Development Planning (CCMAP) was developed to address these critical knowledge and communication gaps. The project is a collaborative effort between the WMO, UNEP, the IPCC, START, the Universities of Ghana and Dar es Salaam and the Bangladesh Centre for Advanced Studies. Financial support for the project comes from the European Commission with collateral support from UNEP. The project, which targets the regions of East and West Africa and South Asia, seeks to encourage a dialogue between scientists, policy makers, and other societal decision making groups on climate change risks and potential responses for adaptation and mitigation, and to develop a process for assessing knowledge of climate change at regional, subregional, national, and local scales that can support effective decision making by organizing a series of national and regional climate activities aimed at; 1) regional knowledge sharing strategy; 2) science-policy dialogues; 3) regional training workshop(s); and 4) participatory regional knowledge assessments.

WCRP facilitated the participation in workshops and conferences of a record number of early-career scientists – in particular those from developing countries. For example:

- WCRP and YOTC MJO Task Force provided support for graduate student and recent postdoctoral researchers to participate in the Monsoon Intraseasonal Variability Modelling Workshop in Busan, Korea, 15-18 June 2010. The attendance of about 15 students and post-docs was supported by NSF and WCRP.
- The CLIVAR WGOMD-GSOP workshop on Decadal Variability, Predictability, and Prediction: Understanding the Role of the Ocean, 20-23 September 2010, Boulder Colorado will provide funding for participation of 12 early career scientists.
- WCRP/CliC supported the Association of Polar Early Career Scientists (APECS): IPY International Early Career Researcher Symposium, Decembre 2009, Victoria, Canada; and APECS meeting with students and young glaciologists in Chile at the "Ice and Climate Change Conference: view from the South", Valdivia, Chile, 1-3 February 2010.

CliC sponsored a lunch at the meeting with senior panel members. Approximately 30 early career scientists and students attended.

- WCRP/CliC supported of summer school "Ice Sheet Models for the 21st Century", Portland USA, August 2009. CliC, through CIRES, provided the support for participation of 3 graduate students.
- WCRP supported the participation of two climate African scientists in a workshop on expanding the AfricaArray seismic network array held June 2-4, 2010 in Washington D.C. at the Howard University. The purpose of the workshop was to bring together U.S. scientists and program managers engaged in geoscience research in Africa and their African collaborators to examine and codify the scientific rationale for expanding the AfricaArray seismic network into a multidisciplinary science network. The workshop assembled participants from a range of science fields that are interested in exploring the benefits of a single instrumentation initiative addressing the science needs of several geoscience disciplines, including, but not limited to, atmospheric science (including climate), geodesy, geography, hydrology, seismology, and space weather. http://africaarray.unavco.org/
- NSF and WCRP joined together to bring 12 students and early career scientists from the US, Iran, Australia, China, Senegal and the Ukraine to the Pan-GEWEX meeting in Seattle, USA, on 23-27 August 2010 (http://www.gewex.org/2010pangewex/home.html). GEWEX IPO hosted a box lunch for the students to meet with some of the senior scientists participating in the meeting.

21.Future Activities – 2011 and Beyond

The future activities of WCRP in 2011 and beyond were the subject of intensive discussion in 2009. The WCRP community is implementing the plan for the period from 2005-2015, which is based on a wide consensus of views on the priorities in the climate science. The overall goal of these activities will be to deliver on main directions of the WCRP Strategic Framework "Coordinated Observations and Prediction of the Earth System".

The WCRP activities and new initiatives will respond to scientific challenges and opportunities identified by the scientists involved in the Programme and national and international scientific priorities requiring the coordination and integration. In addition to the interdisciplinary research and modelling initiatives started earlier, in 2007 and 2008, a few new general themes, such as regional climate assessments, climate information for decision makers, will be given special emphasis by WCRP. The major issue for WCRP is how the Programme should spend its limited resources and use the network of its volunteers in the continuum that begins with observation, research, analysis, modelling and prediction and ends with synthesis and assessment and delivery of the climate information and knowledge to decision makers. The general view is that WCRP must focus on scientific issues that support and enable a comprehensive climate information system in the next decade.

21.1 Program Highlights on Cross-Cutting Activities

The research activities in the domains of decadal predictability, sea-level rise, climate extremes and atmospheric chemistry – climate interactions, are relatively new thrusts for WCRP. The implementation plans for these will develop substantially in the coming years. The activities in the areas of climate change projections, seasonal predictions and monsoons will be aimed at achieving scientific progress needed to meet the climate information needs of decision makers.

Anthropogenic climate change projections

All WCRP projects make unique and important contributions to this activity. Under the auspices of the WCRP/CLIVAR Working Group on Coupled Modelling, the latest Climate Model Intercomparison Project (CMIP5)http://cmip-pcmdi.llnl.gov/cmip5/ and cooperative projects with other WCRP and IGBP groups are being developed. Improvements from CMIP3 included better evaluations, model errors/metrics, greater use of observations in/with models, better documentation and use of an integrated Earth system model. WCRP will make results of global climate model runs available to worldwide community through a comprehensive archive. A joint WGCM/ Working Group on Numerical Experimentation metrics panel had been established. The WGCM, in conjunction with its IGBP partner AIMES (Analysis, Integration and Modelling of the Earth System), will play the lead role in incorporating the knowledge gained to improve climate projections.
In the context of WCRP visioning and future directions, the programme will promote:

- the confrontation of models with observations and results of process studies;
- collaboration amongst various climate science communities (includes numerical weather prediction (NWP), seasonal to interannual prediction and climate projection communities as well as those dealing with biogeochemistry, air quality, terrestrial ecology, etc.);
- application of models to problems of societal relevance, quantifying uncertainties and making sure they are well communicated and understood; and
- model development and improvements.

Model evaluation and improvement:

A WCRP community-wide consultation on model evaluation and improvement survey was developed and circulated in 2009. Over 100 independent responses were received from scientists working on numerical weather prediction, seasonal and decadal predictability and climate change. The results are currently being analyzed for publication in the open literature, and a workshop will be held in 2011 to define the major areas of research for model development/improvement based on the survey results, and to draw up an implementation plan with active engagement of international community to address them.

Polar Predictability

Noting the observed rapid loss of sea ice in the Arctic and the large spread of simulated sea- ice extent predictions in present models WCRP is initiating under the leadership of SPARC and CliC and with participation of CLIVAR and GEWEX, an initiative aimed at studying polar predictability for time scales from monthly to seasonal, interannual and decadal, up to centennial. A workshop summarising the available interdisciplinary knowledge and ideas in the science community within and outside WCRP will take place in Bergen, Norway in October 25-29, 2010 (http://www.atmosp.physics.utoronto.ca/SPARC/PolarWorkshop/main.html). The focus of the workshop in on seasonal to multi-decadal predictability of Polar Climate and will gather experts from all core projects and other scientists less connected to current Programme activities to exchange information on what may be predictable in the polar regions and mid-latitudes due to teleconnections with other regions and interactions between various components of the Earth system.

Polar Thorpex as legacy of IPY

The WMO Commission for Atmospheric Sciences (CAS) recommended, as a legacy of IPY, the establishment of a Polar Prediction Research Project to improve the understanding of polar processes affecting polar weather, the assimilation of data in Polar Regions and the prediction of high impact weather over Polar Regions.

WCRP jointly with WWRP/THORPEX will hold a workshop focusing on improvement of polar predictions on weather-to-seasonal timescales in Oslo, Norway, on 6-8 October 2010 (http://www.wmo.int/pages/prog/arep/cas/documents/doc3.2.1-PolarNWP_Mtg_2010.pdf). The main expected outcome of the workshop is the design of a WMO THORPEX Polar Prediction Research Project that provides an efficient framework for co-operative international research and development efforts to improve operational weather and environmental prediction capabilities for the Polar Regions and facilitate climate predictions up to a season.

Sea-level variability and change

Through the joint WCRP/IOC Task Force on sea-level variability and change (http://www.wcrp-climate.org/SeaLevel.shtml), WCRP will lead research activities aimed at covering the gaps in scientific knowledge of all factors contributing to the sea-level change, globally and regionally. Syntheses of these activities will be produced as a contribution to sea-level change projections. CliC will carry out observations and improve representation in models of spatial and temporal variability of surface mass budget of ice sheets, ice caps and glaciers. This will include an assessment of the Greenland and West Antarctic ice sheet stability and vulnerability to climate change including sudden and potentially irreversible changes. CLIVAR will address ocean thermal expansion with warming climate, including abyssal region warming. GEWEX will contribute information on the global water budget, including understanding of changes in water storage terms over land and in the atmosphere. The continuing effort to close the global water budget will also contribute in this area by quantifying the partitioning and changes of the various components of water over land.

Climate extremes

WCRP will pursue its role as the international coordinator of world climate research to provide guidance on what constitutes a climate extreme and also a framework under which observations and projections of climate extremes can be assessed. WCRP will take the initiative to provide an inventory of agreed to definitions and take the lead in arriving at community consensus on the most useful definitions. A major outcome will be extreme indices with associated level of uncertainty that will be useful to the decision makers and practitioners. Along this effort, CLIVAR and GEWEX are taking the lead on drought prediction and formed the WCRP Drought Interest Group (DIG, http://www.clivar.org/organization/extremes/dig.php). DIG has embarked on identifying strategic research needs in drought prediction and encouraging increased coordination of regional and international drought-research activities. Work has begun on a WCRP White Paper on 'Drought Predictability and Prediction in a Changing Climate: Assessing Current Capabilities, User Requirements, and Research Priorities'. This White Paper will assess current prediction capabilities against user needs with the aim of identifying areas that would benefit from international coordination. A workshop is being organized on this topic on 2-4 March 2011 in Barcelona, Spain.

Atmospheric chemistry and dynamics

The WCRP Stratospheric Processes and their Role in Climate (SPARC) has just completed Phase 2 of its Climate-Chemistry Model Validation Project (CCMVal). This in-depth analysis of the climate - chemistry models' capabilities in the area of dynamics and transport, radiation, chemical processes and microphysics constitutes an important contribution to the WMO/UNEP 2010 Scientific Assessment of Stratospheric Ozone Depletion and will help to shape the IPCC AR5 (http://www.atmosp.physics.utoronto.ca/SPARC/CCMVAL_FINAL/index.php).

A SPARC data initiative is now underway that will include collection of all available chemical datasets and comparison of their seasonal cycles, etc., in close collaboration with scientists carrying out the measurements. The Atmospheric Chemistry & Climate Initiative (joint with IGBP IGAC http://www.igac.noaa.gov/ACandC.php) will couple this effort with model studies of the impacts of climate on atmospheric chemistry, the impact of atmospheric chemistry on climate, and the impact of climate on air quality. Through a set of common diagnostics that can be used to address the uncertainties, the modelling and measurement communities will cooperate to constrain the models and use them to inform measurement planning. AC&C will also evaluate emissions inventories and undertake a coordinated effort to harmonize them and create a platform for their coordinated development in the future.

Analysis of Geoengineering Proposals

The WCRP Joint Scientific Committee has initiated development of a white paper on the role of WCRP in research concerning geoenginerring. Some work has already been undertaken by SPARC to address the aerosol aspect of geoengineering. A recent study on comparing geoengineering and Pinatubo aerosols found that previous estimates of aerosol optical properties were much too optimistic, thus greatly reducing estimates of radiative cooling by geoengineered particles. WGCM is considering a proposal for coordinated geoengineering model experiments with stratospheric aerosols. A demonstration project, not officially under the auspices of WGCM, is being conducted by a few modelling groups. Issues of particular interest included:

- robustness of model responses to geoengineering;

- response of the hydrological cycle; and
- response to stoppage of geoengineering after a few decades.

Challenges of Observation, Data Collection, Assimilation and Reanalysis

WCRP co-sponsors the three observing panels of the Global Climate Observing System (GCOS) to help ensure that ocean, atmosphere and terrestrial observations requirements for climate research are met, and that the corresponding observations obtained by WCRP Projects find their way properly into these networks for long-term stewardship and use. Contribution of WCRP – affiliated scientists was essential for the update of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC - including revised list of GCOS Essential Climate Variables.

A variety of reanalysis activities are underway for the atmosphere and ocean. Products of global reanalysis have provided the basis for advances in many areas, including climate now-casting and diagnostic studies of complex systems such as monsoons or the El Niño-Southern Oscillation. Global reanalysis is also the foundation for regional reanalysis projects and downscaling to study local climate and climate impacts. In addition, the development of comprehensive Earth system models requires expanding the scope of reanalysis and conduct of coupled atmosphere-ocean data assimilation. As the science of reanalysis grows, there is an urgent need to align financial and infrastructural resources for data handling and processing and to foster sustained international cooperation. The WCRP-GCOS co-sponsored Observation and Assimilation Panel (WOAP) is embarking on an inventory of WCRP data sets to facilitate access and assist in model validation and verification. Coordination of the four major ongoing global reanalysis activities by Japan, Europe and United States (i.e. NOAA and NASA) is also a high priority for the near future. USA hosted a series of workshops to review the current status of reanalyses, the lessons learned and to identify the primary technical issues (from assimilation system and observation perspectives) that need to be addressed or that will be addressed in the next reanalyses as well as on new reanalysis systems (CFSR, 20thC, and MERRA), observations, and integrated Earth system analysis. The 4th International Reanalysis Conference is planned for 2012 in USA.

WCRP core and affiliated Projects obtain, archive and distribute climate quality observations as part of many ongoing field efforts and process studies designed to improve understanding of key climate processes. These include global measuring systems such as Argo, BSRN and CEOP, as well as regional investigations such as the VAMOS Ocean-Cloud-Atmosphere-Land Study (VOCALS) in the Eastern Pacific, African Monsoon Multidisciplinary Analysis (AMMA) in West Africa, the Tropical Atlantic Climate Experiment (TACE), the North Pacific Ocean Circulation Experiment (NPOCE), the Southwest Pacific Ocean Circulation and Climate Experiment (SPICE) and DYNAMO/CINDY2011 experiment in the central equatorial Indian Ocean. GEWEX is continuously improving and updating global clouds, radiation, precipitation, aerosols, etc., data sets derived by merging satellite with *in situ* observations and is aiming to complete some major syntheses in the coming year.

Contributing to the Global Framework for Climate Services

The World Climate Conference-3 (WCC-3), held from 31 August to 4 September 2009 in Geneva, decided to establish a Global Framework for Climate Services (GFCS, http://www.wmo.int/pages/gfcs/index_en.html) to strengthen the production, availability, delivery and application of science-based climate monitoring and prediction services. WCRP is taking the steps necessary to address critical issues on the rapidly emerging societal needs for climate services for adaptation and risk management. Climate research, including understanding, modelling, analysis and prediction aspects, helps characterize climate variability and change and to generate quantitative climate information on a range of time and space scales, a major pillar for the GFCS. To support the successful implementation of GFCS, WCRP is collaborating with WMO and other climate observation and research programmes to address the issues of direct relevance to climate adaptation and risk management in general and the GFCS in particular: 1) strengthening and mainstreaming research observations to serve as prototypes for future climate observing systems; 2) developing climate prediction systems with lead times from seasons to centuries; 3) ensuring development of reliable high-resolution products needed for climate adaptation and risk management; 4) promoting interdisciplinary research to develop sector applications, tools and tailored information; 5) facilitating flow of user requirements to the research community and climate services sectors through user feedback; 6) improving the availability of highly-skilled talent to undertake climate research, operational prediction, and communication, particularly in the developing regions/countries.

Major events and conferences

The World Climate Research Programme will host a major international Open Science Conference (OSC) on 24-28 October 2011 in Denver, Colorado, USA (http://conference2011.wcrp-climate.org/). The WCRP Open Science Conference will provide a unique opportunity to bring together major disciplines and leaders of the Earth system research community to help identify opportunities to advance further understanding and prediction of variability and change in the Earth's climate system from seasons to centuries, and from regions to the entire globe. Through active dialogue among the international environmental change research experts, the OSC will:

- Appraise the current state of climate science, thereby making a measurable scientific contribution to the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC);
- Identify key opportunities and challenges in observations, modelling and analysis towards understanding and predicting the Earth's climate system;
- Facilitate discussion on interdisciplinary research required to understand and predict responses of the Earth as a system to climate variability and change, thus helping chart the path forward over the ensuing decades
- Highlight priority research in support of the Global Framework for Climate Services initiated at the World Climate Conference -3.

By entraining early career scientists and students from across the world, especially less-developed and developing nations and regions, the OSC will facilitate growth of the diverse future workforce needed to meet the increasingly complex scientific challenges of the future. The conference aims to attract the world's experts to provide a unique synthesis of current research

findings on climate variability and change, to identify the most urgent scientific issues and research challenges, and to ascertain how the WCRP can best facilitate research and develop partnerships critical for progress in the future.

The WCRP SPARC project will hold its 5th General Assembly, most likely in 2012 in New Zealand. A major Workshop ”Effects of climate change on the World Ocean” is being prepared with partners (IOC, PICES, ICES, possibly others) in Republic of Korea in 2012. The 4th reanalysis conference will be organised in partnership with GCOS in April 2012 in USA.

22.Communication and Education Activities

The WCRP will continue to improve its website and publish four issues of e-zine per year. The core project Newsletters will continue as well. WCRP is planning to publish a series of Fact Sheets on accomplishments and challenges in climate research. The themes will cover: seasonal prediction, decadal prediction, Ozone, Extreme events, Monsoon, permafrost and methane, ice-sheet stability, freshwater assessment, and CMIP5.

WCRP in partnership with START is developing a climate change education and training program designed to meet the capacity building needs envisioned in the Global Framework for Climate Services, and to more broadly enhance two-way communication between the climate research community and end user groups, including policymakers, members of civil society organizations, and various scientific communities engaged in IAV research. The START-WCRP collaboration on the capacity building effort plans to include the following:

- Fellowships for graduate (Masters and PhD) and post-doctoral research, and research grants for early to mid-career scientists affiliated with universities and research centers. Such a research fellowship program would be thematically based and provide for south-south and north-south institutional exchange to foster the development of research networks.
- Development and implementation of climate change curricula. Curricula would integrate climate change and sustainability topics into existing courses, develop new courses on climate change topics as well as design innovative learning mechanisms such as service learning courses aimed at professionals, such as resource managers and government agency representatives, outside of academia. Such service learning courses would aim to increase the general level of ‘climate literacy’ among key decision makers.
- Faculty exchange in support of both research and education.
- Advanced institutes on such topics as regional downscaling, generation and interpretation of climate change scenarios, impacts modeling, and approaches to conducting integrated assessments.
- Accreditation programs with universities to allow participants of advanced institutes to receive certification from external universities.
- Training workshops for compiling and centralizing country-scale data on ancillary effects of climate on the range of stressors affecting socio-economic systems.
- Science-policy dialogues that involve researchers, parliamentarians, government agency representatives, development professionals, resource management experts, and representatives of civil society. The dialogues would serve to both disseminate scientific information and knowledge to the public and to give voice to public concerns in order to

develop more demand-driven processes for generating and disseminating information and knowledge.

CORDEX is providing a potential programmatic focus around which such capacity building is coalesced, especially for Africa. CORDEX will advance knowledge of regional climate responses to global climate change and help to feed these insights into Working Groups 1 and 2 of the IPCC 5th Assessment Report as well as to on-going climate adaptation and risk assessment research and policy planning in the region. The keys to success of this initiative in Africa will be developing a means for analysis and translation of CORDEX data in terms that are relevant to Africa's knowledge needs, developing the internal capacity to perform the analyses and in doing so create expertise at regional level, and to train the next generation of regional experts who will advise on future expanded effort on CORDEX analysis and interpretation in Africa.

A consortium of organizations consisting of the WCRP, the University of Cape Town's Climate Systems Analysis Group (CSAG), START, the International Centre for Theoretical Physics (ICTP), the Swedish Meteorological-Hydrological Institute, and the Climate and Development Knowledge Network initiative have developed an analysis and training program that will provide an initial assessment of CORDEX output that is regionally focused and prioritized to Africa's knowledge needs, and which will foster trans-disciplinary collaborations of individuals from the physical sciences and the vulnerability, impacts, and adaptation (VIA) research arena. The program, to be administered by CSAG in collaboration with START and WCRP, will consist of a series of training workshops focused on skill development in working with climate model results, analysis of CORDEX datasets, and compilation and writing of analytical results to be submitted to a special issue of peer reviewed journal(s). The workshops will be augmented by focused mentoring from a team of experts from the climate modeling and VIA communities. Participants in the program will be grouped into teams of four to five persons consisting of individuals with training in the physical sciences (e.g. meteorology, hydrology, climatology, etc.) and those engaged in VIA-related research from the biophysical and social sciences. Five teams corresponding to Eastern, Central, and Southern Africa, and Francophone and Anglophone West Africa will be engaged. Participants in the program will receive support for travel to the training and assessment workshops; the first of which will take place at ICTP in Trieste, Italy in March 2011, the second in Cape Town in July 2011 and the third at a to be determined location in November 2011.The participants will also have an opportunity to take part in the WCRP Open Science Conference that is scheduled for 24-28 October 2011 in Denver, Colorado.

The WCRP Open Science Conference has as major objective to recruit and actively engage more than 200 early career scientists, especially those from the regions that are most vulnerable to climate change and variability. WCRP is committed to secure and devote a significant amount of funding to support the participation of as many early career scientists as possible.

The three workshops for the Greater Horn of Africa countries are planned for this year as part of the World Bank-sponsored project on climate risk reduction that is being organized by WCRP with WMO, GCOS and ICPAC. These hands-on training workshops will bring together climate practitioners and users to assess available climate data and information for water resources and agriculture, and to identify best practices and gaps that need to be filled.

23.Financing and Budgets

23.1 Financial Report - 2010

WCRP receives financial support from its sponsors, the World Meteorological Organization, the International Council for Science (ICSU), and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. Financial contributions by WMO and IOC are made to the WCRP Joint Climate Research Fund (JCRF) based at the WMO Secretariat. Starting from 2008 funding from ICSU-affiliated organizations and national contributions have been received directly by the JCRF. These funds are used mainly for supporting staff salaries and organizing, conducting and reporting the outcome of the regional and international scientific and technical workshops, conferences and symposia. The funds allocated to WCRP JCRF are presented in Table 1. WCRP core projects CLIVAR, GEWEX, CliC and SPARC also receive financial support for their International Project Offices from their host countries and their major partners. These contributions are in form of cash and secondment of scientific, technical and support staff and office equipment and space. There is a close coordination and dialogue between project offices and the WCRP secretariat to maximize the benefits gained from investments of both sources in coordination and integration support of the scientific and technical activities of the WCRP enterprise.

TABLE 1: JCRF INCOME AND EXPENDITURES FOR 2009 AND 2010 ESTIMATES (EURO)

Updated August 2010			
		2009	**2010 (est)**
BALANCE BROUGHT FORWARD		503,000	659,000
INCOME	WMO	1,260,000	1,434,000
	ICSU	335,000	347,000
	IOC	84,000	98,000
TOTAL INCOME		1,679,000	1,879,000
TOTAL FUNDS AVAILABLE		**2,182,000**	**2,538,000**
EXPENDITURES			
	SALARIES AND RELATED COSTS	907,000	1,094,000
	OPERATING EXPENSES	116,000	108,000
	MEETING SUPPORT	500,000	560,000
TOTAL		**1,523,000**	**1,762,000**

EXPENDITURES			
BALANCE AT YEAR END		659,000	776,000

Exch. rate: 1€ = US$ 1.27
1€ = CHF 1.30

23.2 Future Budgets (2010-2012)

Table 2 provides an estimate of income and expenditures for 2010-2012. These are based on our best guess of income levels and estimates of salaries based on a 1.5% inflation rate. Operating expenses and meeting support are likely to vary according to available resources and the level of activities, but the secretariat will make every effort to maintain a reasonable balance at year end for continuity of operations and to support planned activities early in the following year and prior to receiving the contributions for the new year.

TABLE 2: JCRF ESTIMATED INCOME & EXPENDITURE 2010-2012 (EURO)				
		2010 est	**2011 est**	**2012 est**
BALANCE BROUGHT FORWARD		659,000	776,000	665,000
INCOME	WMO	1,434,000	1,434,000	1,434,000
	ICSU	347,000	340,000	340,000
	IOC	98,000	90,000	90,000
	MISC. INCOME			
TOTAL INCOME		1,879,000	1,864,000	1,864,000
TOTAL FUNDS AVAILABLE		**2,538,000**	**2,630,000**	**2,529,000**
EXPENDITURES				
	SALARIES AND RELATED COSTS	1,094,000	1,250,000	1,250,000
	OPERATING EXPENSES	108,000	130,000	130,000
	MEETING SUPPORT	560,000	600,000	600,000
TOTAL EXPENDITURES		**1,762,000**	**1,980,000**	**1,980,000**
BALANCE AT YEAR END		776,000	665,000	549,000

Acknowledgement

Funding for the activities of the WCRP secretariat in 2009 was provided to the Joint Climate Research Fund by WMO, IOC of UNESCO and ICSU member countries. The Institute Pierre Simon Laplace (IPSL) and CNRS fully support the WCRP Strategic Support Unit in Paris and a staff member of the JPS.

The GEWEX international project office is supported by the US-National Aeronautics and Space-Administration (NASA) and some staff travel is supported by the US-National Oceanic and Atmospheric Administration (NOAA). Japan provides support for the international coordination of CEOP.

The CLIVAR project office is supported by the Natural Environment Research Council, UK, and NASA, NOAA and the US-National Science Foundation through US CLIVAR.

The SPARC international project office is supported by contributions from the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS), the Canadian Space Agency, Environment Canada, and the University of Toronto.

The CliC project office is supported by the Norwegian Polar Institute and the Research Council of Norway. CliC has been co-sponsored by the Scientific Committee on Antarctic Research (SCAR) since 2004 and by the International Arctic Science Committee (IASC) since 2008.

The International Group of Funding Agencies for global change research (IGFA) helps promote dialogue with national funding agencies.

WCRP expresses its gratitude to all of the above organizations.

24.Current and Future Programme and/or Funding Challenges

Key issues offered for IGFA's consideration are:

- the need to have adequate support for the International Project Office for the WCRP SPARC project after it moves to a new location due to termination of operations of the CFCAS;
- continuation of the International CLIVAR Project Office operations beyond 2013/14; a proposal will be prepared and submitted to NERC, and
- support to the CliC International Project office in view of expanding cryospheric research globally and in the Scandinavian region specifically.

WCRP will enhance its activities related to regional climate predictions, hence making invaluable contributions towards providing the necessary climate information for adaptation planning and risks assessments. In this regard, WCRP brings to the attention of IGFA the need for establishing a mechanism for agreeing on priorities for funding national and regional research, which could be

based on increased communication between ESSP and its components and individual funding agencies.

With the importance of the climate change and prediction issues for the world, the need to address these issues from the global scale to the level of almost every locality, and the overwhelming complexity of the Earth climate system, global coordination of climate research is an issue of highest priority. More than ever it requires very strong support at the governmental and non-governmental level. WCRP is one of leaders in promoting and coordinating such research, however its efforts are hampered by the relatively small amount of funding and resources available to the Programme, hence limiting its potential to demonstrate the value of the climate science for society.

WCRP suggests to IGFA that detailed reporting by international programs and projects is made every two years, to save resources of the Secretariats for coordination of science activities.

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Earth System Science Partnership (ESSP)

25. Introduction

The Earth System Science Partnership (ESSP) was established in 2001 by four global environmental change (GEC) research programmes: DIVERSITAS, IGBP, IHDP and WCRP. ESSP facilitates the study of the Earth's environment as an integrated system in order to understand how and why it is changing, and to explore the implications of these changes for global and regional sustainability. As a result of an independent review, the ESSP developed a new strategy that will provide an internationally coordinated and holistic approach to Earth system science. The approach integrates natural and social sciences from regional to the global scale. The mainstay of the ESSP is to identify and define Earth system science challenges, enable integrative research to address these challenges, and build scientific capacity.

25.1 Added Value of ESSP

"As national governments work toward a stable future climate, the scientific community that has revealed the causes of current and probable future shifts in climate and projected plausible consequences of this trajectory still has serious work to do. Cooperative efforts begun in the 1980s to bridge gaps among the Earth and life sciences in order to address interrelated components of the Earth system have led to much of the understanding that is represented in the IPCC assessments. Further advances in these areas need to be encouraged, and enhanced with closer partnerships with engineering and social science communities. The charter of the Earth System Science Partnership reflects a substantial step in this direction. Its initiatives relating to the carbon cycle, food security, water, and human health in the context of global environmental change will provide essential new understanding as society steers to a future that diminishes risk for future human well-being and life all across our planet." (McCarthy, J; AAAS Presidential Address: Reflections on: Our Planet and its Life, Origins, and Futures, Science 18 December 2009, Vol 326, p. 1665). Not only does this statement highlight the overall added value of the ESSP, it also emphasises the importance of the ESSP research community in relation to the visioning process and the next decade of global sustainability research, as well as the key issues identified in the road map to address the Belmont Challenge.

25.2 Activities in 2010

Science Highlights

Global Carbon Project (GCP) launched the *Carbon Budget 2008* at the UNFCCC Conference of Parties (COP 15) in Copenhagen in 2009. It confirms the earlier findings that the fossil fuel CO_2 emissions continues to grow strongly and despite the global financial crisis, and that emissions from land use change contribute on average 15% to the total anthropogenic greenhouse gas emissions. The size of the natural sinks has grown, but at a slower pace than emissions, although year to year variability is large. This implies a decline in the efficiency of the sinks in removing

atmospheric CO_2 over time (from 60% fifty years ago down to 55% in recent years). This trend is expected to continue in the future. More information is provided on: http://www.globalcarbonproject.org/carbonbudget/index.htm. The GCP jointly with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Scientific Committee on Problems of the Environment (SCOPE), and the United Nations Environment Programme (UNEP), have developed a Policy Brief based on this year's carbon budget release (http://www.globalcarbonproject.org/carbonbudget/08/Policy_brief.htm?pg=publications).

ESSP's *Global Environmental Change and Food Systems (GECAFS)* project has published a major, accessible synthesis of its and others' work in "Food Security and Global Environmental Change" (Earthscan, London, 2010). Most other syntheses addressing the subject concentrate on the links between climate change and agricultural production, and do not extend to an analysis of interactions with the wider food system which underpins food security. Based on the novel GECAFS food system concept, this book addresses the broader issues and also highlights the potential benefits of action at regional – rather than just at international or local – levels. *GECAFS* project continues to be involved in the Consultative Group on International Agricultural Research (CGIAR) *Climate Change, Agriculture and Food Security* (CCAFS) Program, leading the multi-region scenarios exercise.

The Global Water System Project (GWSP) continues to work with both global and regional aspects of water quality and availability. One of its recent studies shows that with respect to changing climate, at the global level there will be little shift of the mean annual renewable water resources, however, temporal and spatial variability will increase. At the regional level, these changes are more evident; there is a strong agreement on (i) *increasing* runoff in Asia and Polar regions and (ii) *decreasing* runoff in Latin America and Australia-Oceania. Additionally, GWSP in partnership with DIVERSITAS, focused on water needs for humans and nature. The results indicate that the water shortage problem might grow over the years across many regions. GWSP envisages extensive work on the role of water systems in climate change mitigation and will explore the link of 'water and human health'.

The Global Environmental Change and Human Health (GECHH) made substantial progress in 2009-2010 in developing this emerging research area. Recent work on climate change has focused on how to include health issues into current climate decision making for both adaptation and mitigation policies. For example, adaptation costs for the health sectors have been estimated for Kenya. The co-benefits of climate policies on human health are potentially substantial. The varying costs of implementation of such strategies can be offset, at least partly, by the benefits to human health and as such should be taken into account in international climate change negotiations.

Monsoon Asia Integrated Regional Study (MAIRS) focused on the development of observation and modelling activities in MAIRS drylands and coastal megacities areas in 2009. The MAIRS drylands study includes arid and semi-arid regions in East Asia and South Asia vulnerable to climate change and human perturbation. Drylands research focuses on three key thematic areas: (i) climate change dynamics, (ii) data-model fusion, and (iii) coupled human-environment systems. The MAIRS mega-cities study mainly focuses on issues and environmental problems related to industrial emissions and large scale urbanization in Asian Delta regions (e.g. Yangtze River delta area, Pearl River Delta area, Mekong River Delta area and Ganges River Delta area).

Research focuses on: (i) Observations and facts of climate change in Asian mega-cites, and (ii) Modelling of Mega-city impacts on regional environment. MAIRS also continues networking with related research projects at the national and international level.

The Challenge Program on Climate Change, Agriculture and Food Security (CCAFS) is a new 10-year research initiative of the Consultative Group on International Agricultural Research (CGIAR) and the Earth System Science Partnership (ESSP). Its development was coordinated by ESSP's *Global Environmental Change and Food Systems (GECAFS)* project. It has been an exciting past 12 months of implementation. The secretariat has four staff members based at the University of Copenhagen. CCAFS has seven theme leaders in place and, by mid November 2010, will have all three regional facilitators (West Africa, East Africa and Indo-Gangetic Plains). Numerous scoping studies and initial surveys are being conducted and a baseline is being conducted in all of the selected target regions. These initial activities include work being undertaken by persons in the ESSP community (as an example, reports on the climate trends and the "state of the art" concerning climate model ensembles for the target regions is being conducted by WCRP colleagues). CCAFS has a session in the forthcoming Global Land Project Open Science Conference, and discussions are being conducted with the GCP and DIVERSITAS' AgroBIODIVERSITY.

Science-Policy Highlights

GCP

GCP's annual Global Carbon Budget 2008 has become a regular conduit of data relevant to current discussions on the size of the human perturbation and the magnitude of climate change required. The data is often utilised by policy, governments and UN processes including the recent UNFCCC COP-15. The GCP has published two Policy Briefs with UNESCO, UNEP and SCOPE. Experience with the media communications regarding the carbon budgets has shown that the integrative / syntheticscience products that are released and updated regularly with a direct connection with the policy process are in great demand and fulfill a key role of science in the policy process. GCP's science policy symposiums in 2009 focused on urban carbon issues that have helped communicate key insights with stakeholders and the wider community, including municipal governments. The symposia have also provided a platform to exchange views on future research needs with the user community. GCP's new Policy Brief with UNESCOP-SCOPE and UNEP has helped GCP to further its outreach to the policy community. In addition, GCP contributes to the Newsletters and Bulletins of the sponsors, hosts of GCP offices and other partner programmes regularly (eg IGBP, CCGER/NIES and others).

GECAFS

GECAFS has placed considerable emphasis on science-policy interface, which has resulted in regional science plans receiving the endorsement of major regional policy organisations. Dialogue with the policy process has been maintained throughout the project. Examples include (i) February 2009, Delhi: GECAFS high level Briefing on "Environmental Change and Food Security in the Indo-Gangetic Plains"; (ii) March 2009, Beijing: Food security/GEC contributions to high-level UK-China discussions; (iii) May 2009, Berlin: Food security/GEC contributions to GTZ/DFID/World Bank discussions; (iv) November, 2009, London: Presentation to All Party Parliamentary Group (UK); and (v) Inputs to US State Department World Hunger Strategy discussions.

GWSP

Participation in the preparatory workshop for a conference on the status of Water Science to be held at the end of 2010 in Germany. GWSP also convened a number of specifically science-policy focused events, including brainstorming sessions on the "Bonn a Global Water City" initiative in Berlin.

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Outreach & Capacity Building

The GEC research community faces an increasing challenge to present research results in more accessible and informative ways to stakeholders, especially to policy-makers. In response, the ESSP is developing new services that include knowledge products, a synthesis journal (COSUST), engagement with the media community and interdisciplinary collaborative research.

Knowledge Products

The ESSP provides a mechanism to help promote and deliver knowledge products. As the experience with the carbon budgets released by the Global Carbon Project has shown, integrative and synthetic science products that are released and updated regularly, and have a direct connection with the policy process can generate a lot of visibility and excitement. Several other examples of such knowledge products within the different core and joint projects of the GEC research programmes already exist, including the GWSP digital water atlas (http://atlas.gwsp.org/). Additionally, ESSP promotes the results coming from its projects such as synthesis and scientific papers.

Journal

A new ESSP pioneered journal with Elsevier, 'Current Opinion in Environmental Sustainability' (COSUST, www.elsevier.com/locate/cosust) was launched at the DIVERSITAS OSC in Cape Town, October 2009. COSUST, edited by ESSP SC members Rik Leemans and Anand Patwardhan, aims to address all the economic, social, technological and institutional aspects related to the challenge of environmental sustainability by focussing on integration across academic disciplines and insights with implications for societal practices and processes. It will contain polished, concise and timely reviews and opinions. The subject of environmental sustainability is divided into 6 themed sections, each of which is reviewed once a year: 1) Climate (covering climate change, climate risk management, and adaptation), 2) Human settlements and habitat (covering cities, urbanization, transport), 3) Energy systems (covering

renewable energy, energy efficiency, bioenergy), 4) Terrestrials systems (food systems, biodiversity, and ecosystem services), 5) Carbon and Nitrogen cycles, and 6) Aquatic systems (covering marine and fresh water, fisheries, currents, etc.). IGFA member country scientists have already contributed greatly to this journal and will continue to do so in future.

UNFCCC – SBSTA 32

The Earth System Science Partnership and its research partners, including the GEC research programmes, START and APN presented to the 32nd session of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) on 3 June 2010. Panelist presentations and dialogue with UNFCCC Parties can be viewed at http://unfccc2.meta-fusion.com/kongresse/SB32/templ/play.php?id_kongresssession=2731&theme=unfccc.

IPCC

IGBP organized a meeting together with the ESSP and IPCC, in Brazil (November, 2009), on Impacts, Adaptation and Vulnerability (IAV) questions, especially in context of developing countries. One of the main objectives of this meeting was to ensure the central participation of developing country IAV communities in the IPCC fifth Assessment Report (AR-5).

Global Media Forum

The ESSP and its parent programmes (DIVERSITAS, IGBP, IHDP, WCRP) convened a session at the Global Media Forum (www.dw-gmf.de) on 21 June 2010 in Bonn, Germany. The ESSP session on 'Media-ting Change' focused on how the global environmental change research community can learn from how climate change has been reported in the media.

ESSP at GEC-related Meetings

The ESSP provided scientific and programmatic advice to the European Science Foundation, Global Earth Observation System of Systems (GEOSS), national and European GC committee meetings and and the visioning process and Belmont challenge.

Capacity Building

The ESSP is developing and implementing a scaled-up capacity-building agenda. See START section of this Report for more details about its contribution to advancing global environmental change science, enhancing developing country expertise and its contributions to and interactions with major assessments and conventions. The Joint Projects and MAIRS have also conducted capacity building activities, examples include:

GCP

GCP has been contributing to capacity building by inviting young researchers (student and post-docs) and researchers from the developing countries to present and interact in its meetings, workshops and symposiums. A close communication with START has been kept intact. A joint proposal for running a week long capacity building workshop for researchers from developing countries in Tokyo in 2010 has been developed with IHDP's Earth System Government Project, sponsored by the APN. GCP also contributes to capacity building activities developed by other partner programs and sponsors.

GECAFS
GECAFS Science Officer (Dr. Polly Ericksen) travelled to the Australian National University (ANU) in Canberra to give a series of lectures and a master class on food systems and GEC. Dr Ericksen also fed into the AusAID Australian Leadership Award Fellowship grant programme which included four GECAFS investigators who were awarded grants to participate in the programme.

Dr Polly Ericksen supervised a number of Masters students within the University of Oxford's School of Geography and the Environment. Number of trainings, courses, seminars or workshops convened/offered: 1 briefing, 1 MSc module

List of highlight trainings, courses, seminars or workshops convened/offered:
• Delhi in February 2009, GECAFS held a high level Briefing on "Environmental Change and Food Security in the Indo-Gangetic Plains".
• Polly Ericksen taught a module entitled "Global Environmental Change and Food Security" as part of the Environmental Change and Management MSc taught at the University of Oxford's School of Geography and the Environment.

GWSP
Major GWSP capacity building activities in 2009 include: (i) Graduate school concept: "Bonn Interdisciplinary Graduate School on Risk and Uncertainty", (ii) Lectures on global water system and global water problems (October / November 2009 at FH Cologne and Technical University of Aachen) and a number of trainings, courses, seminars or workshops convened/offered; and (iii) "Teaching Adaptive Water Management - A Training Course for Instructors" by the NeWater project hosted by the UNU Institute for Environment and Human Security (UNU-EHS).

26. Future Activities – 2010 and beyond

Visioning and Belmont
The ESSP will continue to be actively engaged in the development of the next decade of global sustainability research under the visioning process. The ESSP will also provide scientific assistance to meeting the Belmont challenge of delivering knowledge to support human action and adaptation to regional environmental change. Examples of potential synergies with ESSP joint project research and the Belmont challenge include: (i) the GCP 'Regional Carbon Cycle Assessment and Processes'; (ii) GECAFS - CCAFS scenarios to help identify regional and national adaptation options for agricultural development and food security; (iii) GWSP integrated study areas; and (iv) monsoon asia research conducted by MAIRS and other partners. The Belmont challenge panel outlined several urgent areas that need to be addressed, many of which have already been highlighted in the ESSP strategy paper published in 2009. For example, the urgent need for natural and social sciences to work together is the core principle of the ESSP Joint Projects. The ESSP is developing an exciting new initiative on integrative science ('commutuality') with the International Social Science Council and ICSU that will look at the how to actually do integrative research. This initiative is about knowledge production and will look at integration from three dimensions: scientific, international and sectoral. The Belmont

challenge panel also recognised the urgent need to provide information and communication tools that provide authoritative and easily accessible information to policy makes and decision makers. The ESSP has been developing a suite of 'knowledge products' that include the highly successful GCP annual global carbon budget trends and analysis and the GWSP digital water atlas. The ESSP and its joint projects, START and MAIRS have also forged and will continue to forge scientific partnerships between institutions from different geographic regions of the world. These are just some examples of how the ESSP can assist towards meeting the Belmont challenge of delivering knowledge to support human action and adaptation to regional environmental change.

ESSP-ISSC-ICSU Integrated Science ('Commutuality') Initiative

The call for 'integrated science' on global environmental change is becoming more and more prominent. The ICSU Visioning Process, Belmont Forum, IGFA discussions and ESF RESCUE Initiative all focus on an integrated understanding of Earth system dynamics, calling for stronger inter- and cross-disciplinarity and emphasizing the role of different actors groups in processes of knowledge co-production and utilisation. Yet we do not necessarily share a common understanding of what integrated science means, what it entails, how it is accomplished, what the obstacles/barriers are and how best to overcome them. The ISSC, ICSU and ESSP propose to address this issue by means of an advisory study focusing on integration at the research performance level, to understand the practice of integrated science by means of an identification and analysis of case studies of actual research projects and programmes involving integration along numerous dimensions. These dimensions include (i) Scientifically: Bringing together different disciplines (and their approaches, theories and methodologies) from different fields and ensuring the joint framing, design, execution and application of research; (ii) Internationally: Bringing together multiple socio-geographic and cultural perspectives, avoiding the imposition of specific sets of approaches, models and concepts from some parts of the world on others; and (iii) Sectorally: Bringing various stakeholders and decision makers together in the co-design and co-production of scientific knowledge.

The Belmont Forum and Visioning Process have developed space for discussing issues of integration; it is now clear that we need to understand in more depth how best to do integrated science, and to be in a position to advise science policymakers and funders on how best to foster it. This ESSP-ISSC-ICSU initiative should feed into the Belmont and ICSU Visioning processes. The overarching goal to support the identification and analysis of best practice examples, on the basis of which recommendations for actions can be agreed by the scientific community and donors alike.

UNFCCC COP-16 & SBSTA

The UNFCCC secretariat is going to convene a session during SBSTA 33 in Cancun, where the GEC programmes and the ESSP are invited to contribute to the 'updates on research outcomes'. ESSP will also participate in a CCAFS workshop that will take place during the first week of COP-16 and in the high impact Agricultural and Rural Development Day 2 (ARDD2) on the 4th of December.

The Earth System Science Partnership and its research partners, including the GEC research programmes, START and APN are invited to convene a session of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA 34) in June 2011. This is a result of a successful dialogue that was started 3 years ago. SBSTA is requesting even more extensive

interaction “Parties not only would like to see this activity being continued in its present form, but would like to see more: i.e., a workshop to be held in conjunction with SBSTA 34”.

Capacity Building Young LOICZ Forum

ESSP plans to actively participate in various capacity building initiatives. For example, in 2011 an ESSP representative will give a training course for early career scientists (ECS) from APN and developing countries at: the Young LOICZ Forum (YLF) and will sponsor a few fellows to participate in this initiative and in the LOICZ OSC. This well-targeted programme offers young people the opportunity to learn about drivers and pressures on coastal systems and to better define their future professional role in coastal management. Comprehensive educational activities provide the next generation of scientists and decision makers with relevant knowledge and practical skills, opportunities to interact and network with their peers, and to transfer and apply global change mitigation measures and sustainable coastal zone management in the Asia-Pacific region. The YLF is a well-balanced combination of OSC sessions and specific targeted activities for ECS, bringing together senior scientists and ECS from APN countries for both formal training and informal discussions on relevant GEC topics.

Journal

The ESSP journal with Elsevier on ‘Current Opinion in Environmental Sustainability’ (COSUST, www.elsevier.com/locate/cosust) will gather traction in its second year (its impact and citation level is already increasing after its first year in circulation). Papers will be published on environmental sustainability (of relevance to the visioning process and the future of global sustainability research and the Belmont challenge) on (i) climate (covering climate change, climate risk management, and adaptation), (ii) human settlements and habitat (covering cities, urbanization, transport), (iii) energy systems (covering renewable energy, energy efficiency, bioenergy), (iv) terrestrials systems (food systems, biodiversity, and ecosystem services), (v) carbon and nitrogen cycles, and (vi) aquatic systems (covering marine and fresh water, fisheries, currents, etc.). IGFA member country scientists will continue to have an opportunity to contribute to this journal, which is open access for developing countries.

GCP

The GCP is entering an exciting second phase, planned activities include:

1. To prepare and release a new update on the global carbon budget.
2. To advance a new major global assessment "REgional Carbon Cycle Assessment and Processes" including groups from all major regions and ocean basins.
3. To run a new global analyses on the vulnerability of the natural carbon cycle over this century.
4. To develop new diagnostic tools for modelling fossil fuel emissions relating to production and consumption views.
5. To include the human perturbation of the methane cycle in the annual carbon update.
6. To further push the activity on urban energy and carbon emission modelling, and analyses from the perspective of carbon flow across urban system boundaries and consumption in cities
7. To contribute to understanding the realistic potential of land based carbon mitigation including its biological, economical and social constraints.
8. To explore mitigation and sharing rules for CO2 atmospheric CO2 stabilization.

A key task for GCP in 2010 is to finalize the research questions and research direction beyond its 10 years cycle which ends in 2011 to continue further. GCP is currently consulting with the community on various key events and with institutions and established experts on emerging research questions and possible directions for GCP.

GECAFS
GECAFS comes to a close in March 2011, and in this final phase the IPO will, *inter alia*, finalise and publish a Project Synthesis and plan follow-up research. Two main follow-up research activities are envisaged:

1. *GEC and Agriculture*. This research is envisioned as a new international GEC-community project focussed on farming systems and agriculture at landscape level. It will be designed to complement and build on earlier IGBP work on crop responses to GEC, and agroecology (GCTE Focus 3), and the more recent work on food security (GECAFS).

2. *Scenarios to help identify regional and national adaptation options for food security*. This 3-year project, carried out in conjunction with the CCAFS programme, is envisioned to help decision makers overcome the challenge of identifying robust food system adaptation options against the background of uncertain futures.

GWSP
Planned activities include workshops of the three integrated study areas (ISA) in 2010; reviewing and restructuring of the Digital Water Atlas; the education of PhD students; and advancing research on four new science areas: (i) The water climate change mitigation link, (ii) Water and migration, (iii) Water and health, and (iv) National water stress/susceptibility report cards.

GECHH
The GECHH Project has identified a set of key types of global environmental change that are known or suspected to have significant consequences for human health. The evolving Science Plan explores priorities and settings for the future coordinated international study of these relationships, taking into account the complexities of concurrently acting environmental changes and the importance of socioeconomic and cultural contexts as modifiers of community vulnerability. Planned activities for 2010/2011 include official launch of International Project Office at UNU-INWEH in Hamilton, Canada and a Science Symposium on Water and Health, autumn 2010.

27.Financing and Budget

IGFA support to the ESSP office has been critical to ensure: (i) effective planning and timely facilitation of Partnership activities, (ii) assistance to projects and programmes, (iii) fund raising, and (iv) open communications and exchange of information between the science and user communities, including sponsors and research councils. The ESSP is extremely grateful for the support of IGFA member countries (as shown in Table 1).

27.1 Financial Report

Table 1. ESSP provisional budget 2010 (Euros)			
INCOME - Calendar year 2010		**In euros on 31 August 2010**	**Expected (TBC)**
National contributions		**150,279.00**	**49,814.00**
USA 2009 supplemental (Jan - Aug)	(10 000K USD)[1]	7,410.00	
USA 2009 (Sept - Dec)	requested	16,700.00	
USA 2010 (Jan - Aug)	requested	39,629.00	
USA 2010 (Sept - Dec)	pending		19,814.00
Germany		30,000.00	
France		24,000.00	
Norway			30,000.00
UK	requested	15,000.00	
Austria		10,000.00	
China - Taiwan	(10 000K USD)[2]	7,540.00	
GEC programmes support			**15,544.00**
DIVERSITAS	4 000 USD in kind		
IGBP 2009 & 2010			5,544.00
IHDP			2,500.00
WCRP 2009 & 2010	(10 000K USD)		7,500.00
Provision from 2009		**22,264.96**	
TOTAL INCOME		**172,543.96**	**49,814.00**
EXPENSES - Calendar year 2010			
Scientific activities			
Scientific Committee meeting		3,166.20	8,000.00
GECHH		642.20	3,000.00
Other scientific activities			
Participation of secretariat & representatives in meetings		12,401.70	8,000.00
Full salary costs for scientific staff*		112,000.00	
Communication			
Website upgrade			10,000.00
Publications and other communication costs		339.14	
Operating costs			
Full salary cost for administrative support*		7,500.00	

Other operating costs		6,180.32	400.00
Mandatory reserve#		9,000.00	
TOTAL EXPENSES		**151,229.56**	**29,400.00**
Mandatory reserve		9,000.00	
[1]Exchange rate: UN, March 2010			
2Exchange rate: UN, May 2010			
*This figure includes social charges to French government			
#French law stipulates ca. three-months salary reserve			
Best case scenario (A)			
Mandatory reserve	18,000.00		
Positive balance at 31st December 2009	22,264.96		
Gross result at 31st December 2010	41,728.40		
Positive/Negative balance at 31st December 2010	63,993.36		

27.2 Future Budget (2011)

Table 2. ESSP Provisional budget for 2011 (in Euro)		
Anticipated INCOME	**Income**	
1. National contributions		
Austria	10,000	
France	24,000	
Germany	30,000	
Norway	30,000	
China-Taiwan	5,000	
UK	20,000	
USA	50,000	
Sub-total	**169,000**	
2. GEC contributions	**12,000**	
3. Provision from 2009	**63,993**	
TOTAL INCOME (anticipated)	**244,993**	
Anticipated EXPENSES		**Expenses**
1. Scientific activities		
Scientific Committee meeting		10,000

Integrative Sciences and Bioenergy Initiatives		5,000
Other scientific activities		3,000
Participation of secretariat & representatives in meetings		24,000
Carbon offsets		1,500
Provision for activities in 2012		35,993
Full salary costs for scientific staff*		112,000
2. Communication		
Website upgrade		4,000
Publications and other communication costs		5,000
3. Operating costs		
Full salary cost for administrative support**		7,500
Other operating costs		6,000
4. Capacity building		4,000
5. Mandatory reserve^		9,000
		226,993
Mandatory reserve^		18,000
* Two part time staff (4-days per week and 2-days per week)		
** Part time administrative staff (1-day per week)		
^ Obligatory according to French law		

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global change SysTem for Analysis, Research, and Training (START)

This report provides an update on START's activities and budget information for 2010 and projections for CY 2011-2013. The report focuses only on activities that are centrally coordinated by the International START Secretariat. START's recent Annual Report, available at *http://start.org/publications/ar08-09.html*, provides highlights of 2008/2009 program activities, as well as information about the portfolios of START's regional centers and secretariats. Several of these activities, including science-policy dialogues on climate change and the African Climate Change Fellowship Program, have continued in 2010, while others have evolved from one-time events into programs, such as the Asian Cities at Risk initiative.

This report describes the International Secretariat's portfolios of programs and activities that include the development and support of diverse programs in Africa and Asia on vulnerability, adaptation and risk management; global environmental change education; communication of climate change risks at the science-policy interface; and regional scale research aimed at fostering integrated regional studies of global environmental change. START's Strategic Plan for the next decade is under development, and in this context, a systematic review of the organization's overall portfolio and regional structure is underway and expected to be completed during the first half of 2011.

28. Activities in 2010 – Highlights

28.1 Program highlights: research and projects/activities

Several of START's ongoing regional activities have developed into major projects with substantial external funding support. START's programs and projects in such thematic areas as urban adaptation, land-cover change, biodiversity conservation, human health, disaster risk reduction, agriculture and food security and regional climate modeling and climate services are designed to promote research, education and training, and communication and outreach to policymakers and others societal decision makers on issues of adaptation. These programs and projects include:

Climate change, adaptation and development planning in urban areas

Cities at Risk: International Workshop on Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities

Status: Workshop complete; Program activities ongoing

The International START Secretariat, the SEA-START Regional Research Center (Bangkok), the East-West Center, Ibaraki University, United Nations University and Manila Observatory, with funding from the APN and collateral support from the International START Secretariat, co-organized the *International Workshop on Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities*, held 22-28 August 2010 in Sampran City, Thailand. The event brought together scientists, urban planners, managers and researchers to help

develop their capacity in climate change vulnerability assessment and application to urban development planning and governance. The workshop also promoted locally led vulnerability research in Asian coastal cities linked to user needs. It further encouraged the development of partnerships between researchers, planners, and policy makers, as well as the establishment of communities of knowledge for vulnerability assessment in each participating city. A publication for peer-reviewed journal is under preparation.

The August 2010 workshop was one of a series of events undertaken by the International START Secretariat and START's Southeast Asia Regional Research Center over the past 18 months to promote the development of urban adaptive capacities and the integration of science and policy in managing climate risks in Asia's coastal megacities. These efforts are aimed at addressing the limited analytical capacity to carry out risk and vulnerability assessments in many coastal Asian cities. The *Cities at Risk* program has good potential to make an important contribution to ICSU's Integrated Research on Disaster Risk (IRDR) initiative, as described in the following section. For more information on Cities at Risk, visit http://start.org/programs/cities-at-risk.

Case Study on Urban Poverty and Climate Change in Dar es Salaam, Tanzania

Status: Ongoing

START is collaborating with local partners in Dar Es Salaam, Tanzania to undertake one of four urban case studies being carried out by the World Bank Institute and the Mayors' Task Force. The Dar es Salaam case study assesses: linkages between urban poverty and climate change; good practice examples of reducing vulnerability to the impacts of climate change and in taking steps towards reducing greenhouse gas emissions; and relevant policies, programs, investments and municipal improvements that benefit the urban poor and scale up good practices. The case study employs extensive review of relevant literature, surveys of residents and institutions and mapping exercises (such as overlaying maps of current and potential flood hazard areas on maps of poor urban settlements in Dar es Salaam) to arrive at broad policy recommendations and identify good practice examples among national and city level programs and policies.

The International START Secretariat and the Pan-African START Secretariat, based at the Institute of Resource Assessment at the University of Dar es Salaam, are partnering with Ardhi University and the Tanzanian Meteorological Agency to carry out the study, which will culminate with a series of meetings and stakeholder workshops at which key findings and recommendations will be presented, discussed and refined.

Land-cover change and biodiversity conservation

Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD)

Status: Ongoing

The overall goal of the GOFC-GOLD (Global Observations of Forest and Land Cover Dynamics) project is to improve the quality and availability of remote-sensing observations of forests and land cover at regional and global scales and to produce useful, timely, and validated information from these data for application in land cover/land use management and research by a wide variety of users. GOFC-GOLD activities target a number of land use/cover change related issues

including forestry, fire disturbance, agriculture and carbon cycle dynamics. GOFC-GOLD is a component of the Global Terrestrial Observing System (GTOS), which is a joint program of WMO, UNESCO, UNEP, ICSU and FAO, and a GEO member.

Under the recently launched ***GOFC-GOLD/START Regional Network Data Initiative***, supported by NASA and the USGS, small groups of data specialists from Africa and Asia received training at the USGS Earth Resources Observations and Science (EROS) Center on earth observation data availability and applications. Upon returning to their home countries and institutions, the participants were able to serve as focal points for distribution of acquired data and skills in their regions.

START proposes to extend and expand upon this effort, in partnership with USGS, by establishing the "GOFC-GOLD Fellowship program". These fellowships will be targeted to scientists working in relevant national agencies and/or graduate students working on their PhDs, who can readily apply the data in their work. The International START Secretariat has requested renewal grant support from NASA for the 3-year period CY2011-CY2013 for this and other activities. These other activities include continued support for GOFC-GOLD related workshops to promote exchange of information among Regional Network members, to offer training on the use of remote sensing products and to provide Regional Network members with opportunities to present, expand and build on their ongoing data distribution and application efforts. Workshops are a major activity of GOFC-GOLD Regional Networks and have proven to be a very effective tool in accomplishing many of the Network and overall project implementation goals.

Implementation of the above project activities is managed by the International START Secretariat, in partnership with USGS/EROS, Boston University, the University of Maryland and others, in cooperation with the GOFC-GOLD Project Office and its Regional Networks, and through communication with NASA personnel.

Building African Capacity for Conserving Biodiversity in a Changing Climate

Status: Initiated in 2008; Ongoing.

This innovative education and training program addresses the challenge of managing emerging risks to biodiversity from climate change in the biodiversity-rich Albertine Rift region of Africa, a region that encompasses parts of Tanzania, Burundi, Rwanda, Congo, and Uganda. The International START Secretariat and the Pan-African START Secretariat (PASS), based at the Institute of Resource Assessment (IRA)—University of Dar es Salaam, jointly implement this effort with funding from the MacArthur Foundation.

The first round of this program was held in 2008 and the second round in 2010. The program, hosted at IRA, offers MS-level courses for conservation practitioners from the region coupled with externships that allow program participants to apply knowledge from the courses to field-based conservation efforts through conducting assessments within their home countries. Developed with inputs from international experts, the MS-level courses focus on climate change risks to ecosystems and biodiversity and explore strategies for conserving biodiversity in a changing climate. In the second round of the program, START added a training of teachers component, aimed at educators from regional universities, which includes the development of on-

line distance learning course modules that can help them to develop courses at their universities. In addition, a regional science-policy dialogue will be held in early 2011 to examine key findings from the assessments.

The program has helped foster a network of individuals and institutions in the Albertine Rift region engaged in addressing climate change risks to biodiversity. The existing Masters Program in Natural Resource Assessment and Management at IRA has also benefited from integration of courses from this capacity building initiative into that program's curriculum. Additional information on the program is available at: http://start.org/programs/biodiversity.

GEC research in Africa

The African Climate Change Fellowship Program (ACCFP)

Status: Initiated in 2007; Next round to be launched in 2011 (expected)

START, in partnership with the Institute of Resource Assessment at the University of Dar es Salaam (IRA-UDSM) and the African Academy of Sciences (AAS), is managing the inaugural phase of the African Climate Change Fellowship Program (ACCFP). The ACCFP supports African professionals, researchers, educators and graduate students to undertake activities that enhance their capacities for advancing and applying knowledge for climate change adaptation in Africa. Four types of fellowships are offered: Policy Fellowships, Doctoral Research Fellowships, Post-Doctoral Fellowships and Teaching Fellowships. The ACCFP is currently supported by the Climate Change Adaptation in Africa (CCAA) program, a joint venture of IDRC and UK-DFID.

A total of 44 Fellows have completed projects under the first round of ACCFP Fellowship awards (2009-2010). Round 1 Fellows came from 40 institutions in 18 African countries and were matched with 18 Host Institutions where they collaborated with mentors to implement individually-designed projects that assessed and prioritized climate risks, investigated current practices for designing and implementing adaptation projects and/or considered approaches for integrating adaptation with planning and practice. Many Fellowship projects directly supported adaptation decision-making. ACCFP Teaching Fellows reviewed, developed and/or implemented curricula that promoted integration of climate change and climate change adaptation into graduate level education.

In June 2010, ACCFP Program partners organized an ACCFP Seminar during which Fellows participated in interactive exercises that challenged them to think "outside the box" with respect to their work and how that work fits into the overall picture of climate change, vulnerability and adaptation in Africa. In special sessions that targeted the theme "Getting the Message Out – Communicating Climate Change", Fellows were challenged to consider conventional and nonconventional approaches for communicating about their research and about climate change and adaptation, in general.

The ACCFP Seminar was organized in conjunction with the START/OSI forum on Education, Capacity Building and Climate Change: A Strategy for Collective Action in Africa (described in Section 2.1.4). Organization of the ACCFP event alongside the forum enabled ACCFP Fellows,

as well as several ACCFP Host and Home Institution Supervisors, to participate in this bigger event, to interact with the larger climate change and adaptation community in Africa and to contribute reflections and priorities from their Fellowship activities and ACCFP participation to forum discussions. Throughout the forum the ACCFP was recognized as a growing program that had already succeeded in positively impacting the advancement of adaptation research on the continent. An ACCFP Round 1 Culmination Conference is planned for December 2010, during which time Fellows and their ACCFP Supervisors will present their research. More information about the ACCFP, 2010 program events and Fellows' projects is available at http://start.org/programs/accfp.

Funders of the CCAA program have expressed interest in funding subsequent rounds of the ACCFP provided that co-financing, such as from other IGFA agencies, is forthcoming. In the next phase of the program, management of program responsibilities will be devolved from START to an African institution – most likely IRA-UDSM, in collaboration with other African partners.

African Grants Program on Global Environmental Change

Status: Ongoing

The International START Secretariat and the Pan African Committee for START (PACOM), through funding from the US NSF/USGCRP, continue to administer the START Grants for Global Environmental Change Research in Africa. In 2009, 17 awards were made to scientists from 13 African countries. The subsequent and most recent Call for Proposals, issued during June 2009 for work to be carried out in 2010, focused on the Joint Project themes of ESSP and AfricanNESS and sought to foster inter-disciplinary and inter-institutional collaborative research among 3 or more scientists. Over 200 applications were received in response to that call, which means that more that 600 scientists participated in the process. This is striking testimony to the significant demand in Africa for research funds for global change research. Due to funding limitations, however, awards were made to only four (4) research teams to support research to be conducted during 2010. In late 2010, a new call for proposals will be issued and will again reflect on key themes of ESSP and AfricanNESS. Information on ongoing and completed projects supported by START Grants for GEC Research in Africa is available at: http://start.org/programs/africangec.

African Doctoral Dissertation Fellowships

Status: Ongoing

From 2003 to 2007, START administered 5 rounds of NORAD-funded PhD Fellowships. Most of the PhD Fellows have completed or are near completion of their fellowships and have gone on to pursue research on global environmental change-related issues at African universities, and are teaching and mentoring. (Nine Fellows are nearing completion of their research.) In addition, to research and teaching, Fellows have served on committees for other START projects, and others have become involved with the IPCC and other global scientific efforts.

African universities and adaptation

Forum on Education, Capacity Building, and Climate Change: A Strategy for Collective Action in Africa

Status: Forum completed; African Climate Research and Education Network (ACRE-Net) launched in July 2010; Development of ACRE-Net in progress

The International START Secretariat, with generous support from the Open Society Institute (OSI), organized and carried out the Forum on Education, Capacity Building, and Climate Change: A Strategy for Collective Action in Africa, held in Dar es Salaam, Tanzania between 27 June and 1 July, 2010. The purpose of the forum was to explore the role of African universities in promoting education on climate change adaptation in the areas of research, curriculum development and teacher training, as well as to examine issues of how to more fully engage civil society on adaptation through education aimed outside the university. The forum solicited input from a diverse range of experts within Africa, with the intention of informing OSI's recent initiative on education and adaptation. Approximately 155 participants from nearly 40 countries joined the forum, representing universities and research institutions, civil society organizations, international organizations, such as the African Union, government entities, and the media.

The main output of the forum was a strategy for near, medium and long-term actions to support education, research, and outreach on adaptation in Africa, and the formation of the **African Climate Research and Education Network (ACRE-Net)** to develop and implement actions to support this strategy. The strategy contains six outcome areas: 1) Curriculum development for enrichment of existing programs on climate change and creation of new courses for mainstreaming climate change across disciplines; 2) Staff development, including "training of trainers" to develop, enhance and maintain excellence in teaching and research in climate change education; 3) Partnerships and participation for transforming research and education, with an emphasis on trans-boundary efforts; 4) Bridging science and society; 5) Education beyond the university for reorienting university structures to play a larger role in supporting societal efforts to adapt to climate change; and 6) Innovation in climate education to tackle the various barriers in climate change education. START and African university partners are working together to strongly promote ACRE-Net, and inaugural activities of the network are expected in 2011 and beyond.
For more information on the Forum and ACRE-Net, visit http://start.org/forum2010.

Global Change and Human Health in Southeast Asia

Status: Initiated late 2009 and expected to continue through 2012

With support from the National Science Council of Taiwan and the Academia Sinica, the Secretariat for the Southeast Asia Regional Committee for START, with in-kind support and technical advisement from the International START Secretariat, has initiated a new effort on global change and human health in the region. Following an initial workshop in November 2009, an Advanced Training Workshop on Southeast Asia Regional Health Impacts and Adaptation under Climate Change will take place in Tainan, Taiwan, December 3-9, 2010. This workshop is part of SARCS Capacity Building Program. The main objective of the workshop is to promote

climate change and health-related research programs among SARCS member countries, and to provide advanced training on understanding the health impacts and related adaptations in relation to effects of climate change, as well as to develop a climate change and health research collaboration team across SARCS members. It will be hosted by the National Cheng Kung University (NCKU) with partial support from SARCS Secretariat, and sponsored by the National Science Council of Taiwan. This effort is a contribution to the ESSP Joint Program.

Communication at the science-policy interface

Integrating Climate Change Adaptation and Mitigation into Development Planning (CCMAP Project)

Status: Project activities launched in 2009; Ongoing

Adaptation to climate change is becoming an increasingly urgent issue for many developing countries. However, lack of awareness about key aspects of adaptation, and scarcity of sector- and location-specific knowledge, can often inhibit much-needed policy action. In an effort to address these obstacles, START and its partners (the WMO, UNEP, and the IPCC, with regional center partners consisting of the University of Ghana, the University of Dar es Salaam, and the Bangladesh Center for Advanced Studies) are engaging scientists and policy-makers in nine countries spanning West Africa, East Africa and South Asia in a European Commission-funded project that aims at enabling decision-makers to better integrate climate change issues in development planning and poverty reduction measures. Science-policy dialogues have taken place in Ghana, Nigeria, Senegal, Tanzania, Rwanda, Burundi, Bangladesh, Nepal, and Bhutan. In addition to these national-level dialogues, the project's regional centers have produced policy relevant communication materials on climate change and they will be leading regional assessments beginning in 2011, as described in section 2.1.9.
For more information on the CCMAP project, visit http://start.org/programs/ccmap.

Disaster risks and climate change

Support for Integrated Research for Disaster Risk (IRDR) Program

Status: Initiative to be launched in 2010; START seeking funding from IGFA and other agencies

START has recently pledged to support capacity building activities in conjunction with other partners for the new Integrated Research for Disaster Risk (IRDR) program co-sponsored by the International Council for Science (ICSU), the United Nations International Strategy for Disaster Reduction (UN-ISDR), and the International Social Science Council (ISSC). At a 2010 meeting of ICSU-IRDR in Paris, France, START was approved to be the capacity building arm of IRDR. IRDR aspires to create a multidisciplinary research effort that is global in scope and which will examine natural, socio-economic and institutional factors that contribute to disaster risk and its reduction.

Over the next several years, START will be engaged in international capacity building activities to support the IRDR Science Plan, which lays out priority themes for disaster risk research. These may include identifying teaching and learning opportunities on disaster risk management for

visiting scientists and guest lecturers, and assisting in the design and implementation of workshops, advanced institutes, trainings and conferences to support disaster risk reduction programs. Two initial programs could include the 'Cities at Risk' initiative (undertaken jointly by START, the East-West Center, Ibaraki University, and the Asia-Pacific Network), which focuses on reducing vulnerability of Asia's megacities to climate risk, and a series of 'forensic analyses' that investigate in-depth factors that contribute to exposure, vulnerability, resilience and recovery from disaster events.

Agriculture and food security

Support for Climate Change, Agriculture and Food Security (CCAFS)

Status: Initiative was launched in 2010; START seeking funding from IGFA and other agencies

The Challenge Program on Climate Change, Agriculture and Food Security (CCAFS) was launched by the Consultative Group on International Agricultural Research (CGIAR) and ESSP in 2010. START has been selected by the ESSP as the primary capacity building organization for this initiative. The first activity that START will lead under the CCAFS program is a science-policy dialogue on climate change, which will take place in Niamey, Niger in November 2010. The dialogue will examine potential climate change impacts on pastoral and agro-pastoral systems in the Sahel, opportunities for adaptation, and policies and measures needed to support adaptation planning.

START will further engage with CCAFS and the related CGIAR Mega-program on climate change in 2011 and subsequent years as the initiative progresses. Potential START-led activities in support of this initiative include science-policy dialogues, and advanced institutes and regional training workshops that provide targeted learning related to global environmental change and food production.

Assessments of urban food security

Status: Project initiated in 2010; Assessments to begin in 2011

In addition to the supporting activities proposed above, START and CCMAP project partners (see section 2.1.6) will in 2011 launch an assessment of urban food security, including the role of peri-urban and urban agriculture in food and livelihood security, in West Africa, East Africa, and South Asia. These regions are the same as those for CCAFS; thus there is a propitious opportunity for START to support ESSP leadership in this important initiative.

The success of START's role in CCAFS depends on support from IGFA and other funding agencies.

Regional climate modeling and climate services

Support for CORDEX: Coordinated Regional Downscaling Experiment

Status: Ongoing

CORDEX (the Coordinated Regional Downscaling Experiment), initiated by the WCRP in 2009, will produce a set of Regional Climate Scenarios covering 1950-2100 for the majority of land-regions of the globe, with the results being made readily available and useable to the impact and adaptation communities. Africa is the initial priority region for this initiative.

START is currently partnering with WCRP, the Climate Systems Analysis Group at the University of Cape Town, the International Center for Theoretical Physics and the Swedish Meteorological and Hydrological Institute to develop a program to train a core group of African experts on interpretation and analysis of CORDEX results so that they can in turn become sources of expertise within Africa to train and advise a future expanded effort on CORDEX analysis, interpretation, and application. Implementation of this initial effort, to be carried out in 2011 and 2012, will consist of a series of workshops to develop interpretation skills, analyze the results, and write up the results for submission to a special issue of a journal and eventually for consideration in the IPCC 5th Assessment Report. In addition, the partners will be working with the Climate and Development Knowledge Network to enable the core group of experts trained through this effort to engage with a range of decision makers through focused consultative meetings that examine priorities for analysis and application of CORDEX results. In linking training and analysis with outreach, START and its partners are helping to advance efforts on developing climate services, as enunciated at the World Climate Conference 3 in 2009.

28.2 Key Publications

Major START publications for 2009/2010 are listed below:

- "Global Environmental Changes in South Asia: A Regional Perspective" (2010) Edited by (late) A.P.Mitra and C.Sharma, 356 pages.
- "START: the global change SysTem for Analysis, Research & Training" (2009), brochure
- "Communicating Climate Risks: Insights Gained through the ACCCA Project" (2009), brochure
- "Cities At Risk: Developing Adaptive Capacity for Climate Change in Asia's Coastal Megacities" (2009), brochure
- "Capacity Building for Biodiversity Conservation in the Albertine Rift" (2009), brochure
- "Building Shared Understanding and Capacity for Action: Insights on Climate Risk Communication from the ACCCA Project" Climate and Development, under review

START fellows and grantees also publish numerous papers in peer-reviewed journals; these publications are not listed here but many are available on the START website at http://start.org. Publications from START regional centers and secretariats are also not listed here. START brochures published in 2009 were distributed throughout CY 2010.

28.3 Capacity Building & Outreach

Capacity building is an integral part of START's portfolio. All program and project highlights featured in section 2.1 directly contribute to capacity building and/or promote institutional arrangements that foster capacity building. In its ongoing efforts to promote capacity building and outreach, START also emphasizes cross-cutting themes of network and institutional development and strategic partnerships.

Network and Institutional Development

START regional centers and committees, with support from the International START Secretariat, have developed a robust approach to fostering capacity and conducting/supporting research activities based on regional priorities for global environmental change science. However, START is now in the process of re-evaluating its overall strategy and network structure to accommodate potential new opportunities prompted by developments within the global change science community. These developments include the increased demand for integrated regional studies; evolution of the Earth System Science Partnership between IHDP, IGBP, WCRP and DIVERSITAS and establishment of their joint projects; and evolution of the regional structures of core and joint projects of START's original program sponsors, the ESSP partners and ICSU. For example, the development of the MAIRS program and its SSC and the need to relate activities at regional levels substantially to the effort under MAIRS, require an examination and possible restructuring of START regional committees in Asia. Likewise, an examination and restructuring of START networks in Africa is desirable in view of the developments at the ICSU Regional Office in Africa and the AfricaNESS initiative being fostered by the IGBP, as well as the dynamic nature of knowledge needs and demands in Africa observed by START in its undertaking of activities there.

Strategic Partnerships

Collaboration with APN

The International START Secretariat continues an active collaboration with the APN. START representatives participate in APN's Science Planning Group and Inter-Governmental Meetings. The International START Secretariat administers US-support for APN projects through a grant from NSF/ USGCRP to START. There were 17 APN projects supported through START during 2009. START also collaborates with APN on MAIRS-related activities (e.g., the Asian Cities at Risk project described above) and has provided inputs to APN's ongoing evaluation. Information on ongoing and completed projects is available at: http://www.apn-gcr.org/newAPN/resources/list2009projects.htm and http://www.apn-gcr.org/newAPN/resources/list2009capableprojects.htm.

START's grant for regional research was recently approved by NSF. New Calls for Proposals in both Africa and the Asia-Pacific will be issued within this calendar year.

START-IUCN-WWF Collaboration

START is collaborating with the International Union for the Conservation of Nature (IUCN) and the World Wildlife Fund (WWF) in a MacArthur Foundation funded initiative for Ecosystems, Livelihoods, and Adaptation Network (ELAN). The inter-institutional Adaptation Center/Network is aimed at improving communication and coordination across the globally dispersed conservation and development community. START's project on 'Building African Capacity for Conserving Biodiversity in a Changing Climate' described in section 2.1.3 is a key input to this effort. A similar effort is planned for 2010 in the Greater Mekong Basin. Dr. Hassan Virji, Executive Director of START, is a member of the ELAN Steering Group and a Lead Author on a paper on Ecosystem-Based Adaptation and Livelihoods that is currently in a draft form. Dr. Virji recently participated in a meeting of the Steering Group for ELAN at IUCN headquarters in Gland, Switzerland.

Other Outreach

Other significant outreach activities of the International START Secretariat during 2010 include:

- Professional backstopping for an NSF-funded project of the Association of American Science and Technology Centers on "Communicating Climate Change" to the general public through exhibits and educational modules at science centers and museums;
- Assisting in the development of curriculum on global environmental change themes for undergraduate and graduate level education in developing countries;
- Assisting in the development of capacity building activities in the context of the European Science Foundation's program on Responses to Environmental and Societal Challenges for our Unstable Earth (RESCUE);
- Support to the UNFCCC Nairobi Work Programme (NWP) on Impacts, Vulnerability and Adaptation, including leading a synthesis report for the NWP of assessment activities undertaken by NWP member organizations;
- Editors for various scientific journals, including: EOS (AGU publication); Current Opinions in Environmental Sustainability (Springer); and Climate and Development (Earthscan).

In addition, START participates in a number of international meetings each year. In 2010, these meetings included:

- WCRP Joint Scientific Committee 31st Session: 15-19 February 2010, Antalya, Turkey – The WCRP meeting in February 2010 focused on two major items – the WCRP visioning exercise and the role of climate research in support of climate services. The executive Director of START, Dr. Hassan Virji represented START and discussed the role of capacity building in the context of WCRP themes. He emphasized the need for a broad-based global climate education program, as well as capacity building to include institutional strengthening. He recommended that WCRP activities be broadened to include more capacity building efforts and strategic partnerships not only with START, but also with IAI and other similar organizations of interest. The proposed action was to develop a long-term plan for sustained capacity building activities for WCRP.

- UNFCCC–START participated in both the UNFCCC inter-sessional Subsidiary Body meeting in Bonn (June 2010) and the Conference of Parties in Copenhagen (December 2009). At the Bonn meeting, Jon Padgham from the International START Secretariat participated in a panel discussion at the SBSTA Research Forum.
- ICLEI Resilient Cities 2010, 1st World Congress on Cities and Adaptation to Climate Change: 28-30 May 2010, Bonn, Germany - The ICLEI Resilient Cities 2010 1st World Congress on Cities and Adaptation to Climate Change, took place between 28 and 30 May 2010 in Bonn, Germany. Dr. Hassan Virji represented START with a presentation on the Asian Cities At Risk initiative. Dr. Virji highlighted the urgent need to address the disconnect between the geographic and time scales at which the scientific planning and policy communities are working. He further encouraged the urban planning community to take a comprehensive view of climate risks and promote the importance of identifying an "entrepreneur" in urban governments to help make climate change a priority. For specific information on the Cities At Risk program, refer to section 2.1.1 above or visit START website at: http://start.org/programs/cities-at-risk.
- Belmont Report for ICSU – Dr. Hassan Virji, Director of START, was invited to attend this meeting of the ICSU-convened committee tasked with preparing the Belmont Report where he presented a Strengths, Weaknesses, Opportunities and Challenges (SWOC) analysis of the START perspective on international research capability to respond to the challenge of delivering knowledge to support human action and adaptation to regional environmental change.
- IHDP SC Session: September 2010, Bonn, Germany – Prof. Eckart Ehlers, Chair of START Development Committee, represented START at the 2010 meeting of the IHDP SC in Bonn, Germany.
- Science and Technology in Society Forum Annual Meeting: 3-5 October 2010, Kyoto, Japan – Dr. Hassan Virji, Director of START, and members of the START Board of Directors, Scientific Steering Committee and Development Committee will participate in this upcoming forum annual meeting in Kyoto.
- Belmont Forum and IGFA Meeting: 26-29 October 2010, Cape Town, South Africa – Dr. Hassan Virji, Director of START, will participate in the upcoming Belmont Forum and IGFA Meeting in Cape Town.

29. Future Activities – 2011 and Beyond

Assuming START is able to secure funding from IGFA Agencies and other donors, the broad and comprehensive program of capacity building activities described in the previous section will continue during 2011 and beyond. The following sections highlight significant new capacity building actions, in addition to those activities previously described, which will require support from IGFA and other agencies.

29.1 Education initiative on global environmental change

Status: Initiative under development; START seeking funding from IGFA and other agencies

START is developing broad-based comprehensive programs in Africa and Asia for educating and training researchers, professionals, and practitioners on global environmental change (GEC) issues. Actions to support the initiative would include the development of GEC education centers from within existing institutions of strength in the two regions; development of interdisciplinary curricula on GEC education and a comprehensive faculty development program to support faculty in designing and implementing new curricula, and fellowships and grants to support graduate level research. The GEC education initiative would engage a consortium of northern and southern universities in coordinated and complementary actions. START envisions that launching and sustaining a successful GEC education initiative will require 10 years of funding. The strategy developed by the African research community present at the Dar es Salaam Forum on universities and adaptation and the ACRE Network created to implement that strategy, as described in Section 2.1.4, along with key insights gained through implementing the African Climate Change Fellowship Program, provide a solid intellectual foundation upon which to target resources for a long-term investment in education on global environmental change.

The success of this initiative very much depends on support from IGFA and other funding agencies.

29.2 International Young Scientists' Global Change Conference (2011/2012)

START plans to organize and conduct a 3rd International Young Scientist's Global Change Conference during the 2011/2012 timeframe. As in past such highly successful events organized by START and partners, the 2011/2012 conference will be held in conjunction with a major international event, most likely one organized by the Earth System Science Partnership. Previous experience shows that approximately $300,000 USD will need to be raised for such an event.

30. Financing and Budgets

30.1 Financial report – 2010 and future (2011-2013) budgets

The table below provides the operating budget for the International START Secretariat for the current (2010) calendar year and projections for the next several years. The figure below this table shows the distribution of expenditures in 2010 for the International START Secretariat. The distribution of expenditures is not expected to change, or will change very little, in the 2011 through 2013 period.

International START Secretariat

Available / Anticipated Core Operations Funding Budget (best estimates as of 30 Sept 2010)

		CY 2010 *2		CY 2011		CY 2012		CY 2013	
		USGCRP/ NSF *1	External grants and national contributions	USGCRP/ NSF *1	External grants and national contributions	USGCRP/ NSF *1	External grants and national contributions	USGCRP/ NSF *1	External grants and national contributions
Category									
International START Secretariat Operations	Staff (including fringe benefits) *3	523,458	197,778	563,218	194,084	574,483	142,350	585,972	80,000
	Travel	78,000		102,510		104,560		106,653	
	Office Operations (rent, postage, publications, communications, equipment, supplies, insurance, web and database services)	186,748		201,296		203,131		205,003	
	Accounting, audit, and personnel (AGU)	40,048		44,101		44,859		45,632	
Steering committees and Regional Centers	SSC and BOD	12,750	25,000	15,000		15,000		15,000	
	Regional Centers / Committees	0		0		0		0	
TOTAL	TOTAL	841,004	222,778	926,125	194,084	942,033	142,350	958,260	80,000

Additional Need

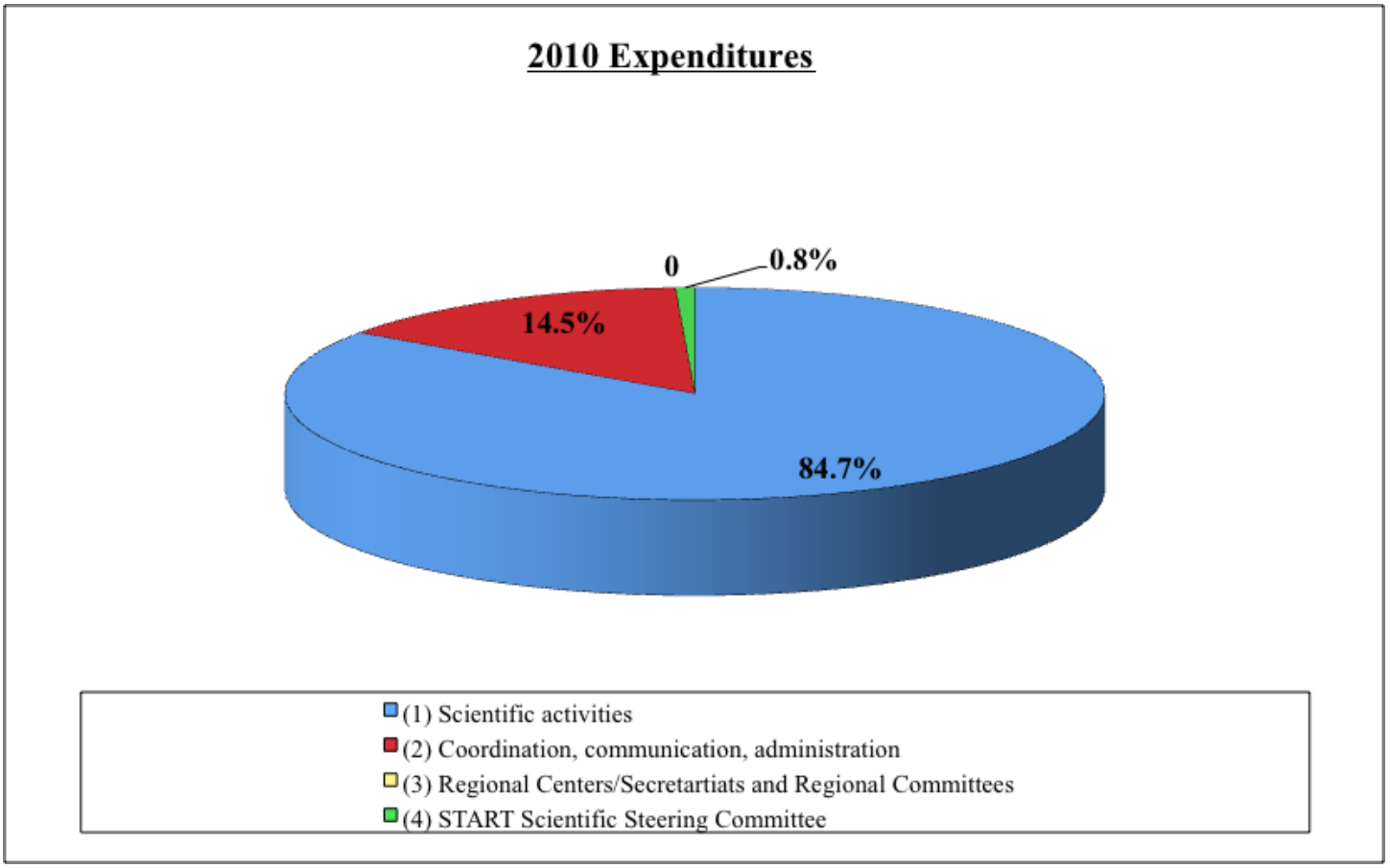
International START Secretariat Operations	----	----	**$39,350** (estimate to be revised if new external grants are secured)	**$112,890** (estimate to be revised if new external grants are secured)
START Steering Committee, BOD, Regional Centers and Regional Committees *4	**$157,250**	**$180,000**	**$180,000**	**$180,000**
Additional Need:	**$157,250**	**$180,000**	**$219,350**	**$292,890**

*1 USGCRP/NSF figures represent budgeted amounts in the grant for US support of the International START Secretariat (GEO-0937206)

*2 Funding available from USGCRP for FY 2010 was less than requested in START's original proposal budget. START secured the balance funding from other grants and contracts. Hence, the 2010 figures are lower than subsequent years.

*3 USCCSP/NSF core support covers less that 100% of scientific salaries. The remainder is obtained from other sources as shown.

*4 Costs estimated at: 5 regional centers at $30,000/year each plus $45,000 for Steering Committee meetings.


2010 Expenditures
0
0.8%
14.5%
84.7%
(1) Scientific activities
(2) Coordination, communication, administration
(3) Regional Centers/Secretartiats and Regional Committees
(4) START Scientific Steering Committee

31. Current and Future Program and Funding Issues

The demand for research-driven capacity building that can both address critical global change knowledge gaps and inform and support decision making across multiple scales and sectors has significantly increased over the past few years. This trend is expected to accelerate over the next several years as Parties to the UNFCCC and other conventions begin to implement adaptation measures to address climate change.

As an organization at the forefront of capacity building, START has experienced increased demand from international organizations, regional bodies, and national universities and research centers to provide capacity building support for GEC research and research applications, and to develop comprehensive programs for GEC education capable of producing a new generation of researchers. START is responding to this demand but its ability to do so with full effectiveness is ultimately circumscribed by funding constraints.

START is actively working to address these funding shortfalls through developing joint proposals with its partners and others, and has had reasonable success in obtaining support from bi- and multi-lateral funding agencies and private foundations in a time of belt-tightening within the funding community. START's solid record of performance and its active and engaged networks of scientists and institutions have made this possible. However, substantive and consistent support from IGFA will be essential for START to effectively meet the growing demand from the developing world for capacity building.

Over the next several years, START anticipates funding needs in both programmatic as well as operational areas, the latter is especially true with respect to START's regional structures. The specific needs for which we seek support and advice from IGFA Agencies are listed in section 31.1.

31.1 Programmatic Areas Needing IGFA Agencies Collateral Support

- Co-financing support for programs and projects described in section
- Collateral support for future rounds of the African Climate Change Fellowship Program
- The African Climate Research and Education network (ACRE-Net)
- Funding to continue START activities that were historically supported by the DGIS, including fellowships/visiting scientists awards, Young Scientists awards, and partial support for START's regional structures
- Support for the African Doctoral Dissertation Fellowships program
- Support for START to fulfill its capacity building obligations under the CCAFS and IRDR programs
- Support for a Young Scientists' GEC conference in 2012

Only with collateral support from the IGFA Agencies, will START be able to substantially leverage additional programmatic funding support and direct support to supplement the needs for the full operations of the International START Secretariat over the next several years. As in the

past, such leveraged funding will be sought form other donor organizations, such as the UN and other international organizations, bilateral development assistance agencies, and the private sector, in collaboration with our strategic partners in ESSP, IGFA and elsewhere.

Report Prepared By:

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Annex 1: DIVERSITAS Scientific Committee membership (2010)

DIVERSITAS Members

Chair **Hal Mooney** Stanford University, USA *Members* **David Cooper** Convention on Biological Diversity, Montreal, Canada **Wolfgang Cramer** Potsdam Institute for Climate Impact Research, Postdam, Germany **Peter Daszak** (Treasurer) Consortium for Conservation Medicine, Wildlife Trust, USA **Sandra Diaz** IMBIV Universidad Nacional de Cordoba, Argentina	 **Philippe Le Prestre** Laval University, Canada **Mark Lonsdale** CSIRO Entomology, Australia **Georgina Mace** (Vice Chair) Imperial College London, UK **Hiroyuki Matsuda** Faculty of Environment and Information Sciences Yokohama National University, Japan **Robert Scholes** (Vice Chair) Natural Resources and Environment, CSIR, South Africa **Billie L. Turner** School of Geographical Sciences and Urban Planning University of Arizona, USA

DIVERSITAS' Projects Chairs

agroBIODIVERSITY **Louise Jackson** University of California Davis USA **Lijbert Brussaard** Wageningen University The Netherlands	**ecoSERVICES** **Charles Perrings** Arizona State University USA **Shahid Naeem** Columbia University USA
bioDISCOVERY **Paul Leadley** University Paris Sud France	**freshwaterBIODIVERSITY** **Margaret Palmer** University of Maryland USA
bioGENESIS **Dan Faith** The Australian Museum Australia	**Global Invasive Species Programme** **William Jackson** IUCN Switzerland

Tetsukazu Yahara Kyushu University Japan	
bioSUSTAINABILITY **Thomas Elmqvist** University of Stockholm Sweden **Stephen Polasky** University of Minnesota USA	**Global Mountain Biodiversity Assessment** **Christian Körner** University of Basel Switzerland
ecoHEALTH **Peter Daszak** Wildlife Trust-New York USA	

***Ex-officio* Members**

ICSU **Deliang Chen** ICSU, France **IUBS** **Jean-Marc Jallon** Université Paris-Sud Orsay France **CBD** **Ahmed Djoghlaf** Executive Secretary, Canada	**SCOPE** **Paul G. Risser** University Research Cabinet, University of Oklahoma USA **UNESCO** **Salvatore Arico** Natural Sciences, UNESCO, France

Global Environmental Change Programmes

ESSP **Rick Leemans** Wageningen University The Netherlands **IGBP** **Carlos A Nobre** Centro de Previsao de Tempo e Estudos Climaticos, Brazil	**IHDP** **Oran R Young** Bren School of Environmental Science and Management, Santa Barbara, CA, USA **WCRP** **Tony Busalacchi** University of Maryland, USA

Annex 2: DIVERSITAS Budget 2010

Includes final figures at 31st August 2010 and provisions for September to December 2010.

INCOME - Calendar year 2010		**Euros**
1 National contributions		**577 092**
USA-NSF (US FY10; Jan-Sept 2010)	236 559 USD	186 172
USA-NSF (US FY11; Oct-Dec 2010)	pending	65 160
France - Ministère de la Recherche		61 200
Germany-DFG	pending	30 600
Germany-BMBF		30 600
United Kingdom		30 700
The Netherlands-NWO		20 000
The Netherlands-KNAW		5 000
Belgium	pending	20 400
South Africa		20 400
Norway		20 400
Sweden	pending	20 400
Switzerland		20 000
Spain		10 200
Austria		10 000
China-Taipei		10 000
Mexico	pending	10 000
Slovak Republic	pending	1 020
2 Grant		**294 765**
NASA for GEO BON (285 230 USD)		197 022
UNEP grant (IPBES)		14 425
UNEP grant (Biodiversity indicators)		75 566
OSC2 grants (provision)		7 752
3 Provisions from 2009		**185 926**
bioGENESIS provision from 2009		7 274
bioDISCOVERY provision from 2009 (including GBO3)		21 775
ecoSERVICES provision from 2009		27 726
bioSUSTAINABILITY provision from 2009		17 974
agroBIODIVERSITY provision from 2009		16 500
freshwaterBIODIVERSITY provision from 2009		15 038
GMBA provision from 2009		23 437
ecoHEALTH provision from 2009		19 003
OSC2 provision		27 200
Provision for administrative expenses		10 000
4 Other income		**12 125**
Reimbursement AKE - OSC2		12 107
Bank interest		18
5 Positive balance 2009		**189 229**
TOTAL INCOME		**1 254 297**

EXPENSES - Proposed for calendar year 2010		
1 TOTAL SCIENTIFIC ACTIVITIES		**995 090**
1.1 Scientific Committee meeting		19 557
1.2 Core Projects and networks		
bioGENESIS		22 274
bioDISCOVERY		36 775
ecoSERVICES		42 726
bioSUSTAINABILITY		49 395
agroBIODIVERSITY		31 500
freshwaterBIODIVERSITY		30 038
Global Mountain Biodiversity Assessment		38 437
ecoHEALTH		34 003
1.3 Other DIVERSITAS scientific activities		
GEO BON		197 022
IPBES		14 289
Open Science Conference 2		27 200
Other activities in 2011		195 862
1.4 Earth System Science Partnership		
GWSP	10 000 USD	7 000
GEC and Human Health	10 000 USD	7 000
1.5 Participation of secretariat & representatives in meetings		34 346
1.6 Full salary cost for scientific staff		245 000
2 TOTAL COMMUNICATION		**60 200**
2.1 Publications		10 200
2.2 Communication consultancy		30 000
2.3 Website (outsourced; new site)		20 000
3 TOTAL OPERATING COST		**161 675**
3.1 Full salary cost for administrative staff		80 000
3.2 Other costs		
Provision office rental		40 000
Office insurance		1 395
Equipement, informatics		2 000
Expendables		2 770
Postage, shipping		12 520
Bank costs		5 032
Accounting fees (outsourced)		15 000
Other expenses		2 958
TOTAL EXPENSES (1+2+3)		**1 254 297**
Mandatory reserve		**266 045**
In kind contribution from France	bioDISCOVERY Science Officer position (CNRS); Office host (MNHN)	
In kind costs	Administrative management of ESSP coordinator position by DIVERSITAS secretariat	

Annex 3: DIVERSITAS Provisional budget 2011

INCOME - Proposed for calendar year 2011		**Euros**
National contributions		**598 439**
USA-NSF (US FY11; Jan-Sept 2011)		195 480
USA-NSF (US FY12; Oct-Dec 2011)		71 839
France - Ministère de la Recherche		61 200
Germany-DFG		30 600
Germany-BMBF		30 600
United Kingdom		30 700
The Netherlands-NWO		20 000
The Netherlands-KNAW		5 000
Belgium		20 400
South Africa		20 400
Spain		20 400
Norway		20 400
Sweden		20 400
Switzerland		20 000
Austria		10 000
China-Taipei		10 000
Mexico		10 000
Slovak Republic		1 020
Positive balance 2010		**195 862**
TOTAL INCOME		**794 301**
EXPENSES - Proposed for calendar year 2011		
1 TOTAL SCIENTIFIC ACTIVITIES		**605 301**
1.1 Scientific Committee meeting		30 000
1.2 Core Projects and networks		
bioGENESIS		15 000
bioDISCOVERY		15 000
ecoSERVICES		15 000
bioSUSTAINABILITY		15 000
agroBIODIVERSITY		15 000
ecoHEALTH		15 000
freshwaterBIODIVERSITY		15 000
GMBA		15 000
1.3 Other DIVERSITAS scientific activities		
GEO BON		20 000
IPBES		20 000

Other activities for 2011 & 2012		43 301
1.4 Earth System Science Partnership		
GEC and Human Health		7 000
1.5 Participation of secretariat & representatives in meetings		35 000
1.6 Full salary cost for scientific staff		330 000
2 TOTAL COMMUNICATION		**28 000**
2.1 Publications		8 000
2.2 Communication consultancy		15 000
2.3 Website		5 000
3 TOTAL OPERATING COST		**161 000**
3.1 Full salary cost for administrative staff		80 000
3.2 Other costs		
Proivsion office rental		40 000
Office insurance		1 500
Equipement, informatics		2 000
Expendables		3 000
Postage, shipping		13 000
Bank costs		5 000
Accounting fees (outsourced)		15 000
Other expenses		1 500
TOTAL EXPENSES		**794 301**
Mandatory reserve		**266 045**
In kind contribution from France	bioDISCOVERY Science Officer position (CNRS); Office host (MNHN)	
In kind costs	Administrative management of ESSP coordinator position by DIVERSITAS secretariat	

Annex 4: Summary of DIVERSITAS projects' support (2009)

(in Euros) for 2009. Figures for 2009 will be communicated to IGFA members later.

Project	Funding sources	Amount (Euros)
bioGENESIS France	DIVERSITAS Provision from 2008 **bioGENESIS Total**	15,000 9,895 **24,895**
bioDISCOVERY France	Convention on Biological Diversity ICSU/UNESCO grant DIVERSITAS GIS Climat, France EU EVOLTREE **bioDISCOVERY Total**	64,321 17,477 15,000 15,000 12,000 **123,798**
bioSUSTAINABILITY (Stockholm, Sweden)	Beijer Institute Formas DIVERSITAS SIDA WWF Stockholm Resilience Centre Provision from 2008 **bioSUSTAINABILITY Total**	20,000 13,500 10,000 10,000 8,000 6,000 3,400 **70,900**
ecoSERVICES (ASU, USA)	NSF-RCN BESTNet DIVERSITAS Provision from 2008 **ecoSERVICES Total**	36,333 15,000 14,198 **65,531**
agroBIODIVERSITY (Wageningen University, The Netherlands, and UC Davis, USA)	Ministry of Agriculture, The Netherlands Wageningen University DIVERSITAS Provision from 2008 **agroBIODIVERSITY Total**	 70,000 25,000 15,000 16,688 **126,688**
ecoHEALTH (DIVERSITAS)	DIVERSITAS Grants from Wildlife Trust, V. Kann Rasmussen Foundation, New York Community Trust, Eppley Foundation, Switzer Foundation Provision from 2008 **ecoHEALTH Total**	15,000 3,000 15,000 **33,000**
freshwaterBIODIVERSITY (DIVERSITAS)	DIVERSITAS Provision from 2008 **freshwaterBIODIVERSITY Total**	15,000 31,320 **36,320**
GMBA (Basel, Switzerland)	Swiss National Science Foundation DIVERSITAS Provision from 2008 **GMBA Total**	113,900 15,000 29,646 **158,546**


Earth System
Science Partnership


DIVERSITAS
an international programme
of biodiversity science


GLOBAL
IGBP
CHANGE
International
Geosphere-Biosphere
Programme


IHDP


WCRP
World Climate Research Programme


START