

## IGBP and Earth System Science for Global Sustainability: Connecting Regional to Global

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For over 20 years, IGBP has assembled overwhelming evidence of the unprecedented scale of changes to Earth's most important biological, chemical and physical processes. The pace of change has accelerated since the 1950s. A growing population, exponential resource use and rapid industrialization are major drivers of most of the global changes and strongly influence others. The planet's human population is set to hit nine billion by 2050.

The world's decision makers require information urgently on how the Earth's social, ecological and physical systems are linked, how they are changing and what sustainable solutions can be applied. More than ever before, the facilitation, coordination, and synthesis & integration of Earth system science and communication with stakeholders are needed. At the same time, there is a need to transform the way global environmental change research is defined and carried out. This transformation is an essential part of a much wider societal transformation towards global sustainability and poverty eradication. It is within this context that IGBP activities have been evolving during the past decade and that we recently updated our strategic vision: *to provide essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change.*

Examples of IGBP activities in support of our new strategic vision will be discussed, as highlighted below.

IGBP has long promoted natural and social scientists' work on environmental observations, analysis, and predictions, as well as integrated process studies. This includes, for example, the co-sponsored by IGBP and IHDP of two core projects (Land-Ocean Interactions in the Coastal Zone (LOICZ) and Global Land Project (GLP)). Both natural and social scientists are members of the governing structure of IGBP including many of our core projects. The innovative IHOPE (an AIMES/PAGES activity) activity is mapping and modeling the integrated biophysical and human system changes over the past millennia to better understand the socio-ecological dynamics of human history and options for the future. IGBP organized the first ever workshop (Nov. 2009) for developing country (natural and social) scientists across the Global South focused on impacts, adaptation and vulnerability.

Developing open access observation databases for improved understanding of the Earth system from regional to global scales is a key activity of IGBP

core projects. Recent databases have been published of global greenhouse gas emissions from the oceans and terrestrial systems and paleo-reconstructions of past global changes. Databases are being developed of emissions of atmospheric pollutants in urban areas around the world, with an emphasis on Asian megacities and in Africa, following concerted efforts in capacity building to ensure comparability of measurements. An IGBP task force is developing an observation strategy focusing on integrating observations of the physical, biogeochemical and human dimensions of global change to detect and understand complex human-environmental system responses to change.

Facilitating dialogue between scientists, decision makers and the general public to support decisions and actions is an important component of many IGBP activities. The IGBP Climate Change Index brings together key indicators of global change to communicate, in a simple index, the direction of climate change to policy makers and the public. The new IGBP Global Change magazine summarizes key findings in global change science for a broad audience. The IGBP 2<sup>nd</sup> Synthesis is producing knowledge about several policy-relevant topics. This is a truly transdisciplinary activity, with engagement of the science, industry and policy communities. The topics include: atmospheric pollution and climate; unintended impacts of geoengineering; global environmental change and needs of least developed countries; nitrogen and climate; land-use change and climate; among others. The results of this activity will be published in the peer-reviewed literature, many in time for inclusion in IPCC AR5, form the basis of summaries for policy makers, and form the basis of a number of special sessions at the 2012 Planet under Pressure conference and go forward to the next Earth Summit, Rio+20. A considerable amount of the science assessed by IPCC comes from IGBP activities. IGBP regularly reports to UNFCCC SBSTA on the latest scientific climate change findings, priorities and uncertainties.

The Planet Under Pressure conference seeks to address two fundamental priorities: society's priority to find solutions and researchers' priority to communicate the challenges and the options to address these challenges. The conference (London, 26-29 March 2012) aims to attract 2500 researchers, policymakers, business leaders and journalists to discuss solutions to global sustainability and build lasting collaboration across communities. IGBP has developed the conference with our sister GEC programs (DIVERSITAS, IHDP, WCRP and our Earth system Science Partnership) and ICSU. The conference in many ways exemplifies the current and future direction of IGBP.

The foundation for all the above rests on the shoulders of the fundamental scientific understanding of the Earth system (its interacting physical, biological, chemical and societal components). As we continue to address the knowledge needs of decision makers and society, we must not forget or neglect this.