International Geosphere-Biosphere Program (IGBP)

Generating policy relevant knowledge for a Planet under Pressure

Jose A. Marengo
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Integrated Earth-system Approach

IGBP launched 1987:

• Leading international research on the planet's key biogeochemical processes including humans

• Integrated Earth-system approach, working globally and regionally.

• Addressing impacts, adaptation and vulnerability

• Using a range of tools (models, inter-comparisons, data evaluation)
How are IGBP’s vision and activities addressing changes in the Earth system?

**IGBP 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.

- Fundamentals of the Earth system
- Impacts of environmental disturbances
- Bio-geophysical and social diversity
- Resource management
- Mitigation and adaptation
Some science highlights from the past year
1st Global climate reconstruction – with regional detail

- 7 regions, >500 sites
- multi-proxy approach
- worldwide Medieval Climate Anomaly (ca. 950-1300 AD)
- worldwide Little Ice Age (c. 1450-1850)
- robust millennial-scale cooling
- warming over last few decades
**CO$_2$ emissions follow worst case scenario**

Emissions are heading to a 4.0-6.1°C “likely” increase in temperature. Large and sustained mitigation is required to keep below 2°C.

- **RCP8.5**: 4.0–6.1°C
- **RCP6**: 2.6–3.7°C
- **RCP4.5**: 2.0–3.0°C
- **RCP3-PD**: 1.3–1.9°C

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Peters et al. 2012a; Global Carbon Project 2012;
Black Carbon: heats up the atmosphere because it absorbs sunlight

Second only to CO₂ as warming agent
1.7 vs 1.1 W/m²

Climate and health impacts

Short atmos life-time

BC emissions by latitude and source type – important information for policy decisions on reducing BC

Bond et al. 2013 JGR Atmospheres
Air pollution & climate: CO2 and BC
mitigation options and policy discussions

engaging a range of stakeholders (scientists, economists, policy makers, etc.)
to assess the status of knowledge with regard to current understanding about
air pollution and climate change
Sustainability in an ever urbanizing planet

Urbanization and Built Environments

• If 3.2 billion additional people by 2100
• Mostly in cities of 1 million
• Require 3200 cities of 1 million over 89 years
• Or a new 1 million person city every 10 days

Karen Seto 2011; UN population projections 2012; Seitzinger et al. 2012
Land-use, land-cover change

Linking local and global observations of land use and ecosystem services

From large scale land cover changes to subtle modifications of land use

Detecting and quantifying changes in land-use and land-cover, as well as understanding the factors driving land-use change,
Social drivers of land use change

Transformation from swidden (slash-and-burn) to other land uses in tropical forest-agriculture frontiers

van Vliet et al. 2012 Global Environmental Change
Continuing to build the dialog

science and decision makers
CO₂ and pH time series in the North Pacific Ocean: Ocean acidification

Impacts on individual species and marine ecosystems is complex

Adapted from R. Feely 2008
PUP 2012 was the largest and most ambitious engagement effort in IGBP’s 25-year history

- State of the planet
- Linking communities
- Solutions
- 3000 delegates

Conference co-chairs, Lidia Brito (UNESCO), Mark Stafford Smith (CSIRO)
Policy Panel

Jane Lubchenco NOAA
HSH Prince Albert II of Monaco
Congressman Sam Farr (D-California)
Jean-Pierre Gattuso, Scientist
Bill Dewey, Taylor Shellfish Farms
Virginia Gewin, Nature
Intergovernmental Panel on Climate Change

IPCC

IGBP joins scoping meetings
IGBP feeds into outline
IGBP facilitates identification of experts

Engagement in many aspects of the development of AR5

AR5 WG1 launch
Stockholm, Sept 2013
Public lecture

Part of expert review

IPCC and IGBP hold joint workshops
Forward look

IGBP SC meeting
17-19 April 2013
Bern, Switzerland
IGBP Synthesis

**Goals:**
- Frame contribution of IGBP core project science & big picture view of development of Earth System science thru IGBP
- Forward look

**Products**

- **Anthropocene:** Anthropocene paper with IHDP
  - Integrated natural and social science perspective of the Challenges of the Anthropocene

- **Earth System Science:** Development of ESS thru IGBP
  - Format:
    - Motivation and highlights
    - Evaluation of questions: looking back and pointing forward

- **Core Project Science:**
  - Project based papers with introduction

Complete by December 2015
The Earth System Science Partnership was set up in 2001 to address integrative research questions and foster greater interaction between the natural and social sciences. In 2013, a new initiative – Future Earth – will respond to the growing emphasis on solutions and greater engagement. (Raupach 2012-IGBP)
IGBP transition into Future Earth

• Core projects are invited to join Future Earth

• IGBP will continue until December 2015 to help ensure a smooth transition of core projects and key activities of IGBP**

• IGBP working with our scientific community, funders, stakeholders, to support smooth transition

** and finalize synthesis