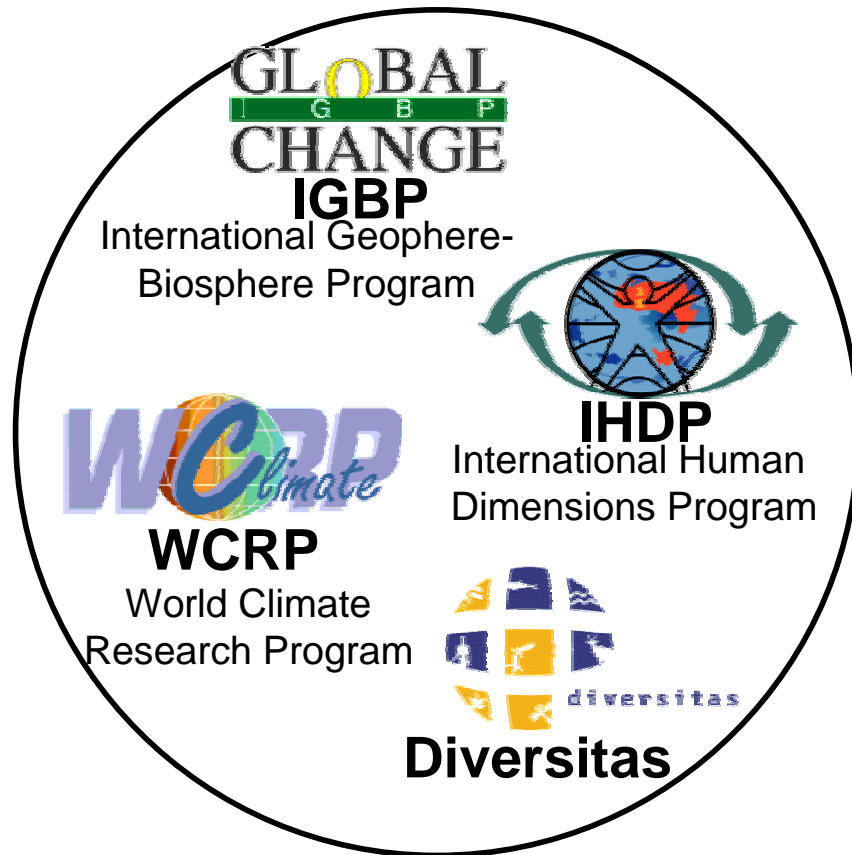


The Global Carbon Project

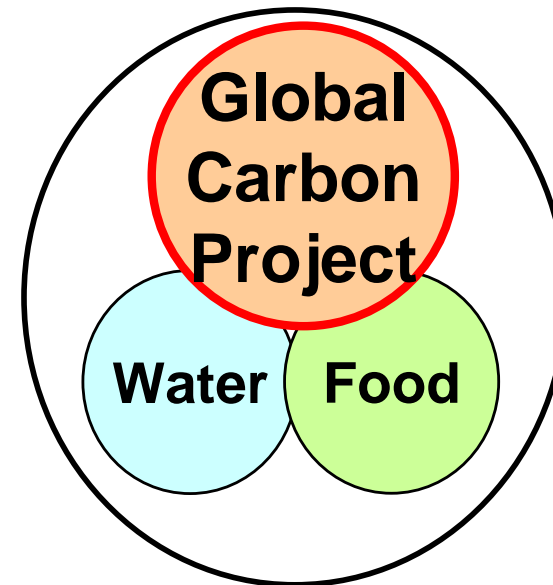


GCP International Project Office
CSIRO Earth Observation Centre
Canberra, Australia
Prepared by Pep Canadell

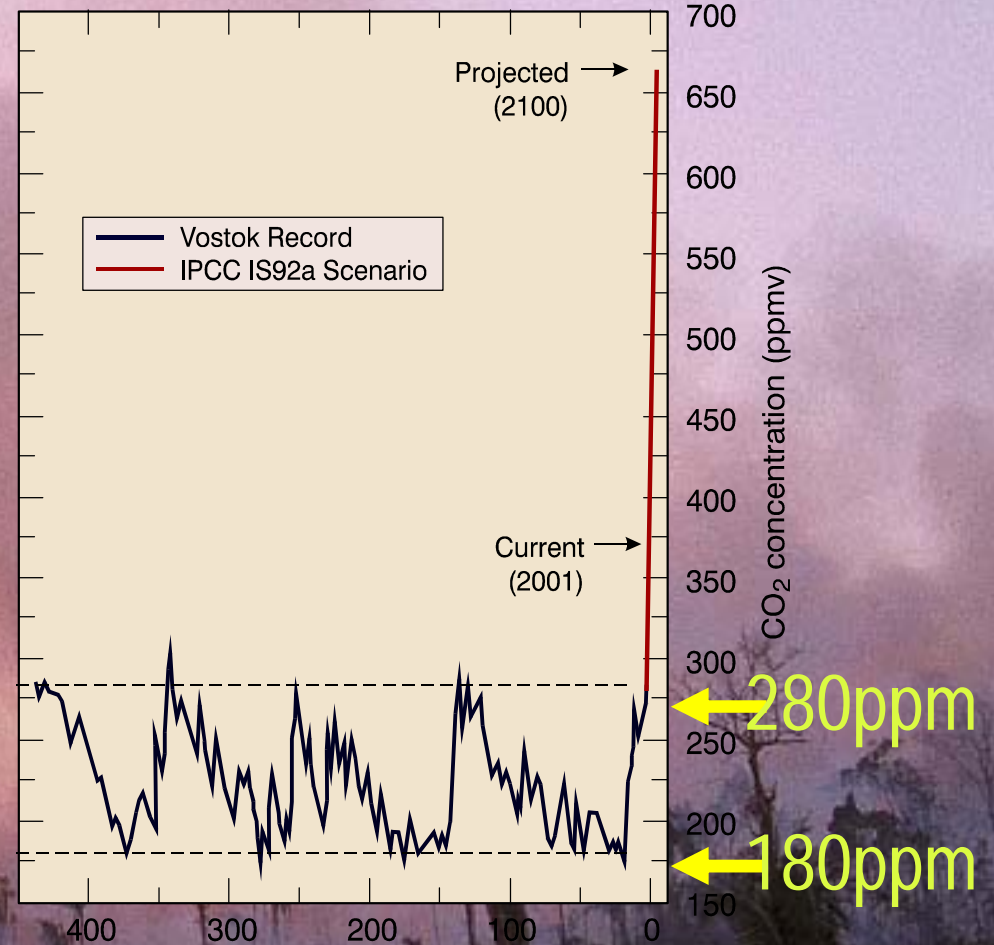
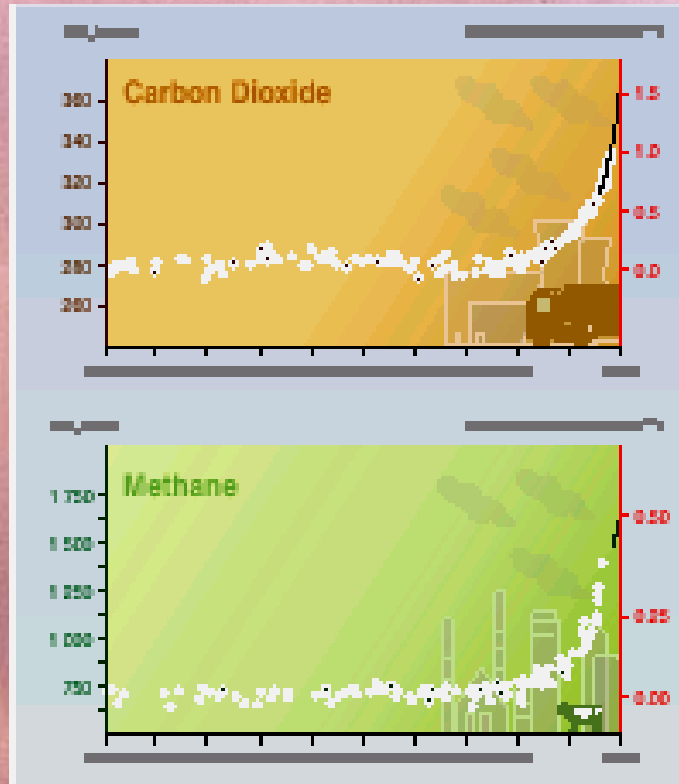
Earth System Science Partnership



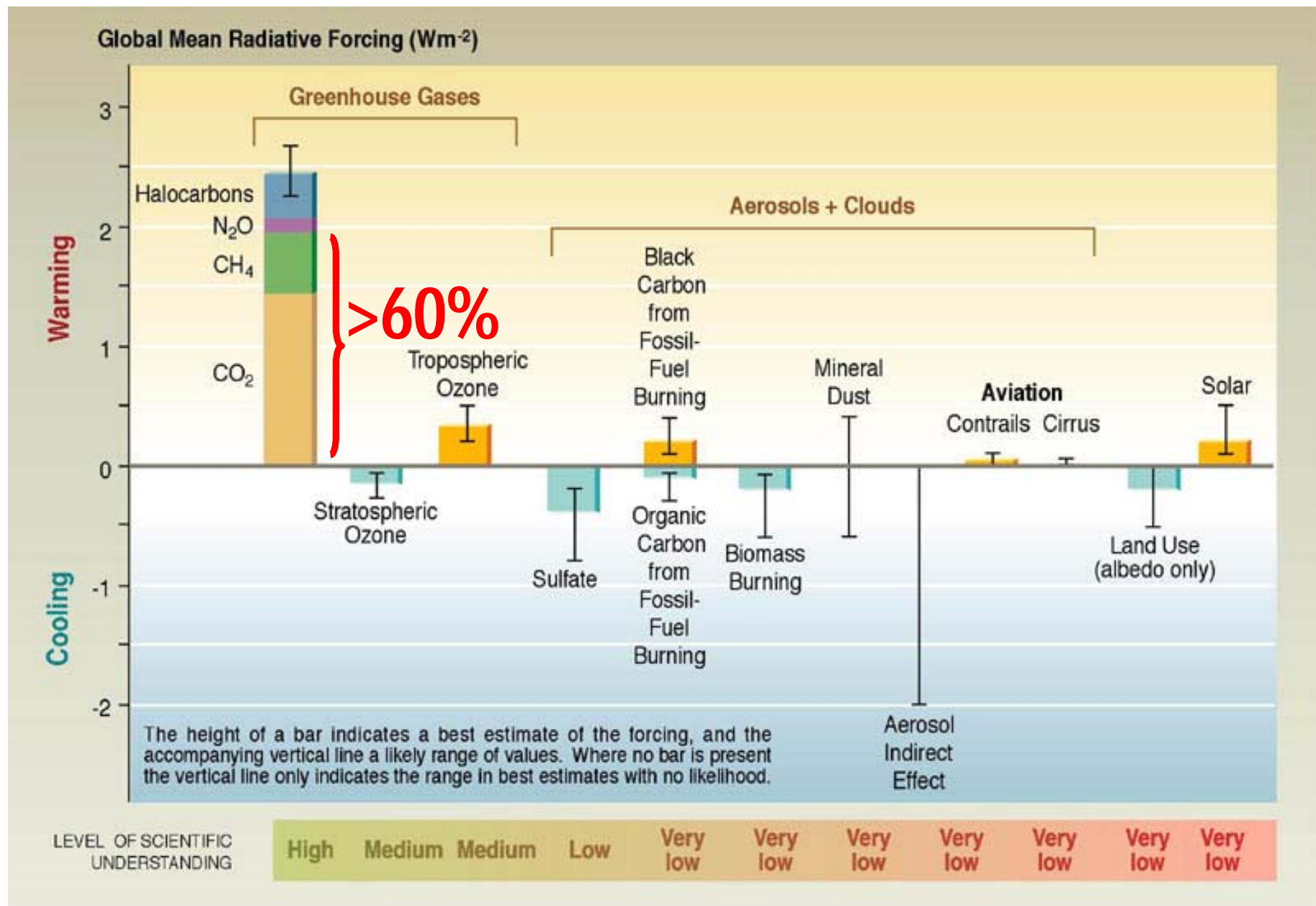
Joint Projects
on Global
Sustainability



1. Past and future atmospheric composition

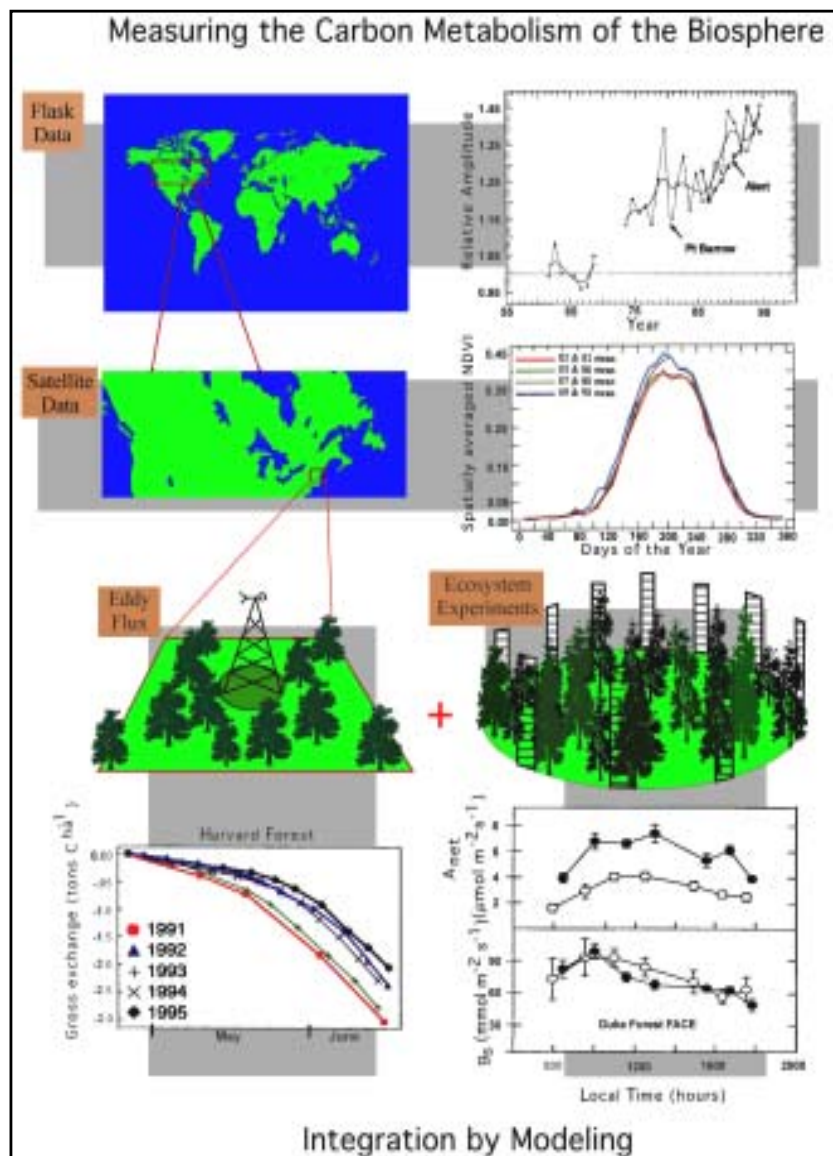


2. Global and annual mean radiative forcing




3. Multiplicity of research disciplines


Biophysical system





Canadell et al. 2000

Management system

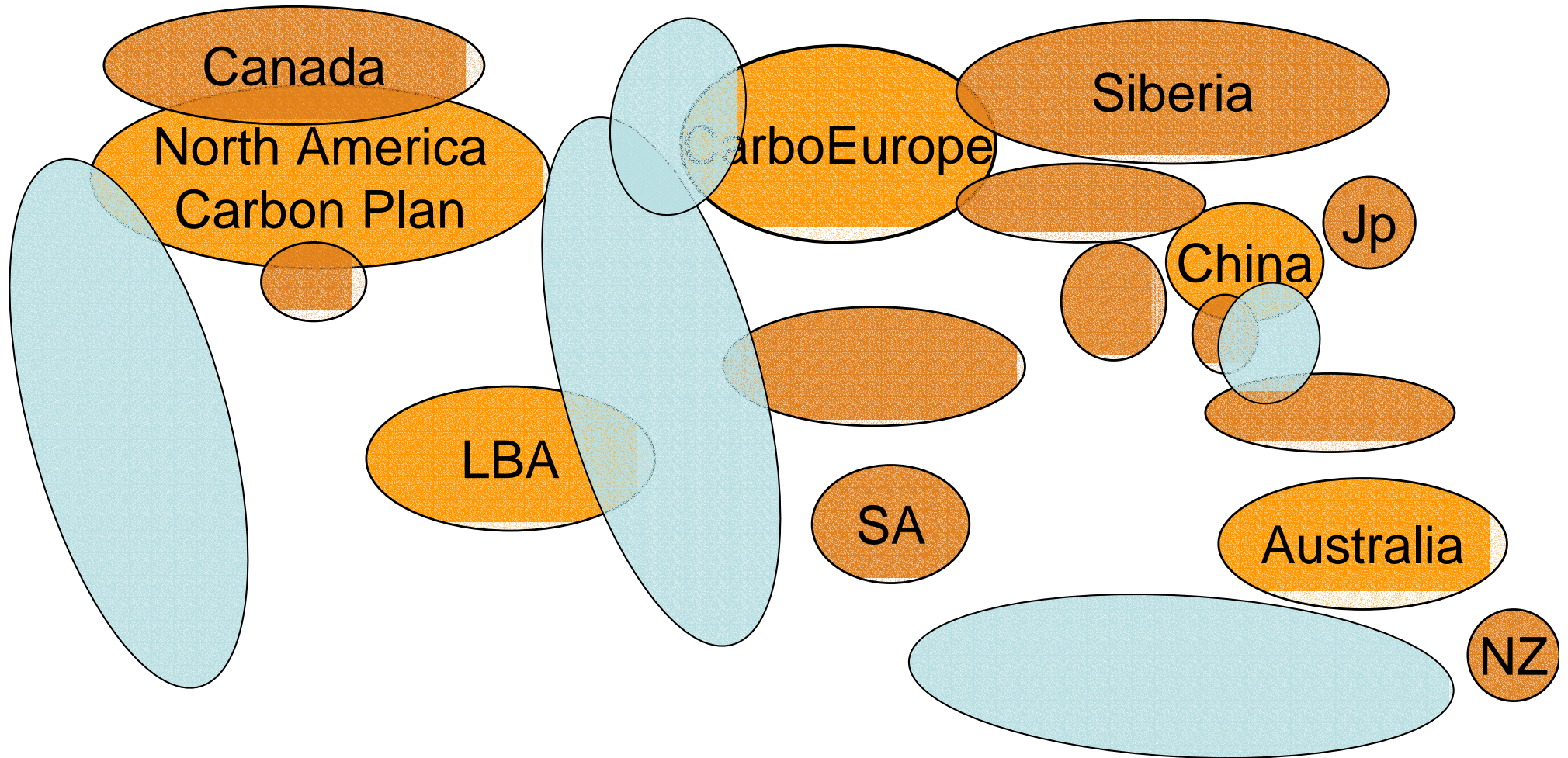
Biological sequestration 

Geological sequestration 

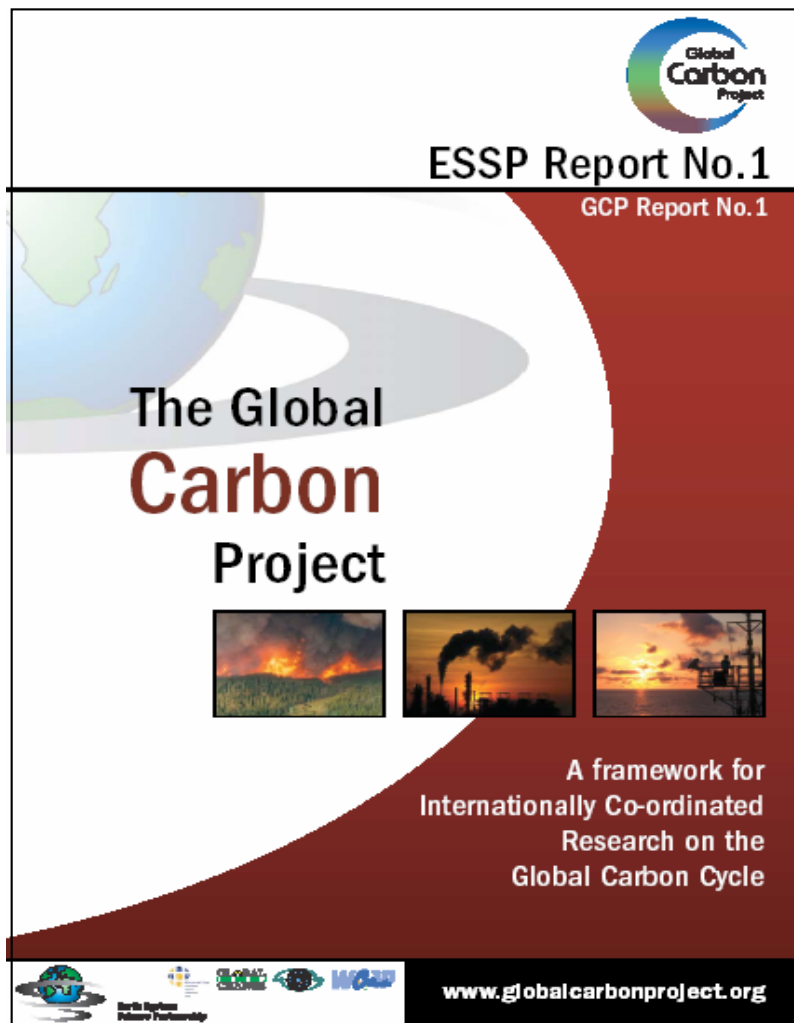
Energy systems 

Institutions 

4. National and regional research



Objectives



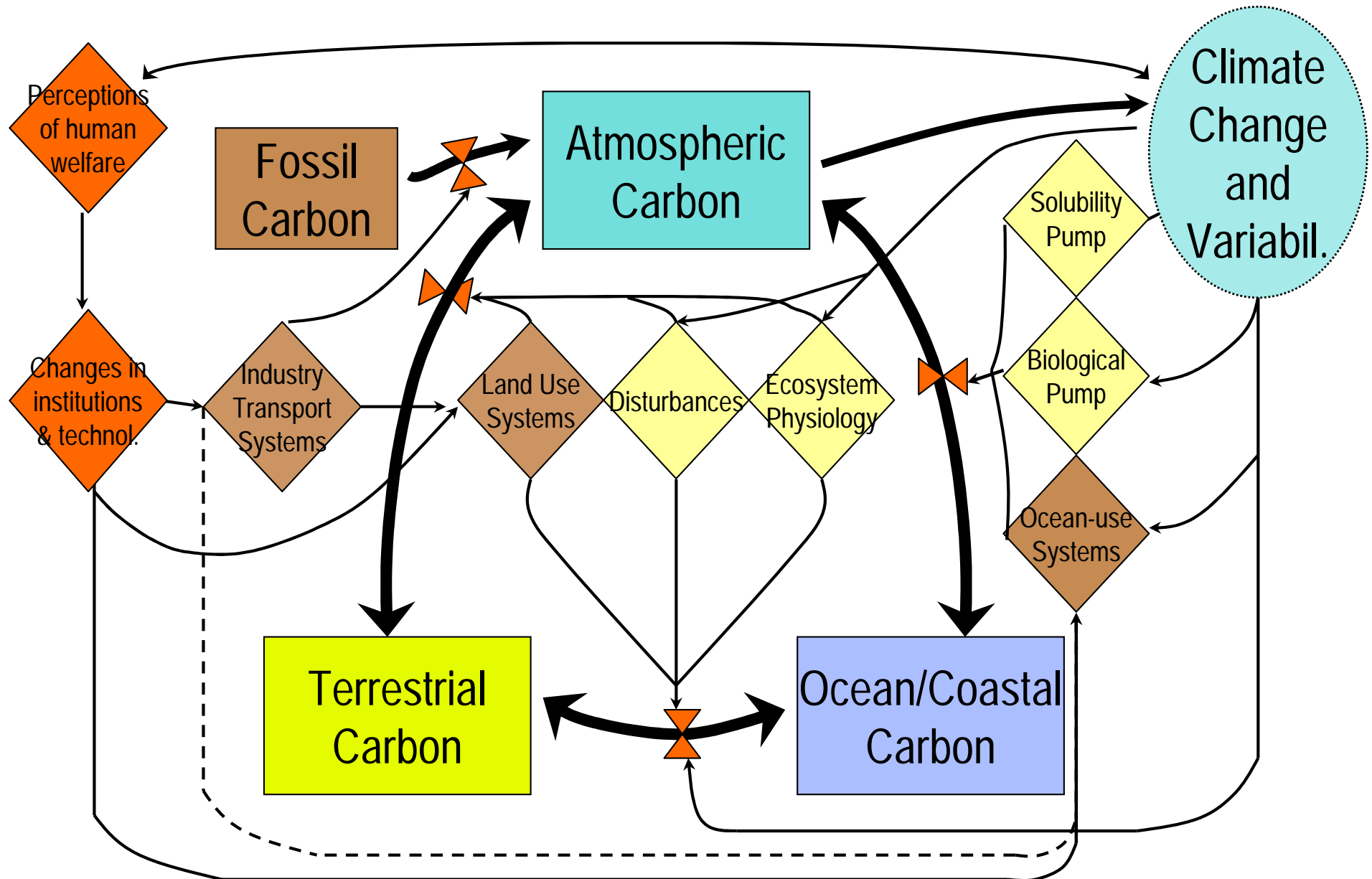
To develop comprehensive, policy-relevant understanding of the global carbon cycle, encompassing its natural and human dimensions and their interactions.

Mandate

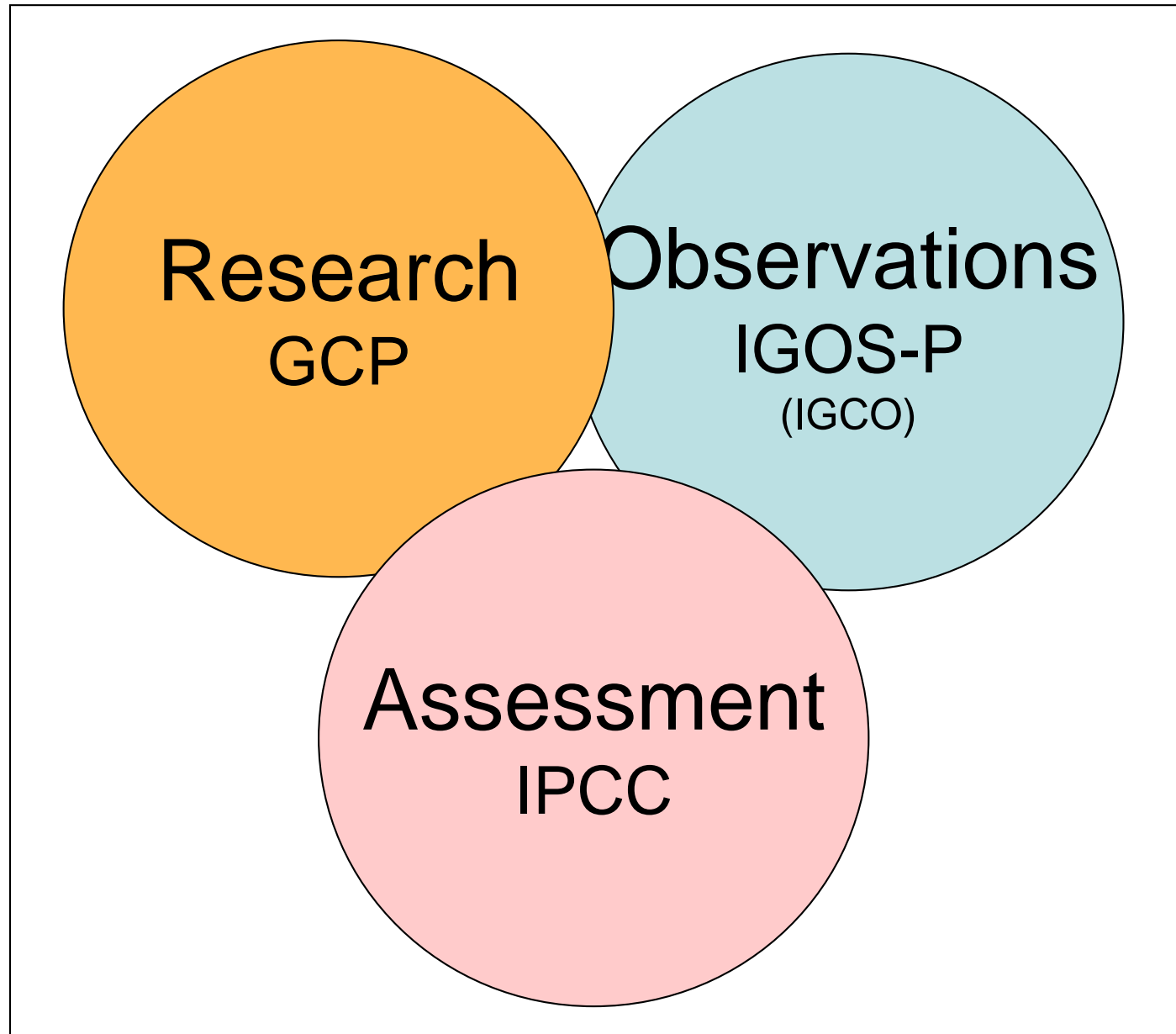
1. Providing international coordination (observing and experimental systems)
2. Increasing comparability and standardization among national programmes
3. Adding the global connectivity and constraints to national and regional studies and budgets
4. Providing capacity building opportunities
5. Leading a highly interdisciplinary research agenda on the CCH system
6. Working with FCCC and other Conventions as a Research Non Governmental Organization

The Conceptual Framework

- Unperturbed C Cycle
- Perturbed C Cycle
- Human Response



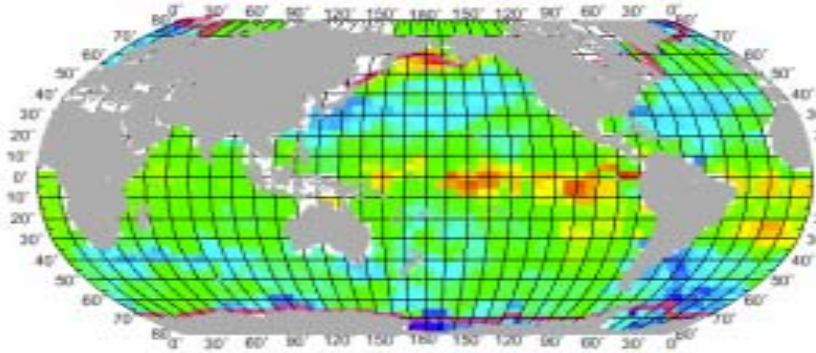
Links to other C international efforts



Theme 1: Patterns and Variability

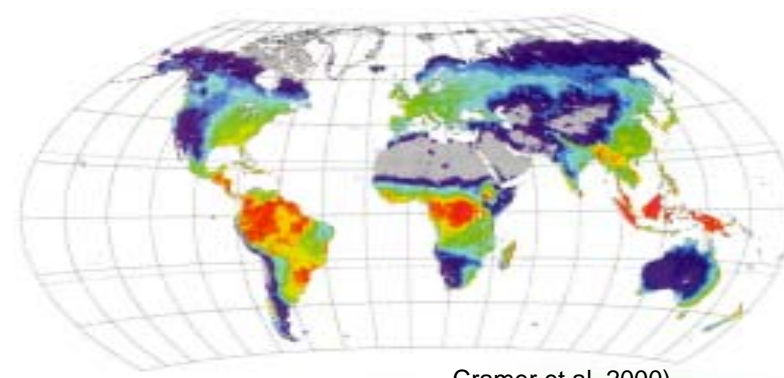
- What are the geographical and temporal patterns of carbon sources and sinks?

Ocean C Fluxes



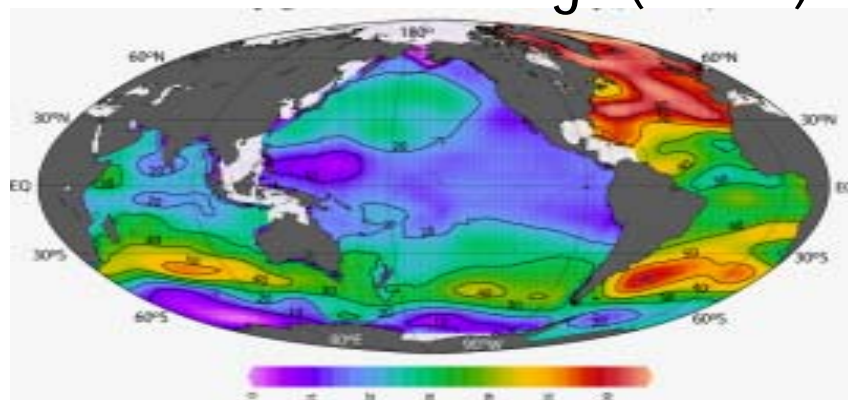
Takahashi et al. 2002)

Terrestrial NPP



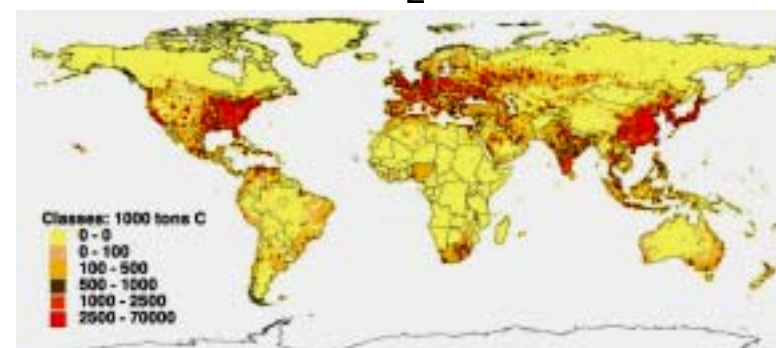
Cramer et al. 2000)

Ocean C Storage (mol m^{-2})



Sabine (unpublished)

1995 CO₂ Emissions



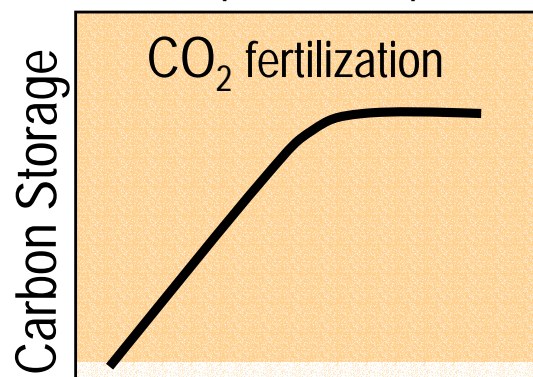
Theme 2: Processes, Controls and Interactions

- What controls and feedback mechanisms – anthropogenic and non-anthropogenic – determine the dynamics of the carbon cycle over years to millennia?

Paleo natural dynamics



New Biospheric Responses



Land Use Change



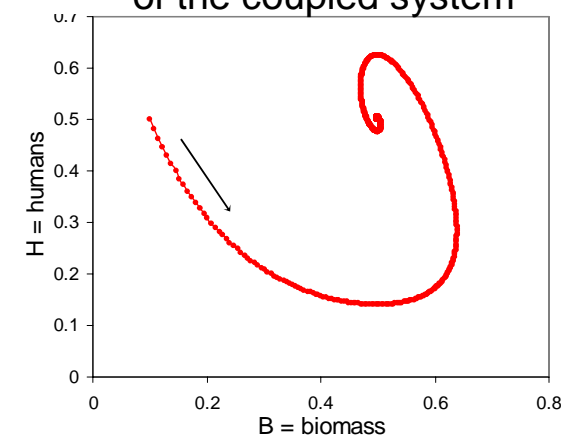
Fossil Fuel Emissions



Institutional Responses

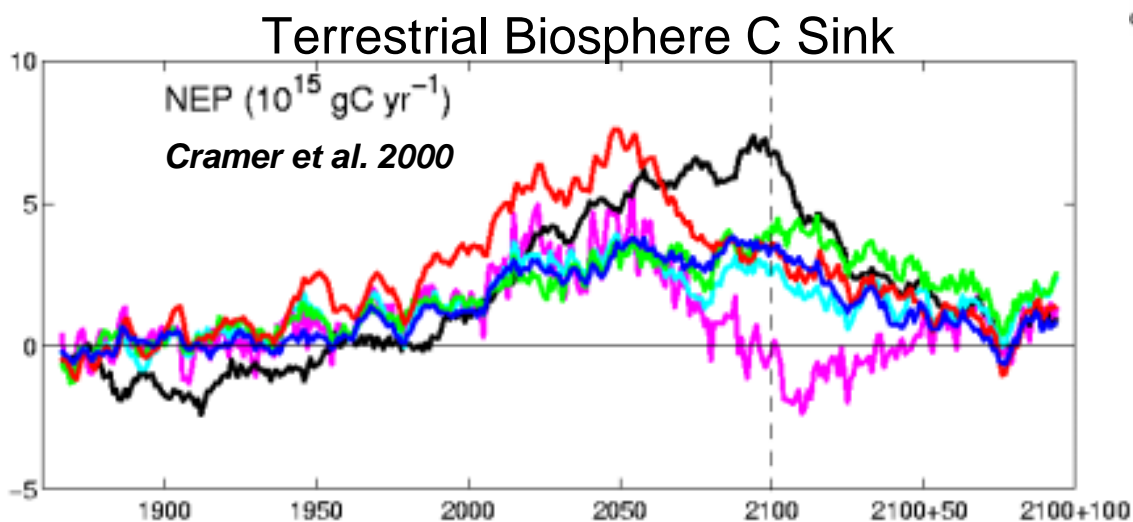
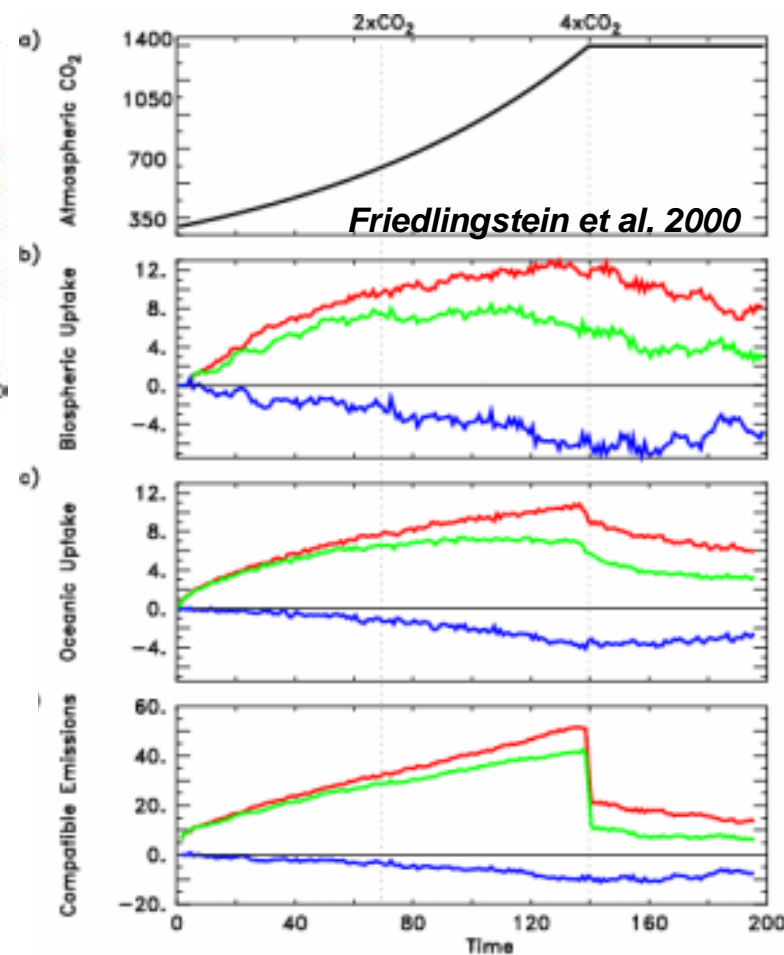
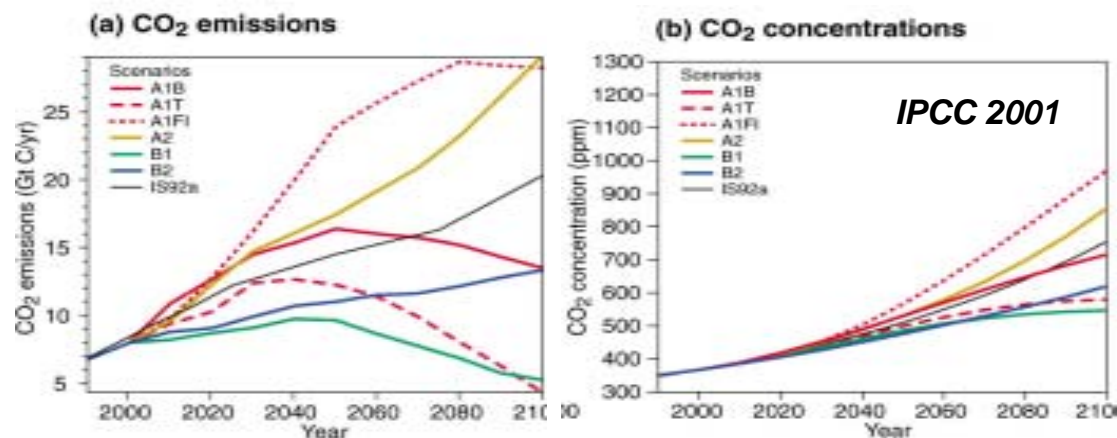


Emergent properties of the coupled system



Theme 3: Future Dynamics of the Carbon Cycle

- What are the likely dynamics of the global carbon cycle into the future?



GCP Implementation Plan



1. Patterns and Variability

1.1. Enhancing Observations

- Coordination & Standardization

1.2. Model-Data Fusion

- Model-data fusion techniques

1.3 Carbon Budgets

- Methodologies, Sector Analyses

2. Mechanisms & Feedbacks

2.1. Integrated C Sink Mechanisms

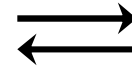
- Multiple mechanisms and interactions

2.2. Emergent Properties C-Climate

- Paleo and Forward

2.3. Emergent Properties C-C-Hum.

- New modeling approaches



3. Future & C Management

3.1. Mitigation Options

- Control points land, ocean, FF

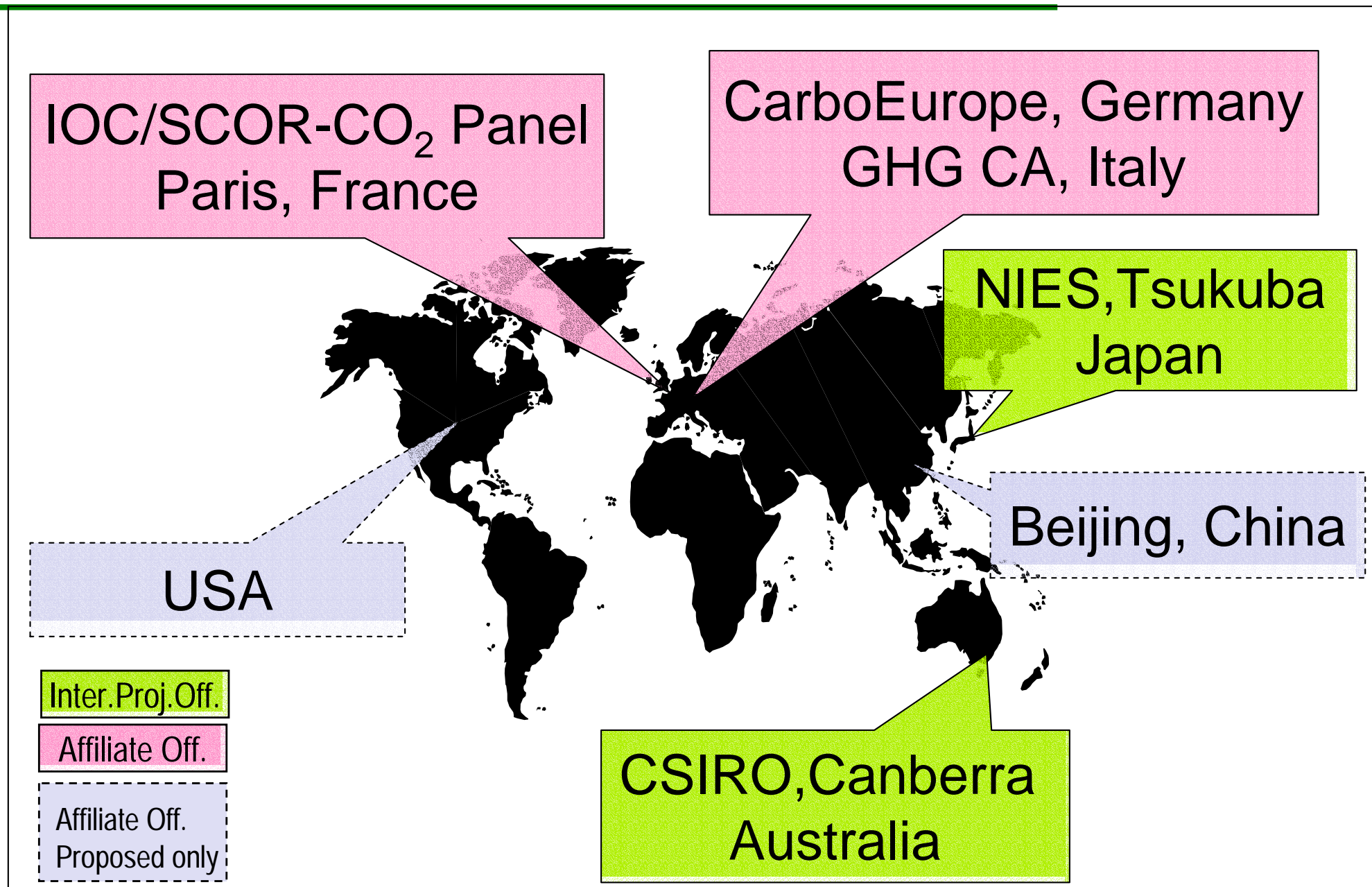
3.2. C Management & Sustainabil.

- Portfolios and sustainable develop.

3.3. Regional/Urban Development

- C consequences and Management

International Project and Affiliate Offices





Scientific Steering Committee

Co-Chairs:

Michael Raupach, **Australia** (IGBP)
Robert Dickinson, **USA** (WCRP)
Oran Young, **USA** (IHDP)

Michael Apps, **Canada**

Alain Chedin, **France**

Cheng-Tung Arthur Chen, **China** (Taipei)

Peter Cox, **UK**

Ellen Druffel, **USA**

Christopher Field, **USA**

Patricia Romero Lankao, **Mexico**

Louis Philippe Lebel, **Thailand**

Annan Partwardhan, **India**

Monika Rhein, **Germany**

Christopher Sabine, **USA**

Riccardo Valentini, **Italy**

Yoshiki Yamagata, **Japan**

Executive Directors:

Pep Canadell, **Australia**

Penelope Canan, **Japan** (starting
April 2004)

CarboEurope Contact:

Annette Freibauer, **Germany**

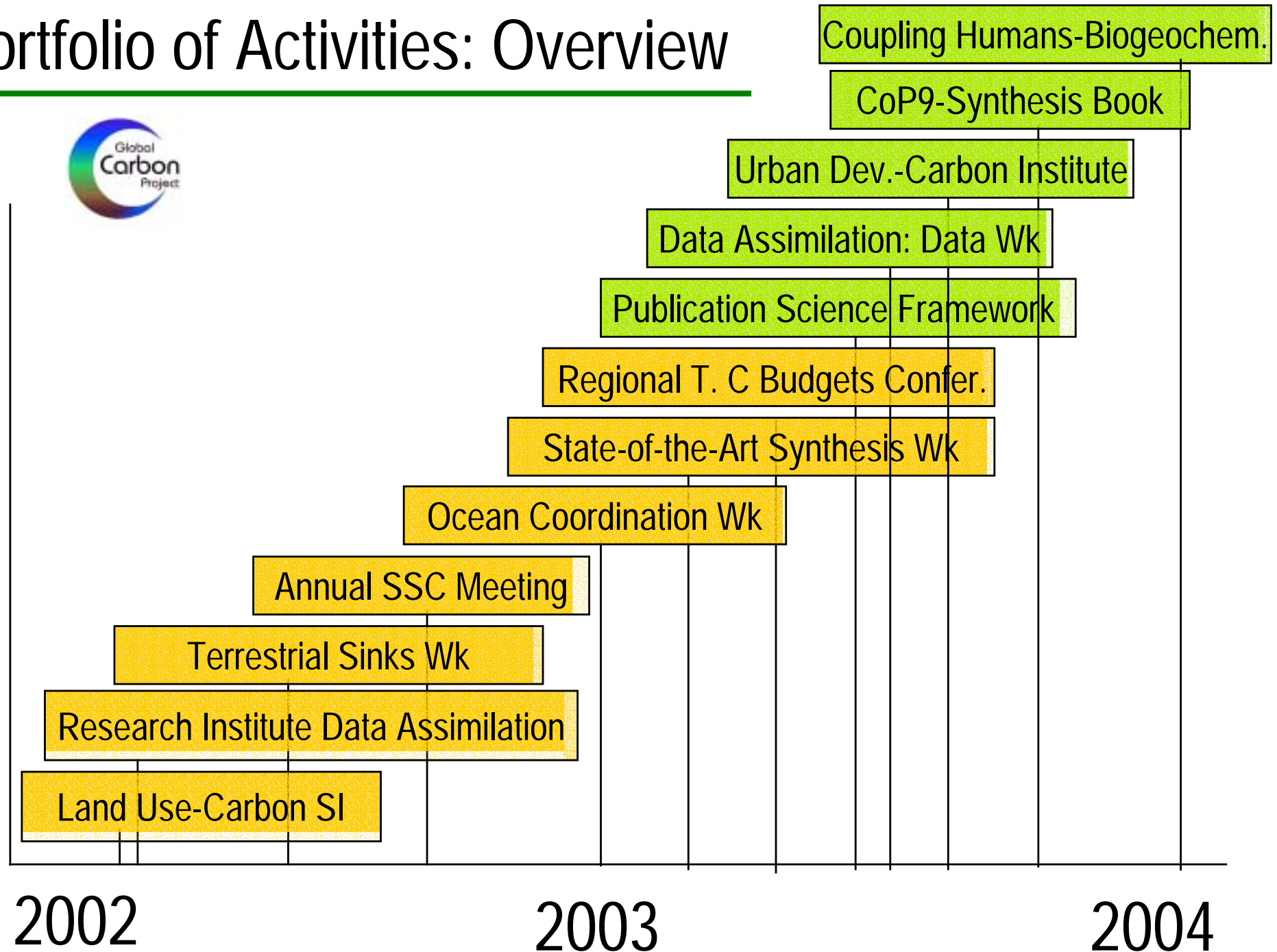
CO₂ Panel Contact:

Maria Hood, **France**

Portfolio of Activities

A few examples

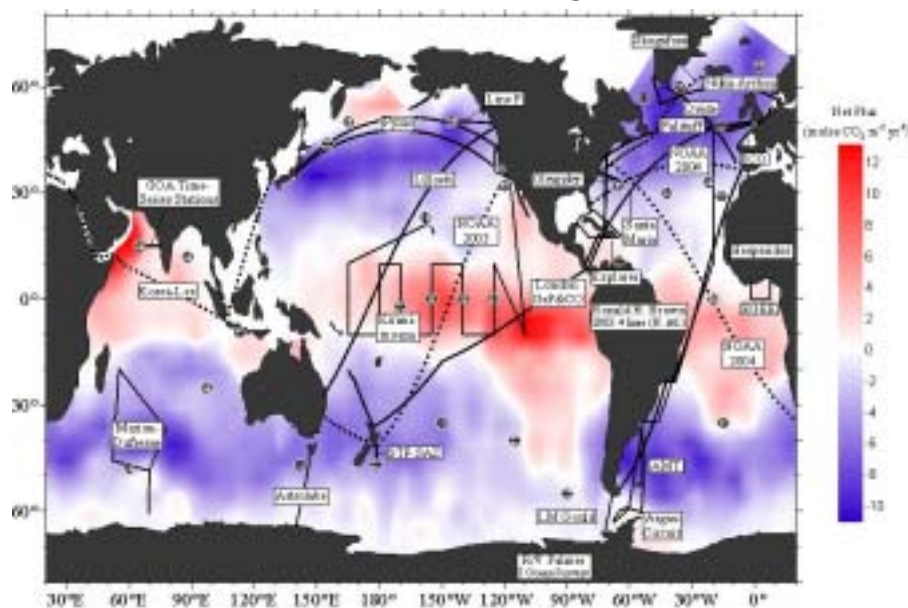
Portfolio of Activities: Overview



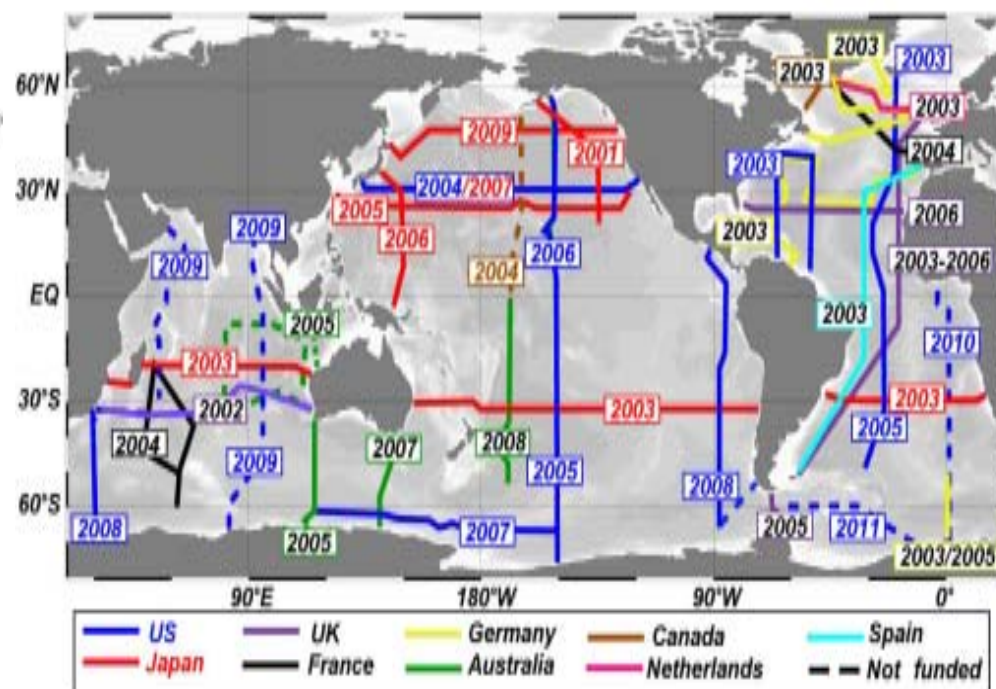
Ocean Carbon Coordination

[with the IOC-SCOR CO₂ Panel]

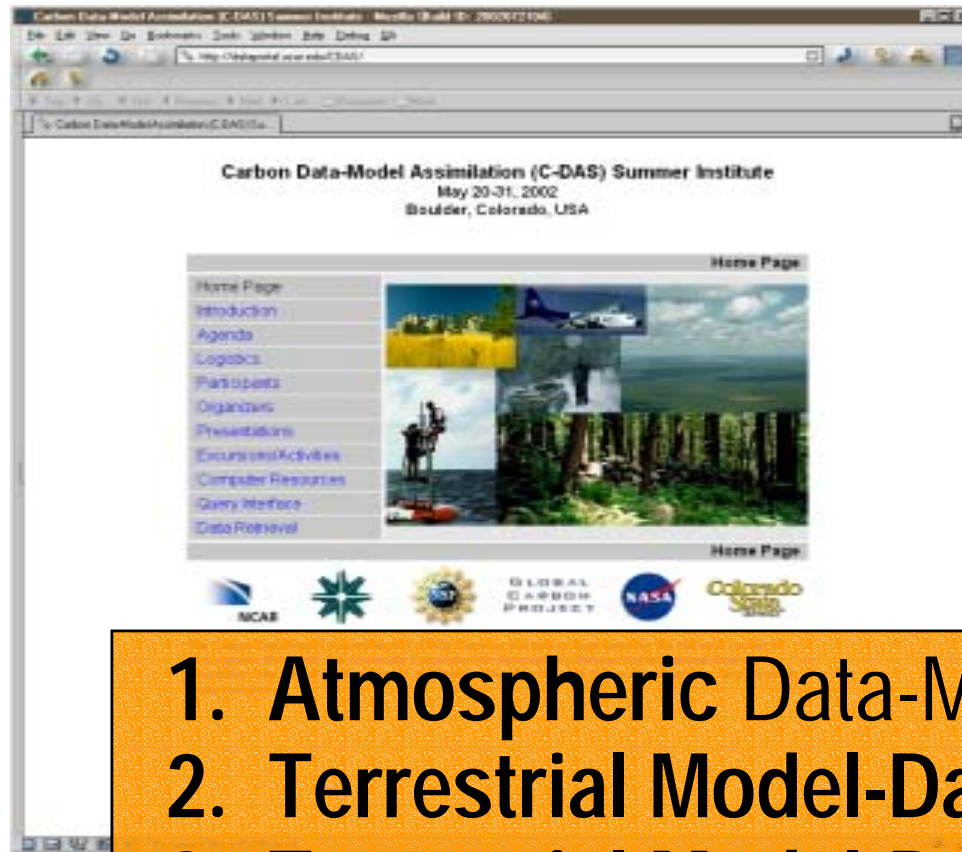
Volunteer Observing Ships



Repeated Sections



Model-Data Fusion (emphasis on Data Assimilation)



Research Institutes (2 weeks long)
and focused workshops

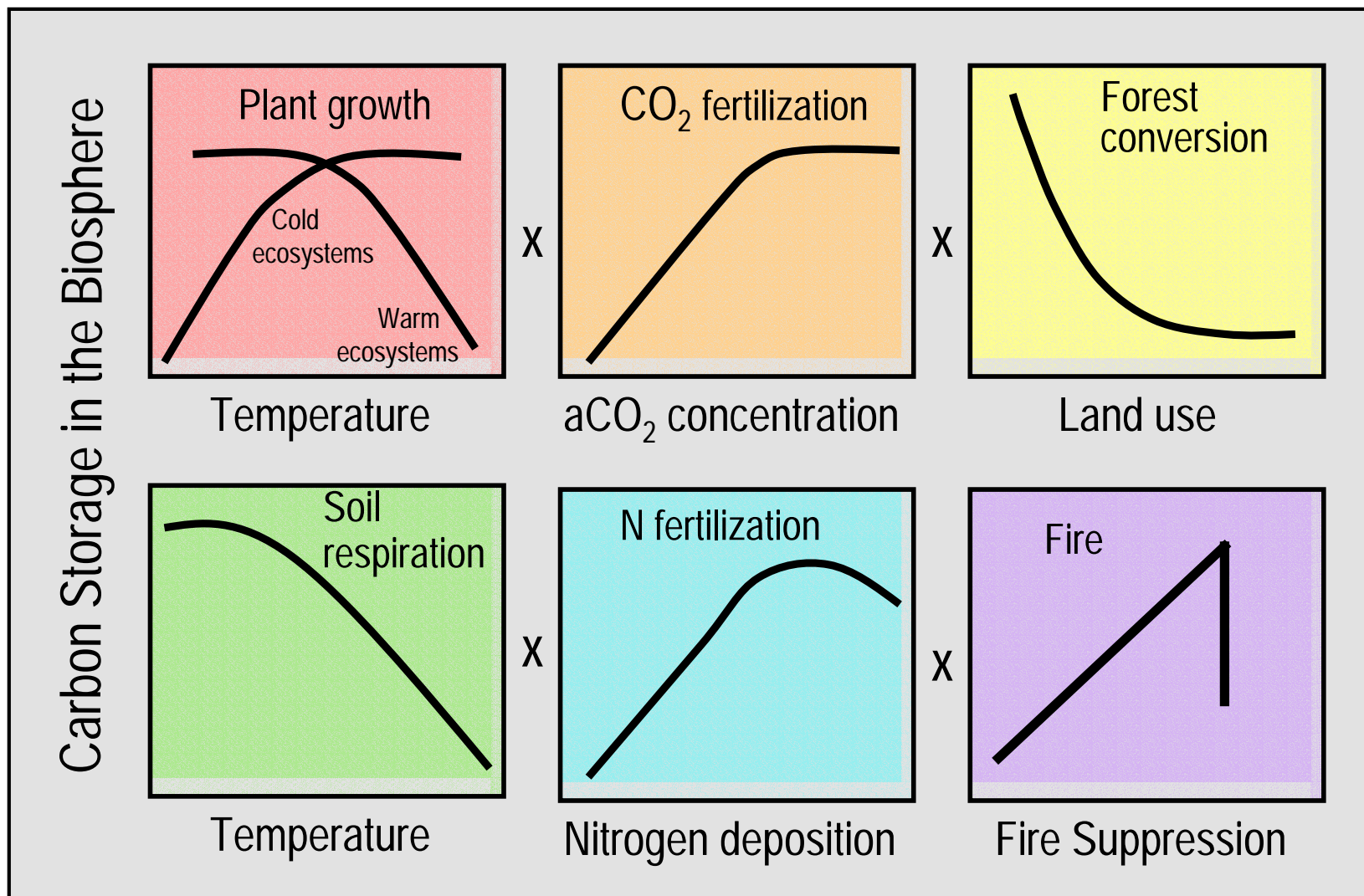
Research, Tool development,
Capacity Building

<http://dataportal.ucar.edu/CDAS/>

1. **Atmospheric Data-Model Assimilation** [2002]
2. **Terrestrial Model-Data Fusion** [2003] w/GTOS
3. **Terrestrial Model-Data Fusion** [2004] Australia
4. **Ocean Data-Model Assimilation** [2005]
5. **Earth System Data-Model Assimilation** [2006]

Integrated Terrestrial C Sink Mechanisms

With IPCC



Options and strategies for reducing greenhouse gas signature in a sustainable Earth

By using a mix of:

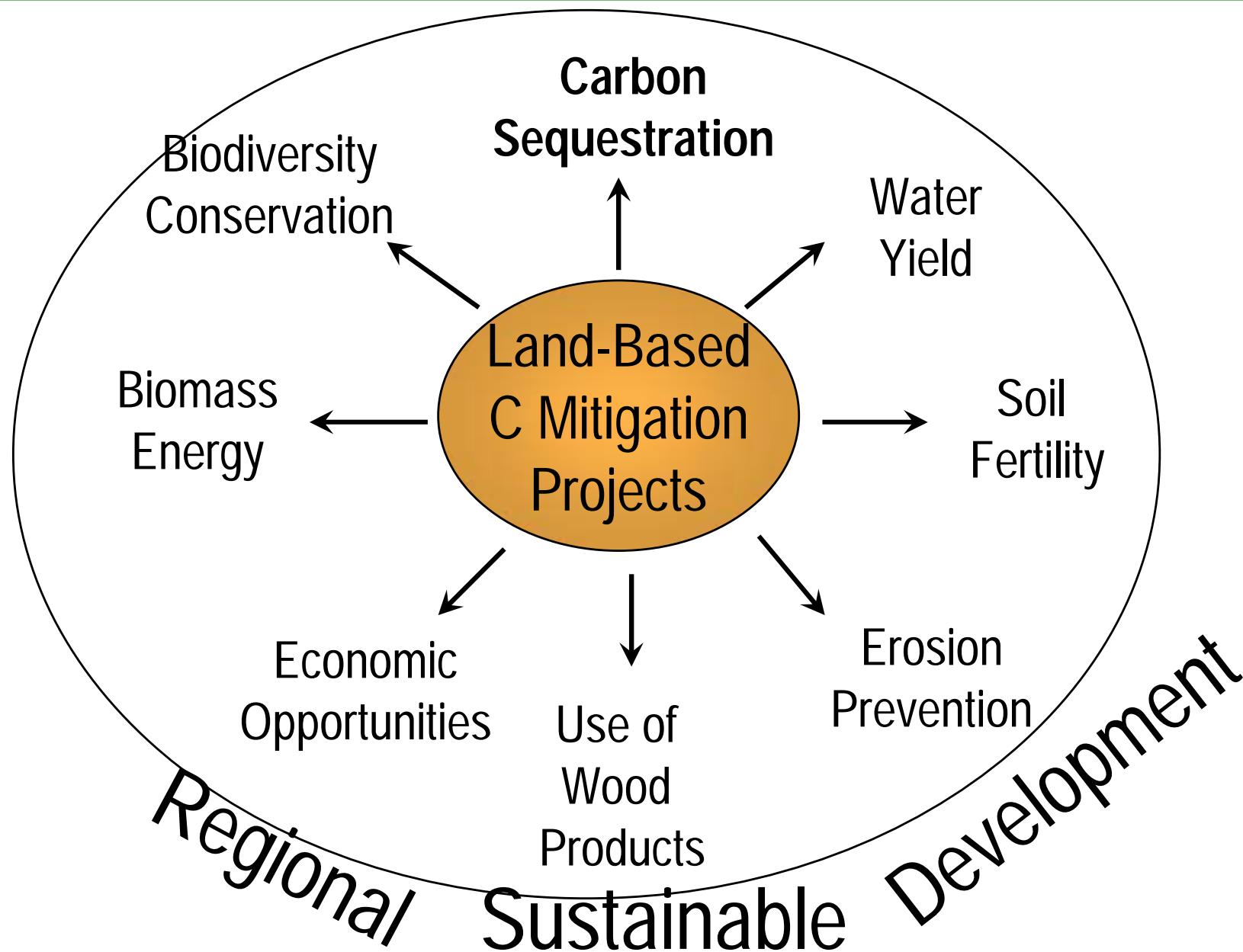
energy strategies (renewables, conservation, cogeneration, efficiency increases)
carbon sequestration (in terrestrial biotic, geological and oceanic sinks)
agricultural practices linked with non-CO₂ emissions.

1. To assess mitigation and adaptation options against environmental, social and economic (triple-bottom-line) criteria, including:
 - (1) **effectiveness**
 - (2) **technological** feasibility;
 - (3) **institutional** viability;
 - (4) **economic** viability;
 - (5) **social** acceptability;
 - (6) non-greenhouse **impacts**
2. To develop and analyse a suite of pathways (**scenarios**)

Understanding coupling between carbon, climate and human systems

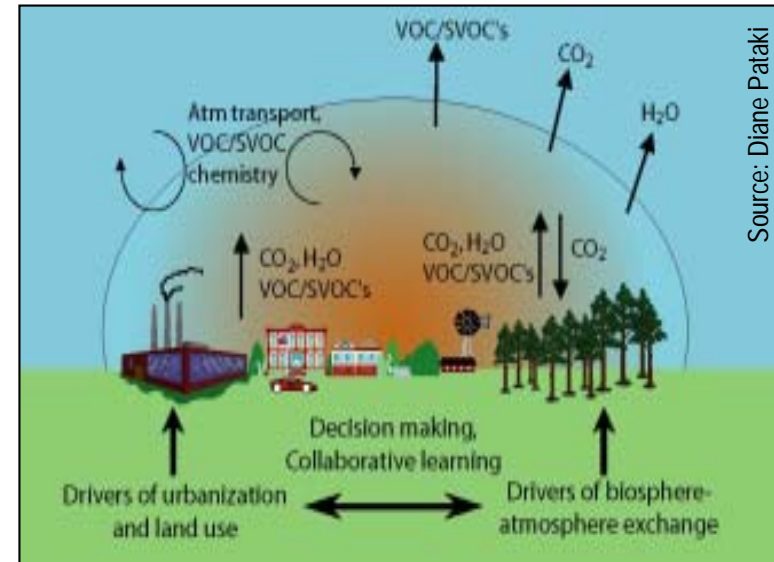
- Improving climate models by including better representation of the carbon cycle
- Developing new numerical approaches to study the coupled carbon-climate-human system including earth system modelling and simpler numerical approaches.

Land-based C mitigation options



C Consequences of Regional Development Pathways

**Advanced Institute on
Urbanization, Emission, and
the Global Carbon Cycle**
START-Packard Foundation
NCAR, Boulder, Colorado,
4 – 22 August 2003



Integrating carbon management into development strategies of cities

Establishing a network of regional case studies

- Asia Pacific (funded)
- Central-South America (proposal submitted)

Integrative Synthesis

Toward CO₂ Stabilization:
Issues, Strategies, and Consequences

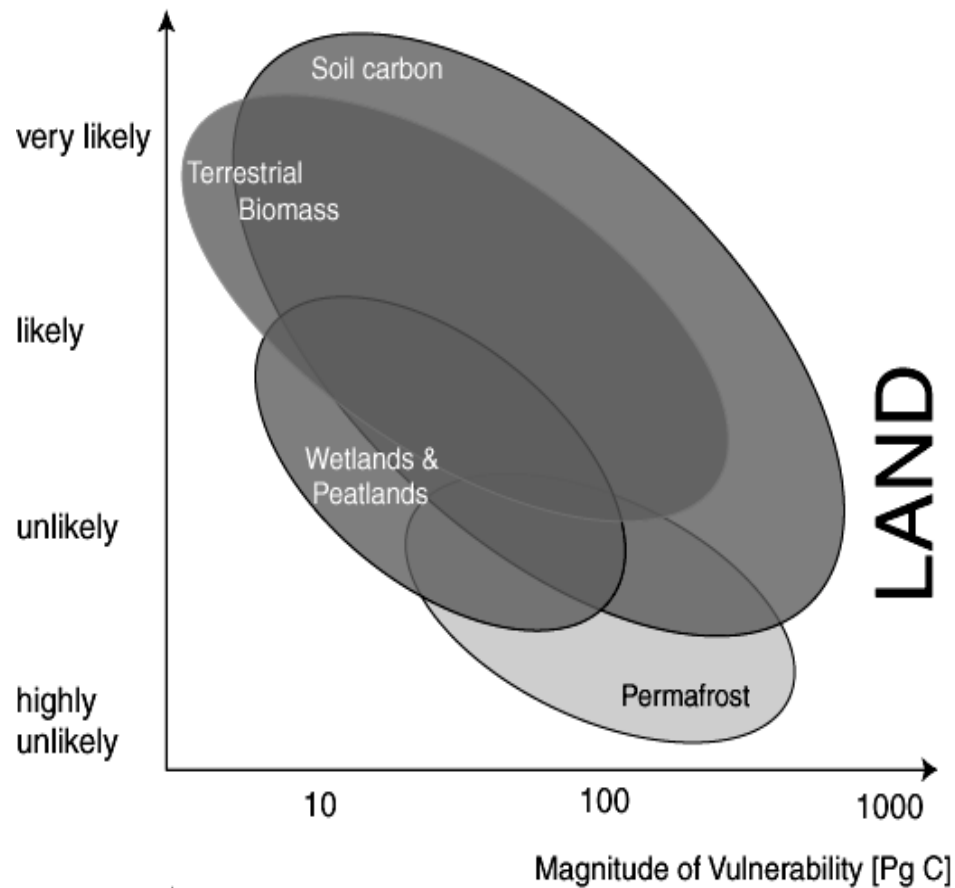
SCOPE-GCP Synthesis Activity

Book Presentation: COP9-Milan, Dec03



- Topics:
1. current status and past trends of the carbon cycle;
 2. vulnerabilities in the carbon cycle in the 21st Century;
 3. scenarios, targets, gaps and costs
 4. a portfolio of carbon management options;
 5. CO₂ stabilization pathways and sustainable Earth System

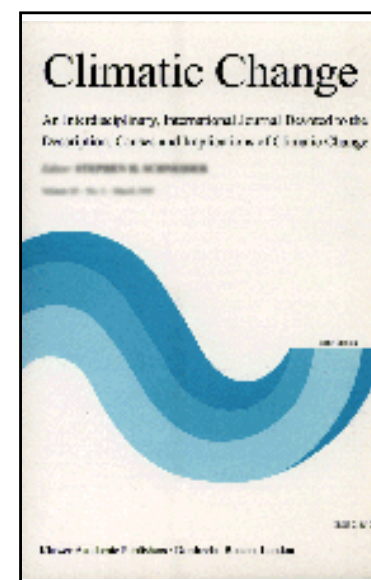
C-Pools at risk in the 21st Century



Terrestrial Sinks and their Policy Relevance

Quantifying Terrestrial Carbon Sinks :
Science, Technology and Policy
Wengen, Switzerland,
September 25 - 27, 2002

Wengen Series-GCP-GCTE
Publication due: August 2004





www.GlobalCarbonProject.org