



Earth System
Science Partnership

Emerging scientific findings, key uncertainties and research needs

Rik Leemans and Martin Rice (ESSP)

Hal Mooney and Anne Larigauderie (DIVERSITAS)

Oran Young and Andreas Rechkemmer (IHDP)

Carlos Nobre, Kevin Noone and Sybil Seitzinger (IGBP)

John Church, Antony Busalacchi and Ghassem Asrar (WCRP)

and all scholars contributing to these international programmes

SBSTA 28, Informal Meeting with the Parties
Bonn, Germany, 5 June 2008

ESSP is a joint initiative of



GLOBAL
I G B P
CHANGE



WCRP
World Climate Research Programme

- Introduction to the International Global Environmental Change Research Programmes and ESSP
 - Structure
 - Achievements
 - Capacity building
- New emerging scientific insights
 - Trends CO₂, N₂O and CH₄
 - Bifurcations and geo-engineering
 - New project: GEC and health
 - New reasons for concern (IPCC Burning embers)
- Conclusions and future directions

ESSP is a joint initiative of





What is Earth System Science?

ESS is an integrated study of the Earth System as a whole, the changes that are occurring to the system, and the implications of these changes for global sustainability.

To understand the physical-biogeochemical-ecological-human systems as complex, dynamic and evolving entities, both natural, technological, social, and economic sciences are needed in an interdisciplinary and transdisciplinary way.

ESSP's perspective on integration is essential!

ESSP is a joint initiative of





Earth System Science Partnership



- an integrated study of the Earth System,
- the ways that it is changing, &
- the implications for global and regional sustainability.



ESSP is a joint initiative of





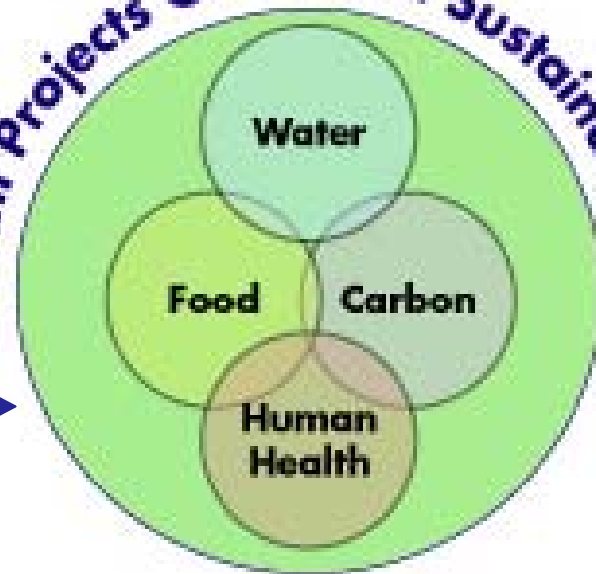
Earth System
Science Partnership

Earth System Science Partnership

Earth System Science Partnership



Joint Projects On Global Sustainability



START

{global change SysTEM for Analysis, Research, and Training}



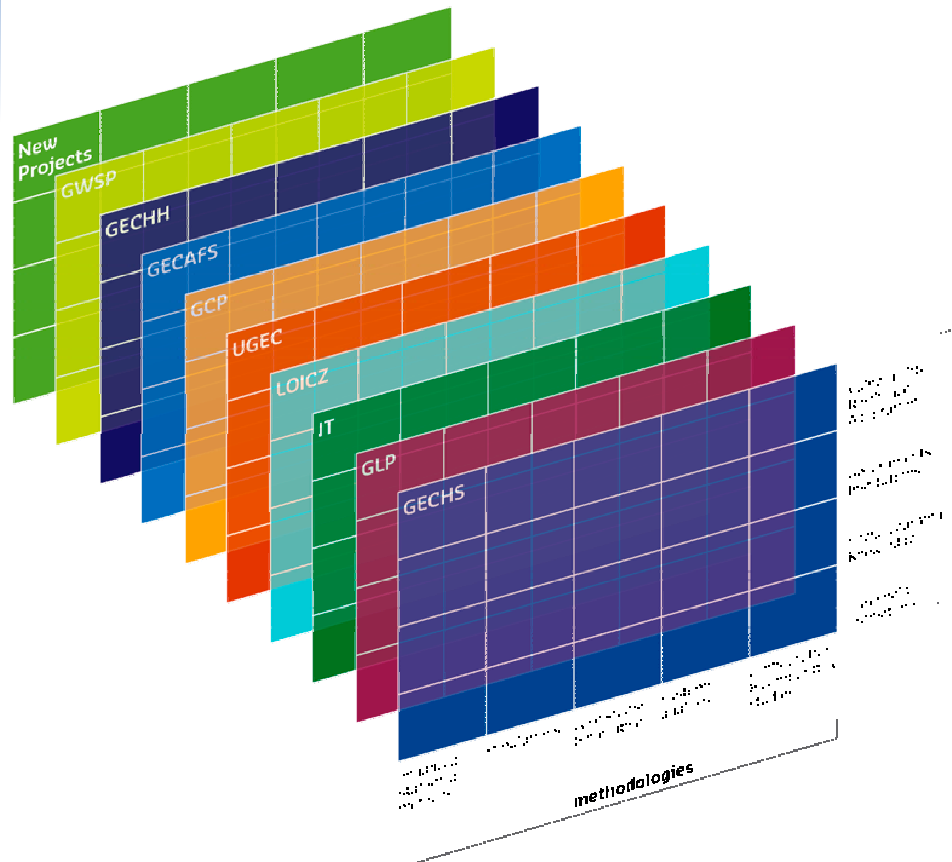
Capacity building with regional networks APN, IAI, Africaness

ESSP is a joint initiative of

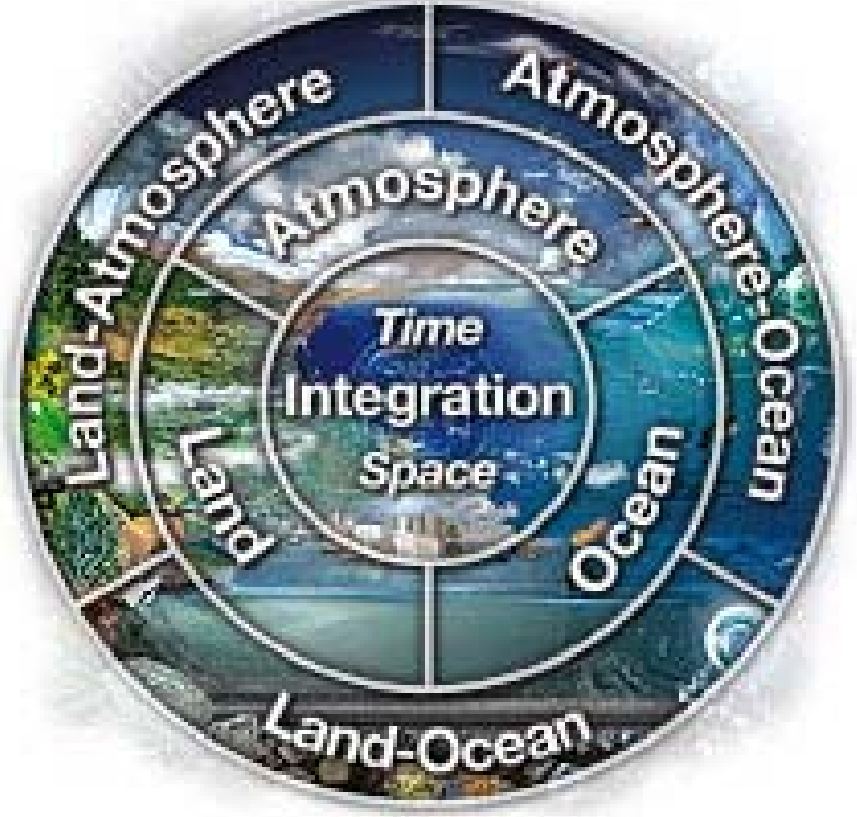




Projects, tools and cross-cutting Themes



The IHDP structure



The IGBP projects

ESSP is a joint initiative of





ESSP Contribution to policy relevant scientific assessments



Almost half of the contributors to IPCC AR4 are WCRP/IGBP/IHDP/DIVERSITAS associated scientists

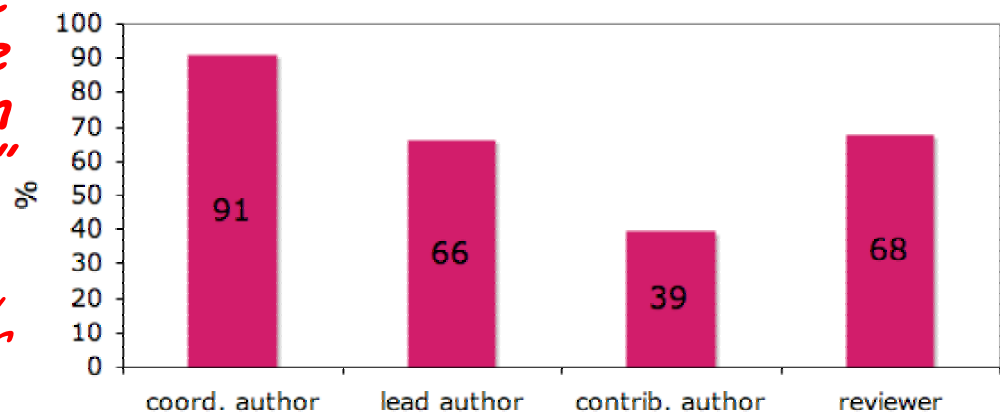
Contributors include climatologists, meteorologists, atmospheric chemists, paleoecologists, ecologists, hydrologists, geographers, epidemiologists, economist and political scientists

Also a strong contributions to the Ozone Assessment, the Millennium Ecosystem Assessment and the Agricultural Assessment

"WCRP serves an irreplaceable role for coordination within the science community, which in turn is invaluable to the IPCC"

*Dr. Susan Solomon,
IPCC Working Group I Co-Chair*

WCRP scientists' contribution to IPCC WG1 AR4




ESSP is a joint initiative of






Important recent achievements: IPCC AR4 Climate Projections

WCRP-IPCC Coupled Model Intercomparison Project 3 (**CMIP3**) archive hosted at PCMDI

 made available to the entire world for free
(1300 users, 1100 diagnostic subprojects, 260 new publications, 33 terabytes of data ready for download)

 Essential for climate science and regional projections (WG1) and for impact and vulnerability assessments (WG2) and policy scenarios and benefit-costs assessments (WG3)



ESSP is a joint initiative of





Important recent achievements:

Easy Access to CMIP3

● A portal for access to climate models' results for regional assessments by African users (government ministries; farmers...): **African Climate Atlas** for regional projections

- interactive website for online plots of e.g. temperature, humidity, rainfall over numerous parts of the world including global, Africa and regions within Africa
- <http://www.geog.ox.ac.uk/~clivar/ClimateAtlas/>

"better assessments and information by using common methodologies"



ESSP is a joint initiative of





It's all connected



We also effectively connect with researchers from other organizations. For example, the International Agricultural Research Institutes (CGIAR) and ESSP will together implement a 10-years challenge programme on Climate Change and Agriculture with integrated scenarios to assess food systems and food security



ESSP is a joint initiative of





Earth System
Science Partnership

Global Carbon Project (GCP)

www.globalcarbonproject.org

The Global Carbon Project (GCP) was established in 2001 in recognition of the enormous scientific challenge and fundamentally critical nature of the carbon cycle for Earth sustainability.

The scientific goal of the project is to develop a complete picture of the global carbon cycle, including both its biophysical and human dimensions together with the interactions and feedbacks between them.



ESSP is a joint initiative of

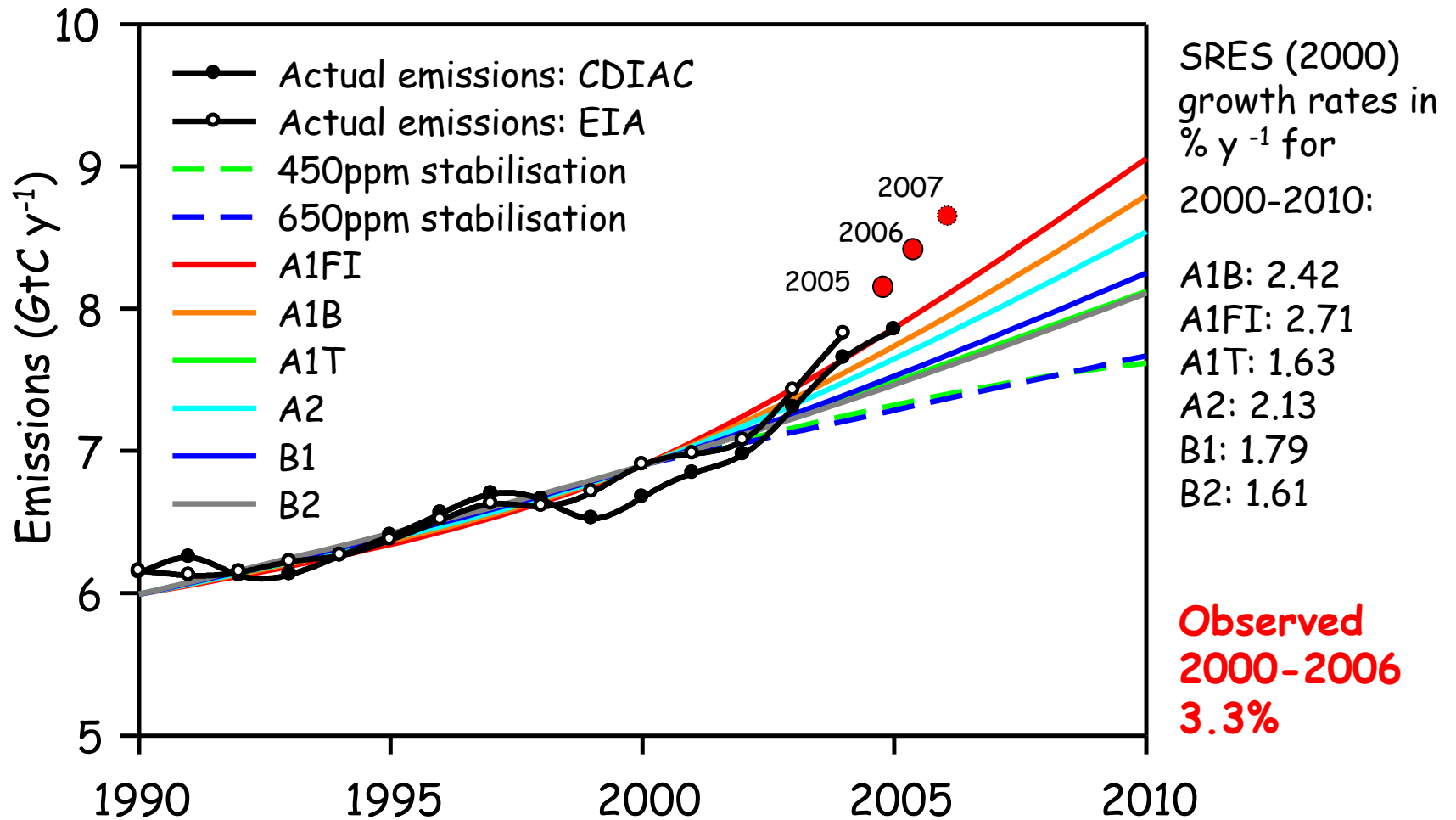


GLOBAL
I G B P
CHANGE



WCRP
World Climate Research Programme

Trajectory of Global Fossil Fuel Emissions



Raupach et al. 2007, PNAS

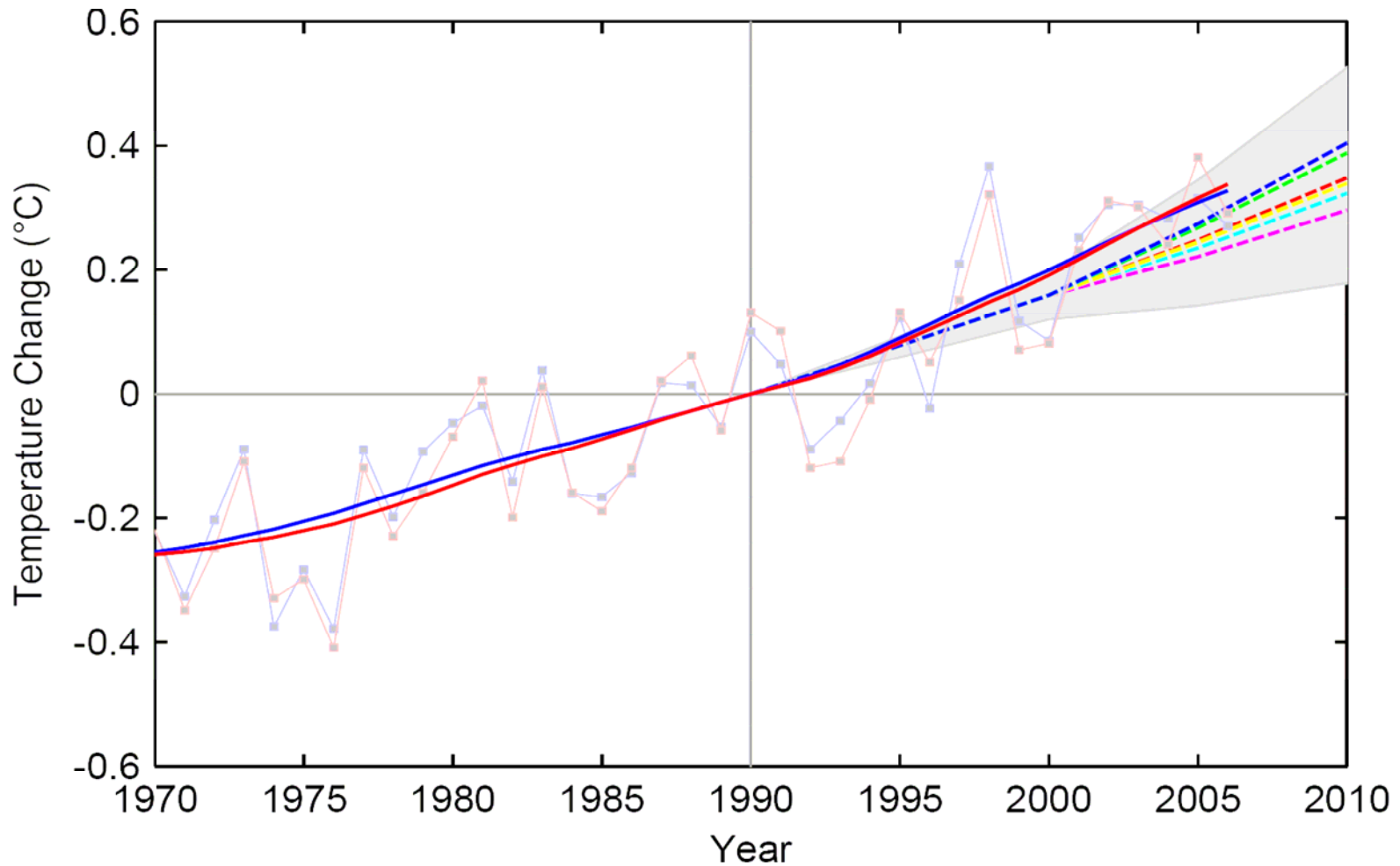
ESSP is a joint initiative of





Observed and SRES trajectories in temperature

Rahmstorf, Cazenave, Church, Hansen, Keeling, Parker and Somerville (Science 2007)

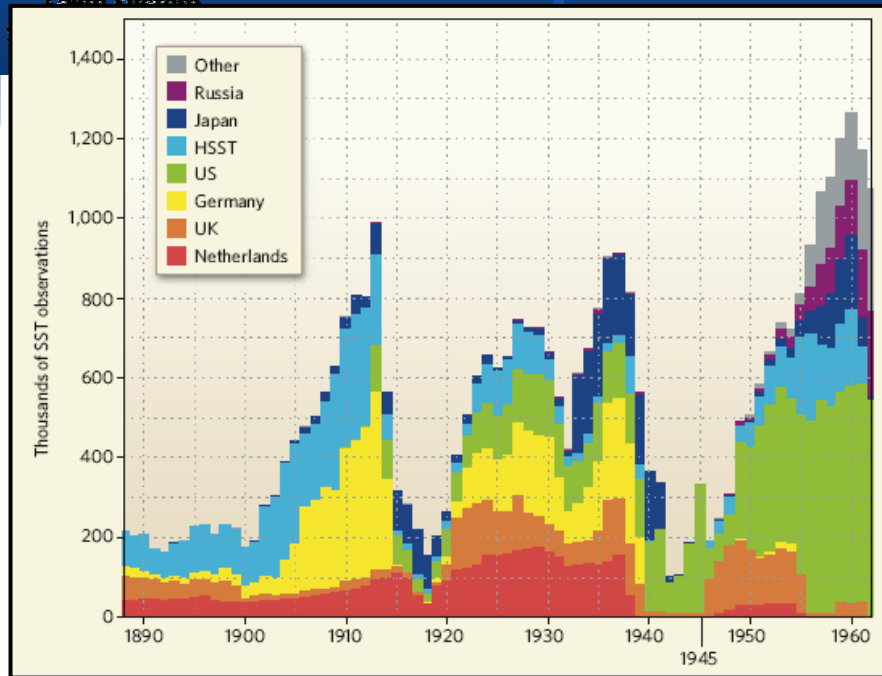


ESSP is a joint initiative of

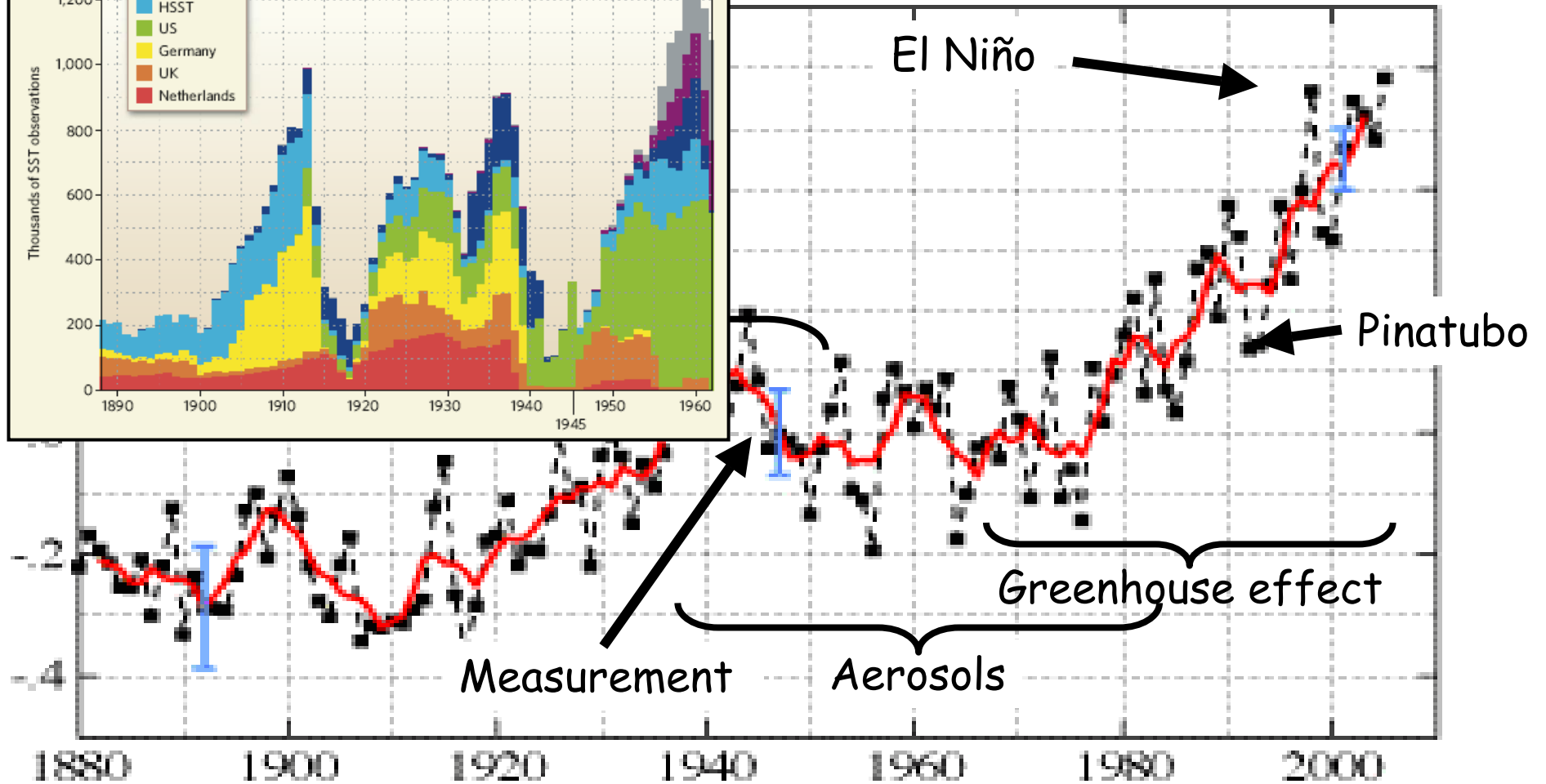




Temperature trend explained



Large temperature (°C, wrt 1961-1990)



ESSP is a joint initiative of



Carbon Emissions from Net Deforestation

FAO-Global Resources Assessment 2005; Canadell et al. 2007, PNAS



Tropical deforestation

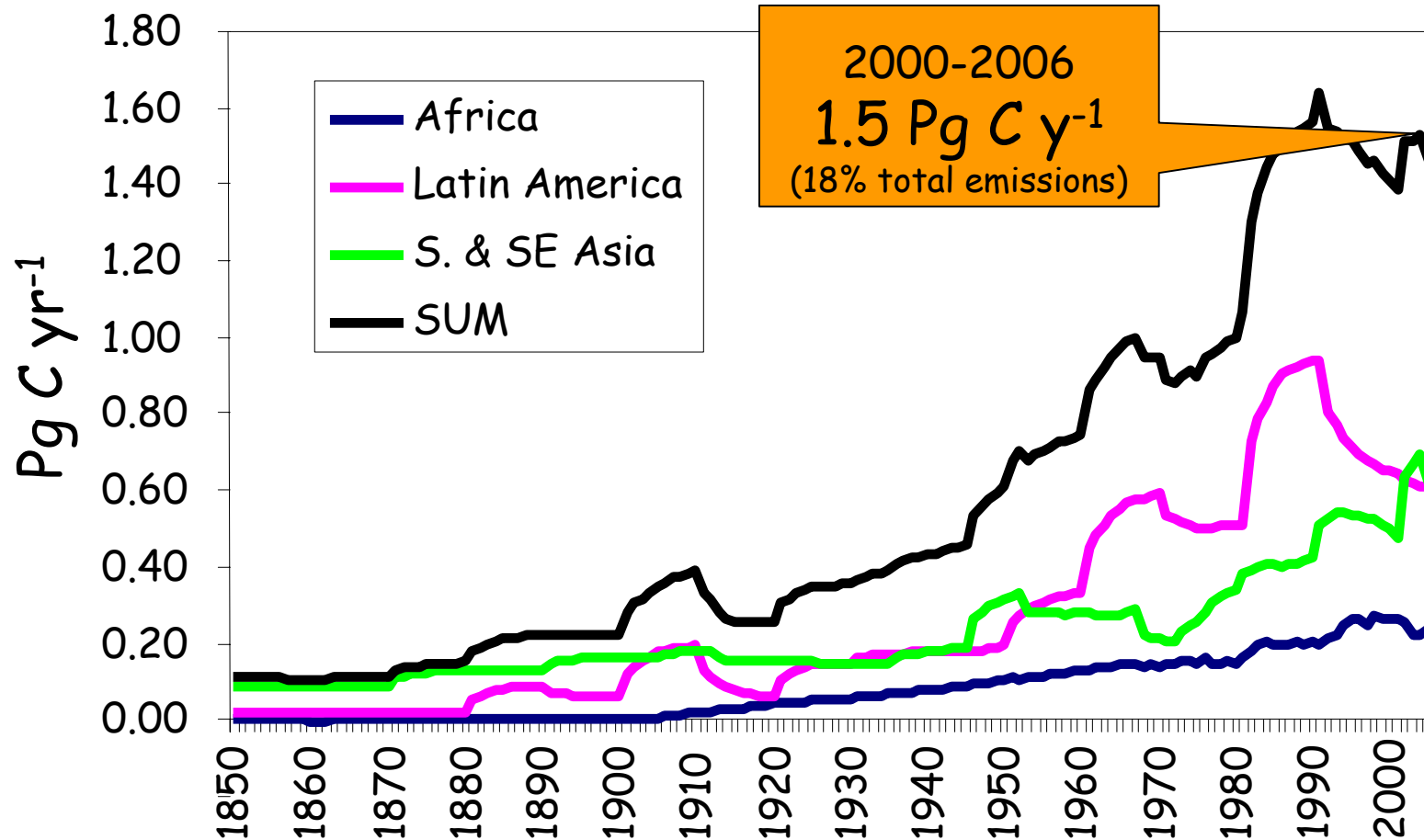
13 Million hectares each year

Trees are worth more dead than alive

2000-2005	
Tropical Americas	0.6 Pg C y ⁻¹
Tropical Asia	0.6 Pg C y ⁻¹
Tropical Africa	0.3 Pg C y ⁻¹
1.5 Pg C y⁻¹	

ESSP is a joint initiative of

Historical Carbon Emissions from Net Deforestation

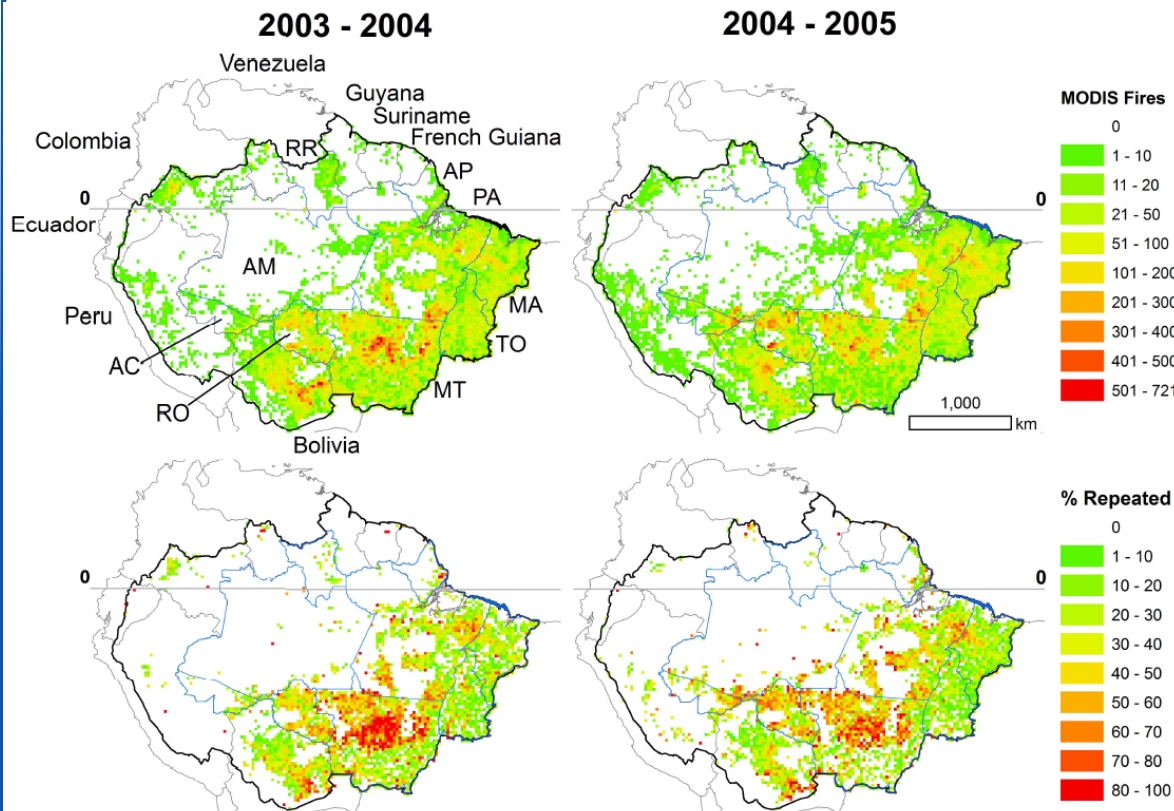


Houghton, unpublished; Canadell et al. 2007, PNAS

ESSP is a joint initiative of

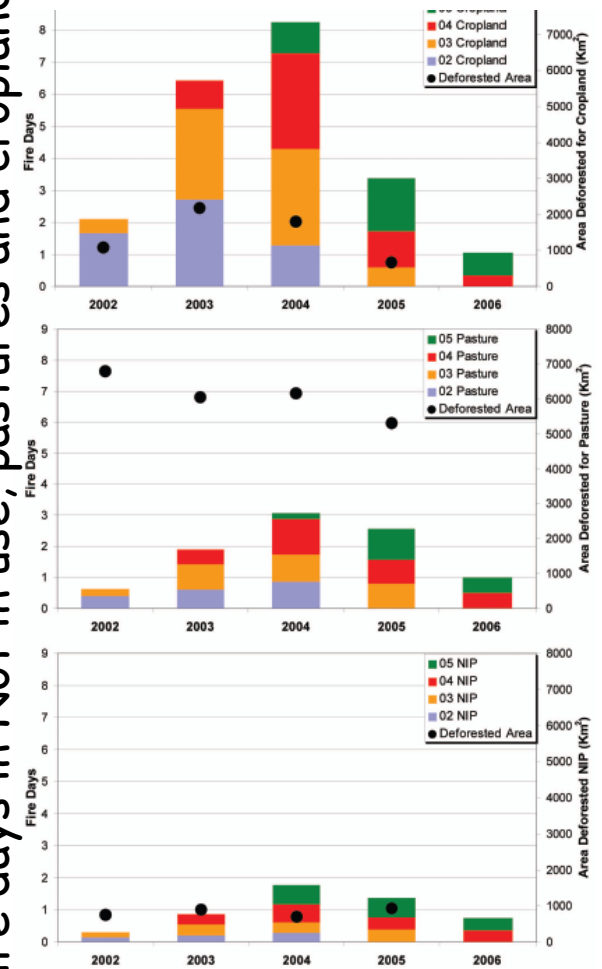


Fire and deforestation in the Amazon



Morton, D.C., Defries, R.S., et al., **Agricultural intensification increases deforestation fire activity in Amazonia.** *Global Change Biology* (in press).

Fire days in Not in use, pastures and cropland



ESSP is a joint initiative of

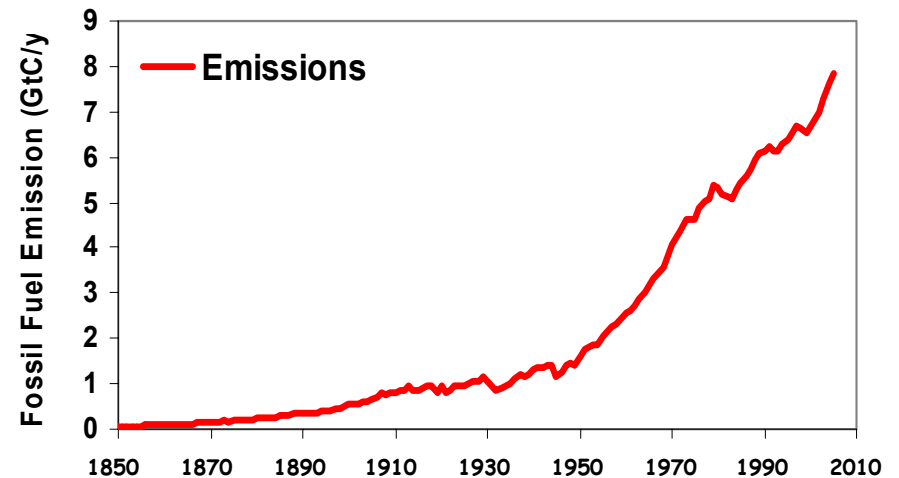
Carbon Emissions from Fossil Fuel



Raupach et al. 2007, PNAS; Canadell et al 2007, PNAS

2006 Fossil Fuel: **8.4 Pg C**

[Total Anthrop.Emis.: $8.4 + 1.5 = 9.9$ Pg]



1990 - 1999: **1.3% y^{-1}**

2000 - 2006: **3.3% y^{-1}**

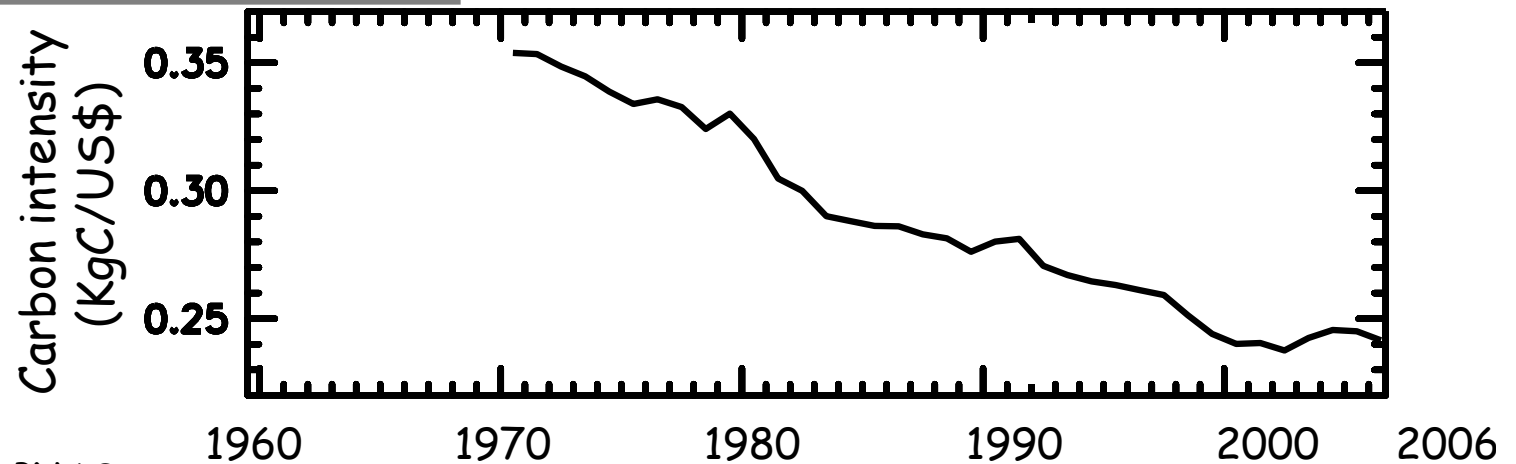
ESSP is a joint initiative of

Carbon Intensity of the Global Economy



Photo: CSIRO

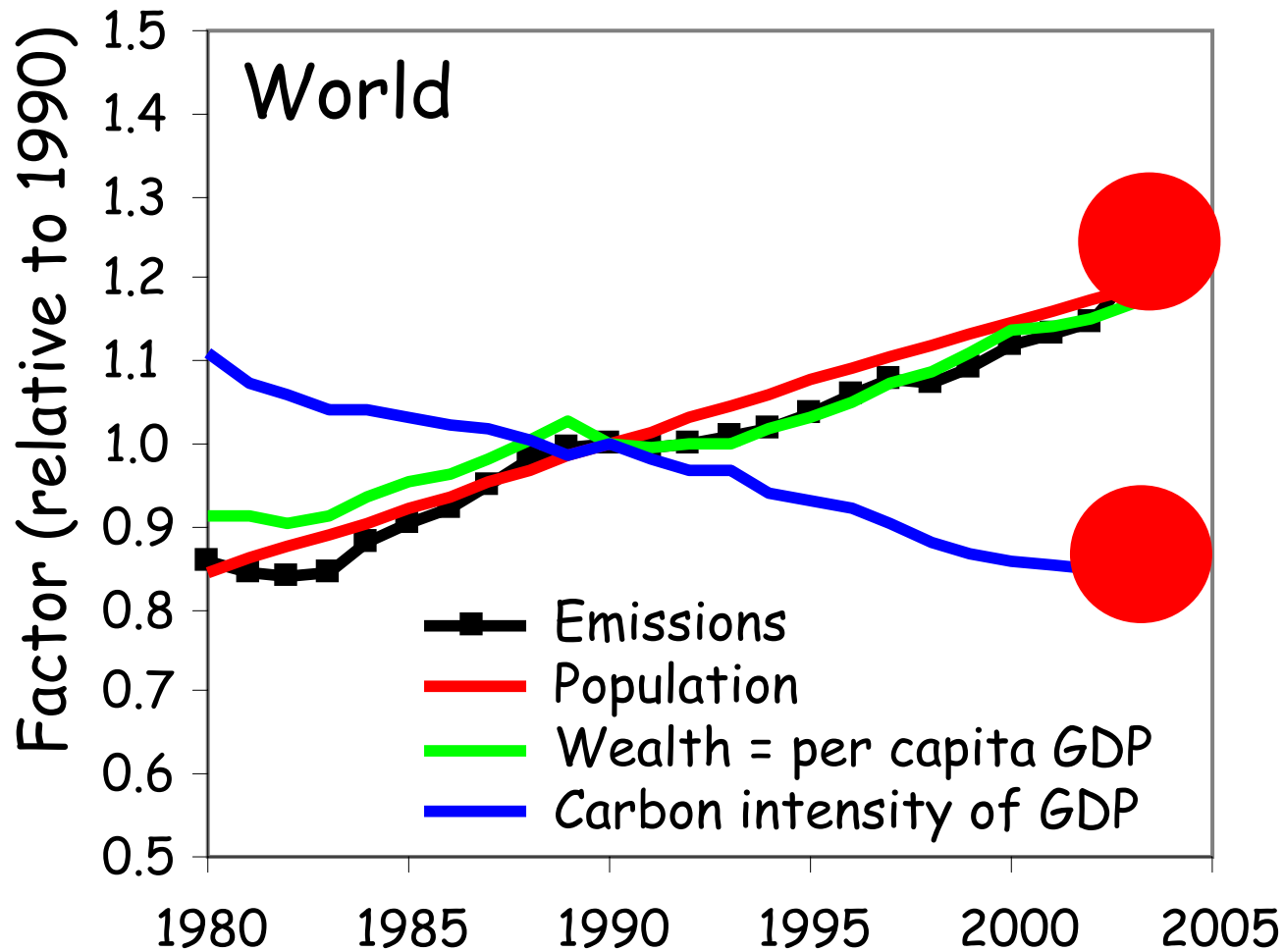
Kg Carbon Emitted
to Produce 1 \$ of Wealth



Canadell et al. 2007, PNAS

ESSP is a joint initiative of

Drivers of Anthropogenic CO₂



Raupach et al 2007, PNAS

ESSP is a joint initiative of