

**T.B. MACAULAY**  
LECTURE

## 34th TB Macaulay Lecture

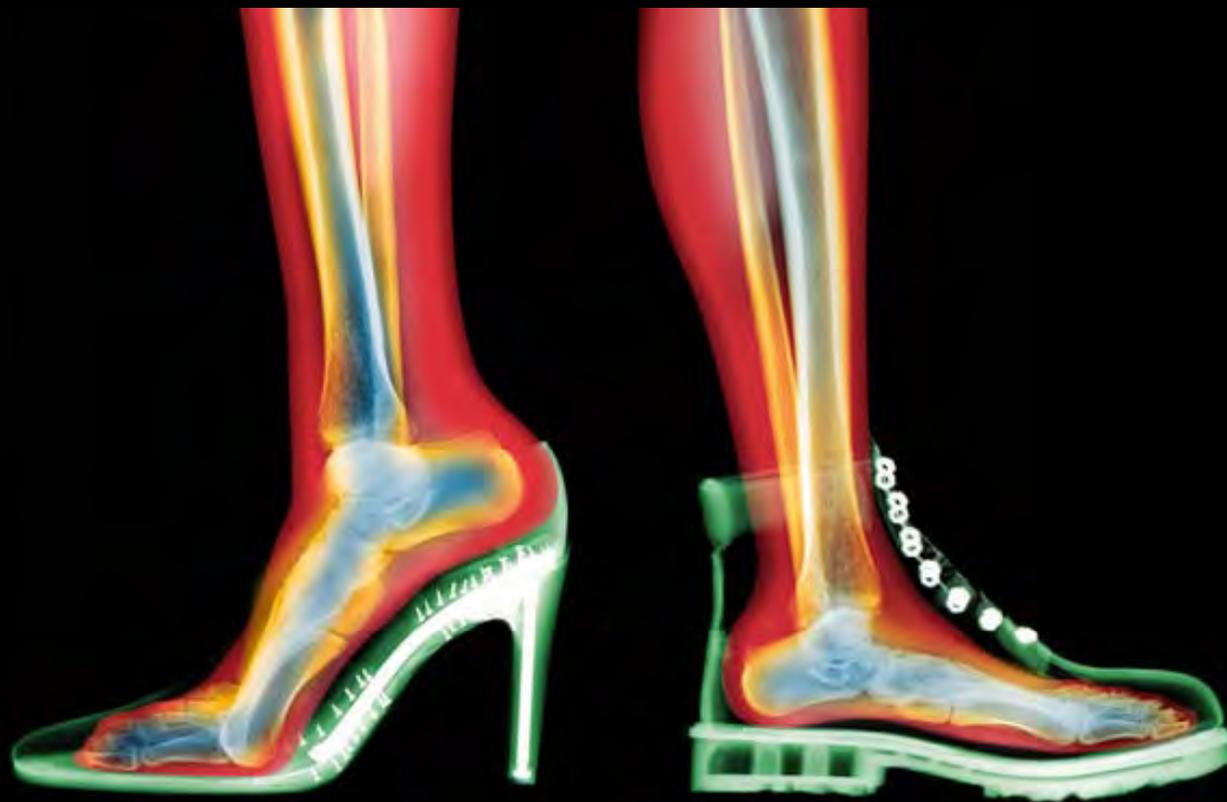
# Scientific policy-making: whose evidence is it really?

- **Professor Jacqueline McGlade**
- **Executive Director, European Environment Agency**

# The X-factor



# The wow-factor



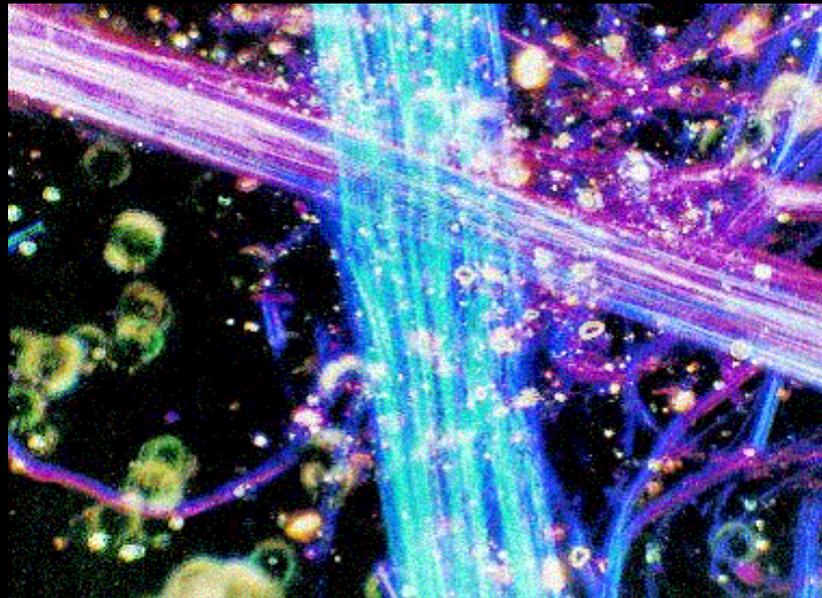
# Evolution



# Alice - a fight for life

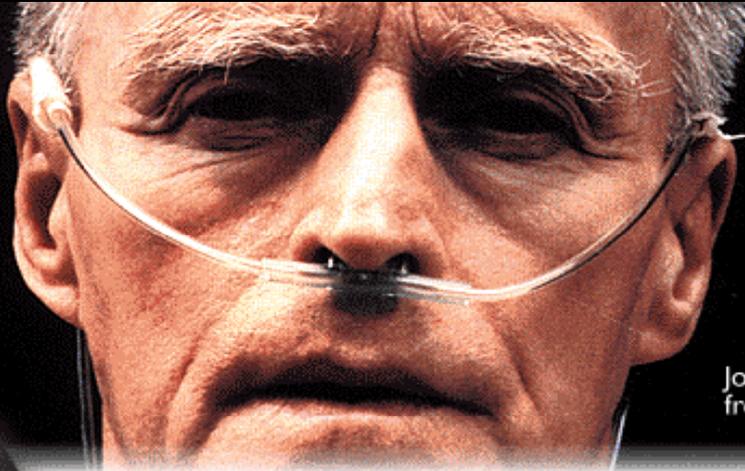
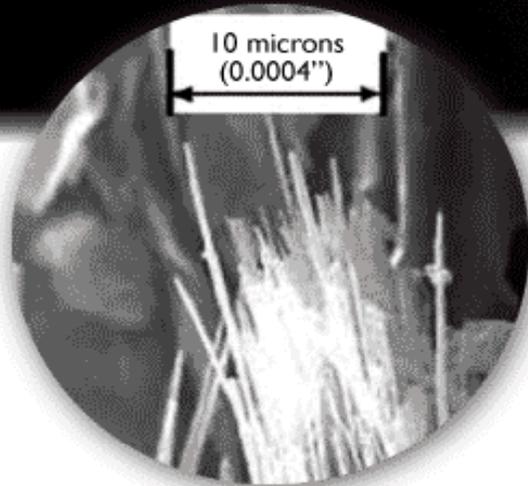


# Fibre of life



# Right to life

## Asbestos



Joe Darabant died from asbestosis in 1990.

**You'd think...** a substance that kills 10,000 Americans each year would be banned.

**You'd think...** that Congress would do everything possible to help those afflicted with asbestos diseases.

**Think again.**

Photograph of Joe Darabant  
Copyright Bill Ravanese | [About the photographer](#)

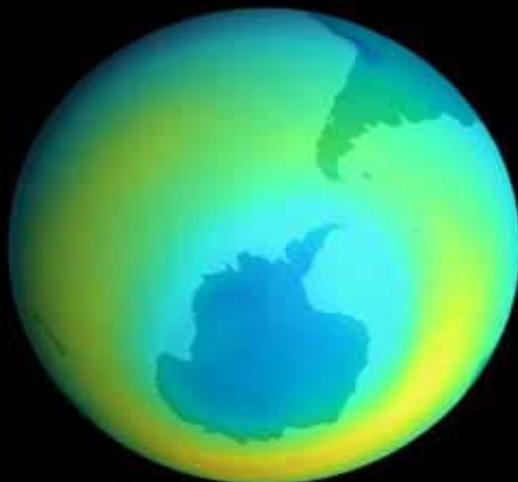
[click for next page]



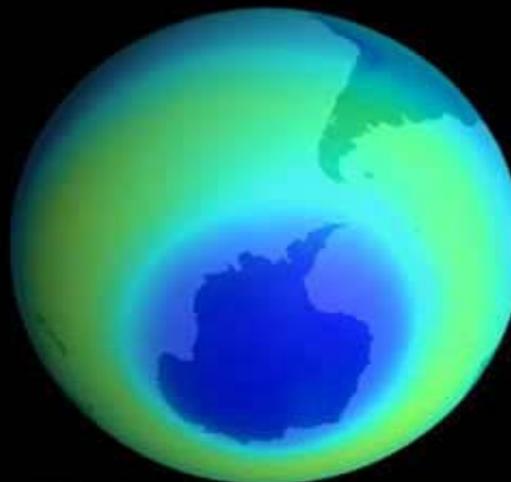
# CFCs



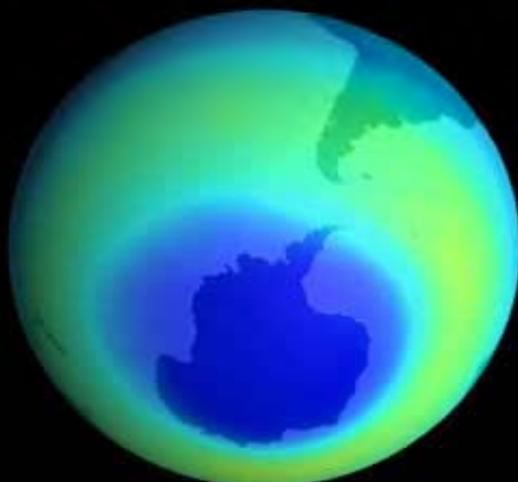
# End of life?



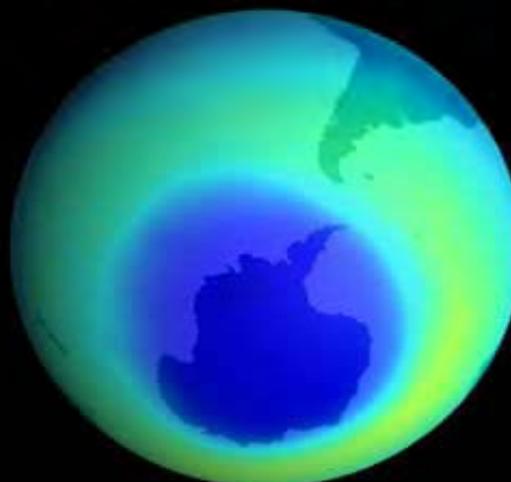
September 1981



September 1987



September 1993



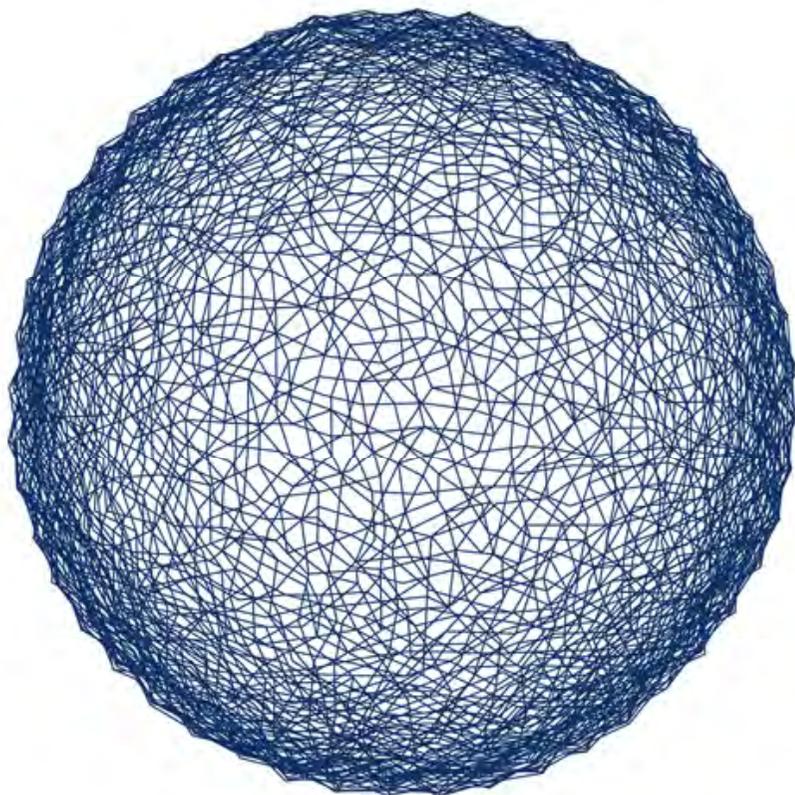
September 1999



# Late lessons from early warnings



# Failure?



COP15

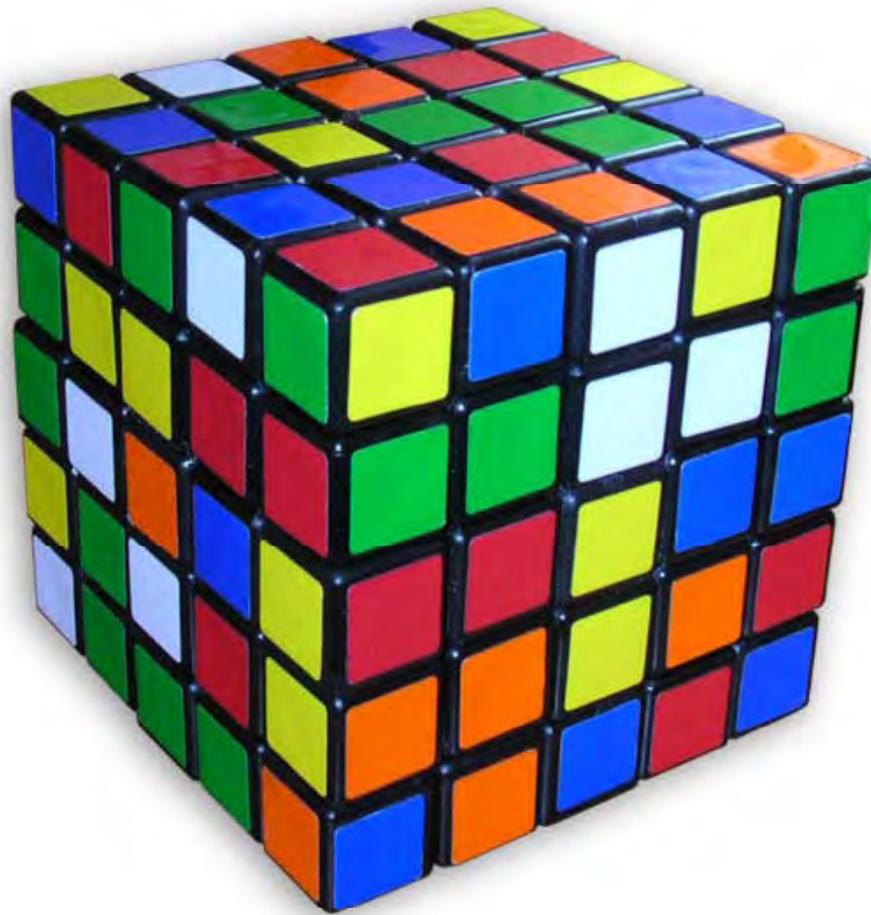
- Current pledges fall well short of achieving the two degree target
- Copenhagen failed to produce a legally binding agreement
- Negotiations are continuing under the Convention and the Protocol

# Cause for optimism?

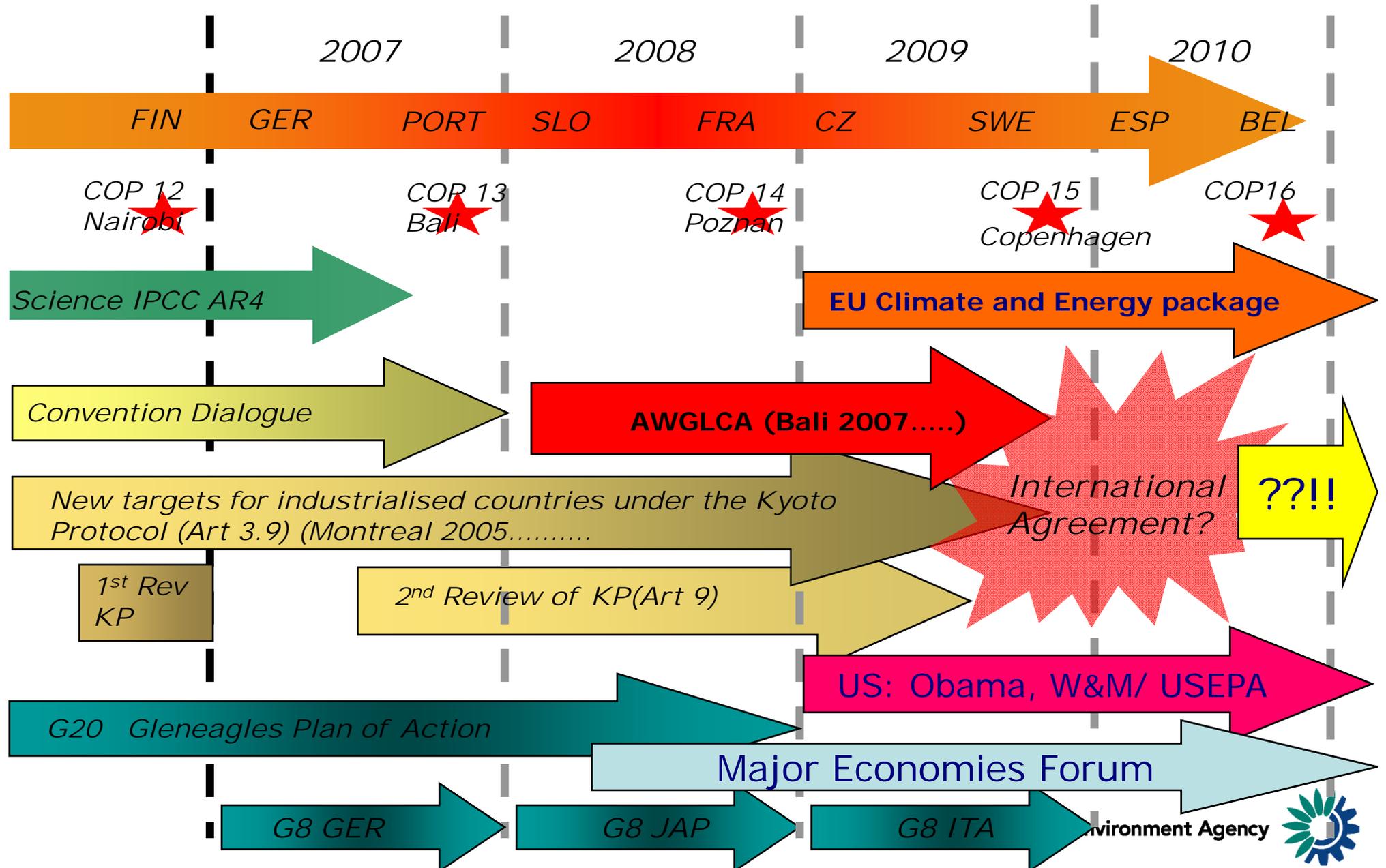


- Copenhagen Accord
- Numerous meetings of governments, business and civil society organisations before and alongside COP15
- Engagement of China and USA in the process of climate change negotiations

The core reason for not achieving more at COP15 was the complexity of negotiations

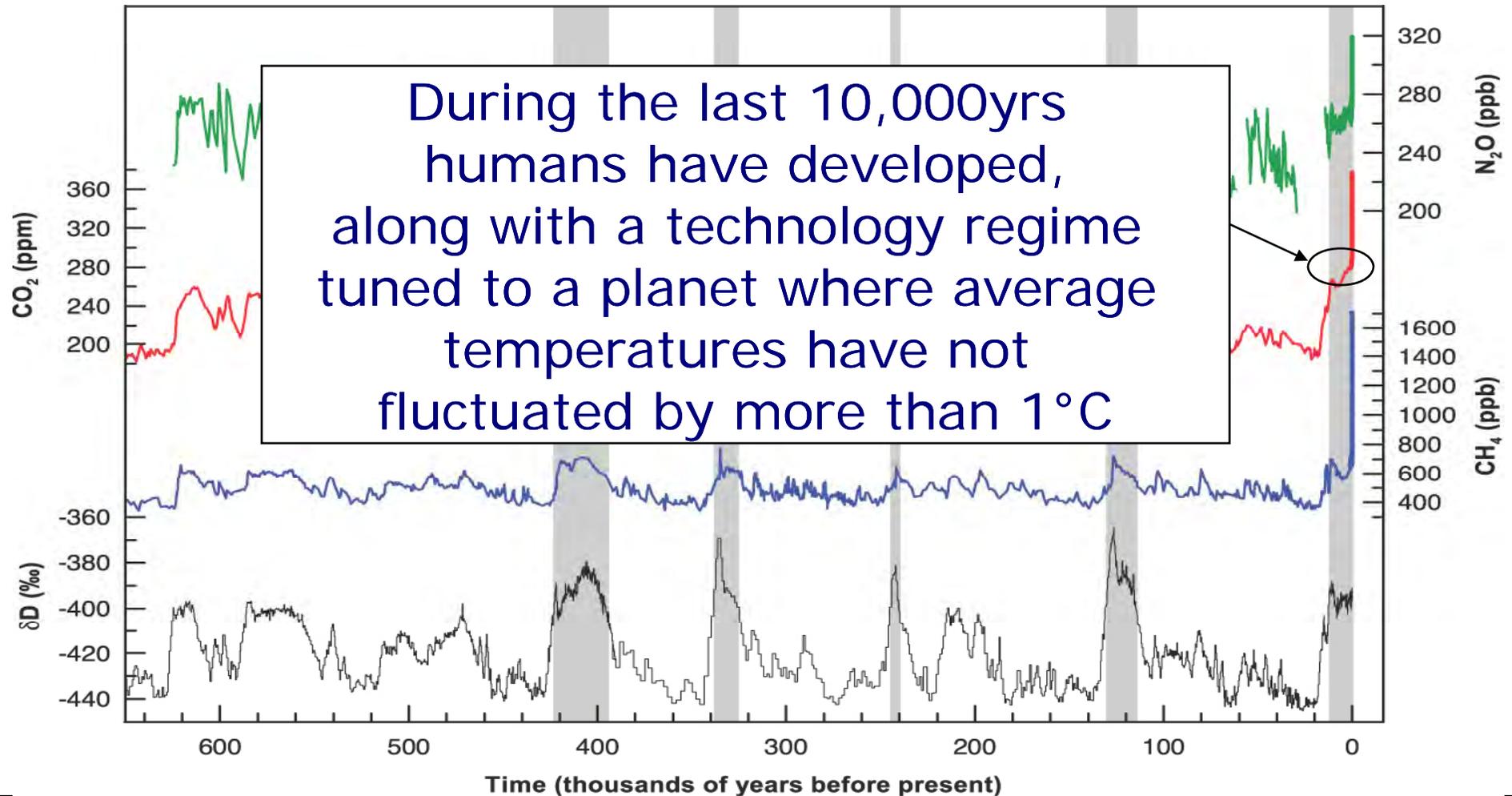


# The policy process has not changed....

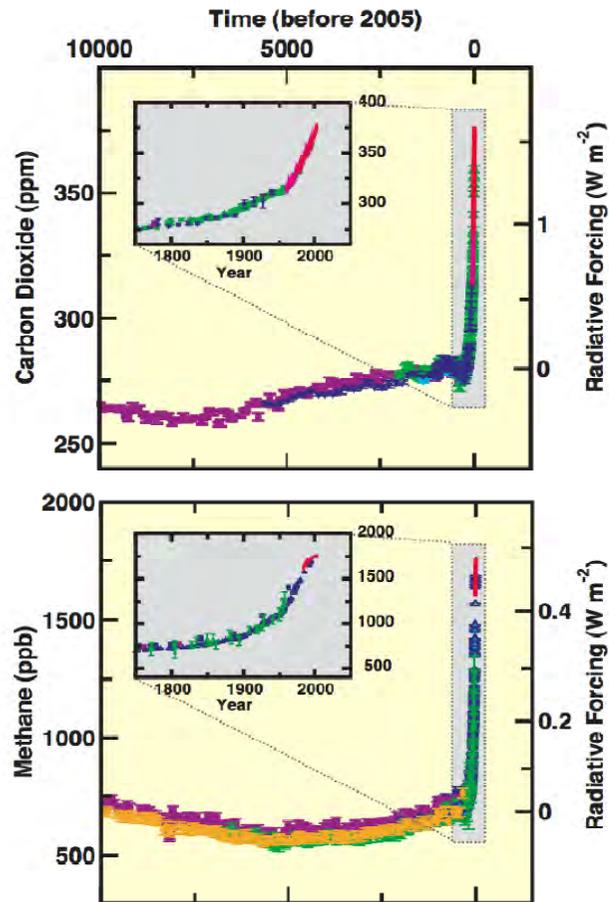


# CO<sub>2</sub> concentration over the past 650 000 years

- Due to emissions from human activities the CO<sub>2</sub> concentration is 387 ppm (2007), far exceeding the natural range over the last 650 000 years (180 – 300 ppm)



# CO<sub>2</sub> : higher levels and faster rise



(IPCC, 2007, Fig. SPM-1)

European Environment Agency





Going, going





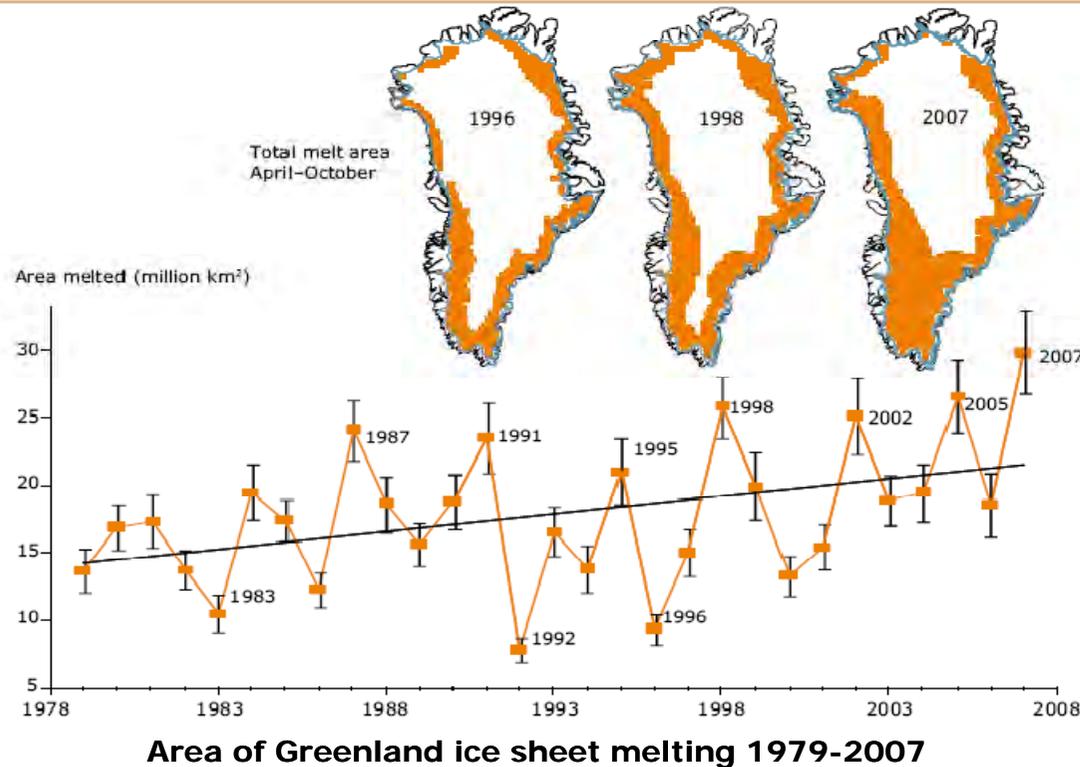
Gone



# Greenland ice sheet

- The Greenland ice sheet is losing 100 billion tons of ice per year since the 1990s
- The contribution of ice-loss from Greenland to global SLR is estimated at 0.14-0.28 mm/year for the period 1993-2003 and has since increased

past



- No reliable prediction of the future of ice sheets can be made, since internal processes are poorly understood
- In the long term, melting ice sheets have the largest potential to increase SLR

future



# IPPC advice to its scientific authors about the perils of prevailing paradigms

Be aware of:

“the tendency for a group to converge on an expressed view and become over confident in it.

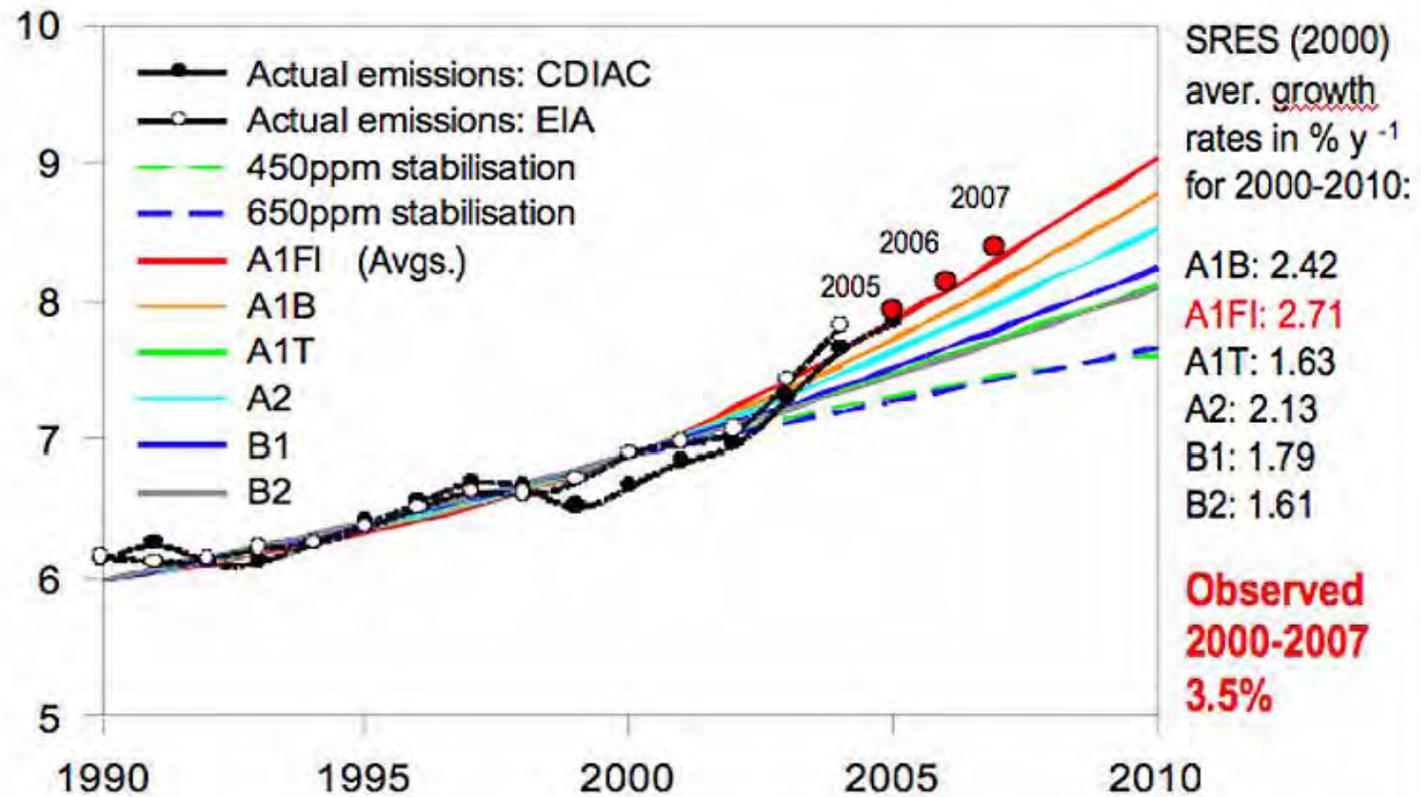
Views and estimates can also become anchored on previous versions, or values, to a greater extent than is justified”.

*(Guidance Note on Uncertainty to its 4<sup>th</sup> Assessment authors, Intergovernmental Panel on Climate Change, 2005)*



# Fossil Fuel Emissions: Actual vs. IPCC Scenarios

Note: **Red** is Business as Usual



Raupach et al 2007, PNAS (updated)



# “Manufacturing Doubt” from Uncertainty and Complexity

**“Doubt is our product** since it is the best means of competing with the “body of fact” that exists in the mind of the general public. It is also the means of establishing a controversy”.

(Tobacco industry executive’s internal memo 1969).

# Unbearable



Climate change & the integrity of science Science 7 May 2010  
"We are deeply disturbed by the recent escalation of political assaults on scientists in general and climate scientists in particular"



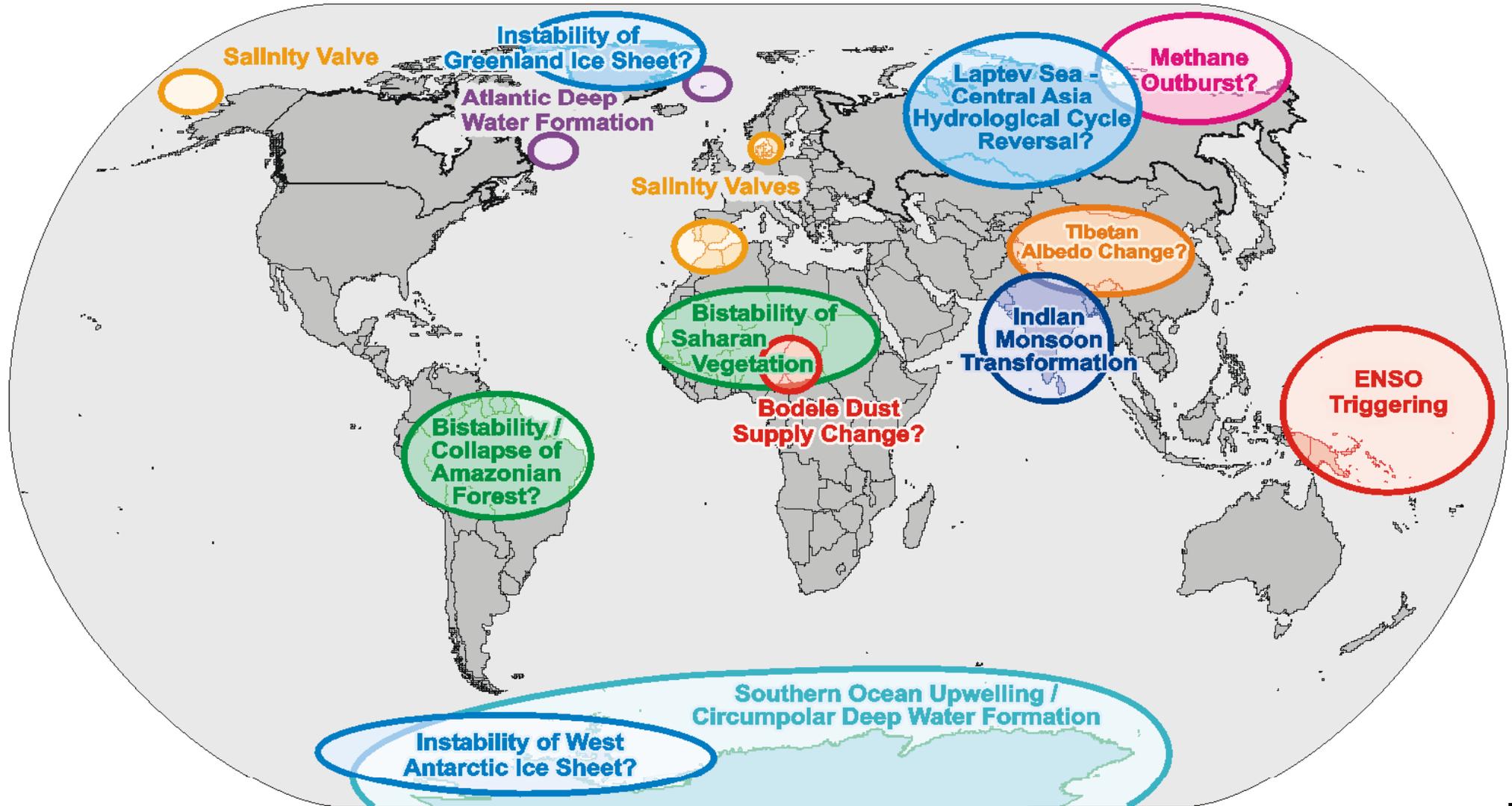
# Complex systems ... some attributes

- **Multiplicity of legitimate perspectives**
- **Non-linearity**
- **Emergence:** “the whole is more than the sum of its parts”
- **Multiplicity of scales**
- **Irreducible uncertainty**
- **Relevance, not precision, is often more useful**

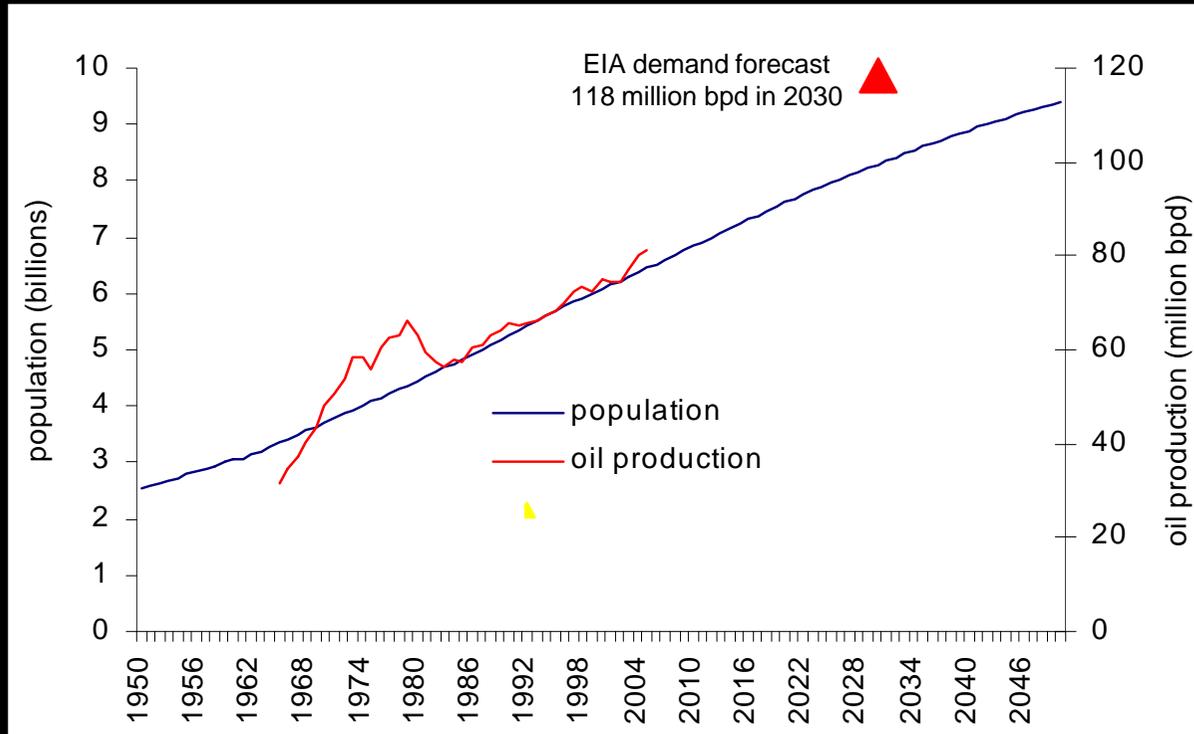
# Safe margins



# Tipping Points in the Earth System (Schellnhuber)



## World population to grow by 1.8 billion by 2031



## Consumption growth since '65:

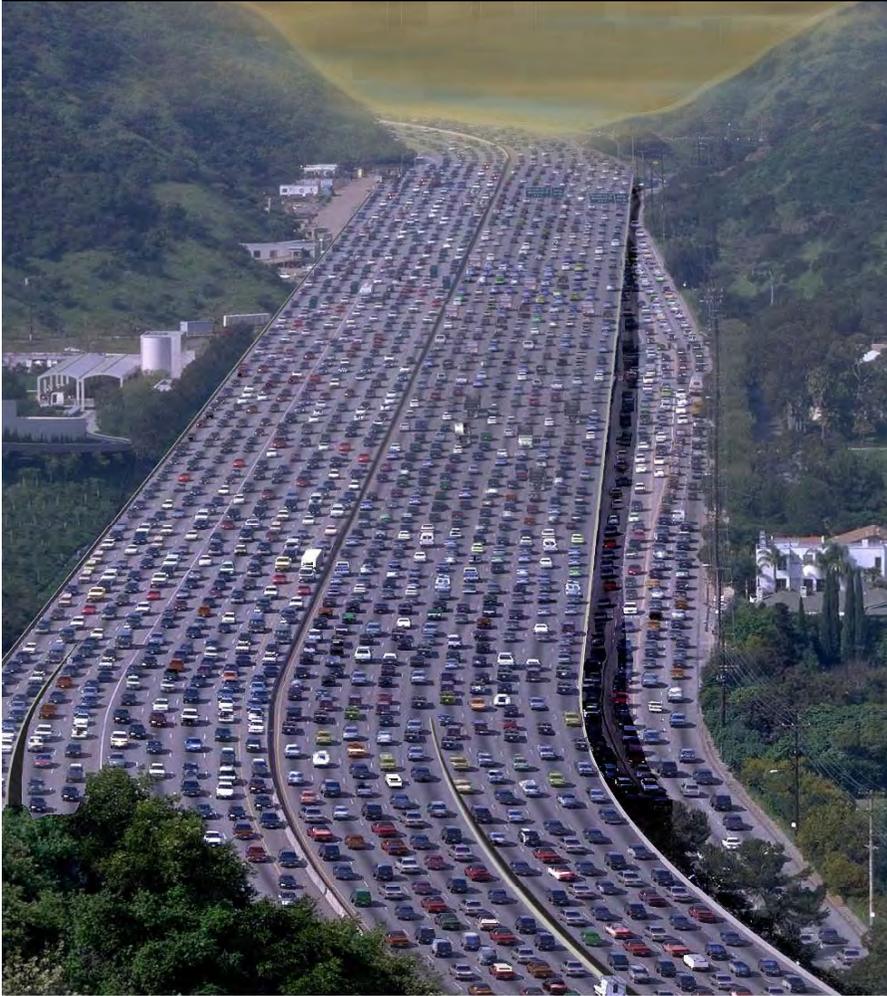
- total energy 284%
- oil 268%
- gas 435%

## Energy demand growth:

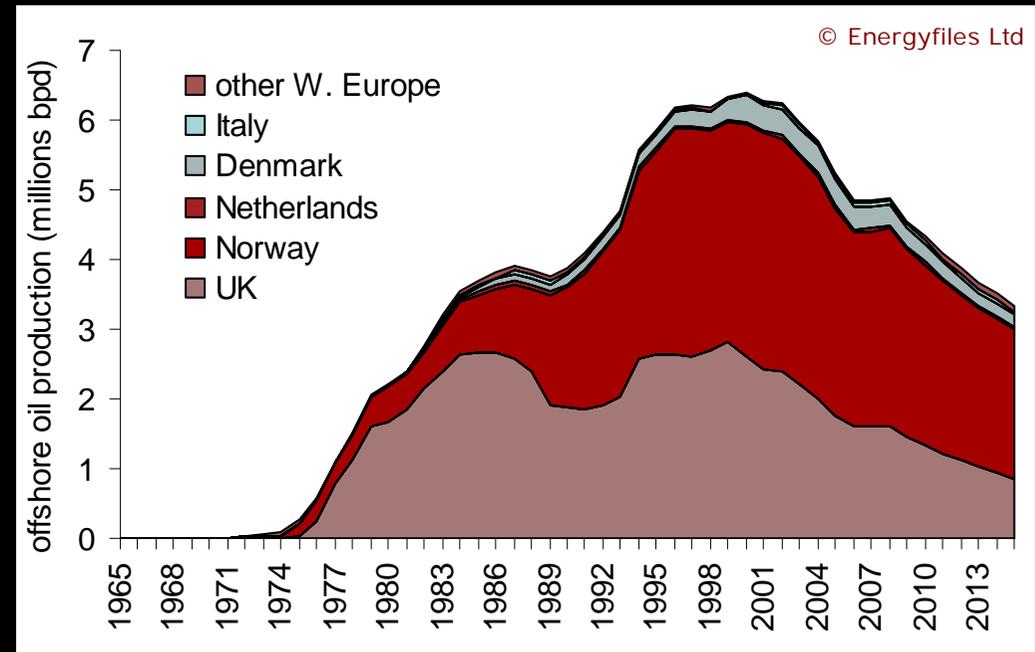
- developed world +111%
- emerging economies +645%



# Oil is the real problem - it is the fuel of transportation



picture courtesy Transfuture.net



European offshore oil production forecast

- Oil accounts for 32% of global energy consumption
- Demand is growing
- Non-Opec production is declining
- Major politically-induced constraints



Unstable





Unsustoppable



# One week's food of a family in the United Kingdom



Source: *Hungry Planet: What The World Eats*, by Peter Menzel and Faith D'Aluisio



# One week's food of a family in Ecuador



Source: *Hungry Planet: What The World Eats* by Peter Menzel and Faith D'Aluisio





# 'Our economic compass is faulty'

Pavan Sukhdev

Making money from money

Over consumption

Capital destruction

“Climate change ... is the greatest and  
widest-ranging market failure ever seen”

Lord Stern, *The Economics of Climate Change*





# Greening the brown economy



Small efficiencies for households translate into huge savings for society

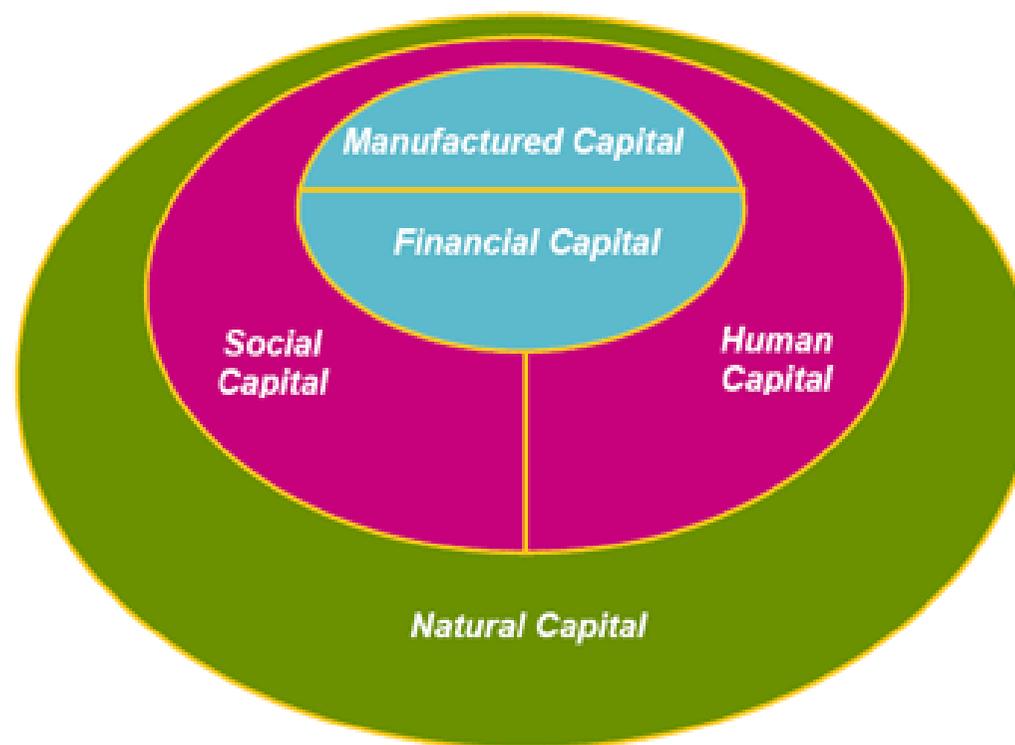


## The three systemic crises

- Systemic multiple crises: finance/real economy, energy/climate, ecosystem/biodiversity, social
- Trust crisis: exposure of concealed debts (including ecological debt which is not even recorded in accounting books)
- Governance crisis: responses are a series of untested rescue packages and trial and error solutions without open and transparent means of gathering and evaluating evidence

# Natural capital underpins our economies and wellbeing

- Manufactured capital
- Financial capital
- Social capital
- Human capital
- **Natural capital**



Source: Forum for the Future

<b>COMMON FEATURES</b>	<b>FINANCIAL CRISIS</b>	<b>CLIMATE CRISIS</b>	<b>NATURAL RESOURCES CRISIS</b>
<b>CAPITAL DESTROYED</b>			
<b>Financial</b>	YES	YES	YES
<b>Human</b>	YES	YES	YES
<b>Natural</b>	YES	YES	YES
<b>Social</b>	YES	YES	YES
<b>RISKS/ DEBTS PASSED ON TO CURRENT AND FUTURE 'OTHERS'?</b>	YES	YES	YES

<b>COMMON FEATURES</b>	<b>FINANCIAL CRISIS</b>	<b>CLIMATE CRISIS</b>	<b>NATURAL RESOURCES CRISIS</b>
<b>MARKET PRICES: Cover All costs?</b>	NO	NO	NO
<b>Reflect real risks?</b>	NO	NO	NO
<b>TRANSPARENT TRANSACTIONS?</b>	NO	NO	NO
<b>ACCOUNTING FOR WHAT MATTERS?</b>	NO	NO	NO
<b>EARLY WARNINGS HEADED?</b>	NO	NO	NO
<b>ROBUST AND SUSTAINABLE SYSTEMS?</b>	NO	NO	NO





# Maintianing natural capital



# Imaginative capital

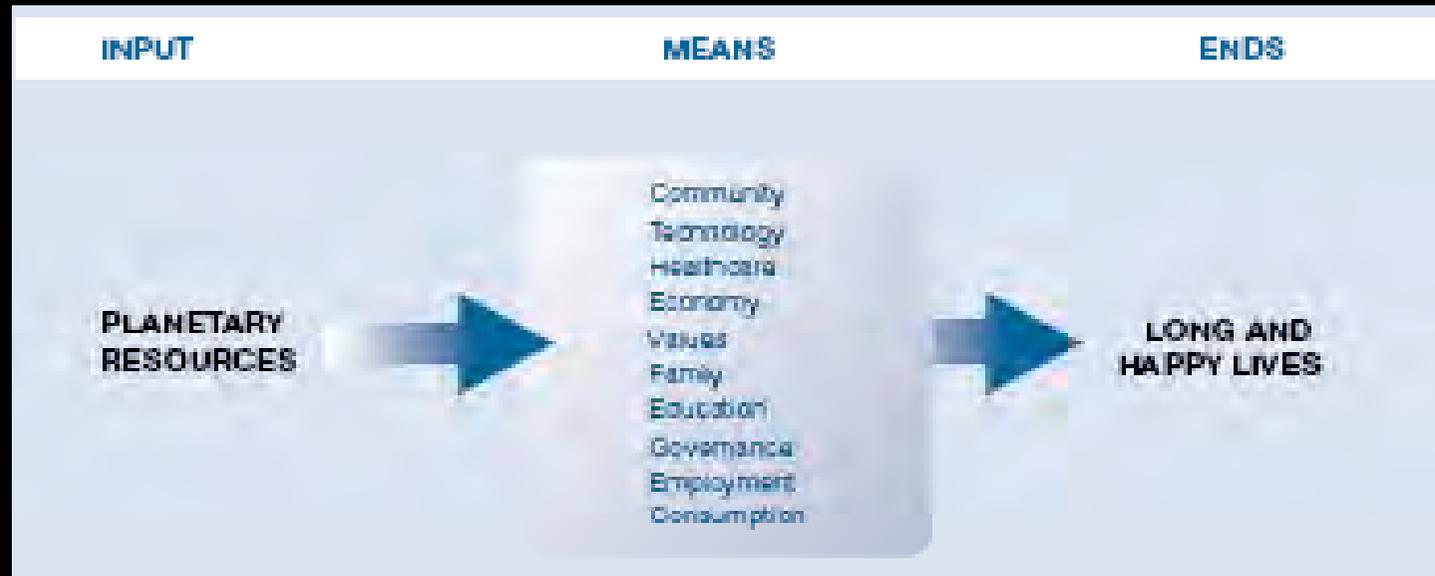




# Social capital –GDP and beyond



The Unhappy Planet FoE/NEF 2006



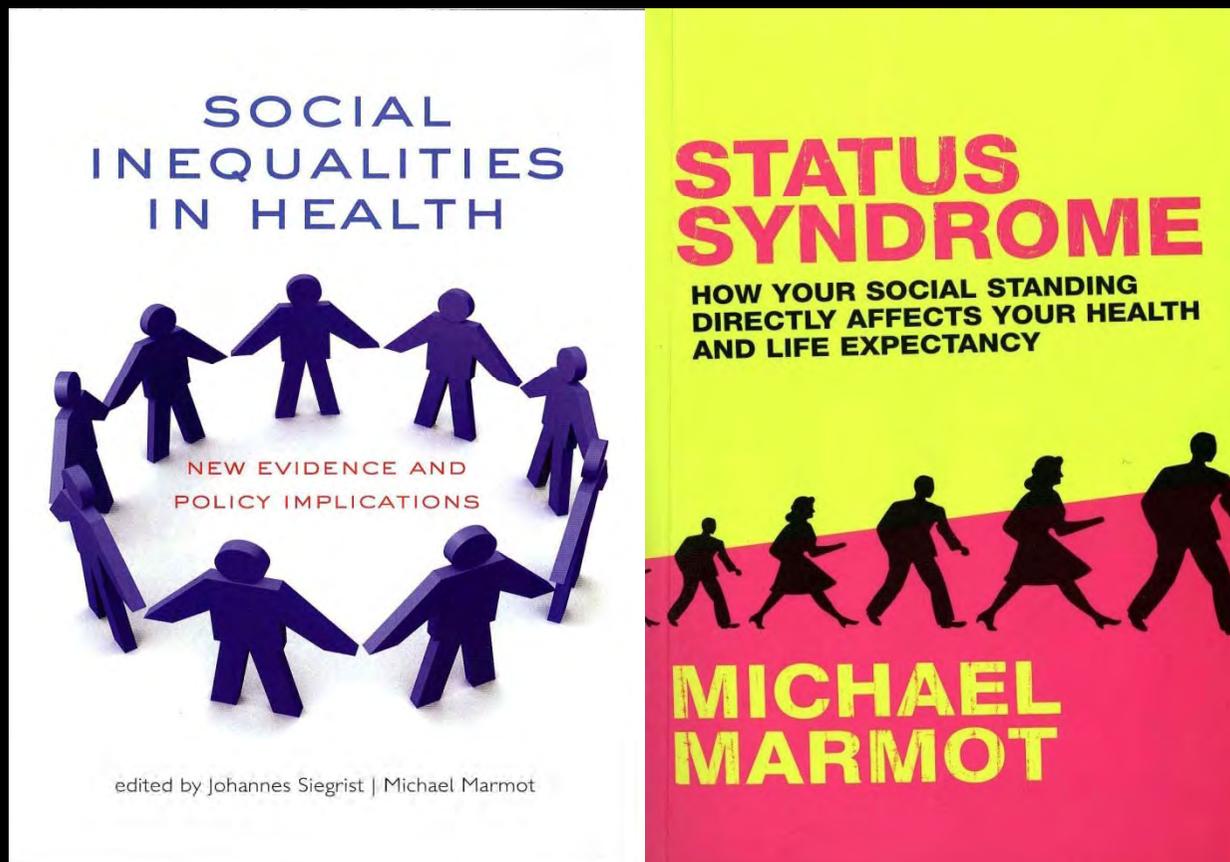
# Happiness counts



# Some features of good governance

- Maintaining capitals
- Meeting needs of today's ageing populations and next generations
- Balancing resource consumption
- Public participation



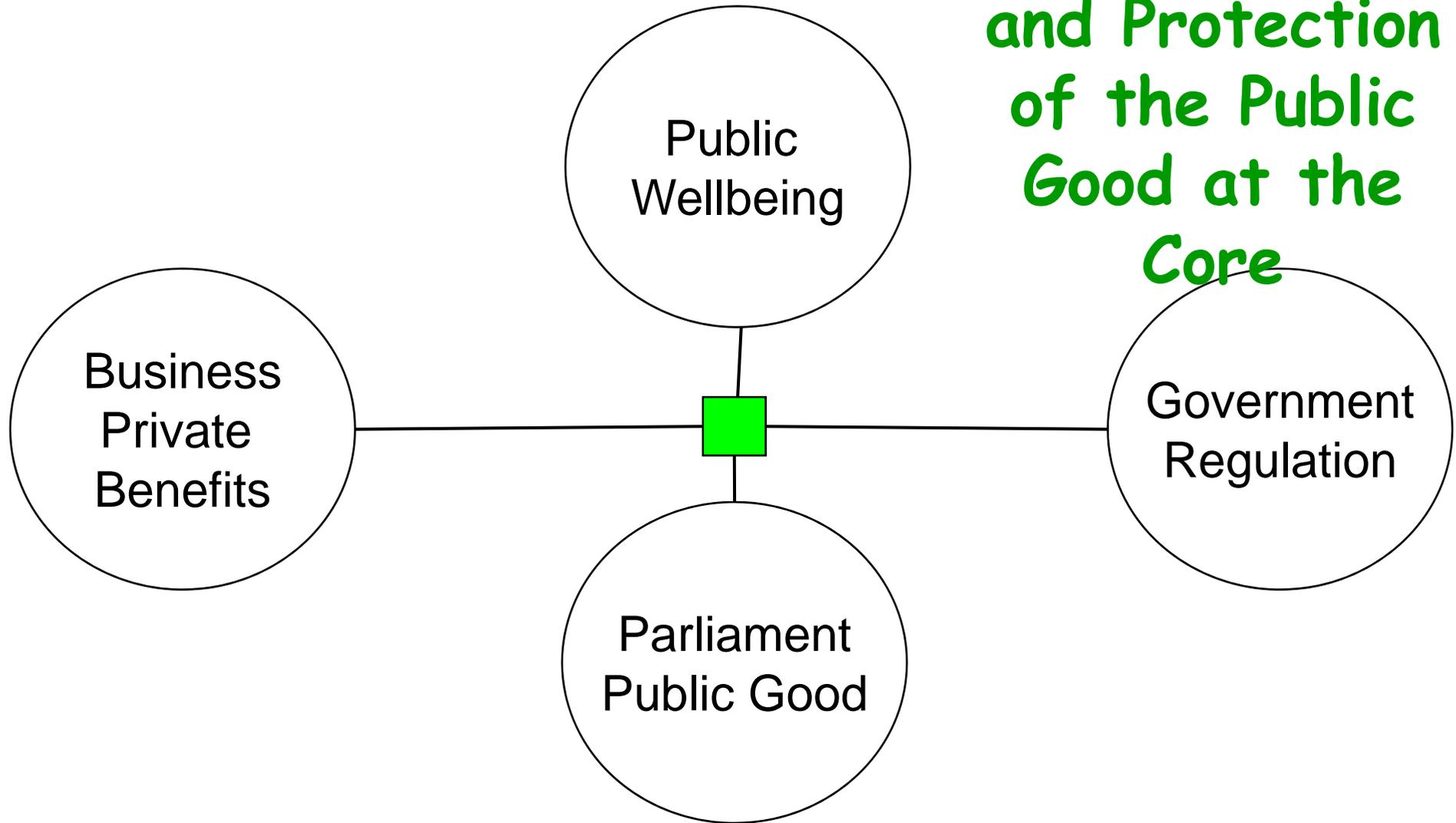


Who do you think you are?



# Green Economy

# Public Participation and Protection of the Public Good at the Core



# Communicating Complex Science?

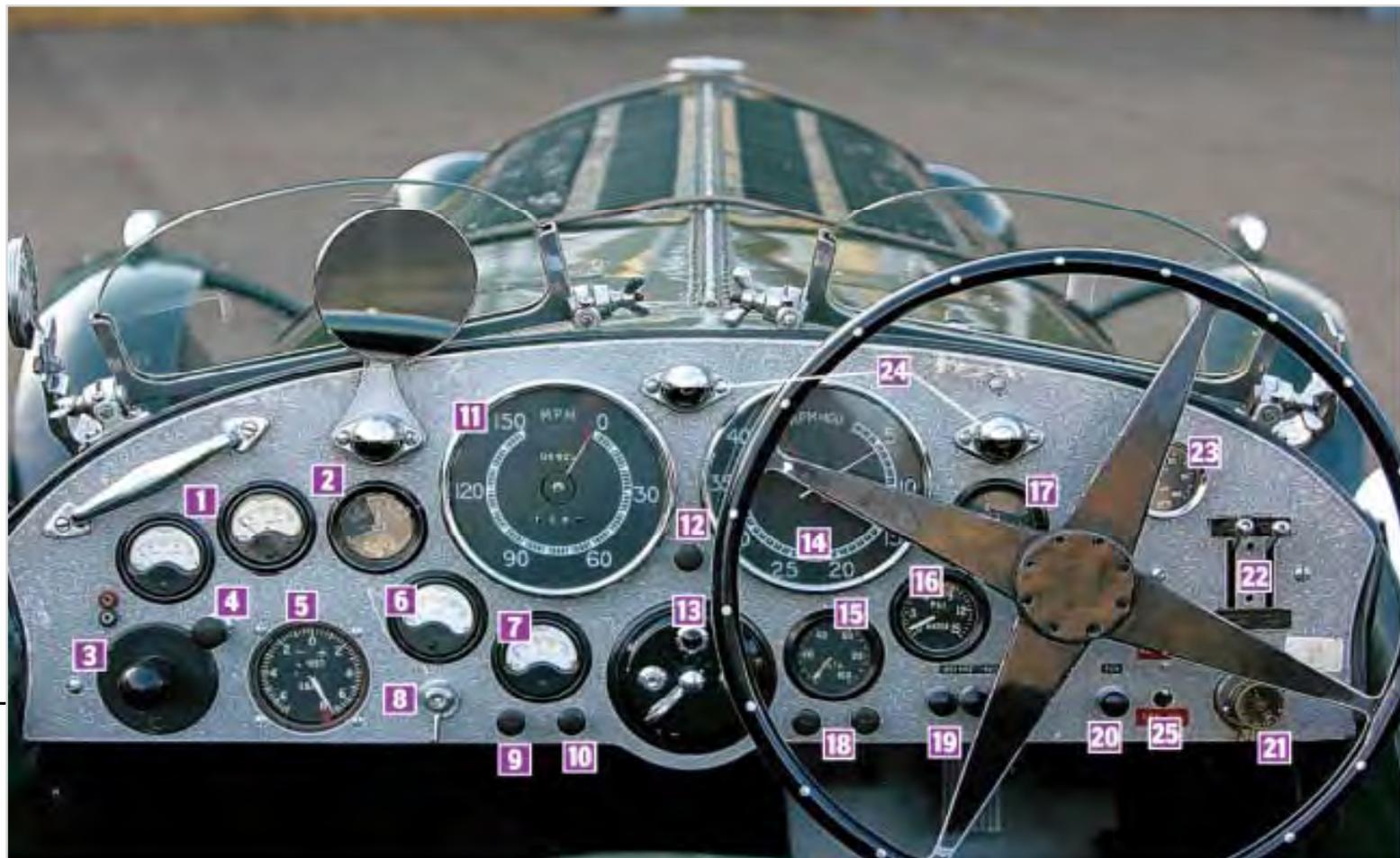
- Beware of “Perils of the precis”
- Strength of evidence: terminology for cause/effects
- Communicating uncertainty
- Communicating Evaluations of evidence

# Some Strengths of Scientific Evidence

- Beyond all reasonable doubt (criminal law & **scientific causation**)
- Reasonable certainty (IPCC, 2007)
- Balance of probabilities/evidence (IPCC,2001)
- Strong possibility (IARC on ELF 2002)
- **Scientific suspicion of risk** (Swedish Chemicals Law, 1975)
- **“Pertinent information”** (WTO justifying Member State actions to protect health)

# Monitoring and observations

- priorities not clear; disconnected information
- customised and not always standardized



# Policy relevant indicators

- key information emphasized
- standard measures



# Scientific paradigms: vested interests?

“A new scientific truth does not triumph by convincing its opponents and making them see the light but rather because its opponents eventually die, and a new generation grows up that is familiar with it”

*(Max Planck, Nobel physicist, 1949)*

## Some common terms for cause/effect links

- "Suspicion that"
- "Indications that"
- "Increasing evidence that "
- "Implies that"
- "Points to their origin in"
- "Considered to be associated with"
- "Tempting to suggest that"
- "Have been shown to contribute to"

(From Nov 06 draft Summary Weybridge + 10 report on EDSs, Finnish Academy of Sciences/EEA 2010).

# Intellectual Bias in the Beef Hormones case at WTO.....2008

"The European Communities alleges that the Panel disregarded its "most important objection "**that Drs. Boisseau and Boobis, who participated in the drafting of JECFA reports, could not be independent and impartial because they were asked to evaluate the risk assessments that were "very critical of the JECFA reports".**The European Communities observes that as "co-authors" of the JECFA reports, these experts "cannot be considered to be independent and impartial in these circumstances..

*Source: p27, para 65 World Trade Organization, WT/DS320/AB/R, "United States-Continued Suspension of Obligations in the EC-Hormones Dispute", (16 October 2008)*

# Minority Scientific Views?

- Science does not require majority rule..
- “Minority/divergent views must be taken into account: but they must be about more than a “theoretical” risk”  
*(EC Communication on PP; ECJ)*
- “Risk Assessments can be based on a Respectable minority view” *(WTO,2008)*

Absence of  
evidence is  
not evidence  
of harm



# Towards more transparent & consistent terminology?

<b>Cause/effect link</b>	<b>Strength of Evidence</b>
Causally linked to	Very Strong
Strongly associated with	Strong
Associated with	Moderate
Little evidence that*	Weak
Unlikely to be*	Very Weak

## Variable Communication of Uncertainty In 100 EU SC Opinions (Hart/Hardy ,2007)

Committee	Any of c 40 terms for uncertainty (Table 16)	“Uncertain” or “uncertainty”	
	In concluding section	In concluding section	Anywhere in opinion
SCCNFP	20%	0%	5%
SCCP	52%	0%	29%
SCENIHR	80%	80%	80%
SCHER	63%	26%	53%
SCMPMD	73%	18%	55%
SCTEE	83%	38%	79%

# Funding Biases..

- The Vatican sought out scientists who would contradict Galileo (*“Rivals”, M. White*)
- Histories of Asbestos, Lead, Pharma, Tobacco, BPA, & Mobile phones  
where **source of funding strongly influences nature of the results**

# BRE findings on evaluation of scientific evidence in 23 Risk Assessments

(For EU WG on Evaluating Evidence, April 2010).

- Few Risk Assessments had information on
  - *Formal numerical weighting of evidence*
  - *Rules for degree of confidence in the evidence*
  - *Rules for terminology on strengths of evidence*
  - *Approaches for communicating strengths of evidence*

# GM a real dialogue?

To: John Curtice, Chair, Steering Group, Food Standards Agency GM Dialogue  
26 May 2010

I wish to reassure you that I am not in any way questioning your independence as Chair and I appreciate that some changes have been made in response to concerns that I have raised in meetings. However, I remain convinced that the FSA process was set up from the outset to provide free “reputation management” to the GM industry at taxpayers’ expense. The FSA appears to actively engaged in trying to use the so-called dialogue to implement the industry’s PR strategy: focusing on a non-existent positive future where new GM crops will ‘feed the world’, whilst lobbying to end the segregation of GM and non-GM food and feed entering Britain and Europe, and opposing the labelling of meat and dairy products produced using GM feed.

This is not a process that I am prepared to support.

Yours sincerely

Dr Helen Wallace

Director

GeneWatch UK

# Leading the way

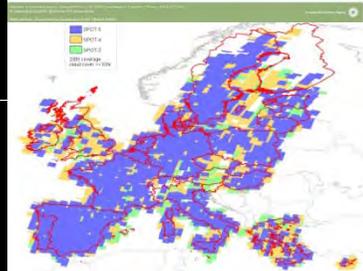
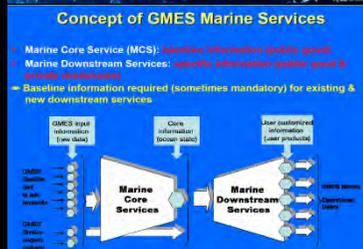


# Shared Environment Information System core principles

- Provide once but using for many purposes
- Quality assured
- Traceable i.e responsible person/institution identified
- Managed as close as possible to source
- Accessible to enable clients to make comparisons at the appropriate geographical scale (cities, countries, river basins, catchment areas)
- Available to the public after due consideration of the appropriate level of aggregation



# GISC – EEA- ESA- ESRIN



Sentinel 1 – SAR imaging

All weather, day/night applications, interferometry

Sentinel 2 – Multispectral imaging

Land applications: urban, forest, agriculture, etc  
Continuity of Landsat, SPOT data

Sentinel 3 – Ocean and global land monitoring

Wide-swath ocean color, vegetation, sea/land surface temperature, altimetry

Sentinel 4 – Geostationary atmospheric

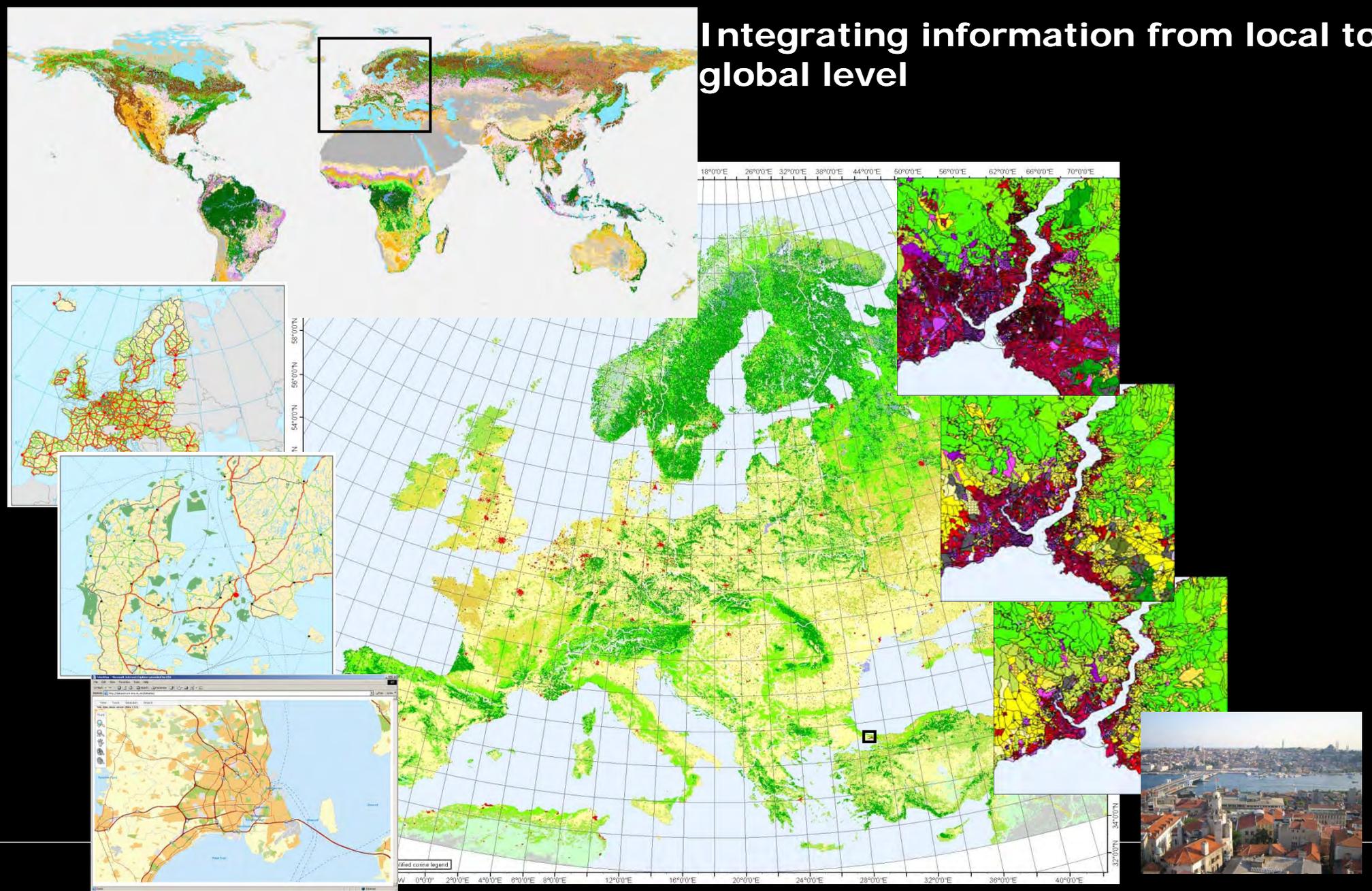
Atmospheric composition monitoring, trans-boundary pollution

Sentinel 5 – Low-orbit atmospheric

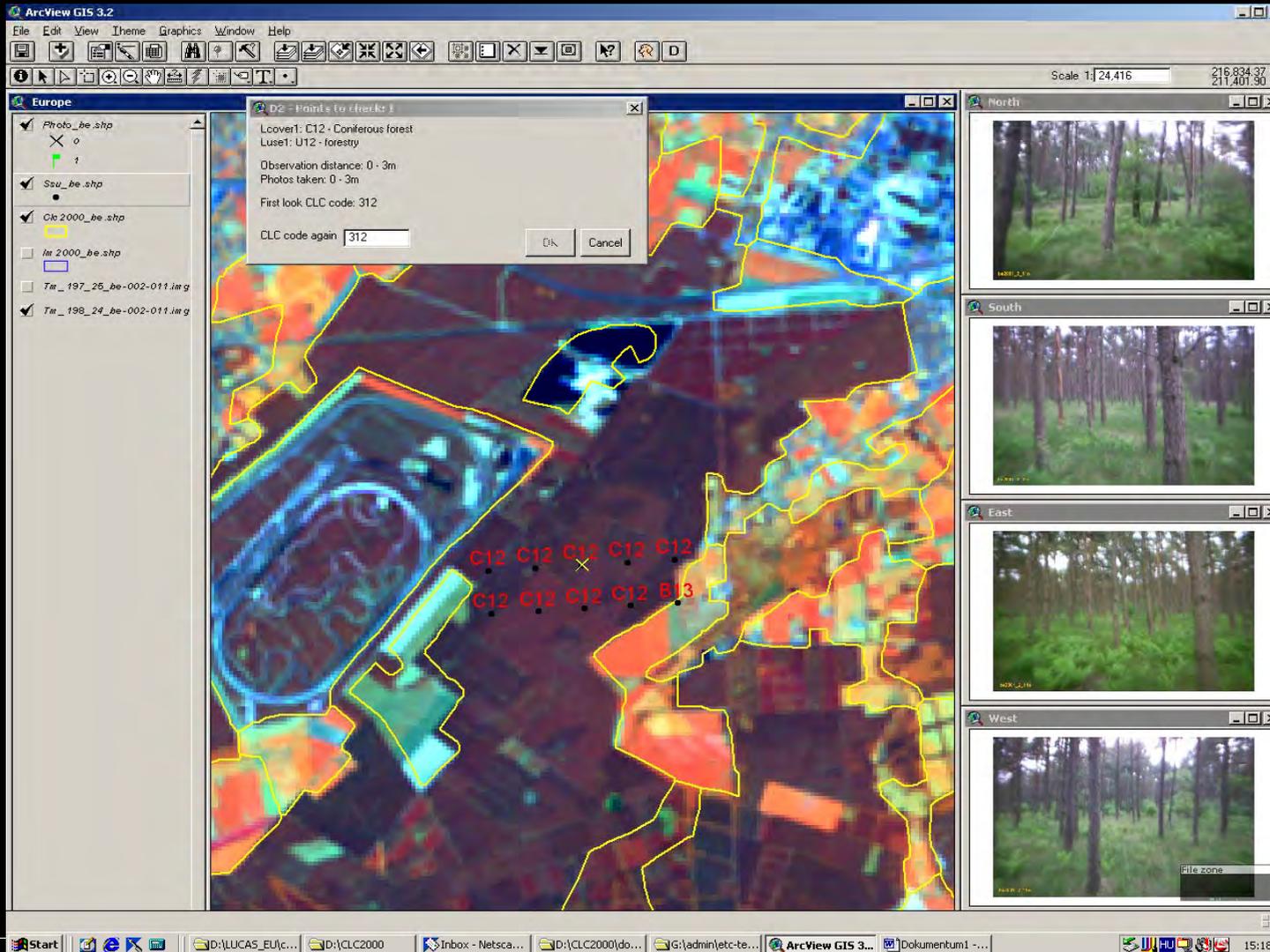
Atmospheric composition monitoring



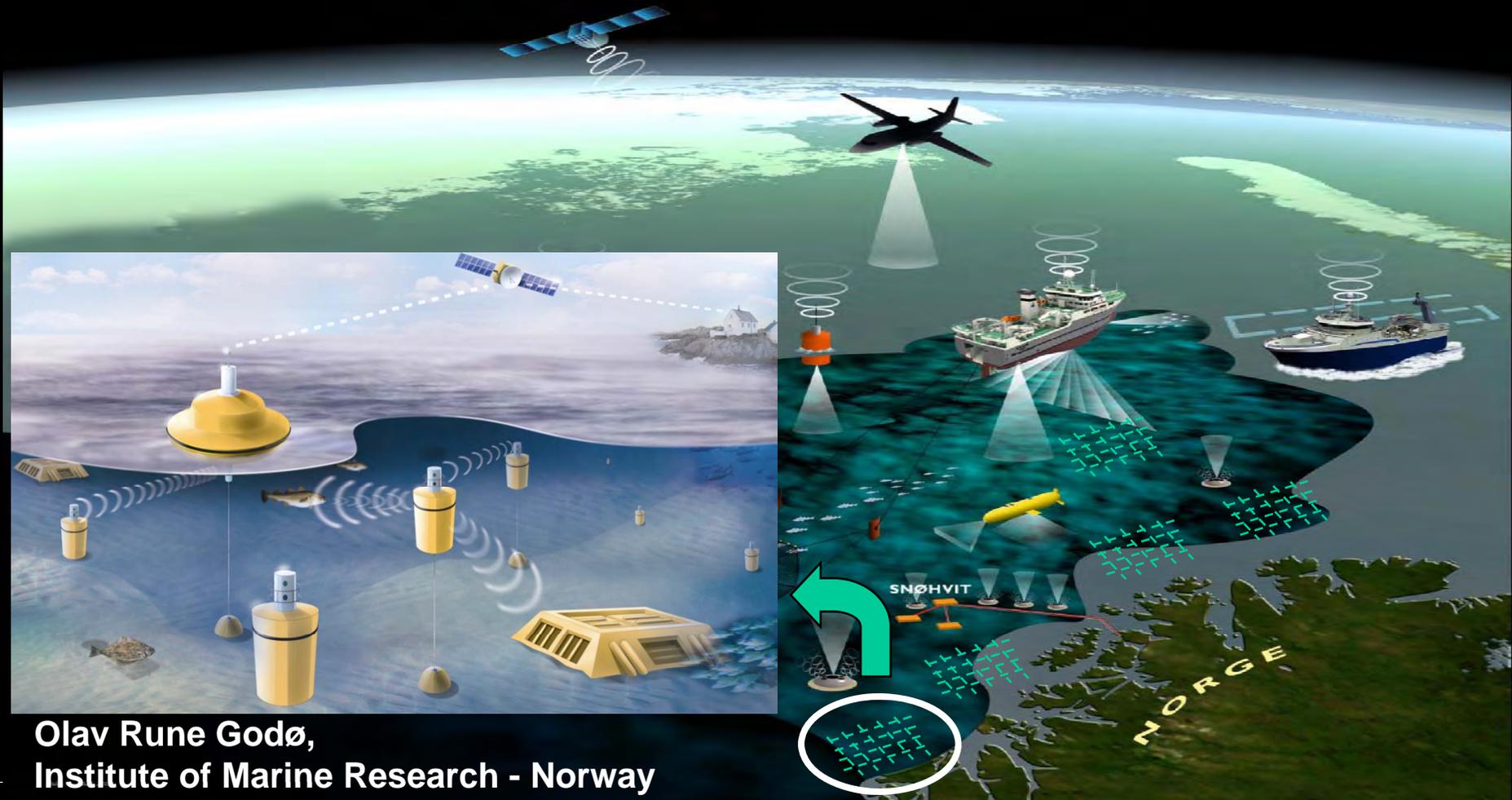
# Integrating information from local to global level



# Farmers integrating space and *in-situ* monitoring

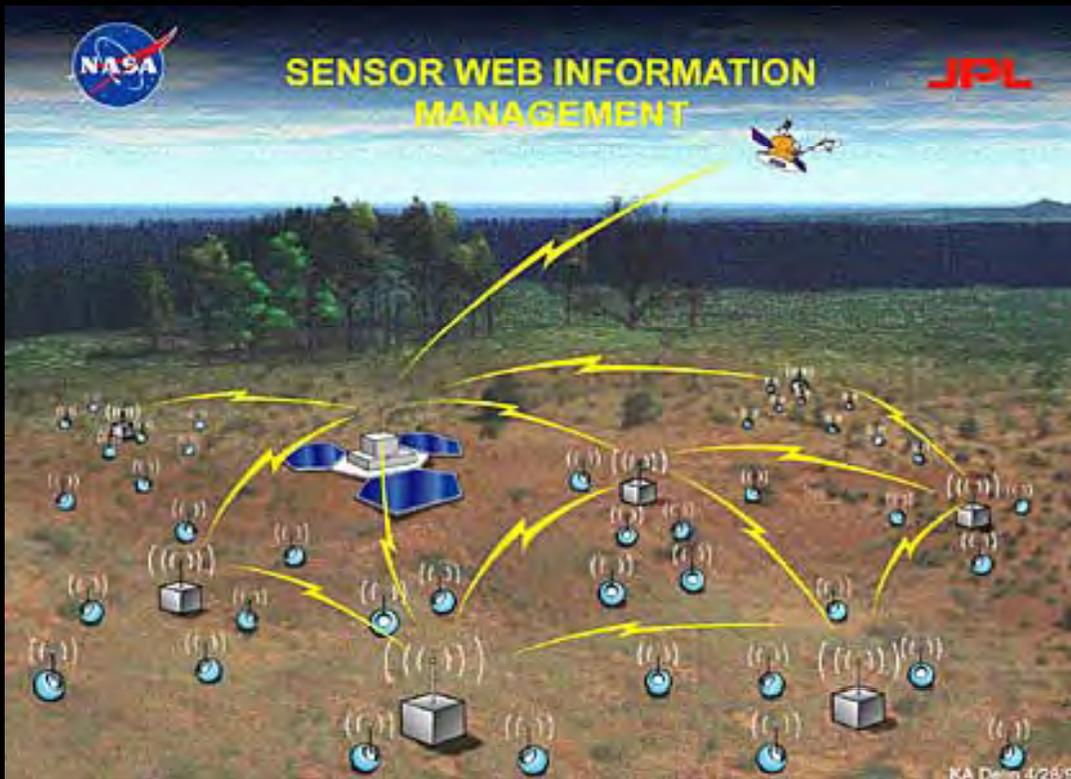


# Integrated monitoring: New Nervous system for the North

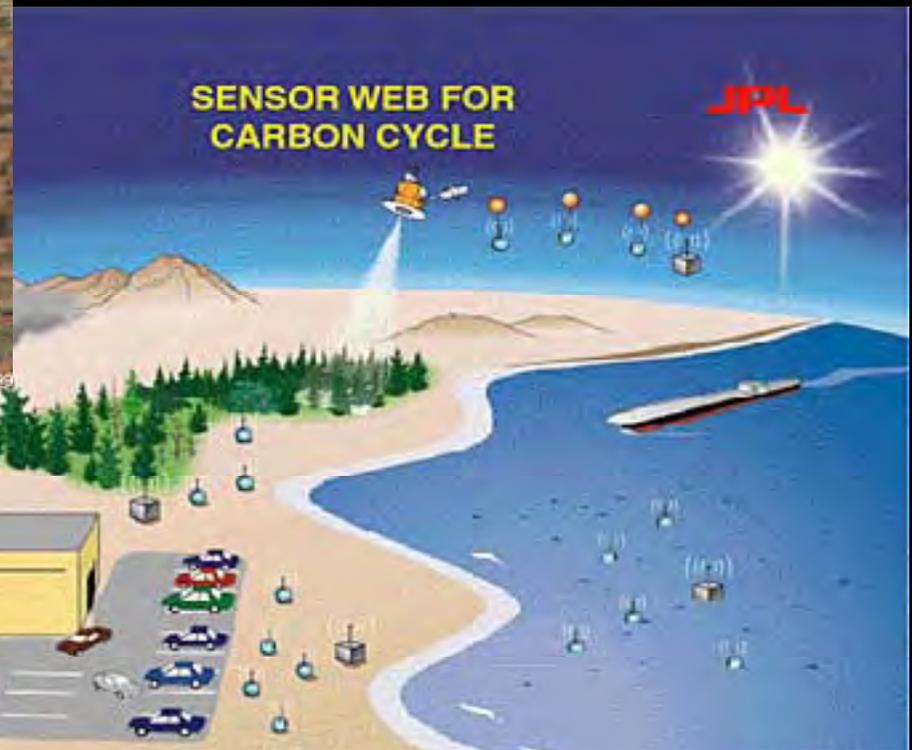


Olav Rune Godø,  
Institute of Marine Research - Norway





# Integrating space and *in-situ* observations: Sensor Web



S@NY  
Sensors Anywhere



Open architecture for Smart and Interoperable networks in Risk management based on In-situ Sensors



# Power to the people





Providing a user-friendly global platform for dissemination of environmental and related data and information containing:

- Quality assured data, observed and modelled, voluntary and/or mandatory
- Secure data tagging for traceability, sourcing and citation
- User observations and feedback
- Showcase for multimedia
- Visibility to citizen's and community actions

Serving a wide variety of communities and individuals at different levels of complexity





# EYE ON EARTH

enter location

Road Aerial Labels Views

Map navigation controls including zoom in (+), zoom out (-), a compass, and a location pin icon.

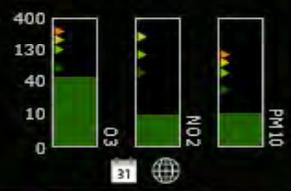


STATIONS [more info...](#)  
■ AIR STATIONS ■ WATER STATIONS

my location sms about help lock

## MALMÖ, SWEDEN Change Location

**OUR RATING**  
1 **VERY GOOD**



**YOUR RATING**  
1 **GOOD**

Irritating Dirty Clean  
**Non-irritating**  
 Odourless Clear  
 Non-clear Smelly  
 1 Rating

AIR WATCH

**OUR RATING**  
1 **GOOD**

nearest station  
 Barometergatan, Malmö, Sweden  
 1 Rating

**YOUR RATING**  
1 **VERY GOOD**

Crowded Polluted Equipped Safe  
 Clean Scenic Dirty Unsafe  
 1 Rating

WATER WATCH

### SMS more info...

**AIR** [location name] OR **WATER** [location name]  
**+44 7786 201 106**

### EEA HEADLINES

- EEA kicks off public activities in the run-up to COP15**  
 On the occasion of Copenhagen Culture Night, the European En...  
 [COP15]
- EU set to miss 2010 air pollutant limits**  
 With 2010 now quickly approaching, updated emission estimate...
- EEA joins forces with European Water Partnership**

Road Aerial Labels Views



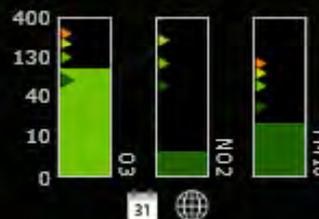
my location sms about help

### COPENHAGEN, DENMARK

Change

**OUR RATING**  
2 GOOD

**YOUR RATING**  
GOOD



Irritating	Non-irritating
Non-clear	Clear
Odourless	Dirty
	Smelly

82 Ratings

**OUR RATING**  
1 GOOD

**YOUR RATING**  
MODERATE

nearest station  
Langebro, 1553, Denmark

Polluted	Scenic	Equipped
Crowded	Safe	Clean
Unsafe	Dirty	

9 Ratings

### SMS

**AIR** [location name] OR **WATER** [location name]

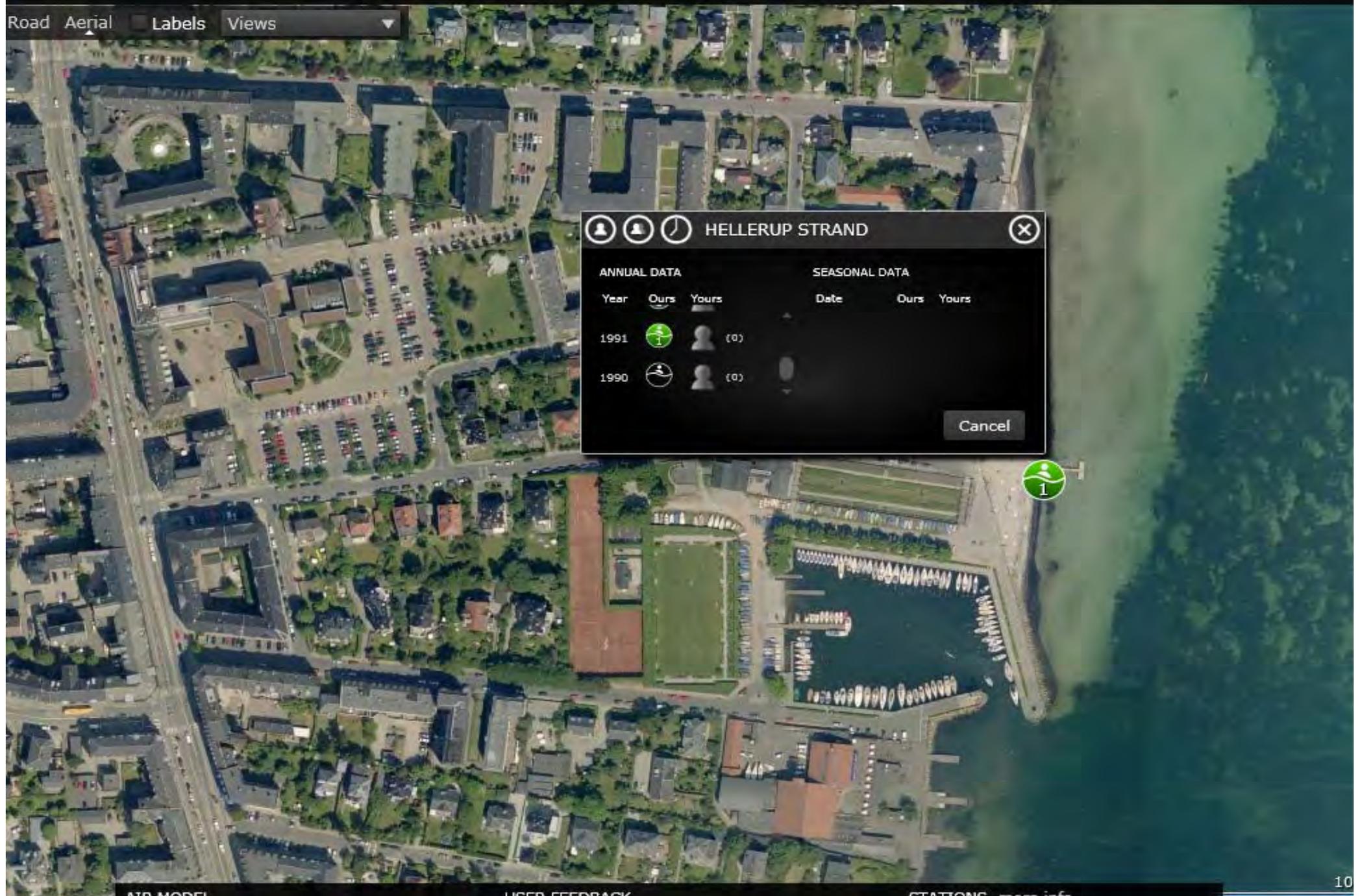
+44 7786 201 106

### EEA HEADLINES

**How will the Western Balkans shape its environmental future?**  
Economic development in the Western Balkan countries is putt...

**Europe to exceed air pollutant emission limits – NOx in particular**  
In 2010, around half of the European Union's Member States e...

Road Aerial Labels Views



**HELLERUP STRAND**

ANNUAL DATA			SEASONAL DATA		
Year	Ours	Yours	Date	Ours	Yours
1991		(0)			
1990		(0)			

Cancel



Road Aerial Labels Views

Onsgårdsvej 6, 2900,...

**OUR RATING**  
2 **GOOD**

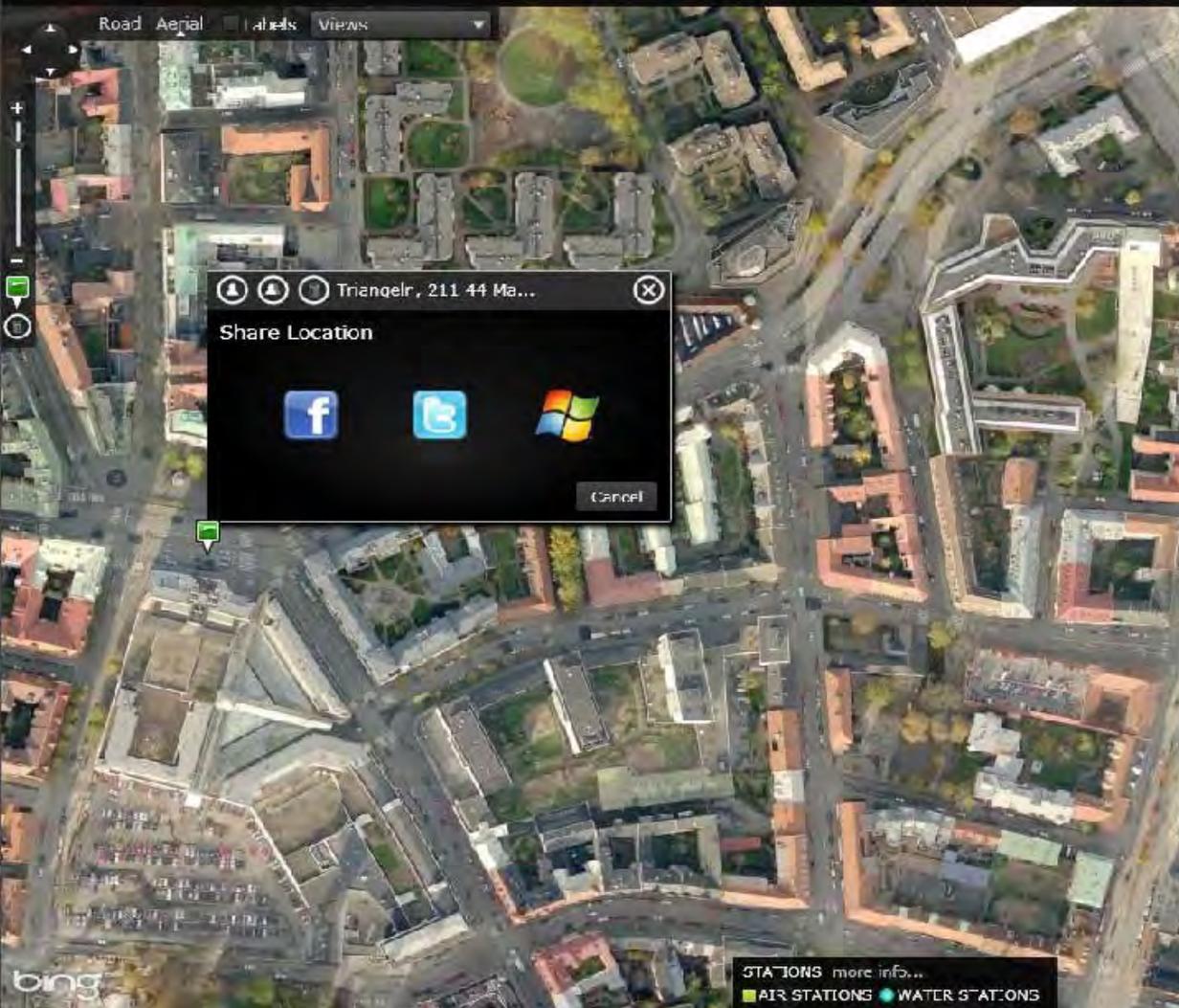
**YOUR RATING**  
GOOD

Pollutant	Level	Quality
O3	31	Good
NO2	~40	Good
PM10	~10	Good

Non-clear Smelly Non-irritating  
Clean Clear Odourless Dirty  
Irritating

5 Ratings

Last updated less than 2 hours ago



my location sms about help lock

## MALMÖ, SWEDEN Change location

**OUR RATING**  
1  
**VERY GOOD**

**YOUR RATING**  
**GOOD**



Irritating Dirty Urban  
**Non-irritating**  
**Odourless** Clear  
Non-clear Smelly

1 Rating

AIR WATCH

**OUR RATING**  
1  
**GOOD**

**YOUR RATING**  
**VERY GOOD**

NEAREST STATION  
Kornhamngatan, Malmö, Sweden

Good! Polluted. Elevated Safe. Clear. Sulfur. Dirty. Unsafe.

1 Rating

WATER WATCH

### SMS more info...

**AIR** [location name] OR **WATER** [location name]

 **+44 7786 201 106**

### EEA HEADLINES

**EEA kicks off public activities in the run-up to COP15**  
On the occasion of Copenhagen Culture Night, the European Environment Agency...

**EU set to miss 2010 air pollutant limits**  
With 2010 now quickly approaching, updated emission estimates...

**EEA joins forces with European Water Partnership**  
The European Environment Agency and the European Water Partnership...

**Best way to get around: bicycle, car or on foot?**  
Every day, millions of Europeans make short trips to work, school...

**STATIONS** [more info...](#)  
■ AIR STATIONS ■ WATER STATIONS



Road Aerial Labels Views



# GIS Technology is Changing

Easy, Accessible and Collaborative

## Enabled By

- Cloud Architecture
- Web Services
- Mashups
- Crowd Sourcing
- Open Data Sharing Policies

... And GIS Software



Richer, New Styles and Techniques

# Expanding to mobile GIS

*... Connecting Mobile Workers*



Capture Photos



Smart Phones



Tablet



Customizable Applications

*... Providing Real-Time Situation Awareness*

# BISE and the biodiversity baseline

The image is a screenshot of a web browser displaying the European Commission Environment website. The browser's address bar shows the URL: <http://ec.europa.eu/environment/nature/biodiversity/>. The website's main navigation bar includes links for Home, Who's who, Policies, Integration, Funding, Resources, and News & Developments. The breadcrumb trail reads: Home > Environment > Nature & Biodiversity > Biodiversity > EU Biodiversity Action Plan. The page title is "EU 2010 Biodiversity Baseline" with the subtitle "Post-2010 EU biodiversity policy". The main content area features a large image of a bee on a flower and a sidebar menu with categories like "EU Biodiversity Policy", "EU Nature Legislation", "Natura 2000 Network", "Outside Natura 2000", "Species protection", "Invasive Alien Species", "Climate Change", "Partnerships", "Knowledge Base", and "Information".

home | login EC-CHM WISE Contact us Sitemap Search

**BISE**  
BIODIVERSITY INFORMATION SYSTEM FOR EUROPE

Policy Topics Data Research Countries & Networks

Home » Policy

European Commission Environment

European Commission > Environment > Nature & Biodiversity > Biodiversity > EU Biodiversity Action Plan

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**EU 2010 Biodiversity Baseline**  
Post-2010 EU biodiversity policy

**NATURE & BIODIVERSITY**

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- EU Nature Legislation
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- Outside Natura 2000
- Species protection
- Invasive Alien Species
- Climate Change
- Partnerships
- Knowledge Base
- Information

The EU Biodiversity Action Plan is a comprehensive plan of priority indicators to monitor progress.

## Environmental Atlas Of Europe

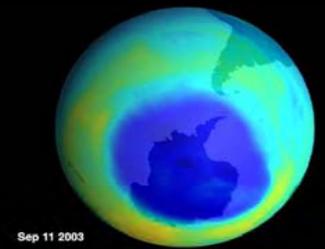
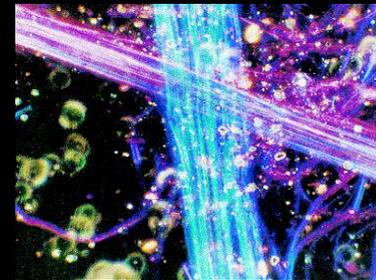
The Environmental Atlas of Europe is a UNEP-EEA-European Space Agency joint project showcasing communities responding to environmental change across Europe.

The screenshot shows a web browser displaying the 'Environmental Atlas of Europe' website. A video player window is open, titled 'Spain-Raimat'. The player has tabs for 'Story', 'Photos', 'Video', and 'Download'. The video title is 'The Ecology of Wine'. The main video frame shows a green tractor in a vineyard. Below the video are six thumbnail images, each labeled 'Raimat', showing various scenes from the video: a tractor, a white building, a bare tree, a vineyard, a purple flower, and a wine label. The background of the website is a satellite map of the region. Logos for the United Nations Environment Programme, ESA, and the European Environment Agency are visible at the top of the video player. A '5 Kilometers' scale bar is at the bottom right of the map.

The films present a series of these inspirational stories about how people are responding to climate change and in so doing, transforming their lives for a more sustainable future.



# Evaluating scientific evidence: transparency, complexity, urgency & ethics





# Europe in Bloom: a living façade at the EEA



BIODIVERSITY