E3G Workshop: Risk Management of Climate Change

Nick Mabey, E3G

September 2009

Introduction to E3G

- E3G is an independent, non-profit European organisation
- Mission to accelerate the transition to sustainable development.
- Based in Europe, Washington and Beijing.
- Work across environment, energy, security, foreign policy and economic/financial sectors
- Strategic management of risk and uncertainty lies at the heart of E3G's work
- Government background in addressing risk management issues in fisheries, conflict prevention, security policy, industrial policy and technology policy

Contents

E3G

Context for Today

E3G

- Motivated by the confluence of E3G's thinking on climate change and security, low carbon innovation, the Copenhagen negotiations and the discussions around real world decarbonistion paths we have been deeply involved in Europe and China.
- Reluctance of policy makers to consider full range of uncertainty around climate science, impacts and policy delivery and develop clear risk management approaches.
- In the worst case policy is being constructed based on average scenarios for climate risks and impacts and highly optimistic scenarios for policy.
- Significant failure of climate policies to achieve expected outcomes, could reduce political and public support for strengthening climate policy as fatalism takes hold.
- The risks of not planning for the worst case scenario are well recognised in other areas; most notably national security. What lessons can be learnt from these areas?
- Not a debate about how worst case scientific scenarios should be communicated to the general public, but focused on elite policy making audiences.

Aims for Today

Workshop aim:

- to produce an outline for a paper on climate change risk management and a process to turn this into a published document in advance of Copenhagen.

Process:

- Examine the issues of uncertainties and risk management in an integrated manner
- Identifying critical risks and risk management options in:
  - ranges of uncertainty in the climate science
  - ranges of uncertainty in climate impacts
  - capacity for risk mitigation through adaptation and uncertainties in adaptation effectiveness and unforeseen impacts
  - risks in the impact and delivery of mitigation response measures
- Discussion of which elements of the risk management agenda are most vital for the security community to engage with in the run-up to Copenhagen and beyond

Risk Management and Climate Security

E3G

- E3G will be linking this discussion directly to its work on climate security primarily in the US and Europe
- We will be working with the security community to develop a shared approach to "What the US security community needs from Copenhagen/the international climate regime?"
- The aim is to influence the Senate and US Administration to strengthen on critical areas of the Copenhagen agreement and domestic legislation.
- The risk management paper will provide part of the analytical basis for this work as aims to fit with existing strategic planning approaches used by the military and other security actors.

Agenda

E3G

1.	Introduction and Agenda	09.30 – 10.00
2.	What is a Risk Management Approach?	10.00 – 10.45
3.	Risk Management in Climate Science	10.45 – 12.30
Lunch		12.30 – 13.00
4.	Risk management of Climate Change Impacts and Adaptation	13.00 – 14.30
4.	Risk Management of Mitigation Measures	14.30 – 16.00
5.	A Climate Security Agenda for Copenhagen?	16.00 – 17.00

Contents

Risk Management is…

- Not optimisation, cost-benefit, cost effectiveness, real options….
- Structural and quantitative assessment of:
  - Magnitude and characteristics of key risks and uncertainties, including threshold effects, positive feedbacks and irreversibility
  - Potential strategies for addressing risks
  - Who bears the risk and how they will react
  - Who is best placed to manage and mitigate risk
- About "who" as well as "what" and "how much"; reassigning risk management responsibilities is critical

Zeitgeist Examples

- Target hardening against terrorist attack
- Regulating financial sector bonus and pay structures
- Flu monitoring and vaccine response systems
- Regional co-management of EU fisheries
- Removing street furniture to reduce car accidents

Why use a Risk Management Approach for Climate Change?

E3G

- Explicitly addresses how climate change discontinuities should affect policy behaviour
- Addresses issues of policy failure that are currently underexplored both in the mitigation and adaptation debate
- Examination of perverse, unexpected and counter-intuitive behaviour driven by incorrectly managed and/or assigned risks
- Systematic discussion of how and by whom risks should be managed

Well-suited for addressing the policy problems where there is a need to avoid crossing critical thresholds but high uncertainties

Elements of a Risk Management Approach

E3G

1. Defining Risks?
   - Uncertainty or scenario
   - Impacts
   - Reversibility/threshold effects
2. What likelihood?
3. Visibility and monitoring strategies
4. Current risk management strategy
   - What?
   - Who?
   - Consequences/effectiveness
5. Alternative risk management strategy

Generic Risk Management Strategies

E3G

- **Isolate**: disease quarantine; India-Bangladesh fence
- **Buffer**: flood controls; mitigation and adaptation R&D;
- **React**: managed retreat; crop adaptation; geo-engineering
- **Govern/Mitigate/Prevent:** UNFCCC; energy sector decarbonisation
- **Capture/Contain**: coercive tropical forest management; arable land grabs; environmental refugee management

Best portfolio strategy depends on nature of risk, ability to monitor and effectiveness of response actions

Example Risk Map: UK Sea Fisheries

Source of Uncertainty	Range of Uncertainty	Can uncertainty or impacts be reduced?
Annual Stock Fluctuations	20-400%	Cannot model complex ecosystems, but large stocks reduce volatility
Stock measurement	20 - 40% min. if measured	Expensive – 20% lower limit?
Climate Change Impacts	Up to 1.5 degrees C by 2020*	Cannot model precise impacts
Enforcement	20-300% over quota	Possible to reduce cheating
Fleet Effort Shifts	10-30% change annually?	Cannot control directly
Prices	20-30% annual	Reduce with marketing/contracts
Costs	10-20% annual	Can hedge impact of some costs e.g. fuel

Source: Net Benefits, HMSO, 2004

* South England Average Air Temperature Rise in 2020
High Emissions Scenario Hadley Centre UKCIP02 Scenarios

Example Risk Management Analysis: UK Fisheries Fishing Sector Response

E3G

Risk:	Annual volatility in catch (recruitment)
Response:	Balance revenues from good years with bad Reduce stock volatility with healthier stocks Pay for any increased cost of information
Risk:	Annual volatility in TACs and management plans
Response:	Set longer term catch rate rules Fishing industry involvement in management process
Risk:	Changes in prices and costs
Response:	Smoothing income and investing in quality and efficiency
Risk:	Product competition from imports
Response:	Efficiency improvements and fleet modernisation
Risk:	Imbalance between fleet size and stocks
Response:	Decommissioning and tie-ups financed by industry

Example Risk Management Analysis: UK Fisheries Government Role

E3G

Risk:	Legacy of excess subsidised capacity:
Response:	One off “Structural adjustment” financed by Government
Risk:	EU regulatory risks
Response:	Improve UK compliance
	Ensure management systems allow fishermen to be compliant
	Improve Commission oversight of Member State compliance
Risk:	Ecological changes – cyclical and climate change
Response:	Regional support for affected fishing communities
	Promote flexibility in UK fleet
	Institute “large stock” policy

Advantages of a Risk Management Approach in Fisheries

- Risk management supplements "economic optimisation" approach with an explicit method for avoiding damaging irreversible ecosystem (and industry) thresholds under high uncertainty
- Risk management process allows clear communication of uncertainties ands responses between different actors without imposing particular analytical assumptions (e.g. CBA)
- Risk management allows simultaneous discussion of goals, responsibilities and policies based on overall outcomes
- EU has moved to a regionally based and risk managed approach

"Risk Management" of Climate Change

E3G

- Separate out the most important aspects of uncertainty based on management decisions; an applied approach.
- Not trying to produce an overall integrated assessment but identify critical implications for decision makers
- Identification of key information gaps a core part of exercise, including theoretical limits to possible knowledge
- Assumption of Bayesian/learning approach and empirical approach to risk perception by decision makers
- Aim is to produce way of framing and handling risks which works for a policy and political audience

Current Risk Management Approaches

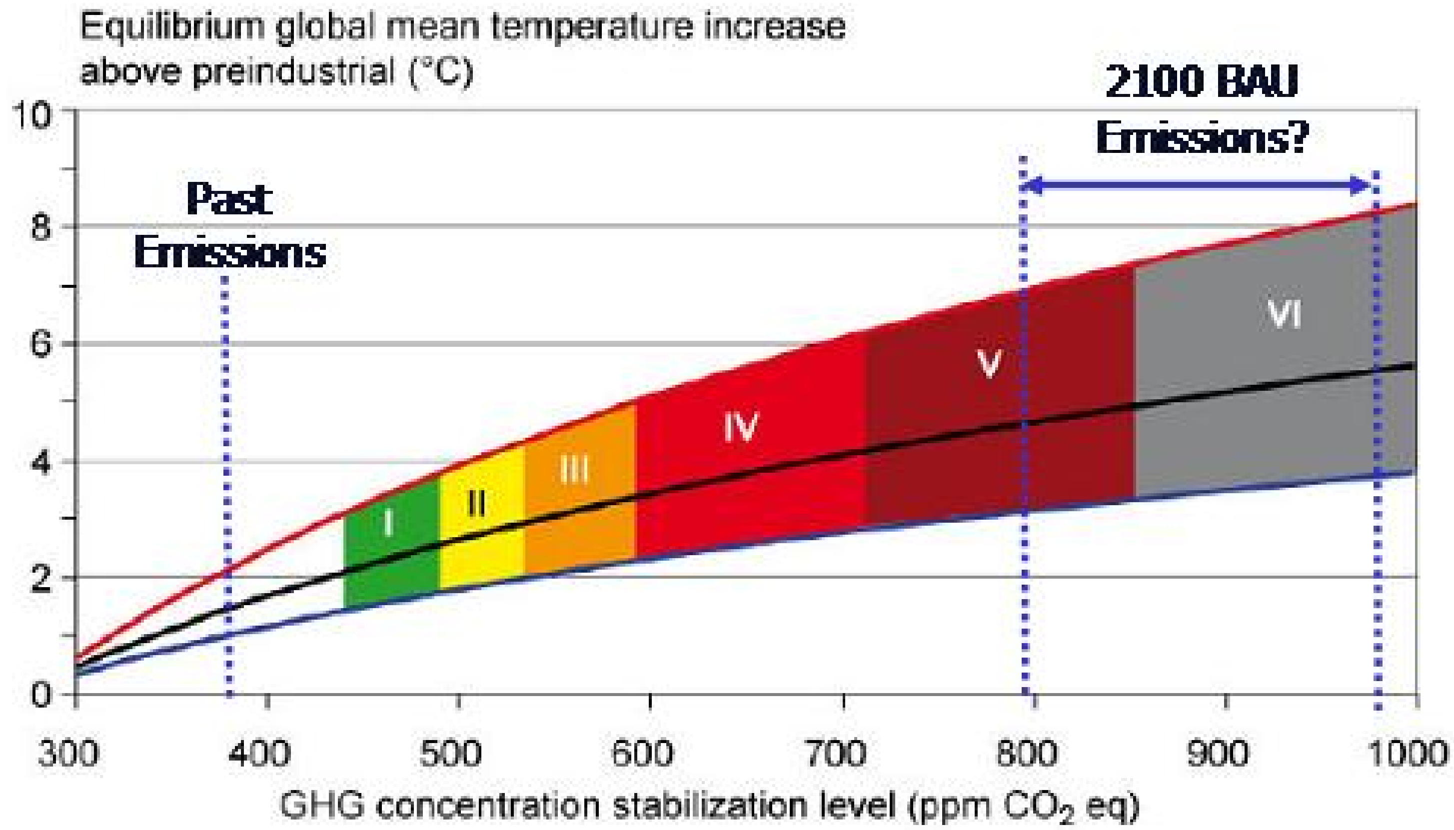
- 2C target – preventing dangerous tipping points?
- Emission trajectories/cumulative budgets which reducing probability of exceeding 2C (some with overshoot)
- Investment in adaptation to climate change impacts

Contents

- Introduction and Agenda
- What is a Risk Management Approach?
- Risk Management in Climate Science
- Risk management of Climate Change Impacts and Adaptation
- Risk Management of Mitigation Measures
- A Climate Security Agenda for Copenhagen?

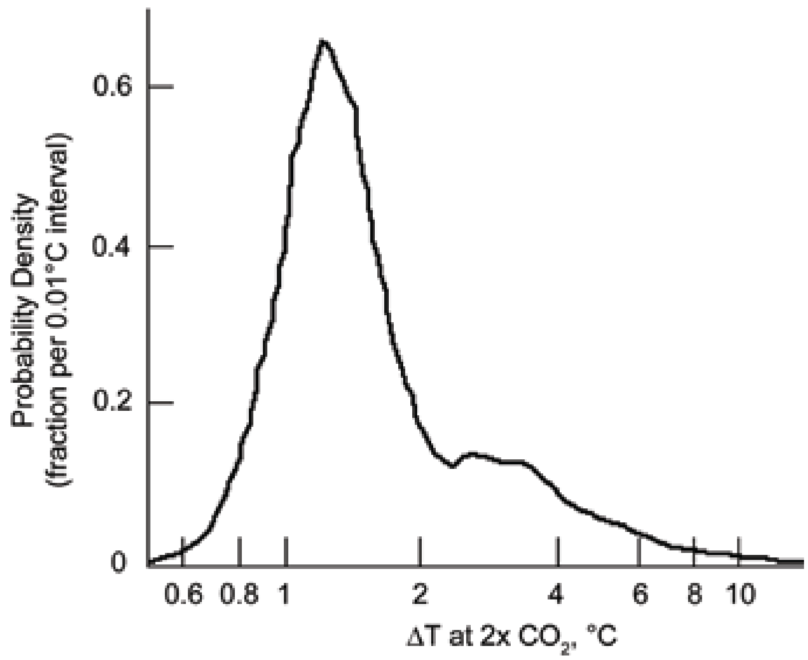
Scientific Uncertainty

E3G



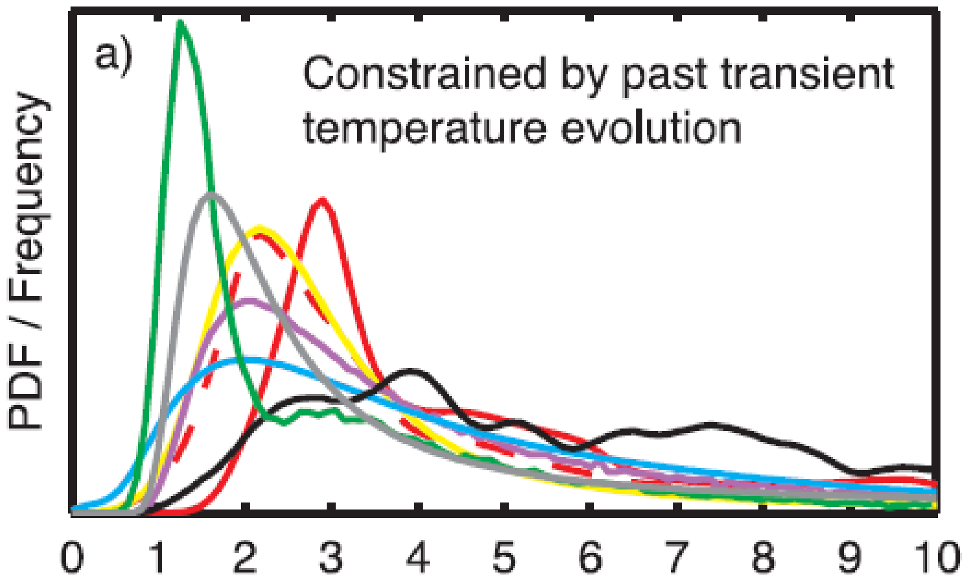
Source: IPCC, 2007

Uncertainty around Climate sensitivity



Source: NOAA, 2009

Source: UK CCC, 2008

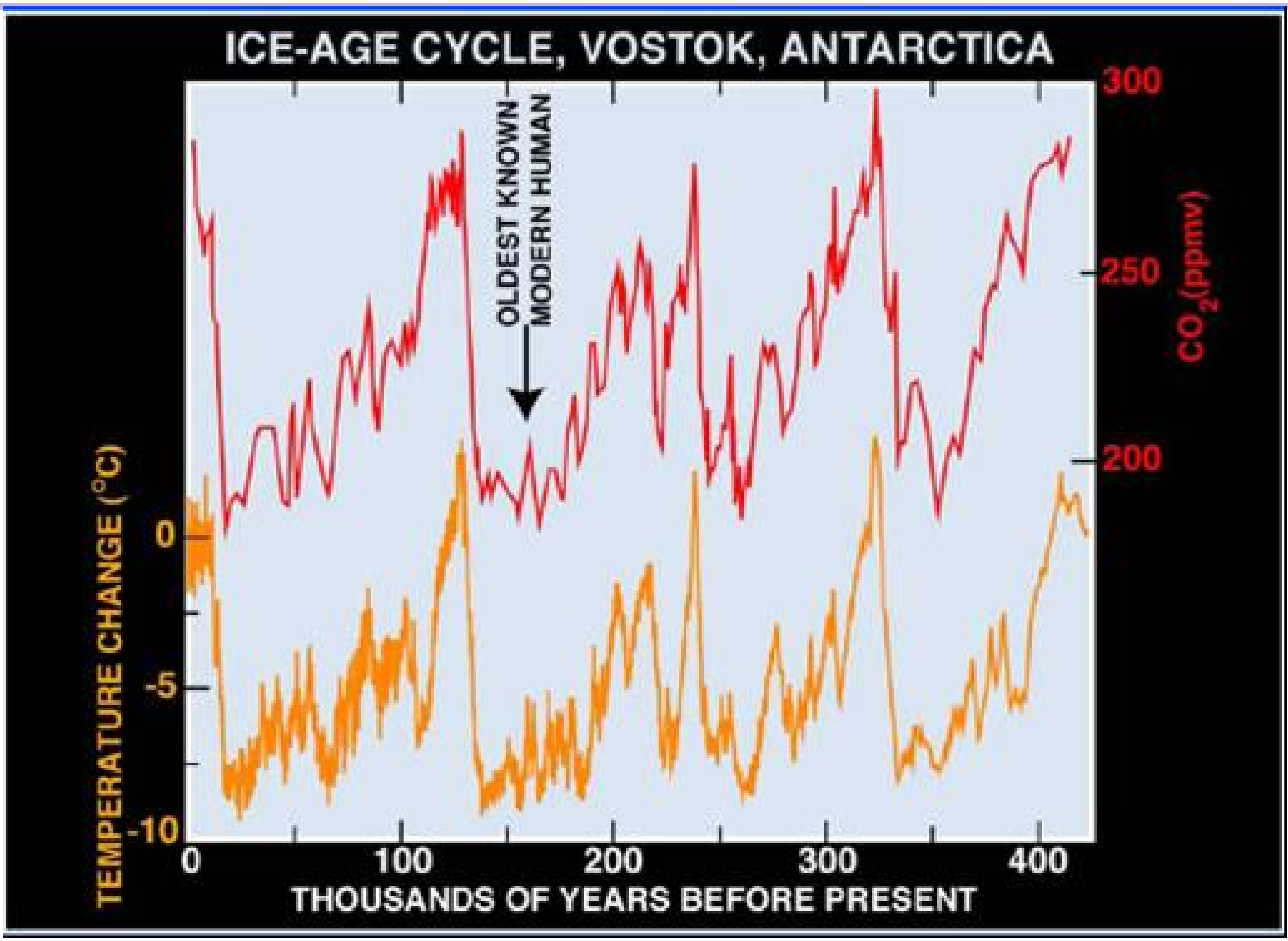


Risks of Exceeding 2C

Trajectory name	Peaking year	Kyoto emissions peak ($GtCO_2e$)	CO_2 emission decrease after peak	Kyoto emissions floor ($GtCO_2e$)	2050 Kyoto emissions cut, from			Cumulative emissions ($GtCO_2e$)			Chance of staying under 2°C by 2100
					1990	2000	2007	1990-2050	2000-2050	2007-2050	
2016:4%low	2016	56.80	4%/yr	6	46%	51%	59%	2423	2045	1743	44%
2016:3%low	2016	56.70	3%/yr	6	33%	40%	50%	2536	2158	1856	37%
2014:3%low+	2014	55.93	3%/yr	6	46%	51%	59%	2252	1879	1579	49%
2016:3%	2016	56.70	3%/yr	11	34%	40%	50%	2535	2157	1855	37%
2016:2%	2016	56.59	2%/yr	11	14%	22%	35%	2676	2298	1996	27%
2016:1.5%	2016	56.53	1.5%/yr	11	2%	11%	26%	2757	2379	2077	20%
2028:3%	2028	65.48	3%/yr	11	0%	9%	25%	3067	2688	2386	17%
2028:2%	2028	65.09	2%/yr	11	-21%	-9%	9%	3152	2774	2471	9%
2028:1.5%	2028	64.88	1.5%/yr	11	-33%	-20%	1%	3200	2821	2519	5%

Source: UK Committee on Climate Change 2008

Climate Surprises



Source: Hansen (2005)

Key Uncertainties

Normal Uncertainty?

- Rate of GHG accumulation in Atmosphere
  - Terrestrial and oceanic sinks

- Radiative forcing impact of GHGs
  - Ozone, CH4 and Ch2 Forcing
  - Aerosol Forcing

- Climatic impact of radiative forcing
  - Cloud behaviour
  - Albedo effects

} Climate Sensitivity?

Extreme Impacts

- Tipping point positive feedback loops
  - Methane hydrates
  - Permafrost methane
  - Boreal and Tropical Forest dieback

Risk Management Table

Risk	Impact	Dynamics	Likelihood	Visibility	Current Risk Mgt	Alt. Risk Management
Sinks	Double CO2 accumulation rate	Gradual and irreversible	?	Immediate impact on GHG rates	2C target	Crash GHG reduction Artificial sinks
Climate Sensitivity	2-3 C?	NA	NA	Modelled quantity	2C target	Crash GHG reduction Geoengineering 4C Adaptation
Methane Hydrates	Catastrophic	Threshold and irreversible; gradual impact?	Unknown threshold	Thresholds not monitorable	2C target	?
Forest Dieback	2C additional?	Gradual and irreversible	From 2-3C onwards?	Early signs observable	2C target	Crash GHG reduction Geoengineering 4C Adaptation
Permafrost Methane	Low	Gradual and irreversible	Occurring now?	Observable	2C target	

Key risk management issues

E3G

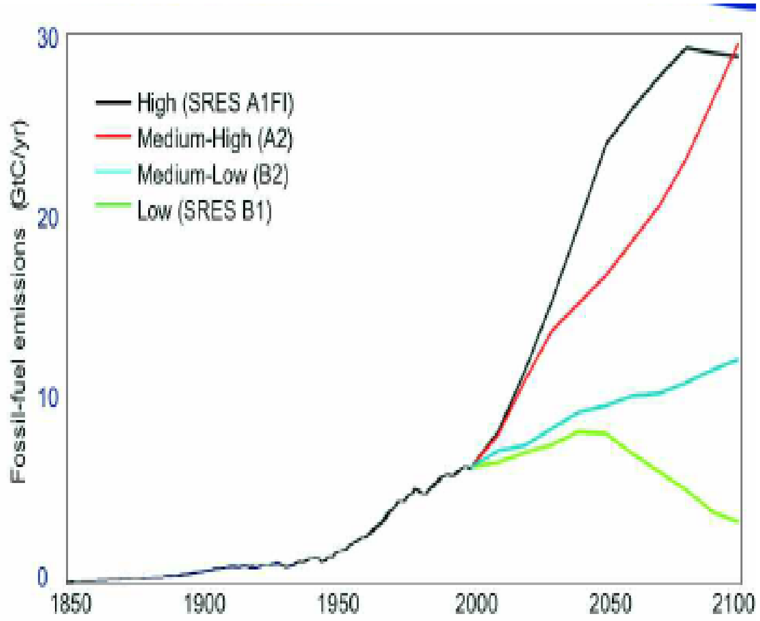
- Is 2C threshold driven by climate impacts or risk of triggering tipping point effects?
- Is overshoot a risk management option or are climatic lags too long?
- How quickly will we understand the behaviour of methane hydrates better?
- Who should be responsible for updating risk assessments? Is the right monitoring being done to give early warning of key thresholds?
- How to make a crash GHG reduction programme feasible?
- Is 4C the right planning target for adaptation measures?

Contents

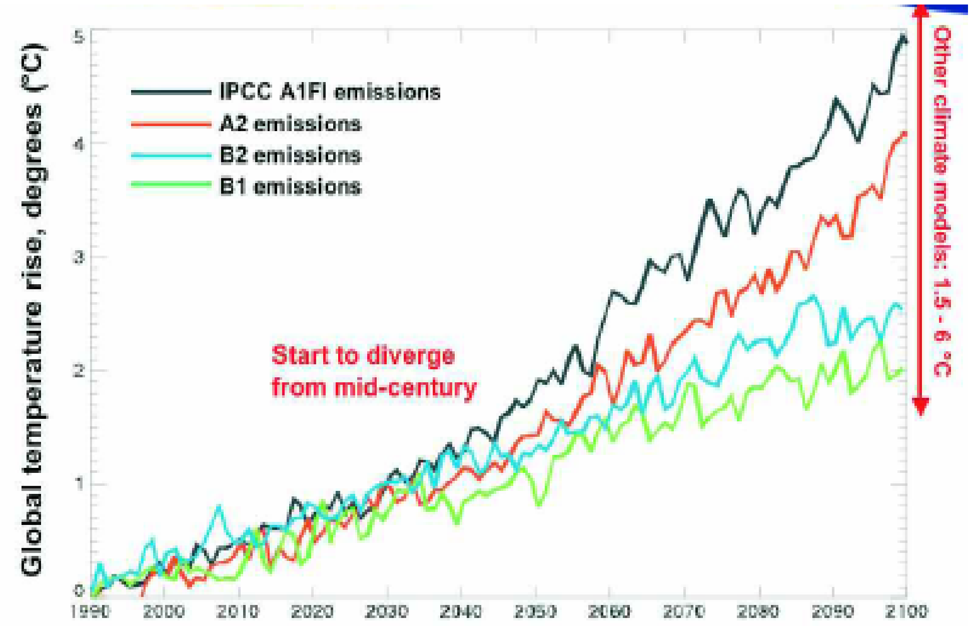
Large scale adaptation is needed for at least 40 years – even with the most aggressive mitigation measures

E3G

Emission Scenarios Diverge Radically …



But impacts only begin to slow after 2040



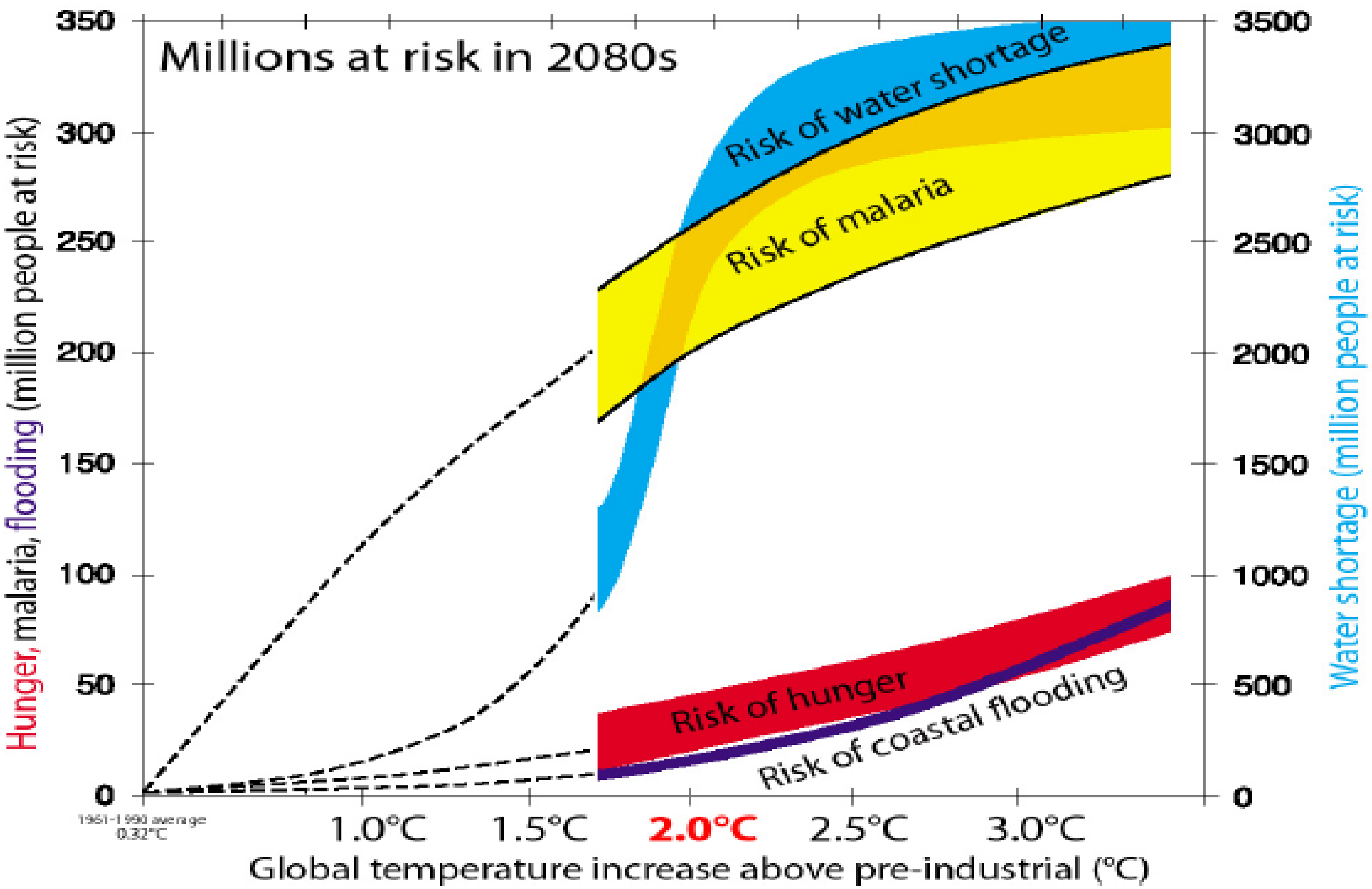
The low emissions scenario is consistent with a 450ppm (CO2 eq) atmospheric concentration

This effort would give a 50% chance of limiting temperature rise to 2C, and requires global emissions to peak by 2020

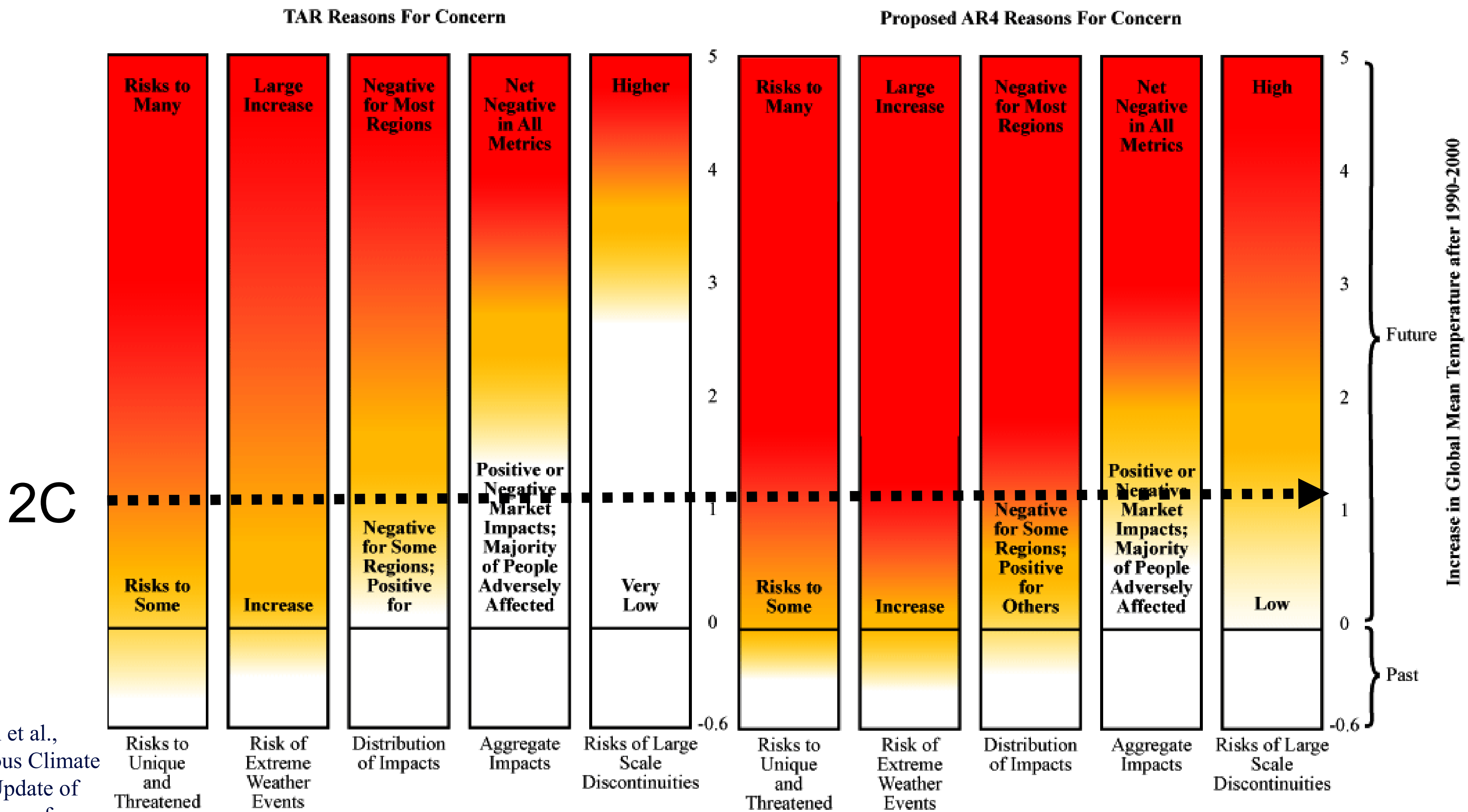
Source: Hadley Centre (2006)

2C Impact Point

E3G



Risk management of increasing impact estimates?



Source: Smith et al., 2007 Dangerous Climate Change: An Update of the IPCC Reasons for Concern

Key Uncertainties

E3G

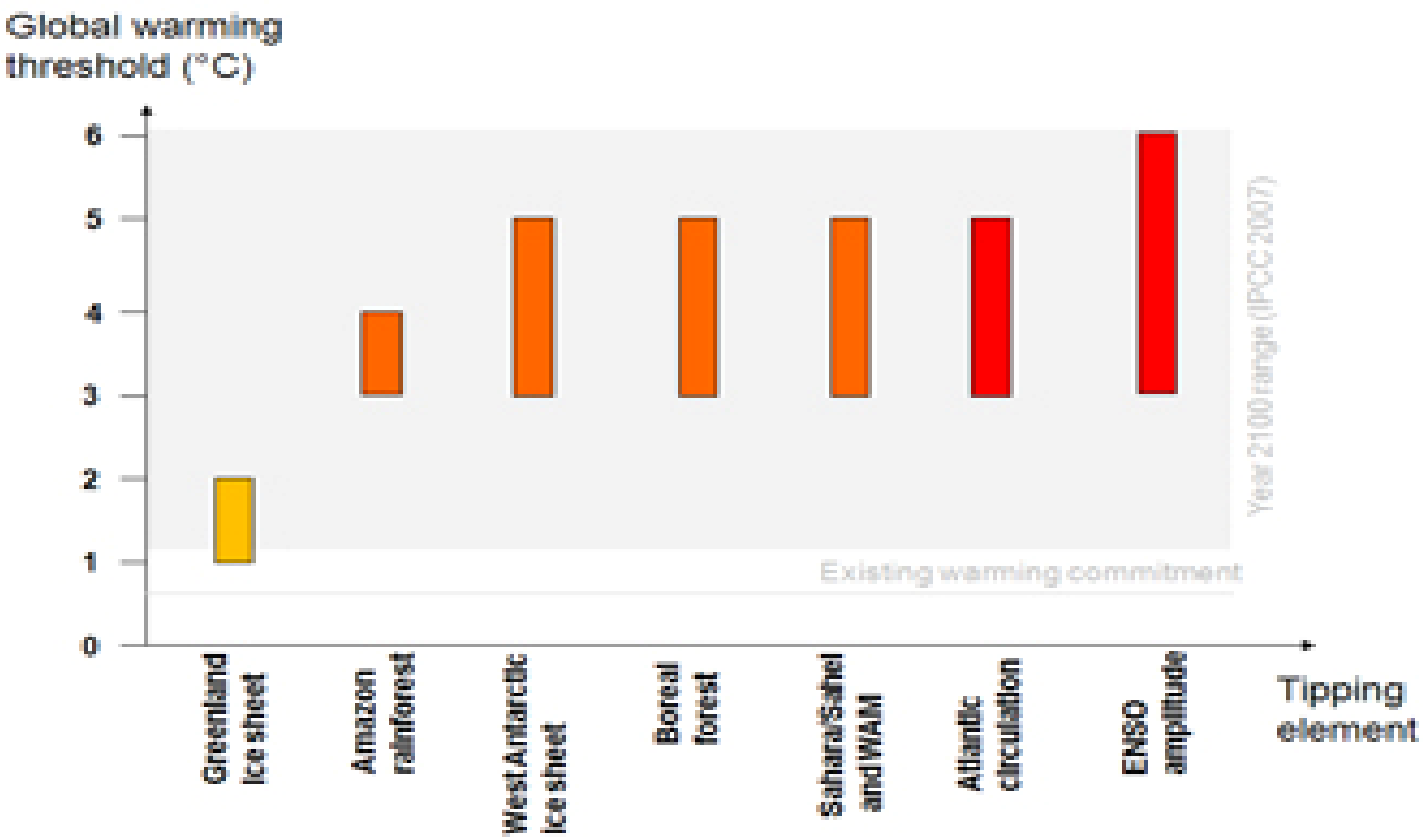
Normal Uncertainty?

- River basin hydrological cycles
- Glacial melting changing major river flows
- Speed of Greenland ice-shelf melting
- Frequency of extreme weather events
- Ocean acidification/ecosystem impacts
- Impact of maladaptation and climate driven conflict

Tipping Point Impacts

- Indian Monsoon weakening/increased volatility
- Arctic Sea Ice Melting
- West Antarctic Iceshelf melting
- Atlantic circulation shifting

Threshold Estimates?



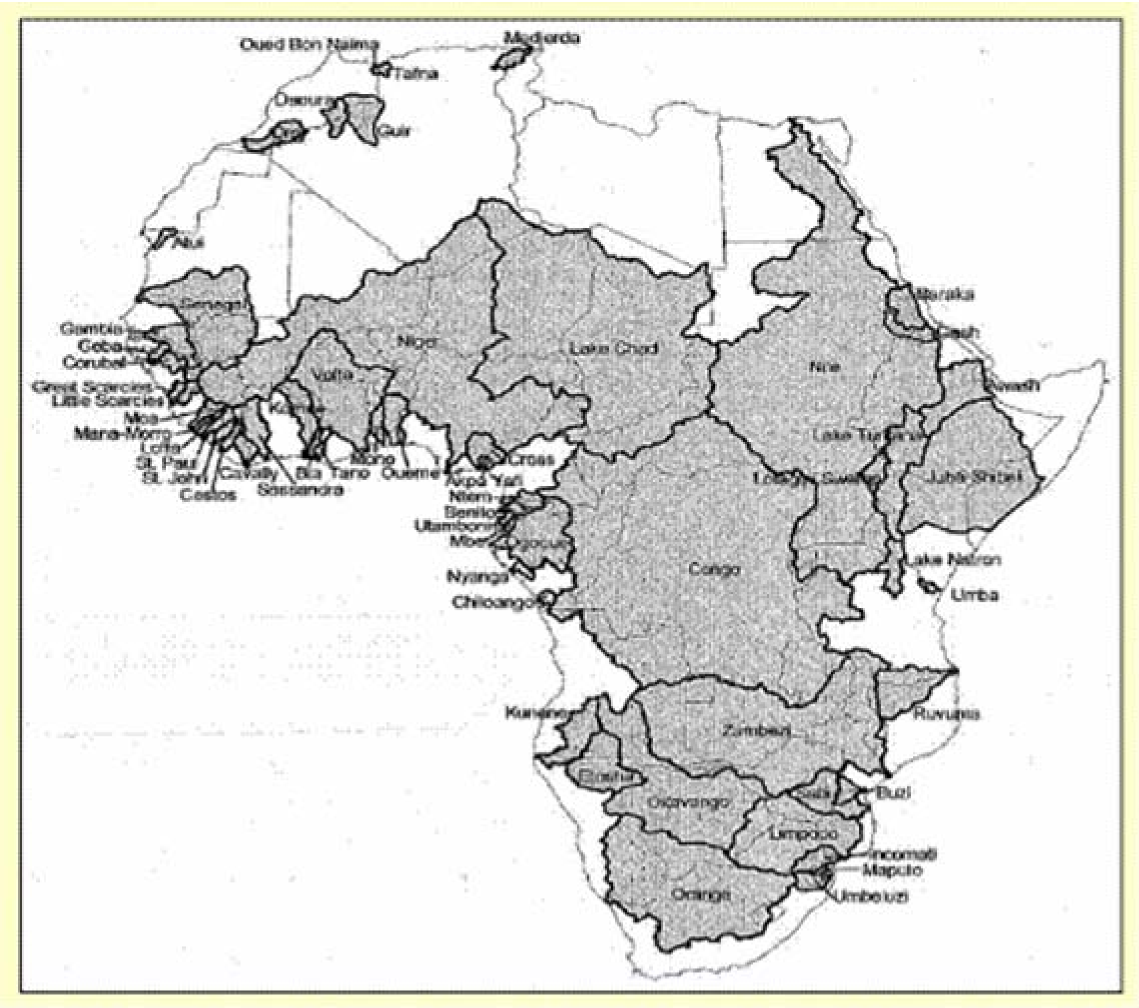
Source: Lenton (2009) http://researchpages.net/ESMG/people/tim-lenton/tipping-points/

Climate Change: high costs but not an existential threat?

- Stern Review estimates cost of climate change to be between 5-20% of global GDP from 2050
- World Bank estimates that 40% of development aid investment is at risk from climate change
- Humanitarian costs could rise by 200% by 2015
- Weather disasters could cost as much as a trillion dollars in a single year by 2040

Existential impacts for most countries come from reaching tipping points and large scale conflict / maladaptation?

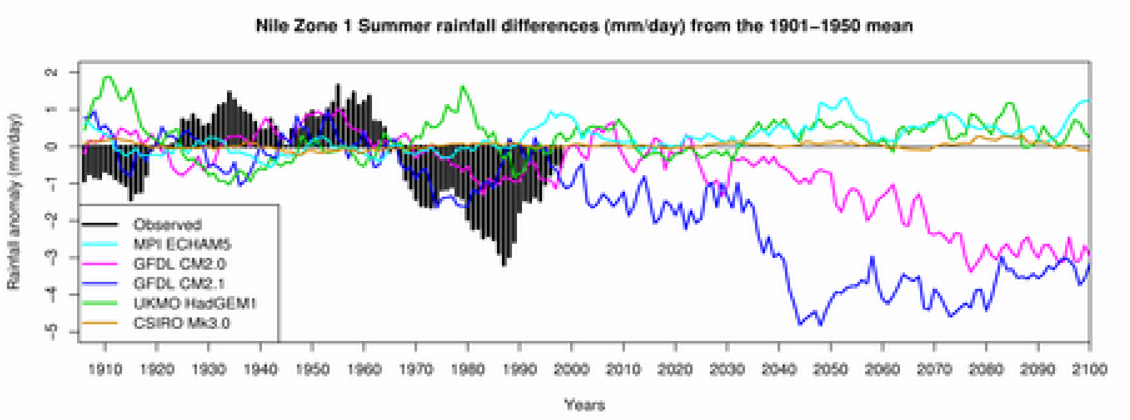
Boundaries and Resource Sharing: African Transboundary Water Management



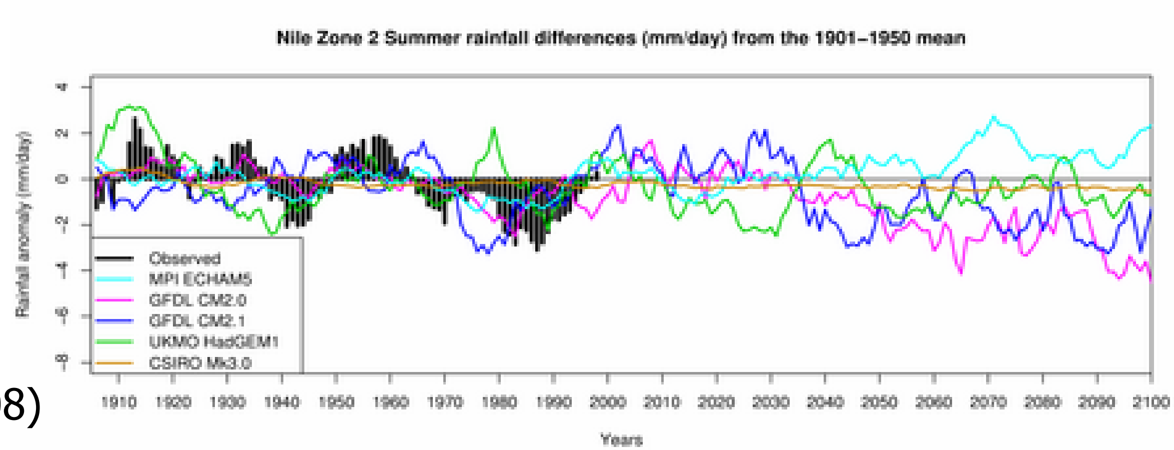
Source: Conway and Goulden (2006)

Uncertainty increases existing tensions – leading to conflict if not managed?

Projected rainfall in Eastern Sudan from selected climate models

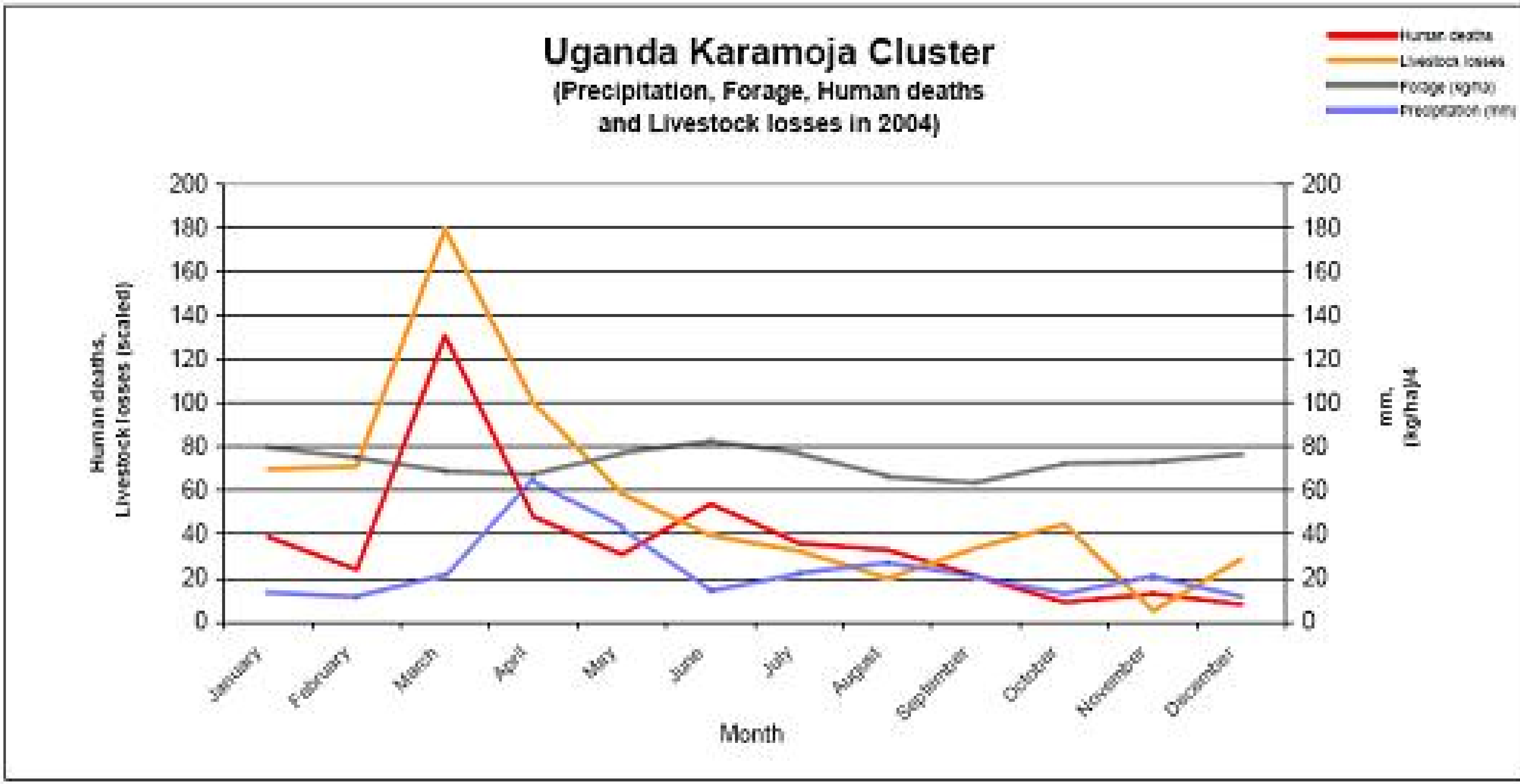


Projected rainfall in Ethiopian highlands from selected climate models



Source: Bates (2008)

Weak understanding of the detailed dynamics resource conflicts



Source: Bond and Meier (2005)

Risk Management Table

Risk	Impact	Dynamics	Likelihood	Visibility	Current Risk Management	Alt. Risk Mgt
Hydrological cycles	High and variable	Gradual and unpredictable	High	Volatility masks shifts	Water management adaptation	
Glacier Melt	Reduction in river flows	Threshold and irreversible	High	Retreat monitorable	?	
Greenland Icesheet	1-2m rise by 2100; max 7m	Threshold and irreversible	High after 1.5C warming	Melting rate monitorable	Additional sea defences Migration	
Extreme weather events	High impacts	Gradual and irreversible	?	Volatility masks shifts	Preventive disaster relief planning	
Ocean ecosystem disruption	High but variable on fish stocks	Gradual and irreversible	High	Volatility masks shifts	None	Fisheries adaptation Migration
Climate driven conflict	High	Gradual	High but regional	Poor monitoring of impacts	None	Investment in resilience

Risk Management Table II

E3G

Risk	Impact	Dynamics	Likelihood	Visibility	Current Risk Management	Alt. Risk Manage ment
Indian Monsoon	Unclear		High above 3-4C?	Volatility mask shifts	?	
Arctic Sea Ice	Positive?	Gradual with possible threshold	High	Ongoing measuremen t	Resource agreements between Arctic powers	
West Antarctic Ice Shelf	1m by 2100? Maximum 7m	Threshold and irreversible?	High above 3-4C?	Unclear	2C limit	
Atlantic circulation	Large cooling in Europe	Threshold and irreversible?	High above 3-4C?	Weakening could be monitored	2C limit	

Risk Management Questions

- Does reducing temperature target – 1.5C – change any of these outcomes?
- Can changes be clearly measured before they are already irreversible? Or is prevention the clear strategy?
- What are the limits to gradual adaptation?
- Shift from adaptation through interdependence (e.g. food trade) to resource capture?

Contents

Key Uncertainty Issues

Normal Uncertainty?

- Energy efficiency increases

- BAU projections
  - Global GDP growth
  - oil price/energy security politics
  - Transportation use in developing countries

- Reduction in deforestation rates

- Development and diffusion rates of new low carbon technology
  - CCS
  - Biofuels
  - Nuclear

Tipping Point Impacts

- Integrity of the climate change control regime
- Nuclear accidents/terrorism
- Development of surprise low carbon technologies

Risk Management Table

Risk	Impact	Dynamics	Likelihood	Visibility	Current Risk Mgt	Alt. Risk Mgt
Efficiency	High – 50% abatement to 2050	Gradual	Medium	Visible but monitoring poor	Weak	Increased low carbon energy
BAU	High	Gradual	High	Monitored	Annex I caps	Increased low carbon energy
Deforestation	Move to 550ppm trajectory	Gradual except food /oil shock	High	Monitored but shocks not modelled	None	Increased low carbon energy
Technology failure	CCS failure 70% cost increase	Gradual through learning by doing	Medium	Unclear due to commercial interests	None	Increase RD&D/TAPs Flexible infrastructure
Integrity of Climate regime	10 year mitigation delay	Threshold	Medium		UN monitoring	
Nuclear accidents/ proliferation	Low on most scenarios	Shock	?	Only after event	NPT regime IAEA system	NPT review Gen IV

Security Implications of a Nuclear Renaissance?

E3G

- Baseline IEA forecast – 20% growth in capacity bu 2030

- MIT forcast 400% growth by 2030; 50% in developing countries

- MIT forecast= 10% necessary mitigation activity to 2030

Box: Global Nuclear Build Programmes

Committed/Under Construction

	Size	NPT?
China	15000 MW	Yes
India	5000 MW	No
Japan	14000 MW	Yes
Korea	11000 MW	Yes
Russia	30000 MW	Yes
Iran	2000 MW	Yes

Planning/Under Consideration

	Size	NPT?
Pakistan	600 MW	No
Indonesia	1300 MW	Yes
Vietnam	1000 MW?	Yes
Argentina	700 MW	Yes

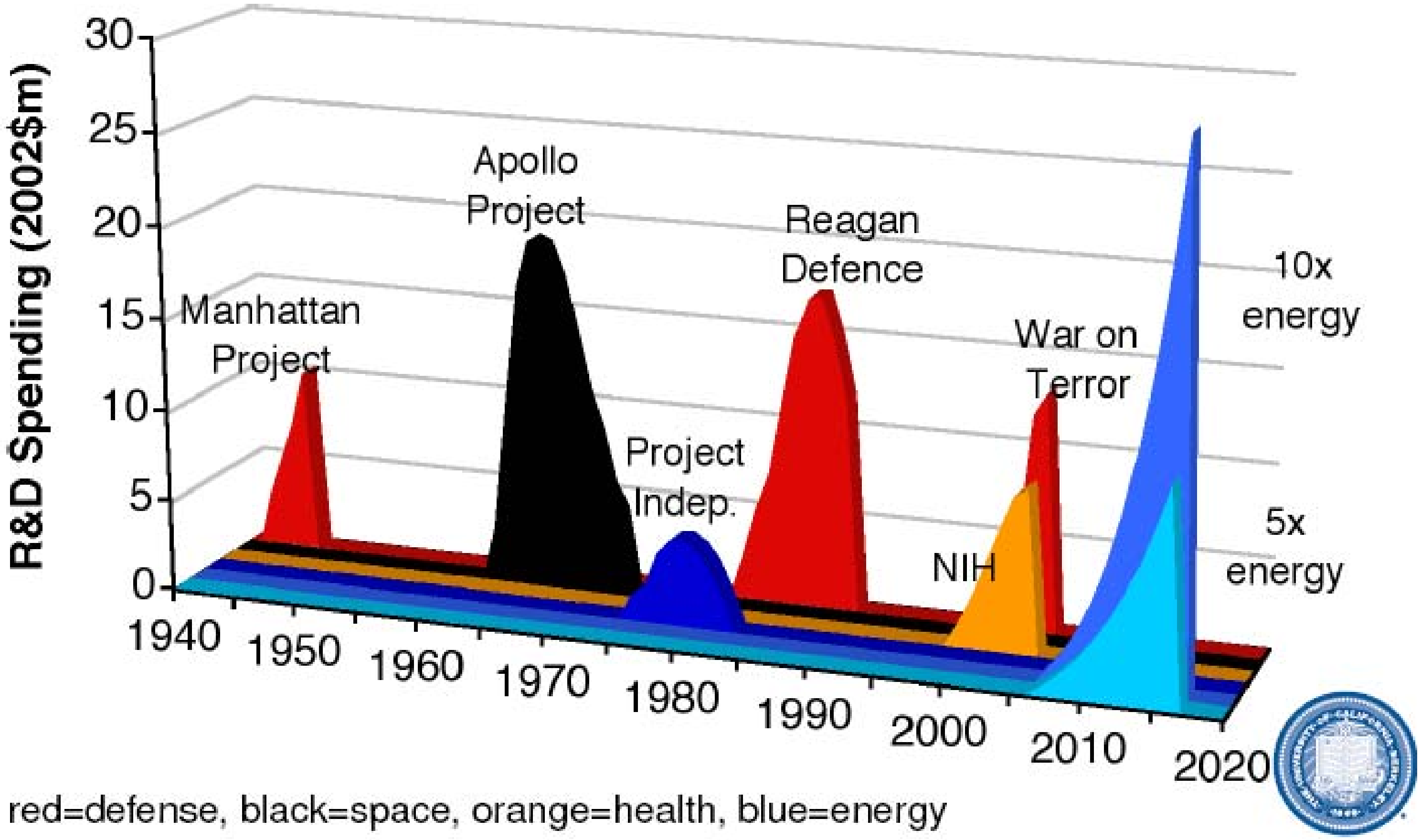
Countries considering new nuclear build include US, France, Nigeria, Israel, Kazakhstan and Egypt.
(Source: World Nuclear Association)

Risk Management Questions

- Emphasis on delivering more low carbon energy options earlier than trajectories need
- Are lifestyle changes an additional risk management option?
- How far is the climate regime a reliable manager of mitigation risk?
- What is the real role of nuclear?

Not outside Historical R&D Precedents

E3G

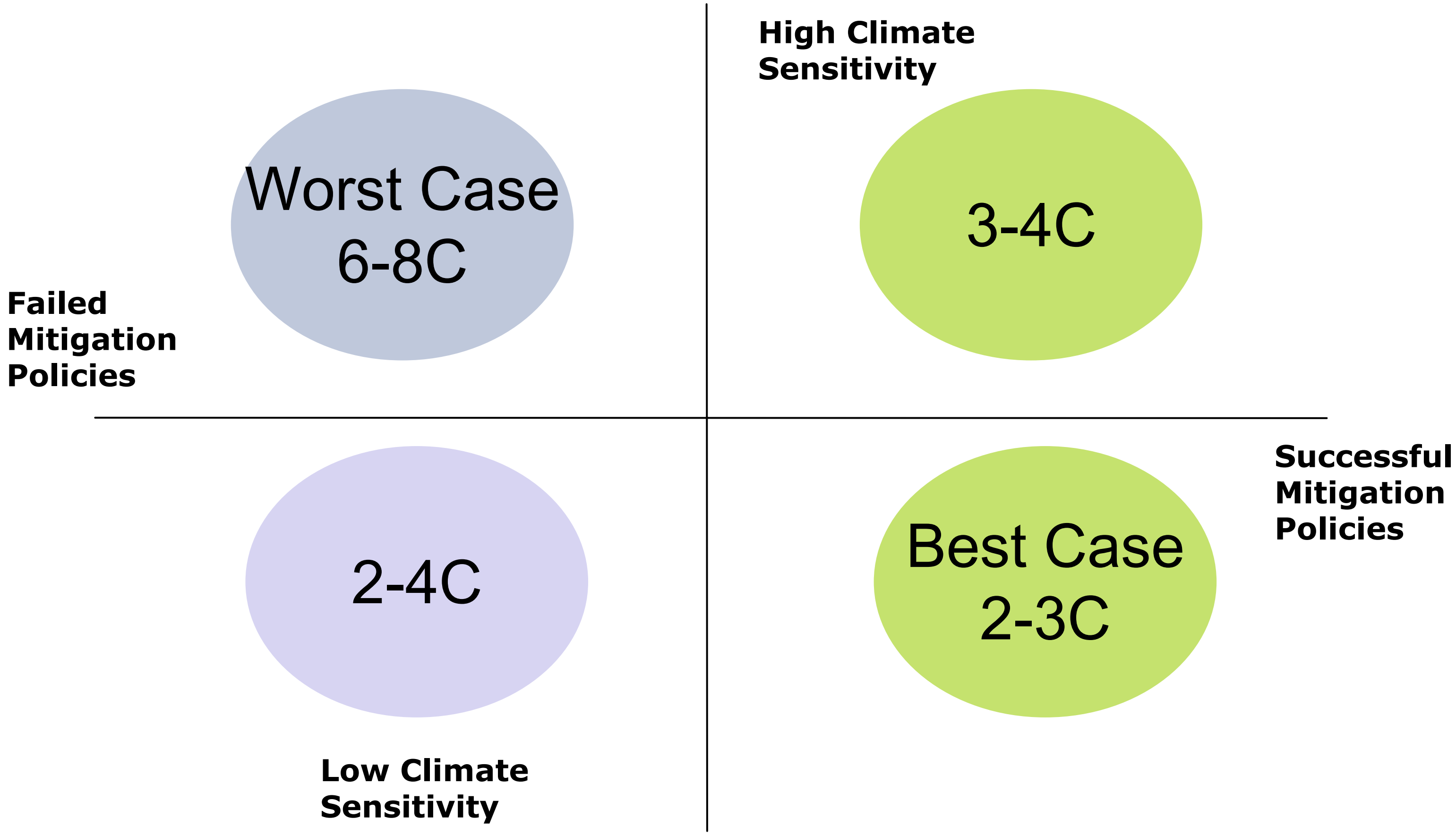


Source: Nemet and Kammen (2006)

Contents

- Introduction and Agenda
- What is a Risk Management Approach?
- Risk Management in Climate Science
- Risk management of Climate Change Impacts and Adaptation
- Risk Management of Mitigation Measures
- A Climate Security Agenda for Copenhagen?

Scenario Analysis



Strategic Logic of Climate Driven Instability

E3G

- Successful adaptation to climate change will be fundamentally challenged by borders, existing property rights (e.g. water) and vested interests
- Poor governance systems – especially communally controlled resource management – will amplify climate change impacts not damp them. "Adaptation" policies are not politically neutral.
- Impacts of climate mitigation policies (or policy failures) will drive political tension nationally and internationally; climate change driven deaths are different politically.
- In an increasingly interconnected world a wide range of interests will be challenged by security impacts of climate change: investment in China; drugs and Afghanistan/Caribbean; extremism and economic failure in N Africa; oil prices and Niger Delta/Mexico extreme events.

Climate Security Scenarios

Central scenario to 2020-2030

- Climate change multiplies instability risks in vulnerable and low resilience countries; Middle East, Africa, Central Asia, Small Islands
- Combined with energy and resource constraints will increase levels of conflict and "ungoverned spaces"
- Impacts can be mitigated with improve preventive strategies and interventions

Worst Case Scenario/Uncontrolled Climate Change post -2030

- Large scale social breakdown in major countries – China, India
- Inter-state tension/conflict over borders, water supply and migration
- Livelihoods untenable for hundreds of millions of people in Africa and Asia

Security environment cannot be guaranteed under uncontrolled scenario

No Credible Security Guarantee under a Worst Case Scenarios

- Current climate change politics and policy does not adequately reflect credible worst case scenarios.
- Global emissions must peak by 2015-20 (perhaps earlier) to give 2C scenario
- A failure to acknowledge and prepare for the worst case scenario is as dangerous in the case of climate change as it is for terrorism and WMD proliferation.
- Worst case is a combination of **climate policy failure plus worst case climate science** combined with other resource pressures:
  - Security actors can give **no credible guarantee of current security levels** (consistent with global open economy)
  - Move to "defensive" adaptation response – capturing resource access
  - Global crash programme in nuclear fission

Probability of worst case scenario is not small!

The Security Sector at Copenhagen

E3G

- Communicate the security consequences of worst case scenarios to decision makers; no hard security solution to managing climate change risks

- Need very high likelihood of avoiding temperature rise above 3C

- Promote clearer strategic risk management approach to climate change policy; **what is the necessary outcome of Copenhagen in order to preserve climate security**.

- Need confidence that international regime will monitor GHG emissions and respond to changes in climate science

- Argue for far higher investment in innovative and disruptive R,D&D to prepare for crash programme: CCS, CSP, solar, biofuels etc

- Engage in policy discussions for design of large scale collaborative R&D programmes inside timescales.

Improving climate resilience

- Analysis of the proliferation implications of high nuclear build and any conditionality needed in the Copenhagen agreement on funding. Acceleration of Gen IV programme on lower risk technologies?

- Agreement on how to handle key security related policy issues inside and outside UNFCCC framework:
  - Transboundary water management- adaptation funding conditionality?
  - Border issues – freeze at 1990 positions? Arctic and Law of the Sea?
  - Environmental refugees – framework for handling rights and responsibilities?

- Including conflict and security issues inside adaptation/conflict prevention programmes based on 4C warming scenario?

Response is better prevention/resilience but where to invest?

- Climate Change is another serious stressor in already unstable countries, regions and communities (Africa, ME, S Asia, SIDS)
- If worst impacts hit it will dominate most other factors by 2020-50 in many vulnerable countries, and earlier in vulnerable areas (e.g. Sahel)
- Its practical impact on policies to lower risks of conflict and instability can only be understood through comprehensive analysis – have yet to develop adequate tools to do this. Limited by weakness of broader conflict analysis tools and models.
- Responses imply a greater focus on governance, resource management, local conflict resolution capability etc. Key issue is providing analysis to practitioners allowing them to prioritise.

Targeting interventions is biggest challenge