

A Long-Term Perspective On Climate Change, Adaptation and Sustainability

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Greenhouse gas emissions: current situation

- Little chance of keeping warming below 2° C target to avoid “dangerous anthropogenic interference with the climate system”¹
 - Requires capping emissions below 450 ppm or (much) lower²
 - CO₂ concentration in 2005 was 379 ppm (IPCC, 2007)²
 - Current CO₂ *equivalent* concentration estimated at ~455 ppme³ and 412 ppme⁴
- Almost certain to be breached - Anderson & Bows (2008) recommend:
 - 2 ° C target for mitigation
 - 4 ° C target for adaptation
- Policy debate around a “more realistic” 550 ppm target⁵ (Anderson & Bows, 2008) - likely to result in ~ 3° C warming⁶

What can we expect over the 21st century?

2° C warming likely by mid-21st century¹

- Comparable temperatures to last interglacial ~120,000 yrs ago²
 - Sea-levels 4-6 m above modern levels²
 - Much wetter conditions in much of the northern hemisphere sub-tropics

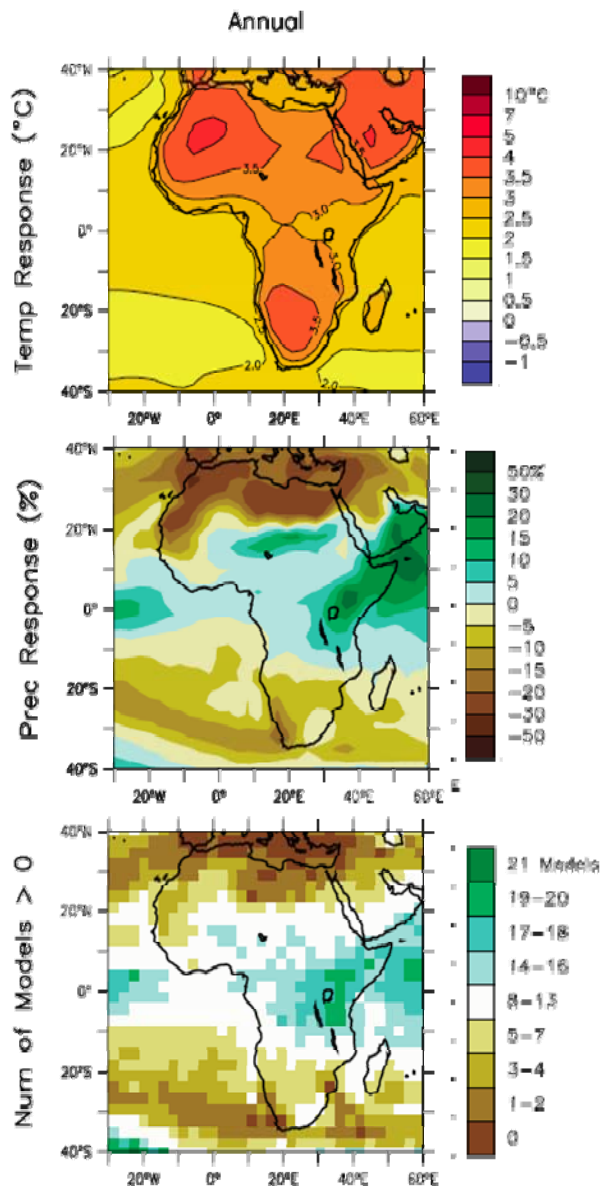
3° C warming currently seems likely by ~2070s¹

- Comparable temperatures ~3.5 million yrs ago
 - Sea-levels 15-20 m above modern levels²
 - Suggestions of “permanent” El Niño-like conditions^{3,4}
- Associated with elevated risks of “abrupt” changes in climate, landscapes, etc⁵

Warming of > 3° C

- No past analogues (similar temps. millions of yrs ago; different continental configurations and constraints on climatic behaviour)

Potential impacts of a warming of $> 2-3^{\circ}$



- Extreme desiccation & desertification in N. Africa¹
- Partial or total collapse of Amazon rainforest²
- Desertification in southern Africa³
- Loss of water resources from glacial melt⁴
- Loss of land from sea-level rise & increased erosion⁵
- Widespread terrestrial & marine ecosystem collapse⁶
- Decline in food production in many areas (& globally)⁷
- *Generally: environmental/landscape change & in many areas increase resource scarcity (water, productive land, pasture, food, economic assets)*

¹Christensen et al. 2007; ²Betts et al. 2007; ³Thomas et al. 2005; ⁴Bradley et al. 2006;

⁵Nicholls et al. 2007; ⁶Fischlin et al. 2007; ⁷Easterling et al. 2007

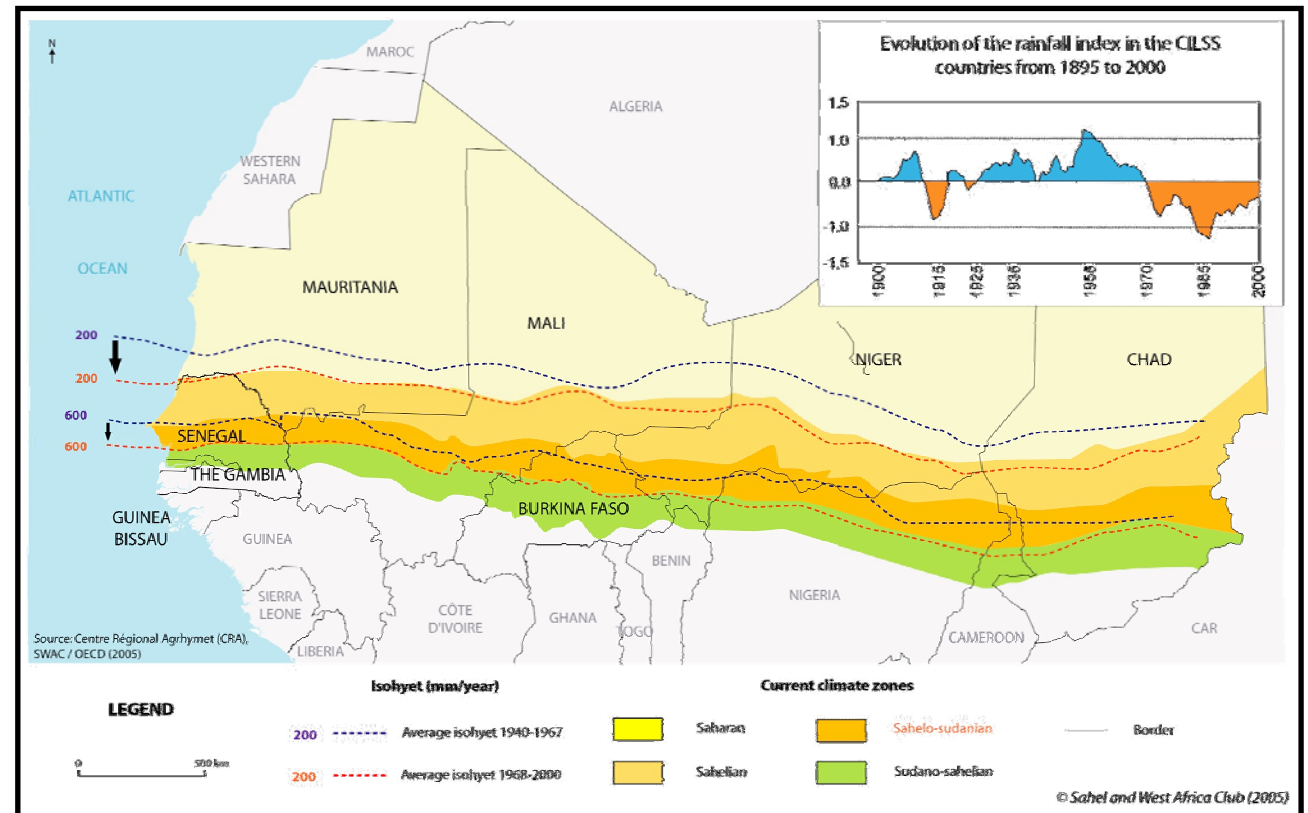
Adaptation & Sustainability

Current approaches

- Modern economies geared to dependence on maximum productivity & growth
- In practice, adaptation seen as way of securing “business as usual”
 - E.g. what “additional” investments are required to “climate-proof” development
- Focus on managing incremental increases in risk, transient disasters, extremes
- Little consideration of adaptation to large & abrupt changes
- Little questioning of whether current approaches viable under climate change
- *At this stage, an example is instructive...*

Illustrative Example: The African Sahel

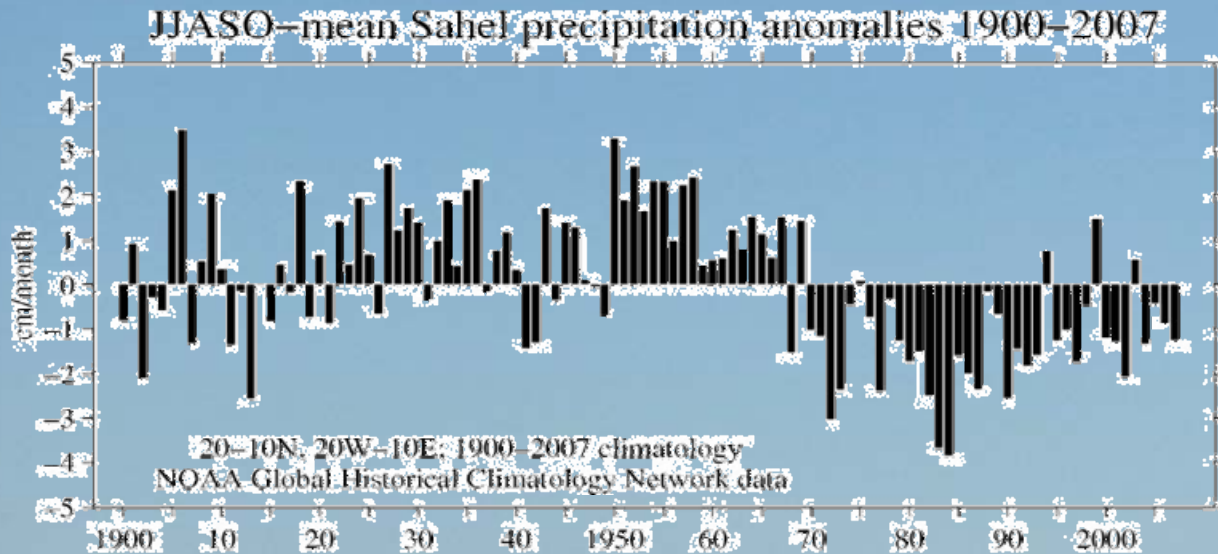
- Semi-arid transition zone between humid tropical Africa & Sahara desert
- Highly variable climate
- Marginal conditions for agriculture in many areas
- Drought common from year to year
- Protracted dry periods (decades) appear to be the norm from historical records
- Isohyets shift as monsoon system varies in strengths over multiple timescales
- Traditional livelihoods focus on resilience, risk spreading, mobility



Graphic from OECD:

http://www.oecd.org/pages/0,3417,en_38233741_38246685_1_1_1_1_1,00.html

Severe climate change and “maladaptation” in the Sahel



- Wet 1950s - modernisation for economic growth: subsistence to commercialisation
- Agricultural intensification & expansion into historically marginal areas, pastoralists pushed to desert fringes
- No consideration of long-term climate variability
- Famine in 1970s when rainfall declined & agriculture collapsed

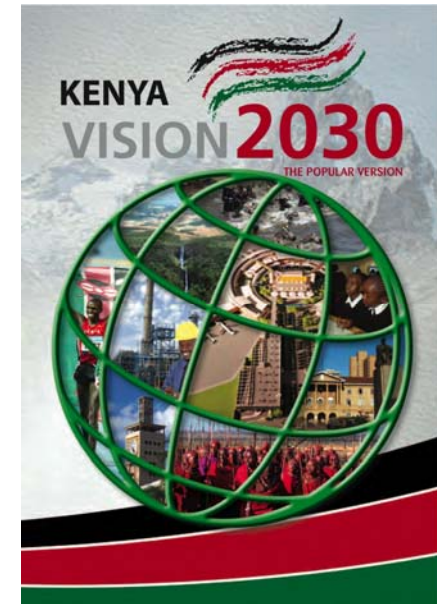
Development policies

- Replaced resilient systems with systems focused on productivity & growth
- Assumed continuation of existing conditions - failed to consider variability
- Massively increased vulnerability, primed region for disaster

Maladaptation continues...

E.g. Kenya Vision 2030

- Aims to generate 10% growth per year for next 25 years
- Construction of 2 coastal cities
- Agricultural commercialisation, intensification, expansion into 'currently idle' lands
- No detailed consideration of climatic/environmental change or long-term variability



E.g. Tlaxcala province, Mexico (see Eakin, 2004, 2005)

- High climatic variability, increasing drought, El Niño
- Traditional subsistence based on risk spreading, resilience, state support
- Current emphasis is on commercialisation, more productive strains
- Undermining subsistence, increasing resource use, reducing diversity & resilience

ADAPTATION: Current Assumptions Versus Past Experience

1. Way of delivering “smooth” transitions
Occurs during periods of disruption and transition
 2. Way of preserving existing social & economic systems
Can result in fundamental changes to societies
 3. Will help secure increases in human well-being
Can be associated with costs - e.g. more inequality
 4. Possible with “right” interventions
There are (physical) limits to adaptation in situ
 5. Will help prevent migration and conflict
Migration key strategy, conflict common
- *Benefit of foresight, but how much difference will this make?*

*Lessons from studies of
last period of global
climatic reorganisation
~6000-5000 years ago¹*



Conclusions

- Sustainable systems must accommodate long-term variability & change
- Current approaches not geared towards resilience - as no redundancy
- Some changes will be large - adaptation challenge greater than appreciated
- “Climate proofing” the *status quo* does not go far enough - lack of consideration of large changes risks locking us into “maladaptation”
- Adaptation assumptions overly optimistic and not grounded in reality
- Need to rethink both adaptation and development from bottom up
- Need to find a balance between productivity/growth & resilience
- Requires fundamental rethinking of relationship between humanity & “nature” - not separate but former embedded in latter

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Additional Slides

Rethinking development

Examples illustrate that

- Where societies rely on climatic conditions remaining “optimal” they are more vulnerable to climatic shocks - greater risk in marginal & variable environments
- Pursuit of growth and focus on maximizing economic productivity can thus increase risks associated with climatic & environmental variability & change

Linking adaptation & sustainability

- Climate change will result in increased variability & fundamental environmental changes - cannot afford to rely on continuation of current conditions
- Must build resilience & redundancy into systems, & move away from current models that seek simply to maximise productivity under current conditions
- Climate-proofing business-as-usual may risk locking us into patterns that are unsustainable and maladaptive in the long-term
- Build development around (dynamic) environment not vice versa - requires change in philosophical approaches to the environment & “nature” ¹

Adaptation: Some Current Assumptions

Adaptation should provide vehicle for change in approach to development & environment, but adaptation approaches embedded in business-as-usual thinking

Implicit & explicit assumptions in adaptation discourse are that adaptation

1. Is way of delivering “smooth” transitions
 2. Will enable us to preserving existing social & economic systems
 3. Will help deliver increases in human well-being
 4. Is possible provided “right” interventions identified & implemented
 5. Will help prevent migration and conflict, not be associated with them
- *General attitude is that “climate proofing” will enable us to carry on with development & economic growth along broadly business-as-usual lines while “greening” our economic activities (carbon markets, offsetting, etc.)*

Comparison with past experience

Last global climatic reorganisation ~6-5 kyrs ago

- Period of climatic transition & 'abrupt' climate change
- Onset of regular El Niño after long period of quiescence
- Desertification of northern hemisphere sub-tropics
- Small global *cooling* of $\sim 0.4^{\circ}$

Period of widespread social disruption & transition

- Significant changes in human population distribution
- Abandonment of drying areas, concentration in refugia
- Increased social inequality with greater resource scarcity
- Fundamental changes to social & economic organisation
- Evidence of increased competition & organised conflict



Adaptation requires fundamental rethinking of how we relate to environment

