

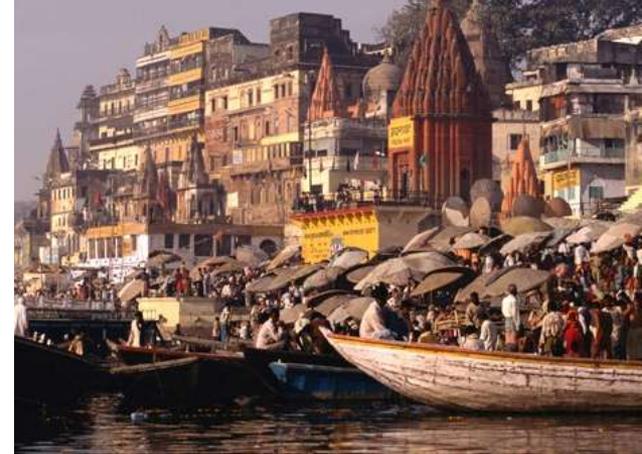


“Turn Down the Heat” and Ramp Up Adaptation

Rosina Bierbaum
Dean Emeritus & Professor
University of Michigan
World Bank Fellow
March 20, 2013

Today: An unsustainable world

- 1.4 billion people in poverty
- A quarter of children malnourished
- A quarter of women illiterate
- 1.4 billion without modern energy
- 1/6 without clean water



Tomorrow: climate change exacerbates inequities

- Most impacts will be negative, especially for poorest, most vulnerable nations.
- Water resources, coastal infrastructure, health, agriculture, and ecosystems will be challenged in virtually every region of the globe.
- International, regional, and national entities are ill-prepared to manage.
- Both mitigation and **adaptation** are needed NOW because;

–It's already too late to avoid substantial climate change.

–Many adaptation measures are more costly and less effective as magnitude increases.

November 2012

**A Report commissioned
by the World Bank**

Prepared by the

***Potsdam Institute for
Climate Impact Research
and
Climate Analytics***

Turn Down the Heat

Why a 4°C Warmer World
Must be Avoided

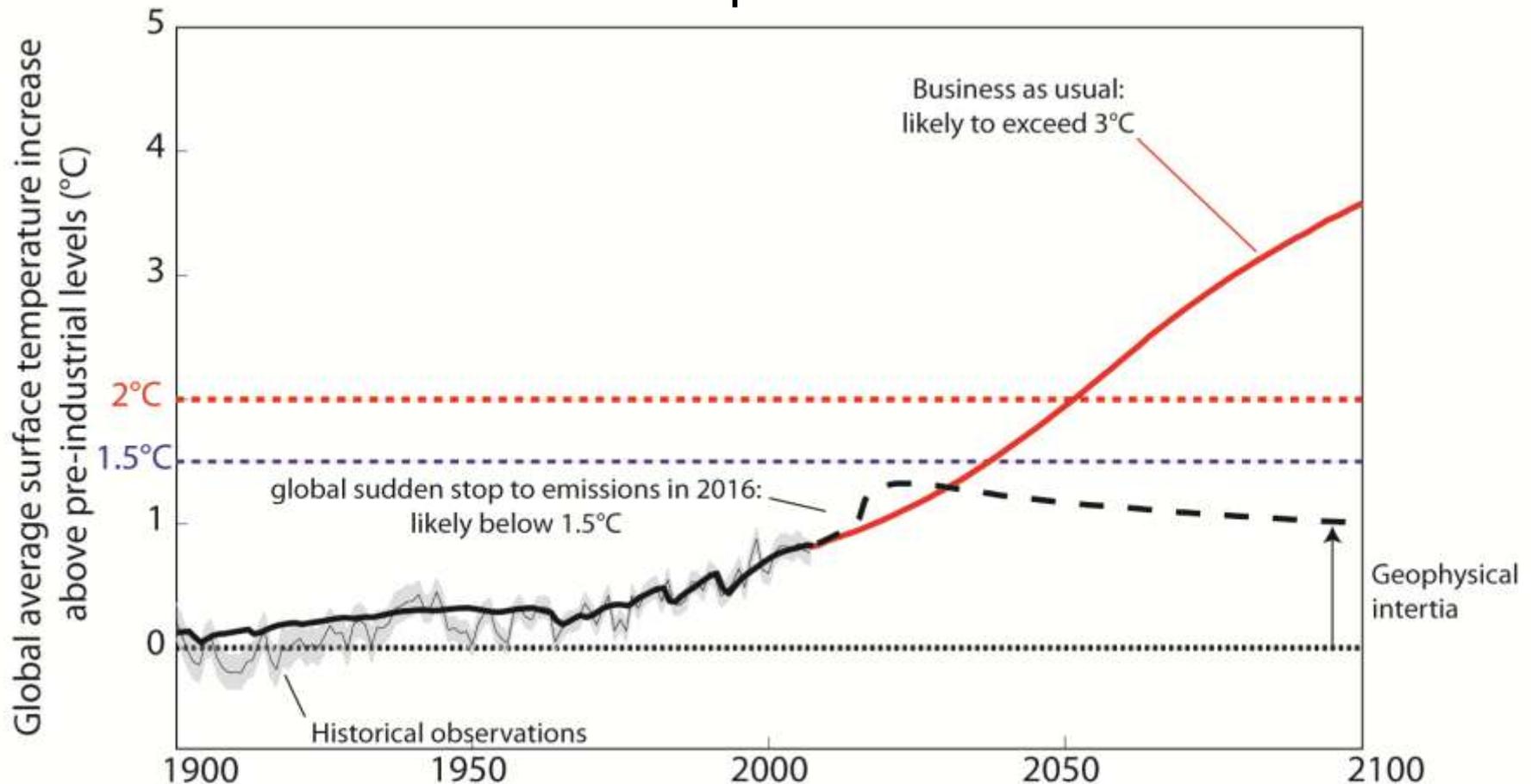


THE WORLD BANK

What is achievable?

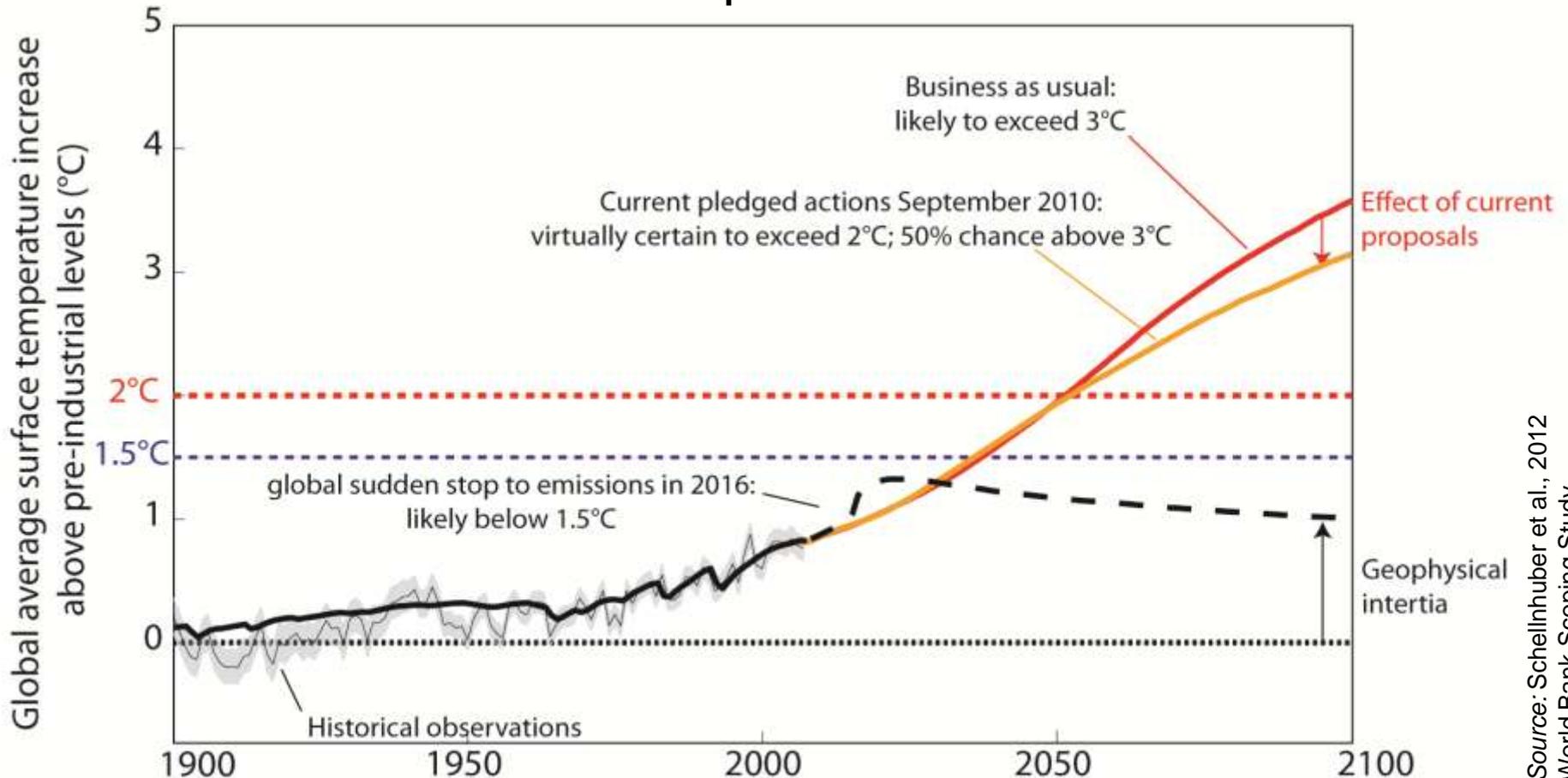
Geophysical inertia vs political 'will'

Global-mean temperature increase



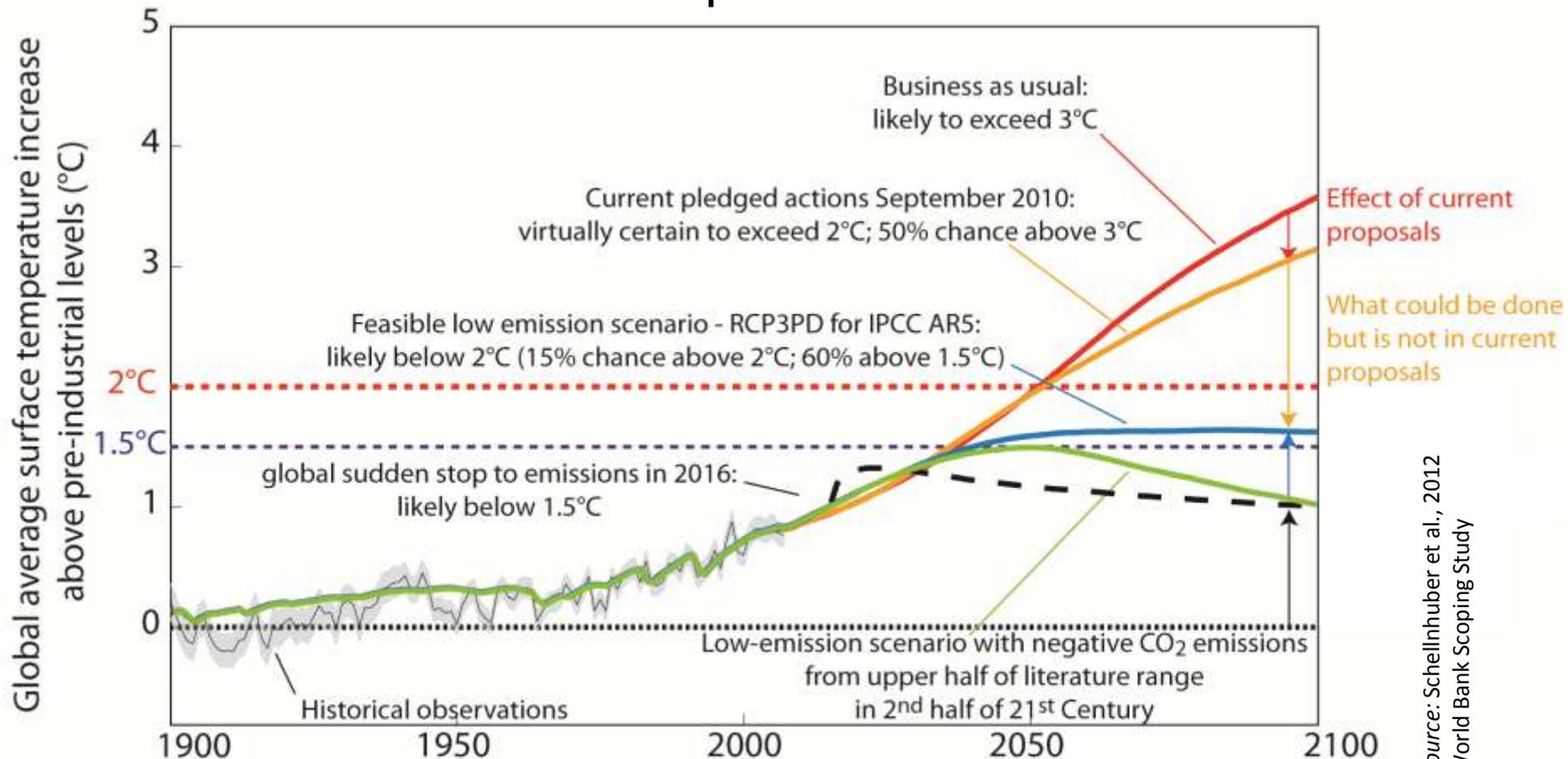
Geophysical inertia vs political 'will'

Global-mean temperature increase



Geophysical inertia vs political 'will'

Global-mean temperature increase



New messenger on Climate Change



"It is my hope that this report shocks us into action."

"The World Bank is a leading advocate for ambitious action on climate change, not only because it is a moral imperative, but because it makes good economic sense."

"A 4°C world can, and must, be avoided."

Dr. Jim Yong Kim
President, World Bank Group

Citing the World Bank:

Climate Change goes to the very core of how we do our development work.

- *The World Bank is helping 130 countries take action on climate change.*
- *Last year, all Bank Country Assistance/ Partnership Strategies required to address climate resilience.*
- *All recent sector strategies ranging from environment, education and social protection, to urban and transport infrastructure try to 'mainstream' climate considerations.*



4°C – World Bank Report

Context:

- Current mitigation actions: **about 20% risk >4°C by 2100**
- Impacts not evenly distributed: **poor will be affected most**

Geophysical impacts:

- 4°C global mean warming: more pronounced over land (**some regional projections >6°C** in Africa, the Middle East, & Amazon)
- In tropics, a new climate regime: **coolest** months at end of 21st century substantially **warmer** than **warmest** months of end of 20th century
- Increase in the intensity and frequency of high-temperature extremes: **heat waves such as in Russia in 2010 are likely to become the new normal summer in a 4°C world.**
- Tropical South America, central Africa, and all tropical islands in the Pacific are likely to regularly experience heat waves of **unprecedented magnitude** and duration.
- Ocean acidification rises to levels **higher than known from Earth history**



4°C – World Bank Report

Societal and ecosystem impacts:

- **Severe sea-level rise** for small island states and cities highly vulnerable to extreme flooding (e.g., Mozambique, Madagascar, Mexico, Venezuela, India, Bangladesh, Indonesia, the Philippines, and Vietnam)
- **Water scarcity** substantially amplified (particularly North & East Africa, Middle East & South Asia)
- Significant **risk for global food security** (India, Africa, U.S. & Australia)
- Ocean acidification in combination with warming ->**regional extinction of entire coral reef ecosystems**: impacts on coastal and fishing communities and tourism
- Likely **large-scale biodiversity loss**: dramatic reduction in ecosystem services.

Conclusions: Given the massive threat to the living conditions of mankind:

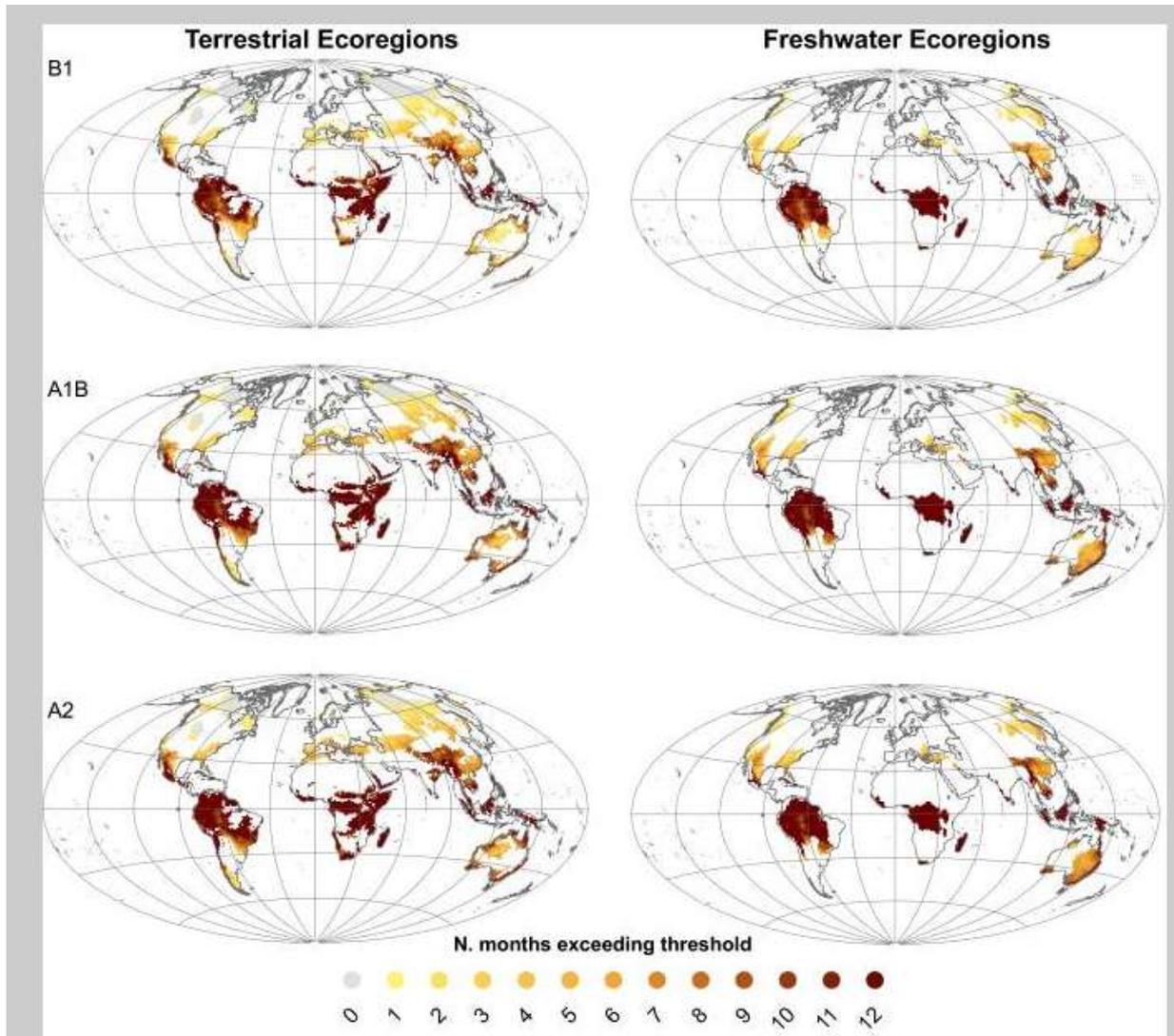
No certainty that adaptation to a 4°C world is possible

Warming of 4°C can still be avoided: studies show technically and economically feasible pathways to hold warming near 2°C. (UNEP Gap 2012)

Record Breaking Weather Extremes 2000-12

Region (Year)	Record-breaking event	Attribution Confidence	Impact, costs
England and Wales (2000)	Wettest autumn on record since 1766. Severe rainfall records ²	Medium ³⁻⁵	~ £1.3billion ³
Europe (2003)	Hottest summer in at least 500 yrs ⁶	High ^{7,8}	exceeding 70,000 deaths ⁹
England and Wales (2007)	May to July wettest since records began in 1766 ¹⁰	Medium ^{3,4}	Major flooding ~ £3 billion billion damage
Middle East (2008)	Driest winter since 1902 (see Fig 19)	High ¹⁵	Substantial damage to cereal production ¹⁶
Victoria (Australia) 2009	Heat wave, many stations temperature records ¹⁷	Medium ^{8,14}	Record worst fires, deaths and houses destroyed ¹⁷
Western Russia (2010)	Hottest summer since 1500 ¹⁸	Medium ^{8,13,14,19}	25% crop loss, death toll ~55,000; US \$ 158 B I ¹⁸
Pakistan (2010)	Rainfall records ²⁰	Low to medium ^{21,22}	Worst flooding in history, affected 20 m people ²³
Western Europe (2011)	Hottest and driest spring on record in France since 1880 ²⁶	Medium ^{14,27}	12% French grain loss
(TX, OK, NM, LA, Mexico) (2011)	Record breaking summer heat and drought since 1880 ^{28,29}	High ^{3,14,29,30}	3 m acres burned (\$6 to \$8 billion) ³¹
Continental U.S. (2012)	July warmest month on record since 1895 /severe drought ³²	Medium ¹ ^{3,14,30}	Abrupt global food price increase / crop losses ³³

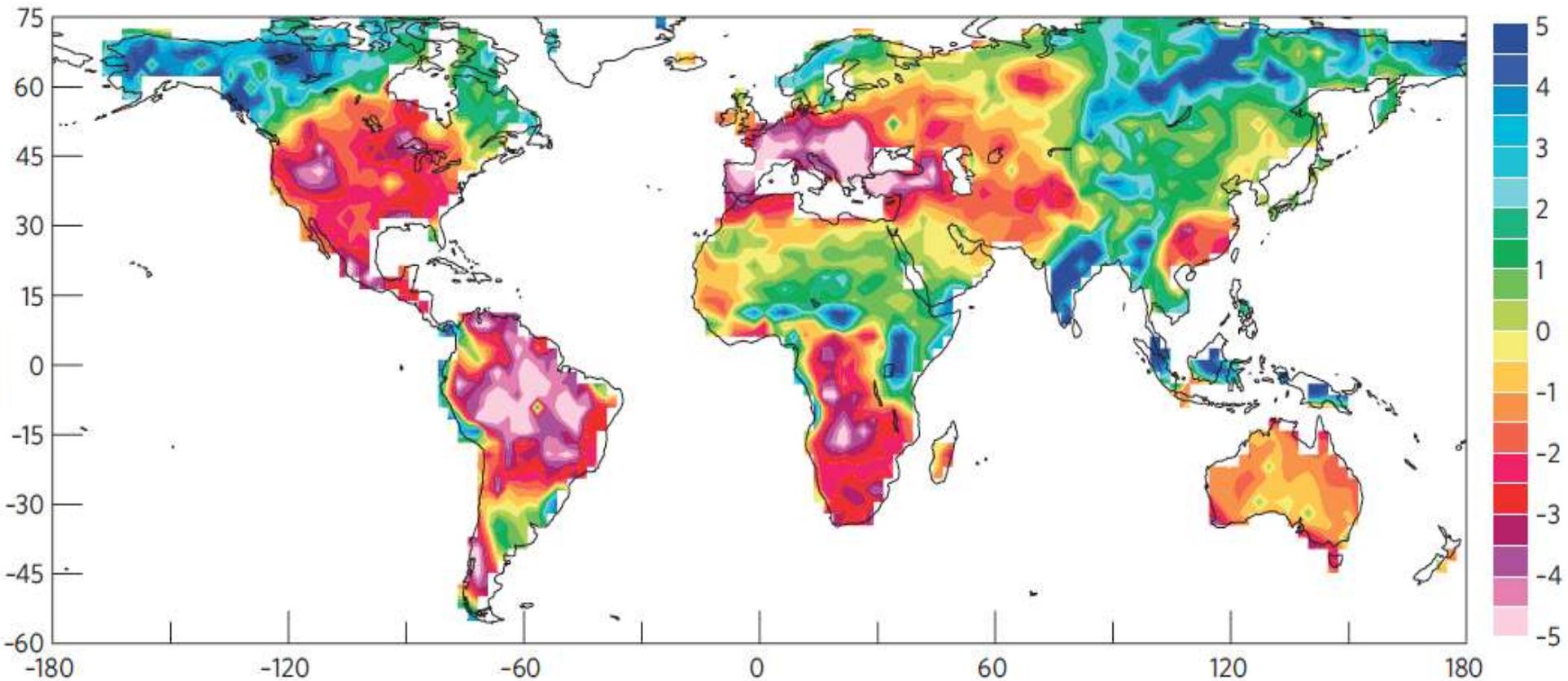
Impacts on the World's Most Exceptional Ecoregions (Global 200)



The number of months by 2070 where monthly average temperature is projected to exceed thresholds of 2σ across terrestrial or freshwater ecoregions, under three emission scenarios.

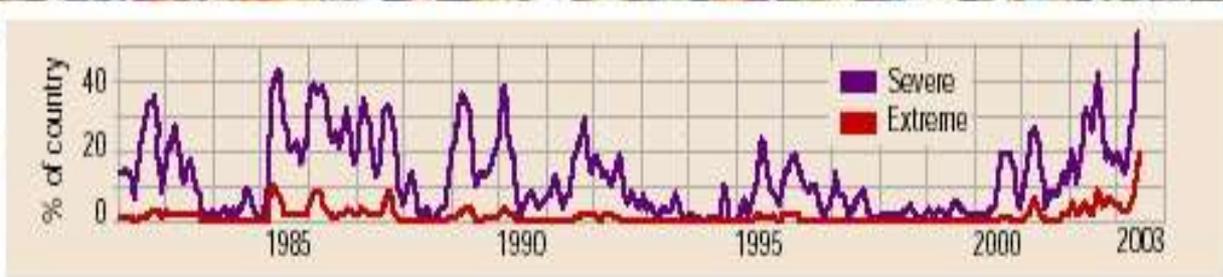
Average drought risk at $\approx 3^{\circ}\text{C}$ by 2100

e.g., red to purple colors are severe to extreme drought





India's worst drought for 20 years left people struggling to find water.

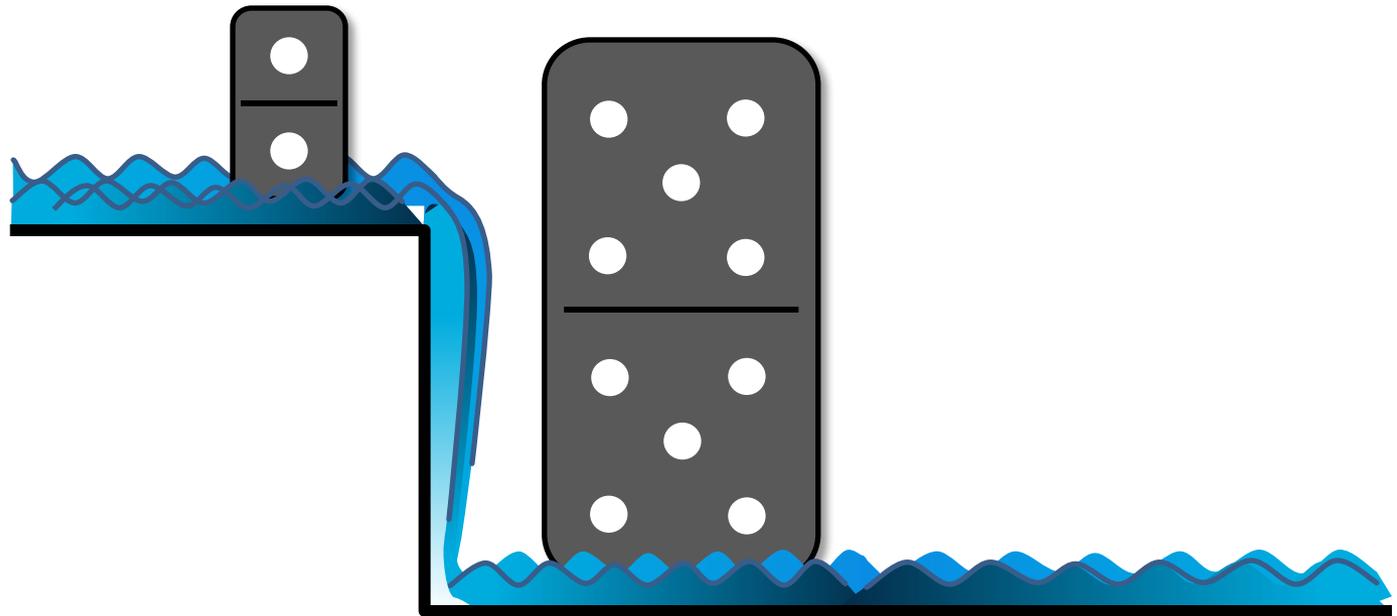




Systems Interactions and Nonlinearity:



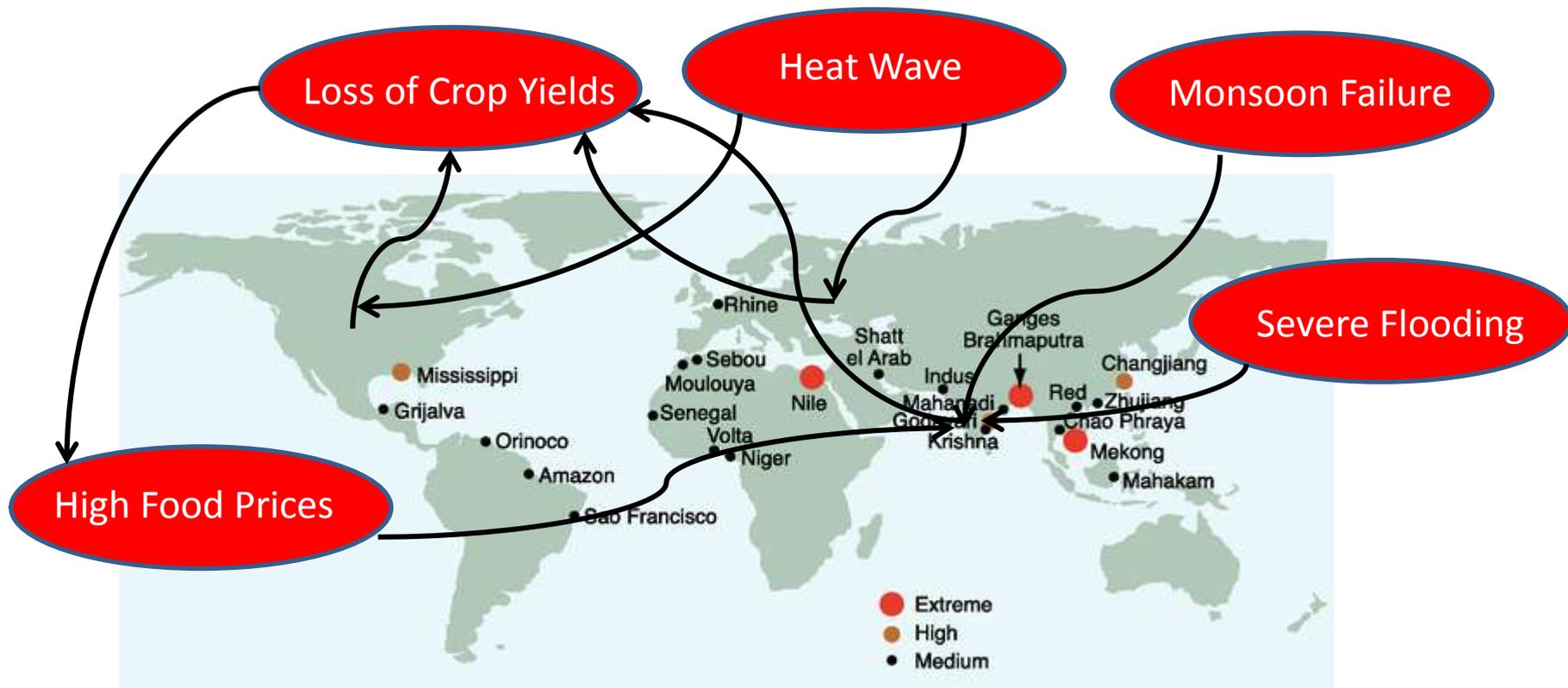
Cascades or Tipping Points



WE ARE SEEING MASSIVE TREE MORTALITY FROM INCREASED HEAT AND DROUGHT



Exemplary Extreme Vulnerability Due to Cascading Effects and Interaction of Impacts



Points: Relative vulnerability of coastal deltas as shown by the indicative population potentially displaced by current sea-level trends to 2050 (Extreme = >1 million; High = 1 million to 50,000; Medium = 50,000 to 5,000; following Ericson et al., 2006).



Adaptation efforts must be co-equal with mitigation efforts

***Mitigation is needed
to avoid the unmanageable***

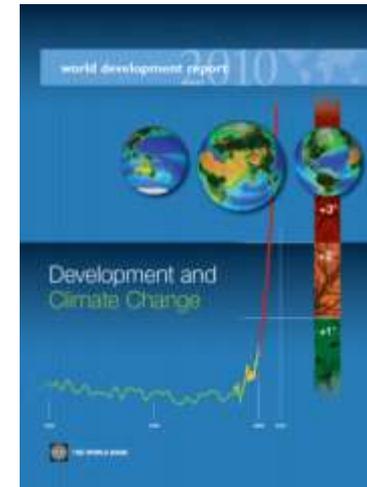
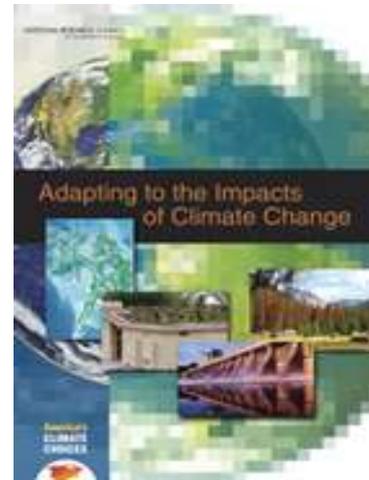
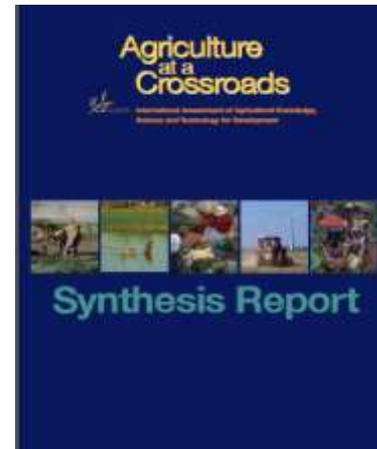
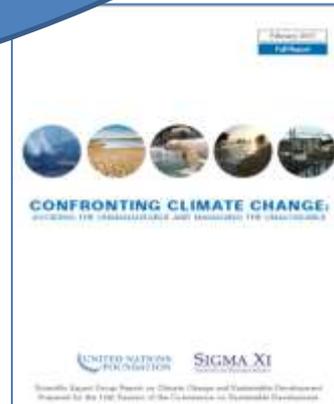
***Adaptation is needed
to manage the unavoidable***

Adaptation is no longer a forbidden word!

AN INCREASED NEED TO PREPARE FOR & ADAPT TO CHANGING CONDITIONS

- Response strategies that work on the multiple stresses
- Infrastructure to withstand
- Seed varieties that
- Prioritize
- Emergency systems
- D
- L

This is a HUGE agenda that has not been tackled seriously domestically OR internationally!
IT IS TIME TO GET ON WITH IT!

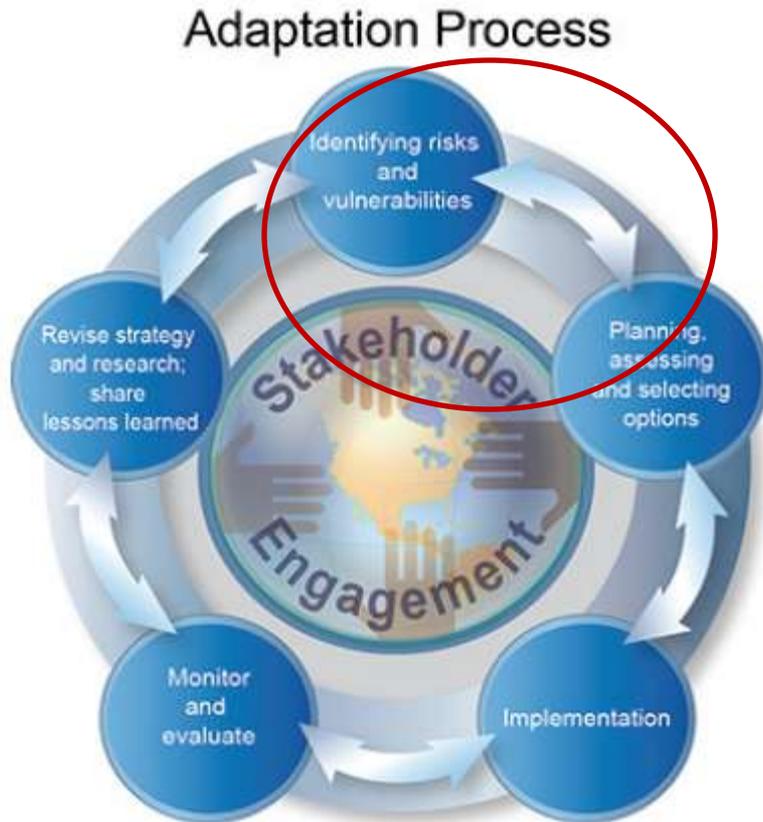


Environmental capital can offer co-benefits

- Loess plateau before



Most “adaptation” efforts focused on **characterizing vulnerability** & some **planning**.



Little work on implementing actions, monitoring and evaluating their effectiveness, let alone revising strategies and sharing ‘best practices’ with others. There is no “one-size fits all” adaptation, but there are similarities in approaches across regions and sectors



Earth at Night
More information available at:
<http://antwrp.gsfc.nasa.gov/apod/ap001127.html>

Astronomy Picture of the Day
2000 November 27
<http://antwrp.gsfc.nasa.gov/apod/astropix.html>