

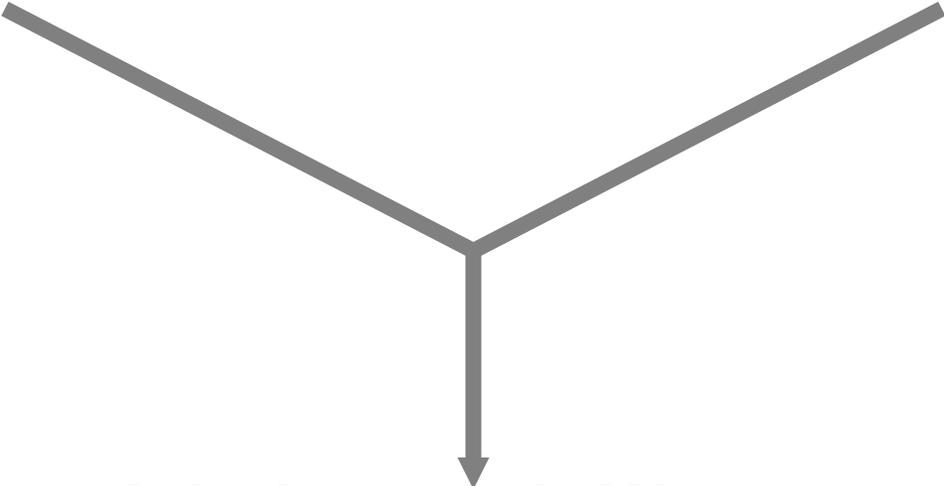


# **IMPACT OF CLIMATE CHANGE ON DEVELOPING COUNTRIES**

Lars Friberg

Sensitivity

Adaptability



Vulnerability

# Sensitivity

- Biophysical effect of climate change
  - Change in crop yield, energy demand
- It considers the socioeconomic context, e.g., the agriculture system
- Grain crops typically are sensitive
- Manufacturing typically is much less sensitive



# Sensitivity cont.



# Developed Country Catastrophes



15 September 2006

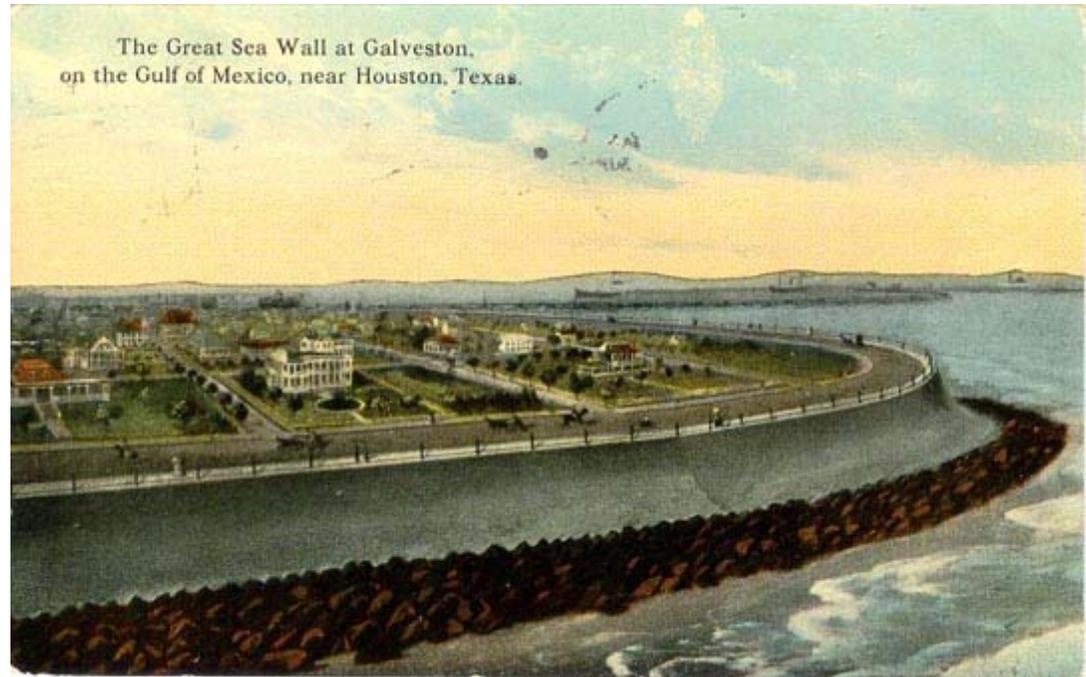
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# Adaptation

- “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm of exploits beneficial opportunities”  
(IPCC Third Assessment Report, Working Group II)
  - Notice includes “actual” (realized) or “expected” (future) changes in climate

# Adaptive Capacity

- Capability to adapt
- Function of:
  - Wealth
  - Technology
  - Education
  - Institutions
  - Information
  - Infrastructure
  - “Social capital”
- *Having* adaptive capacity does not mean it is *used* effectively



# Vulnerability

- Vulnerability to climate change is the risk of adverse things happening
- Vulnerability is a function of three factors:
  - Exposure
  - Sensitivity
  - Adaptive capacity



# Sensitivity to Damage cont.

- 73% of disasters reported between 1900-2004 were climate related
- GDP growth in Mozambique dropped from 8% (1999) to 2% (2000) post cyclone.
- >1/4 of Africa's population lives within 100km of the coast. Numbers at risk from coastal flooding to rise from 1m in 1990 to 70m in 2080

# Socioeconomic impacts

- Even small increases of temperature will prompt food prices to increase due to a slowing in the expansion of global food supply relative to growth in global food demand
- Climate change will lower incomes of the vulnerable populations and increase the absolute number of people at risk of hunger
- What would the impacts be in a already fragile society of mass starvation? Climate refugees?
- How would the rich world react? Especially if it was also struggling with the negative effects of climate change?

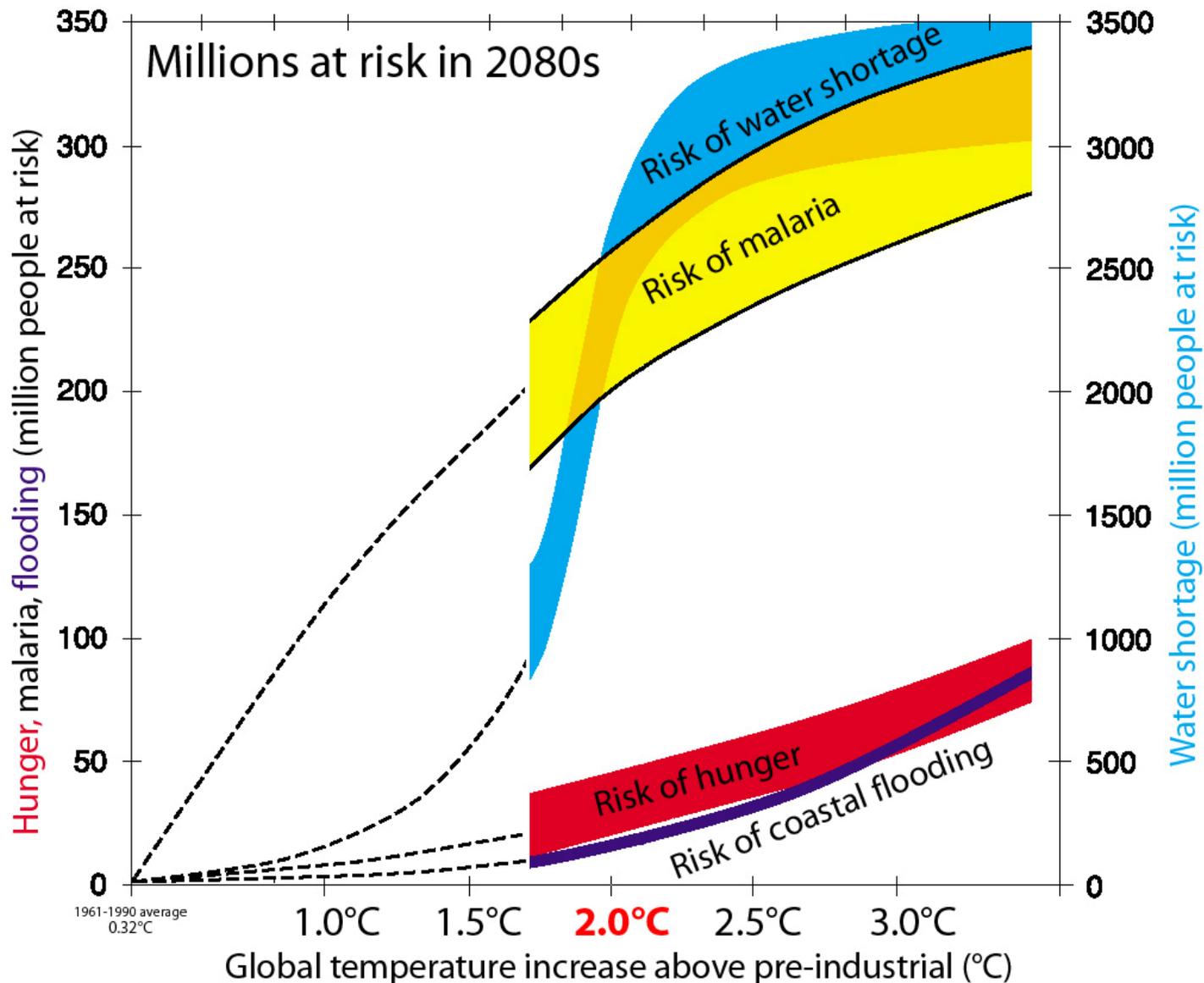
# Climate Change & Poverty

- Disproportionate negative impact on poor
  - 94% of disasters and 97% of natural disaster related deaths occur in developing countries
- Annual costs of natural disasters estimated at \$55 billion (2004). Economic damages are greatest in developed countries, e.g. total economic impact of Hurricane Katrina in Louisiana and Mississippi may exceed \$150 billion
- Climate Change impact is a structural factor that will exacerbate inequality and thwart pro-poor growth
- Dependent on climate sensitive sectors
- 22-53% of total ODA in Bangladesh (~\$1bn) at risk from climatic changes

# Impact on Human Development and the MDGs (Millennium Development Goals)

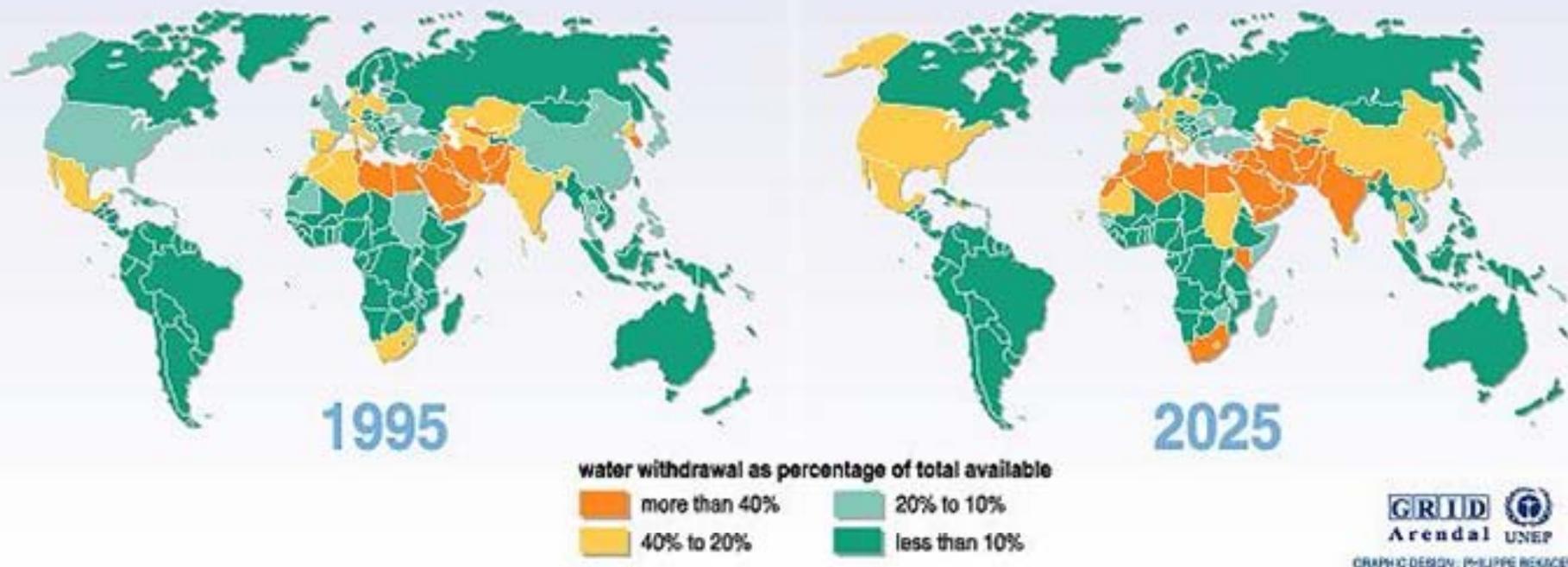
- Biophysical effects associated with climate change will in turn impact on human development and the achievement and sustainability of MDGs
  - **MDGs 4,5,6 (health)**: Incidence of Cholera increased 6-fold in Nicaragua following flooding as a result of Hurricane Mitch
  - **MDG2 (education)**: In Bihar India, annual flooding shuts schools across the state for 3 months.
  - **MDG3 (gender)**: 90% of victims in 1991 Bangladesh cyclone were women and children.
  - **MDG7 (environment)**: 1997 El Niño killed up to 80% of livestock in Somalia and Kenya.

# Millions at Risk (Parry et al., 2001)



Source: Parry et al. (2001) "Millions at Risk" Glob. Env. Change. Graph adapted by M. Meinshausen, Nov. 2004.  
 Note: The original graph presented temperature levels above 1961-1990 average (see Hulme, Mitchell et al. 1999), not above pre-industrial. The 1961-1990 average is 0.32°C above pre-industrial levels (1861-1890). Thus, a 0.32°C temperature difference has been added to the original scale. Furthermore, the original graph presented temperature levels in 2080 for different CO2 equalization (l) stabilization scenarios. For a climate sensitivity of 2.5°C (as underlying the work of Parry et al.), the 2080 temperature level for the S550 CO2eq emission path has been about 1.4°C above 1990 (2°C above pre-industrial).

# Freshwater Stress – Billions at risk



Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

# Agriculture and Climate Change

## Indian Agriculture

GDP from agriculture: 34% , 1994  
42% , 1980  
Area under agriculture: 50% , 760 mha  
Dependent population: 70%  
Average farm size: 1 to 5 ha  
Landless dependent on others

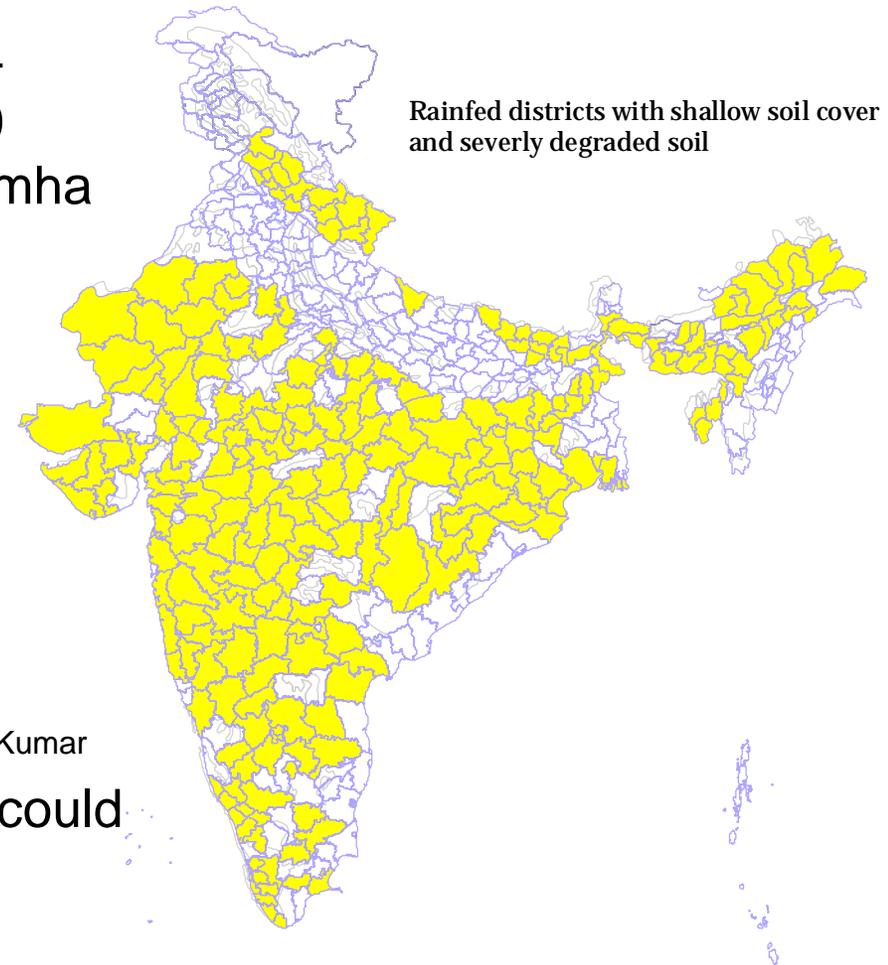
2.5° to 4.9°C increase with -20% drop in precipitation

rice yield - 15% to - 42%

wheat yield - 25% to - 55%

Source: Parikh J and Kavi Kumar

2-3.5°C increase in temperature in India could reduce farm net revenues by 9 – 25%



Source: TERI, 2002

# Paradise lost?

Existential threat for nations



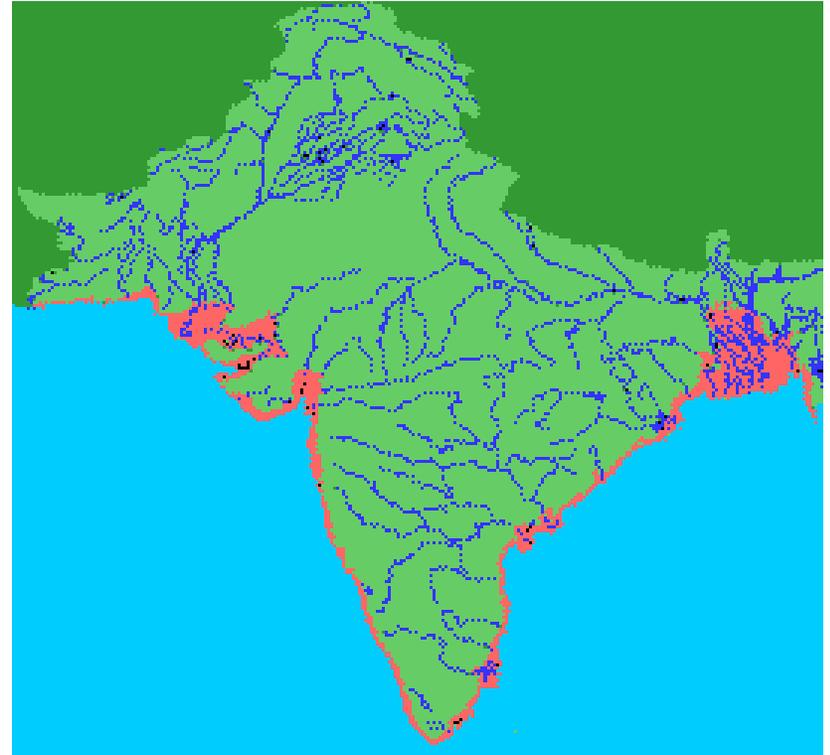
# Sea Level Rise Indian subcontinent

## Bangladesh

- Displace 13 million
- 16% of national rice production lost

## India

- Displace 7 million, est. cost \$Bn 230
- inundate 1700 km<sup>2</sup> agricultural land
- necessitate 4000 km of dykes and sea walls
- submerge 576 km<sup>2</sup> total land & 4200 km of roads

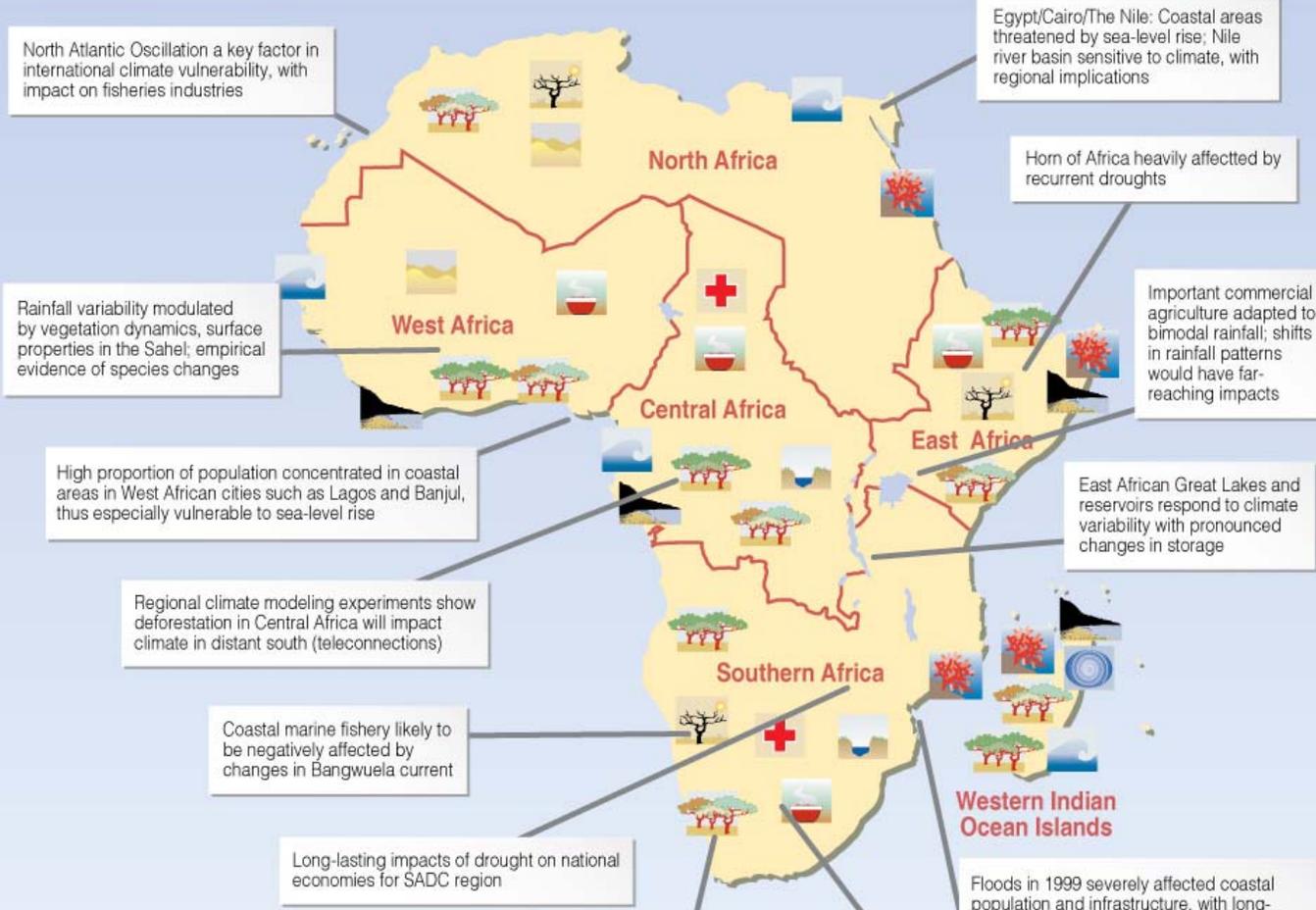




## AFRICA

- the poorest, most technologically backward, debt distressed, marginalized continent will probably suffer the most, again...
- Drought, disease, civil conflicts, poor governance
- 52% sub-Saharan Africa people live on less than US\$ 1 per day
- Importance of agriculture (as GDP and exports) and its reliance on rainfall patterns
- Predicted increase in drought severity and frequency in Horn of Africa

# Climate Change Vulnerability in Africa



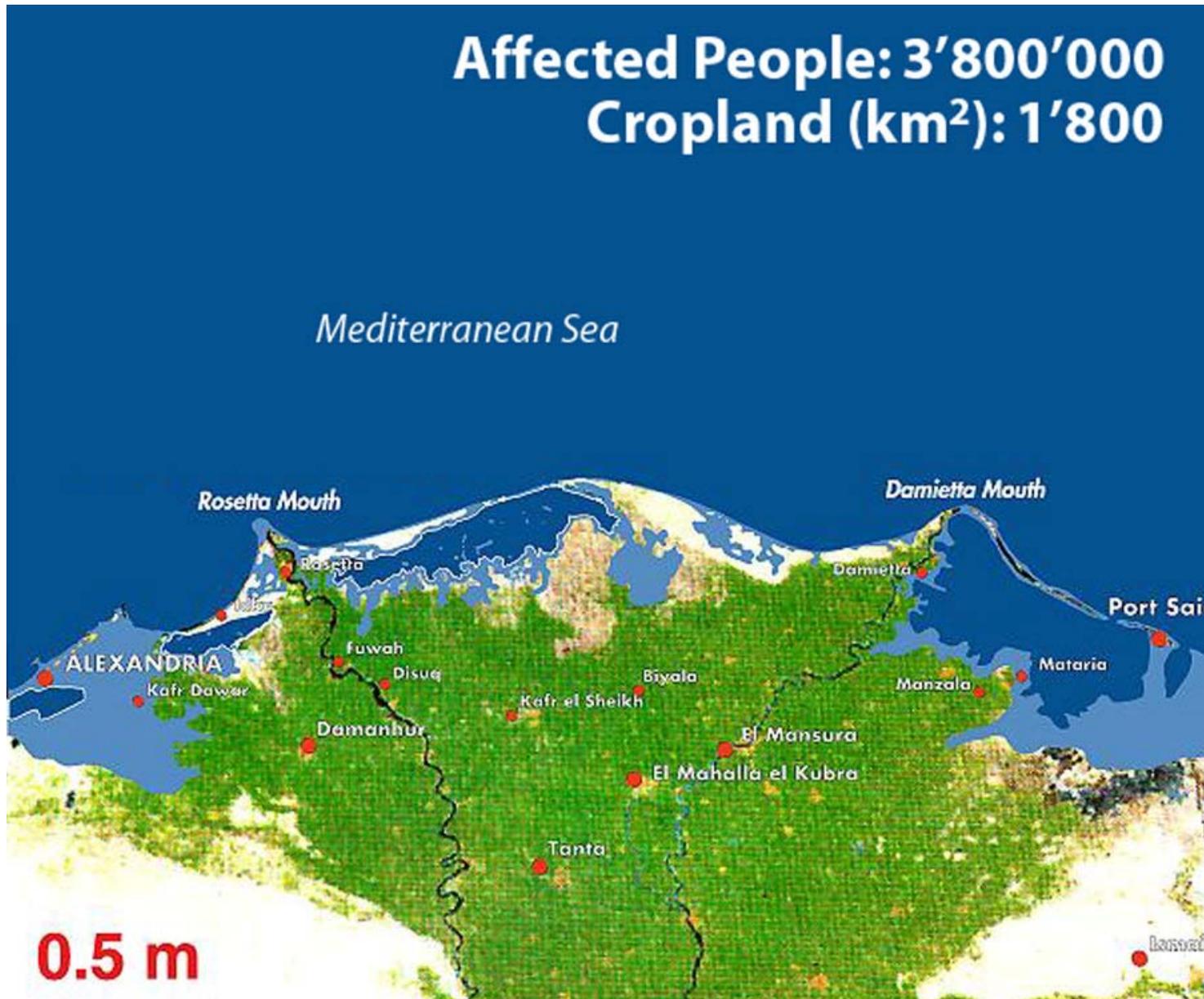
**The vulnerabilities**

	Desertification		Deforestation
	Sea level rise		Loss of forest quality
	Reduced freshwater availability		Degradation of woodlands
	Cyclones		Spread of malaria
	Coastal erosion		Impacts on food security
			Coral bleaching



**Source:**  
Delphine Digout, & Hugo Ahlenius, UNEP/GRID-Arendal

# Potential Impact of Sea Level Rise: Nile Delta

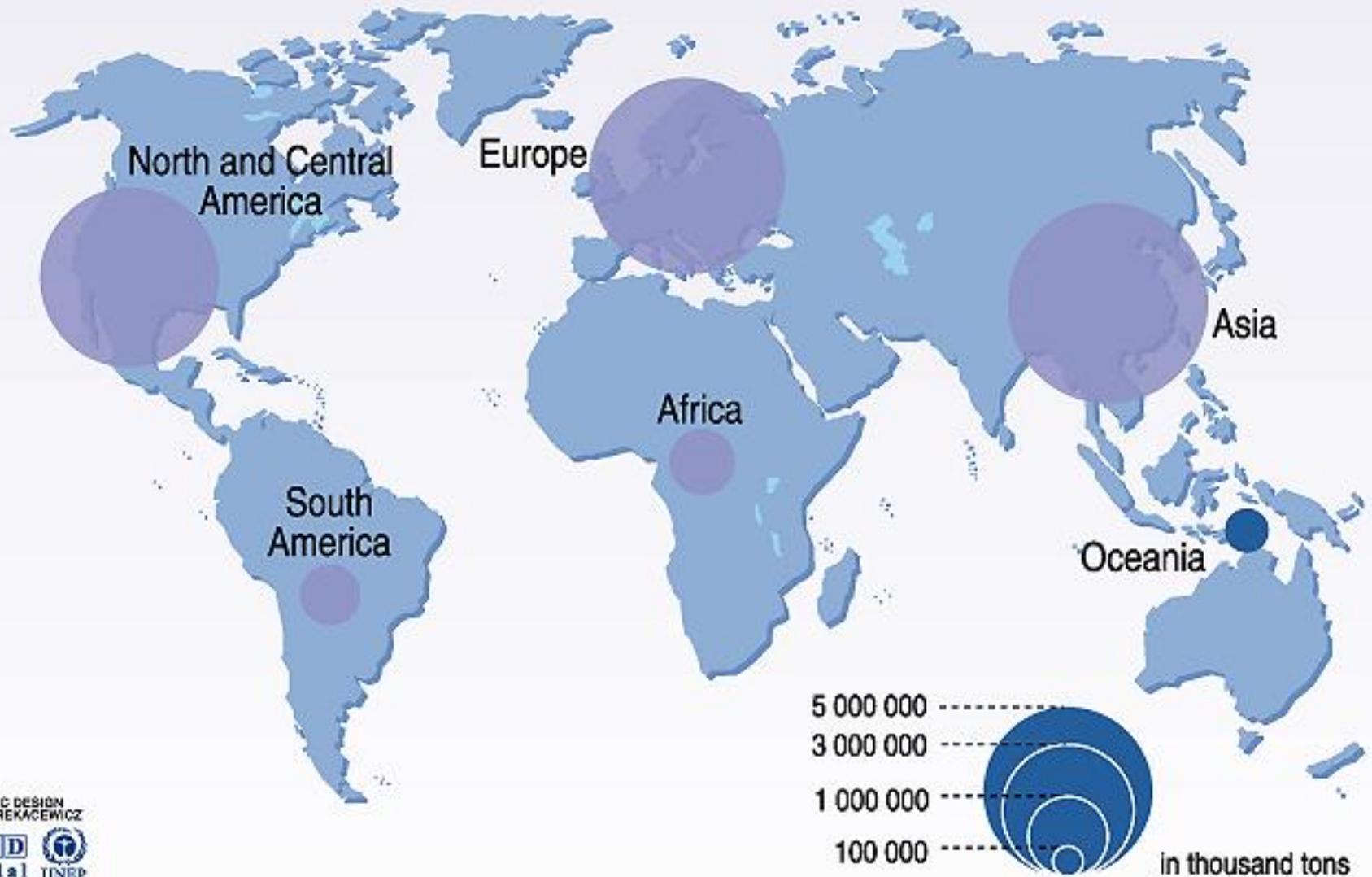


# Maghreb and North Africa



For a global mean warming of 1.8-2.6°C all climate change projections indicate a decrease of precipitation, in some cases up to -40%, by the 2050s compared to 1961-1990 levels. This in an already extremely dry area with high population growth.

# CO<sub>2</sub> emissions from industrial processes



Source: United Nations framework convention on climate change (UNFCCC).

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# Mitigation



China, India, Brazil & South Africa, will become major GHG emitters in the next 20-30 years, overtaking the US in China's case

Mitigation of GHGs poses a fundamental equity problem: total emissions must decrease but developing country share of emissions will need to increase

## Obstacles:

- Political risks: domestic (government interference), international (no price for carbon if no +2012 framework)
- Price gap between cleaner development and Business As Usual
- Price of carbon too low to incentivise action
- Price of access to clean technology (Intellectual Property Rights)

# The Worlds Greatest Challenge?



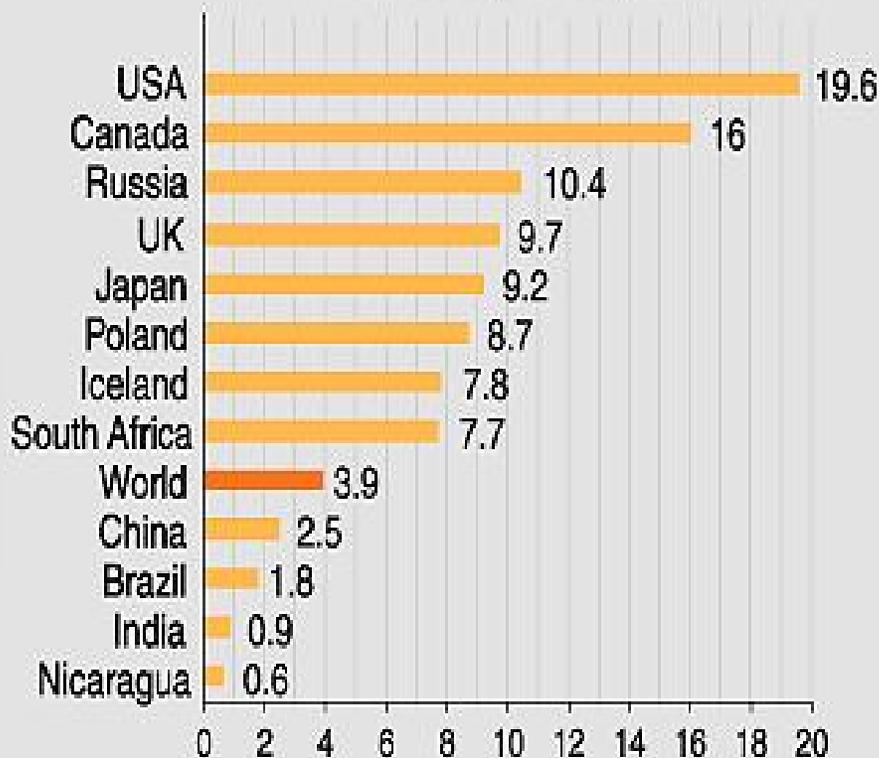
Every year China builds 60 gigawatts of power-generation capacity, almost as much as Britain's entire existing capacity.

Four-fifths of Chinese power is generated by coal, the dirtiest source of electricity.

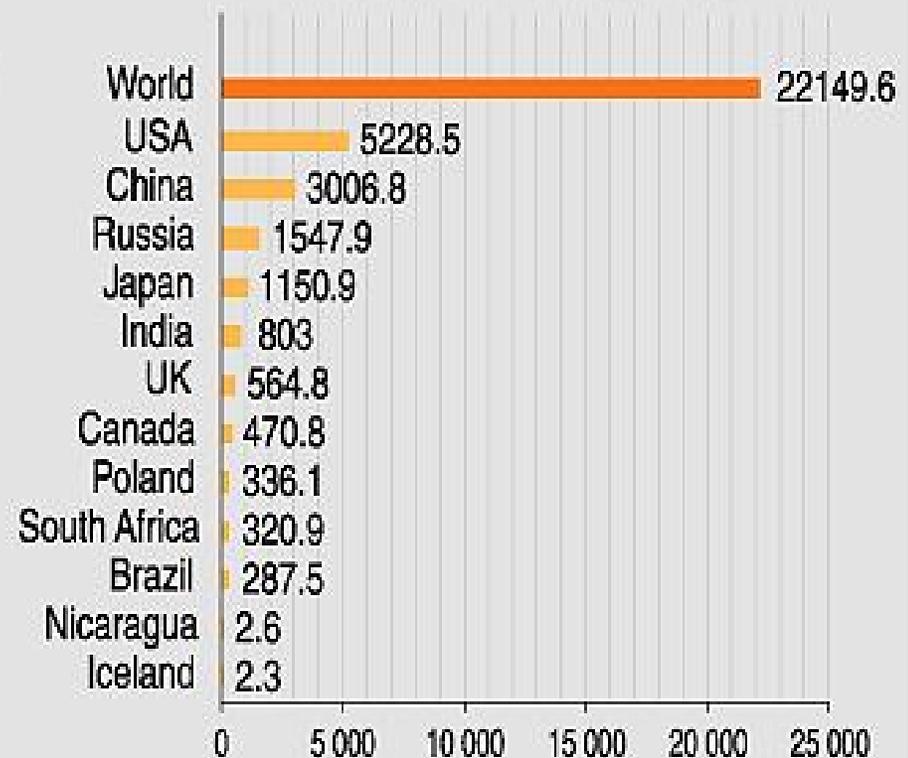
China currently uses 40% of the world's coal—more than America, Europe and Japan put together.

# Emissions of CO<sub>2</sub> - selected countries (1995)

## Tonnes per capita



## Total million tonnes



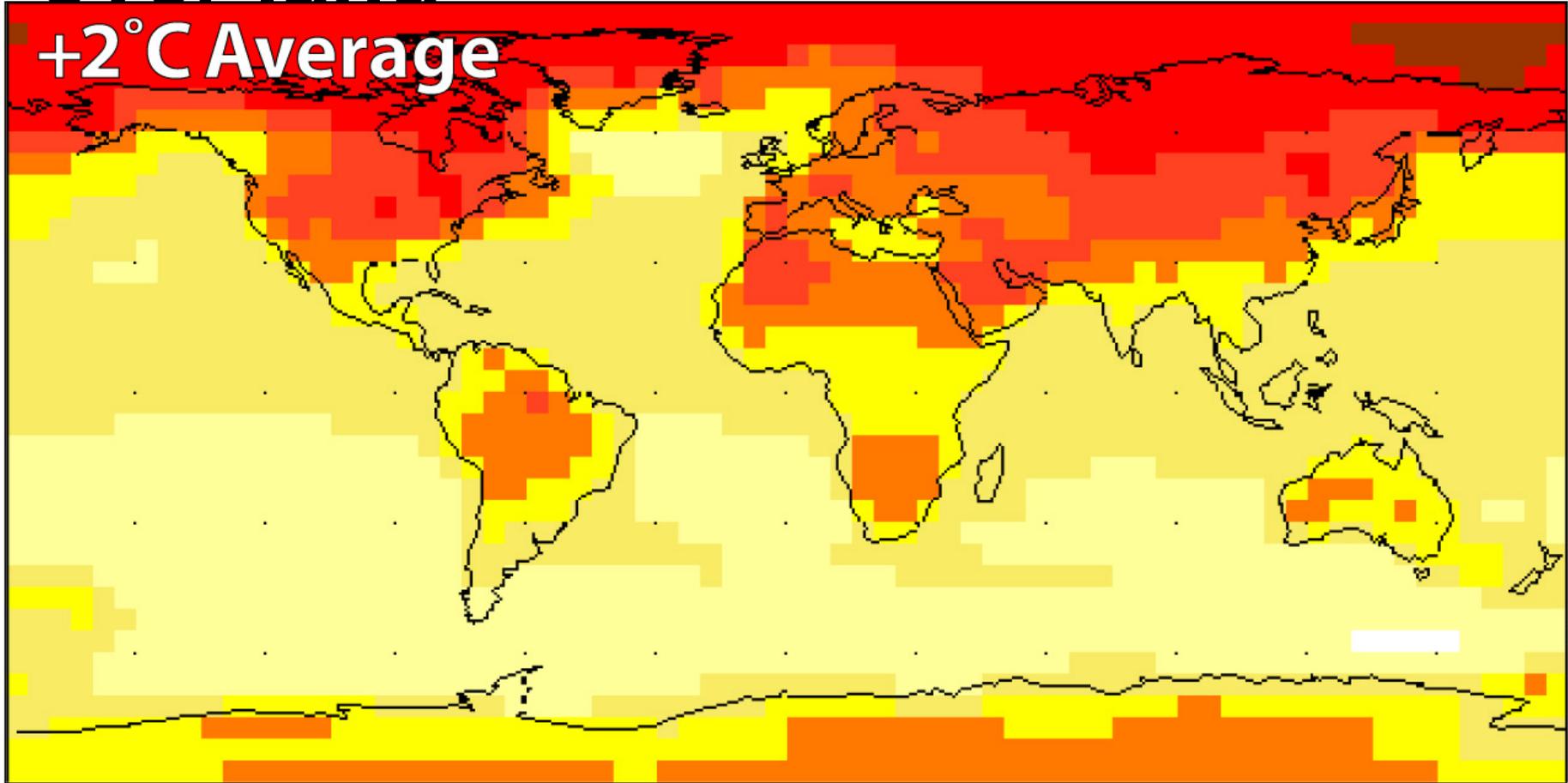
GRAPHIC DESIGN : PHILIPPE REKACZEWICZ



Source : International Energy Agency, 1996.

# Temperature increase higher over land

+2°C Average



(c) malte.meinshausen@env.ethz.ch, ETH Zurich, 2004

Approximate annual mean surface temperature distribution for global increase by 2°C



Note: Employed linear pattern scaling method as implemented in the SCENGEN model (by Wigley et al.).

The displayed pattern is the average of the default set of models, namely CSM (1998), ECHAM3 (1995), ECHAM4(1998), GFDL(1990), HADAM2(1995), HADAM3(2000).

The pattern has been derived for a temperature increase of 2°C above 1990 in a transient run with emission scenario IPCC SRES B2. Note that the equilibrium temperature pattern for a 2°C increase above pre-industrial levels will be quantitatively different, although qualitatively similar.

# Future Climate Regime needs Solidarity to Work

- **TARGET/DATE:** max. **+2°C** = **-70%** GHG globally by 2050
- **FAIR /EFFECTIVE:** Need global participation through national targets, consistent with the global limit
- **MARKET/FISCAL:** Need new financial mechanisms to steer \$17 Trillion of energy investments into low carbon solutions
- **MAINSTREAMING:** Climate risks must be factored into policy and investment decisions - active risk mitigation

**If you are not part of the solution you are part of the problem!**

- Need both **MITIGATION** and **ADAPTATION** on unprecedented level – real urgency! We have 10-15 years, at best, to create a working regime, to break the current trend

GATT ->WTO = 58 years

European Coal and Steel Community -> EU = 41 years

# Conclusions - I

- Warming of 2°C threatens many tens of millions with increased risk of hunger, hundreds of millions with increased Malaria risk, millions with increased flooding and billions with risk of water shortage.
  - All these threats most severe for developing countries and poor people everywhere
- Warming of 2°C risks major ice sheet responses with commitments to many metres of sea level rise. At least 1m by 2100, could be much more later
  - Ensuing sea level rise threatens large populations everywhere and particularly in developing countries
- Warming of 2°C threatens major ecosystems from the Arctic and Antarctic to the tropics
  - Loss of forests and species will affect the lives of all with economic costs falling disproportionately on the poor and developing countries
- Avoiding 2°C warming is going to be very difficult now, but not impossible!

It may be long before the law of love will be recognised in international affairs. The machineries of government stand between and hide the hearts of one people from those of another.

Mahatma Gandhi



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