Why addressing climate change may be good for your health

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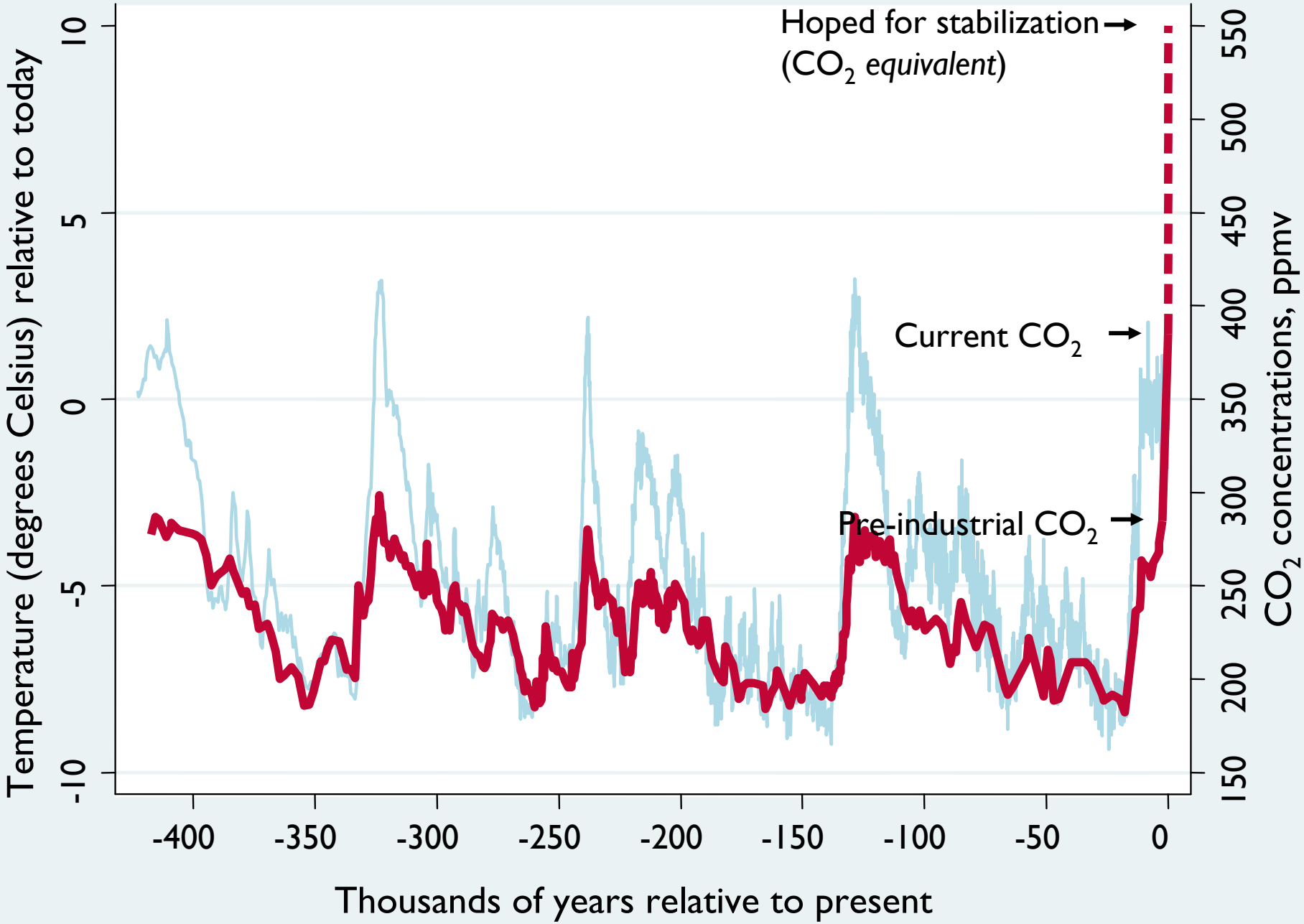
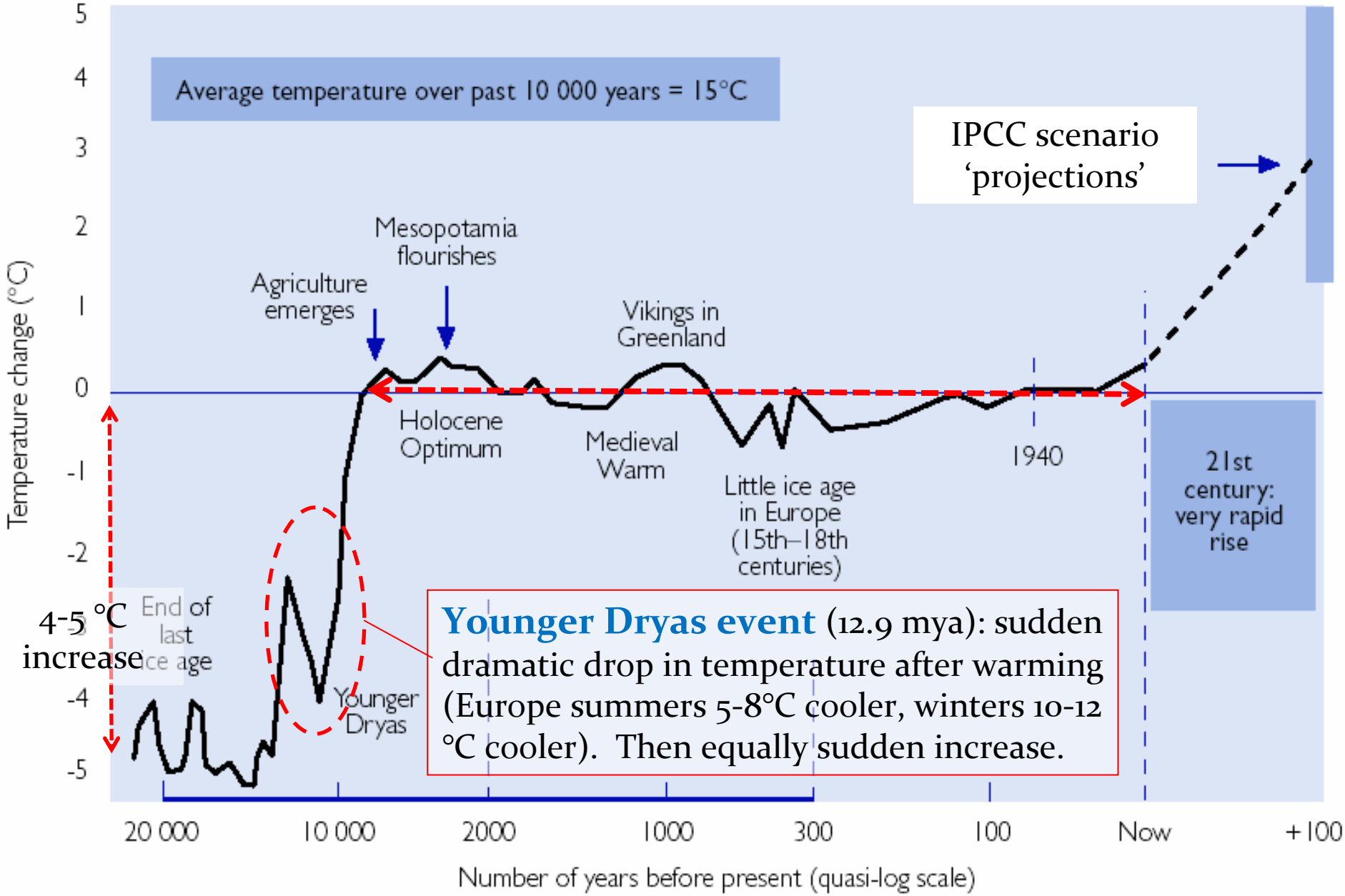
Paleo-climate & CO2 record, Vostock ice cores, Antarctica





Source: WHO, 2003: Climate change and human health: risks and responses.

Responses

Adaptation

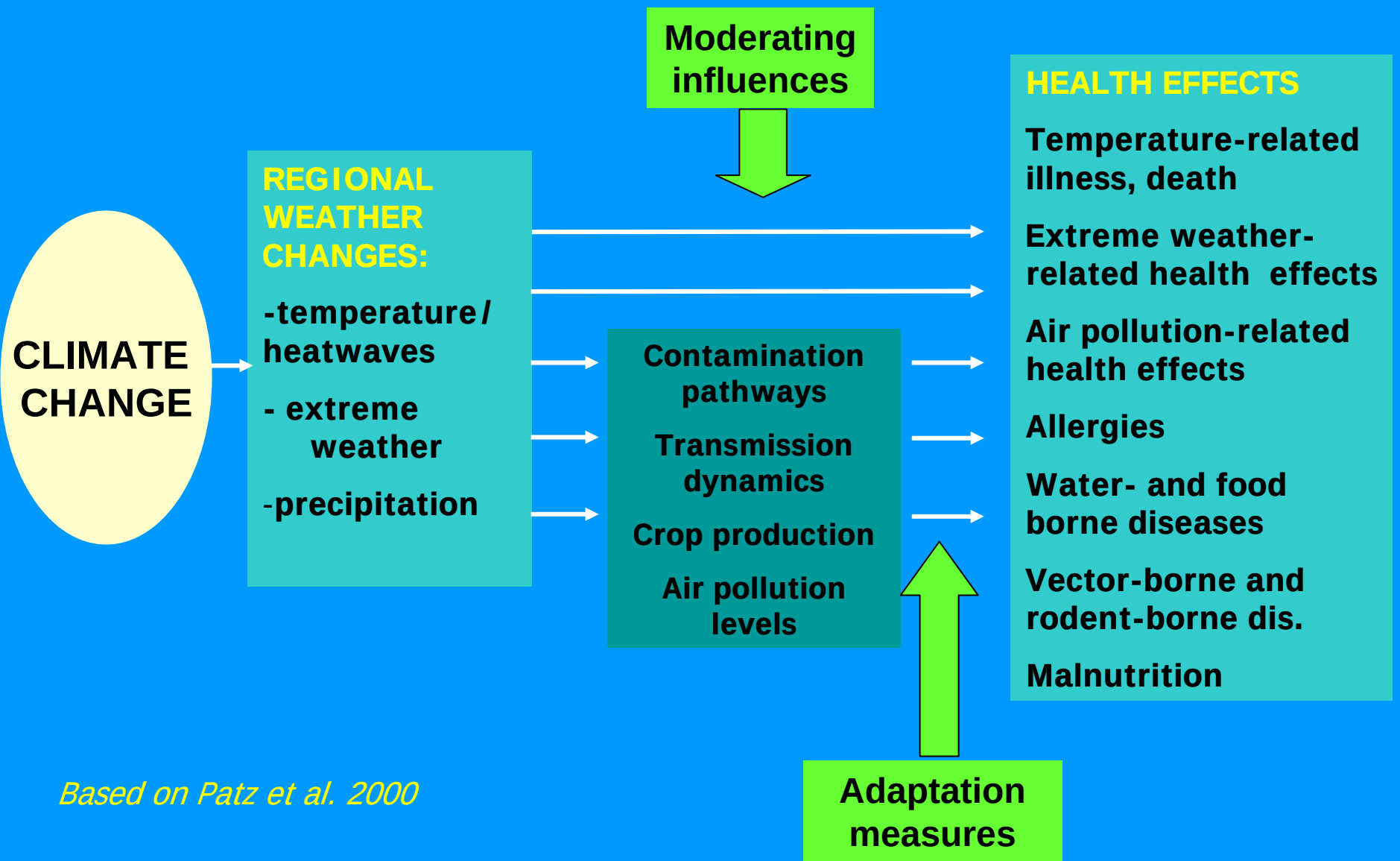
"actions taken to help communities and ecosystems cope with changing climate conditions"

Mitigation

"implementing policies to reduce GHG emissions and enhance sinks"

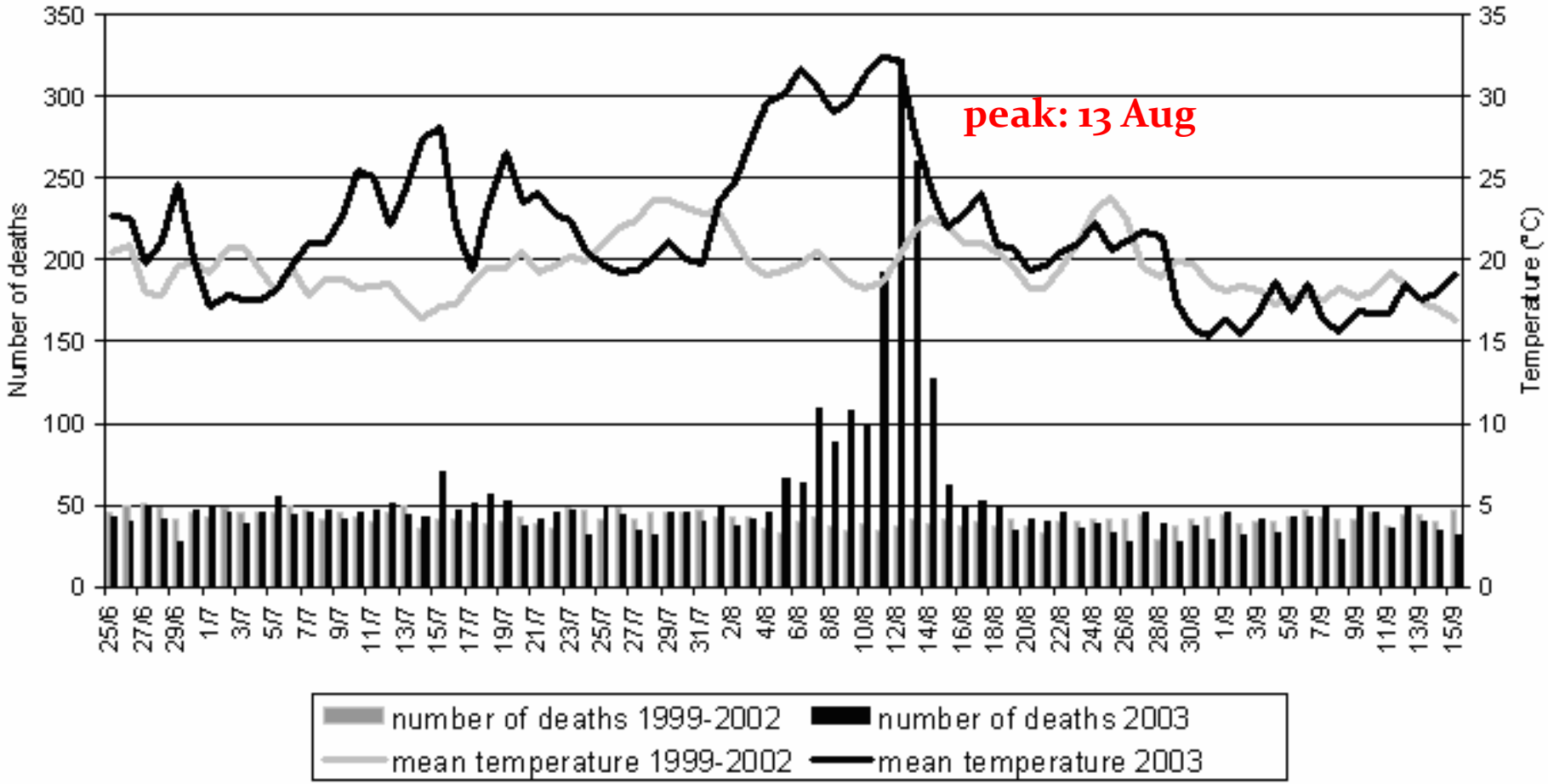
Reducing the impact on health of climate change

CLIMATE CHANGE & HEALTH

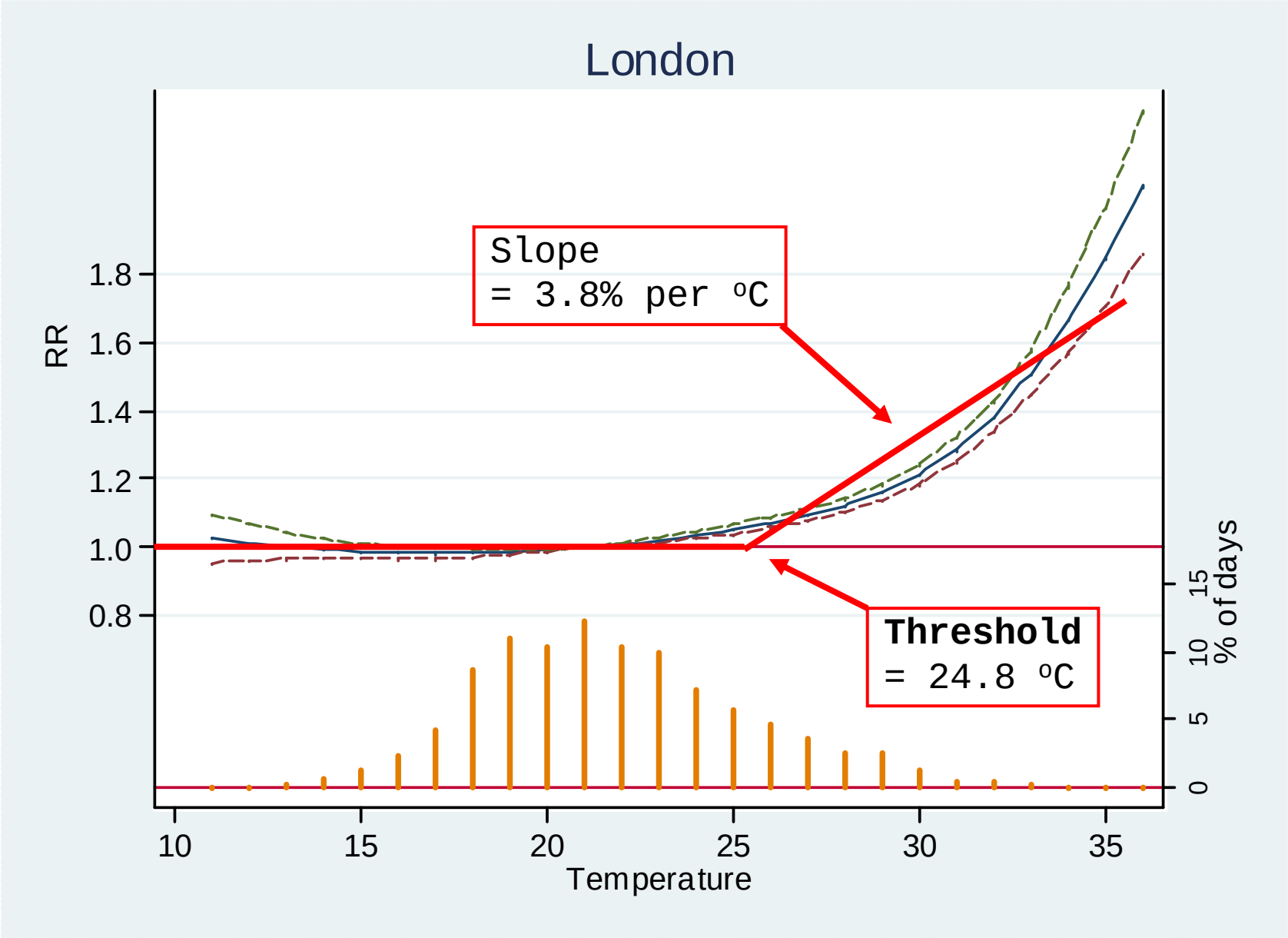


Based on Patz et al. 2000

Mortality in Paris, 1999-2002 v 2003



Epidemiological relationship: London

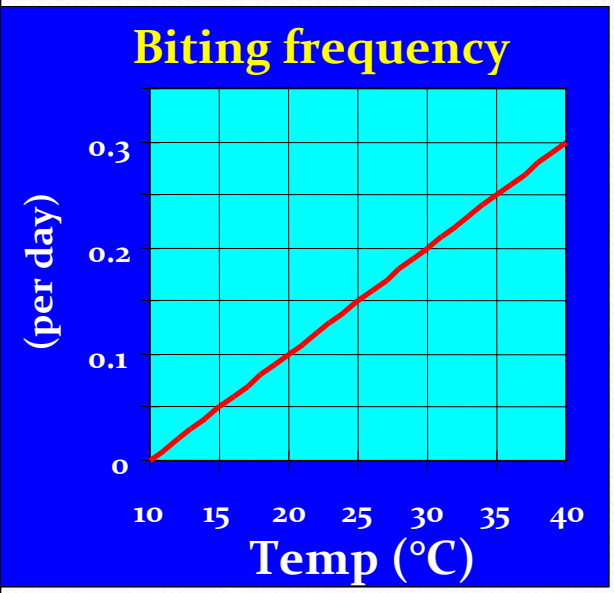


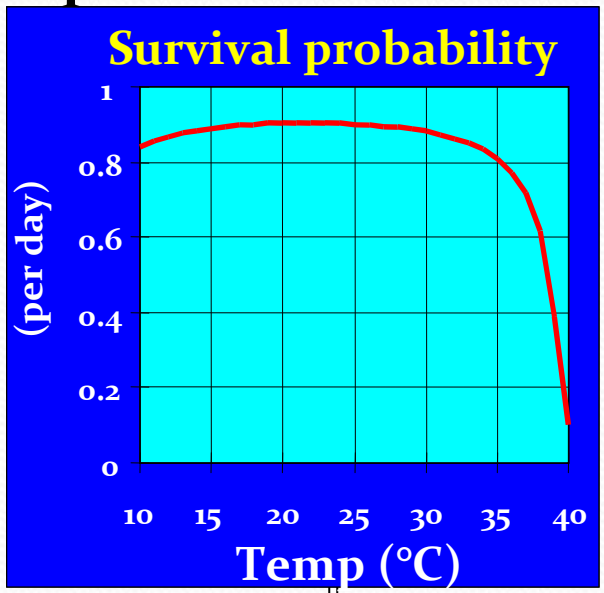
Source: JECH 2010

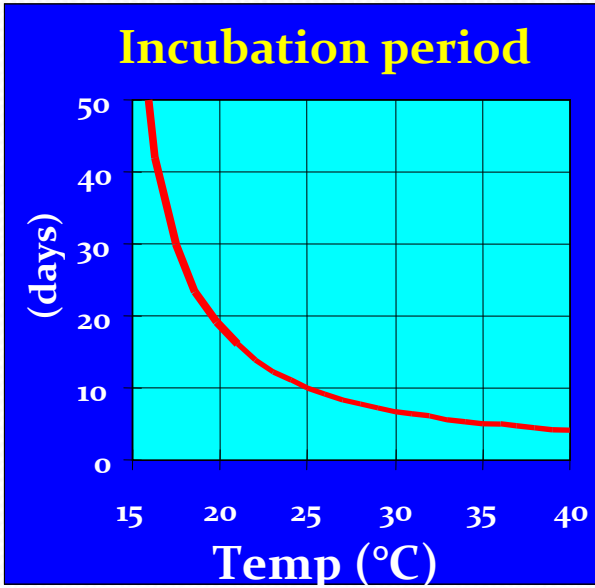
VECTOR-BORNE DISEASE

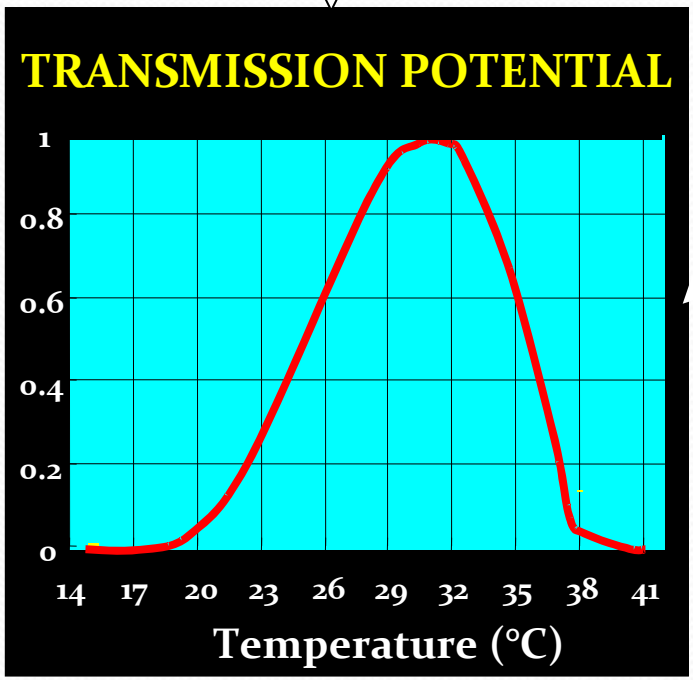
Mosquito

Parasite

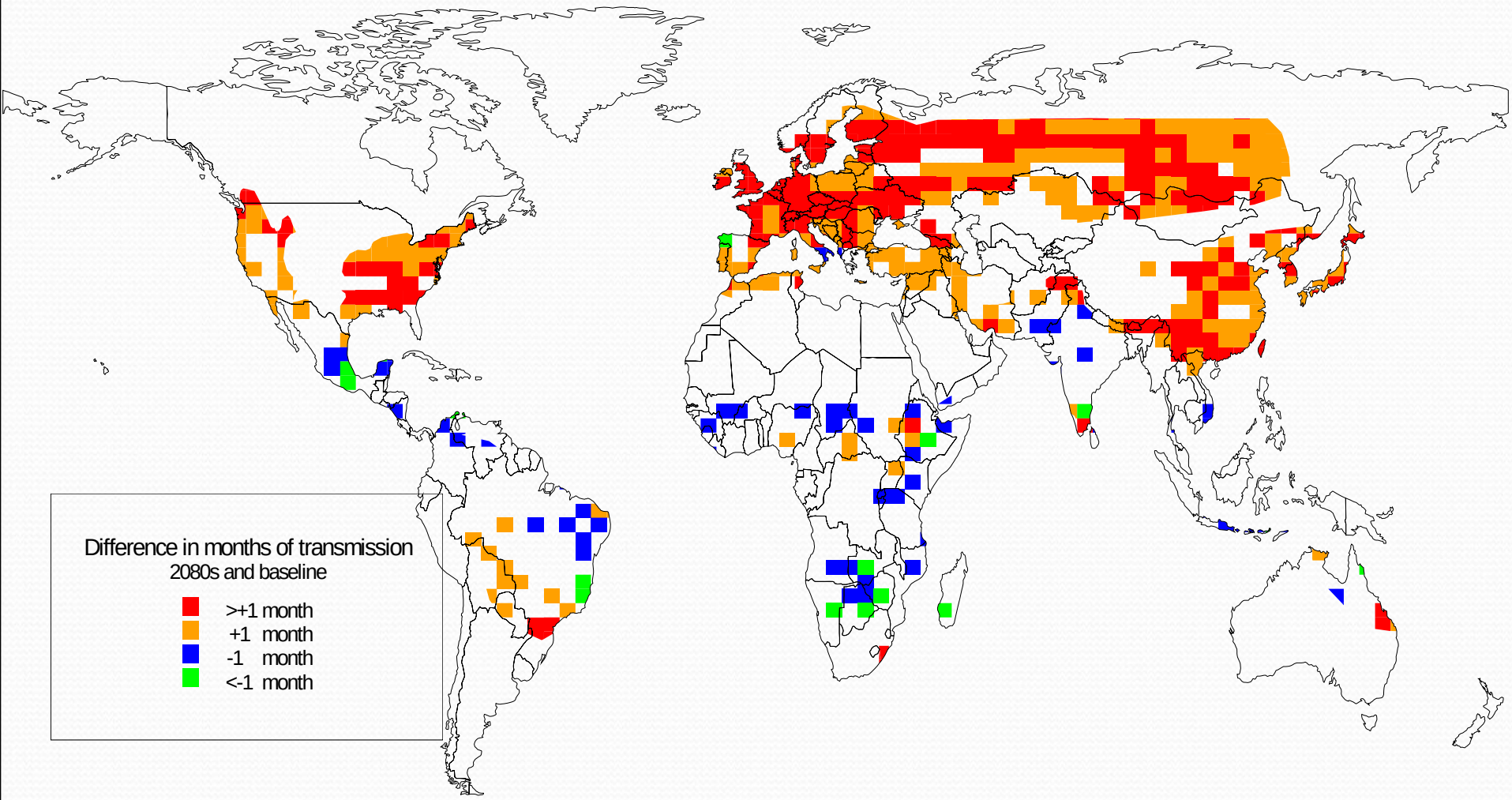








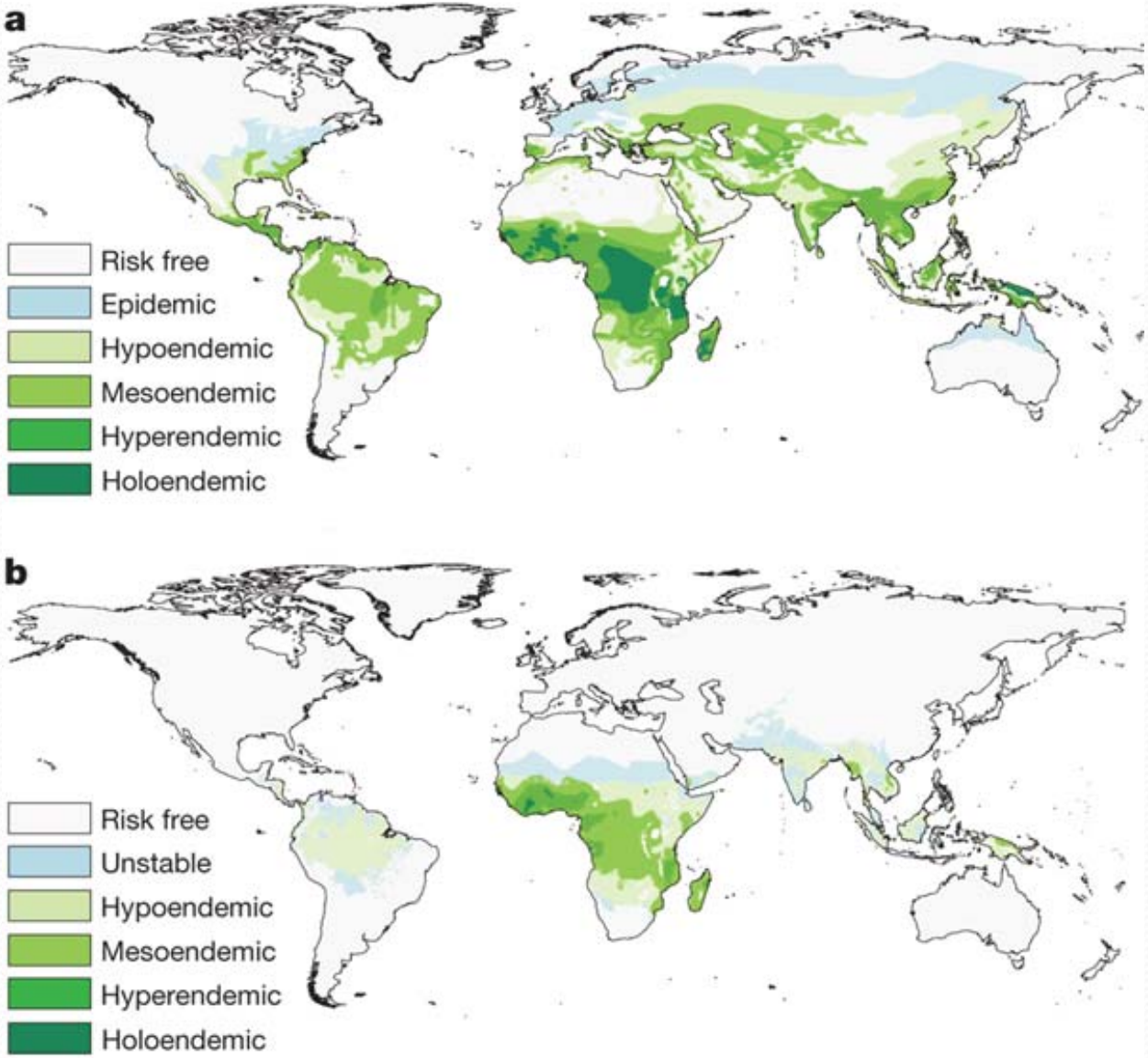
PREDICTED CHANGE IN MONTHS PER YEAR OF FALCIPARUM MALARIA TRANSMISSION BY 2080



From Martens et al. 1999

[Climate change scenario developed by the UK Hadley Centre]

Changing global malaria endemicity since 1900.

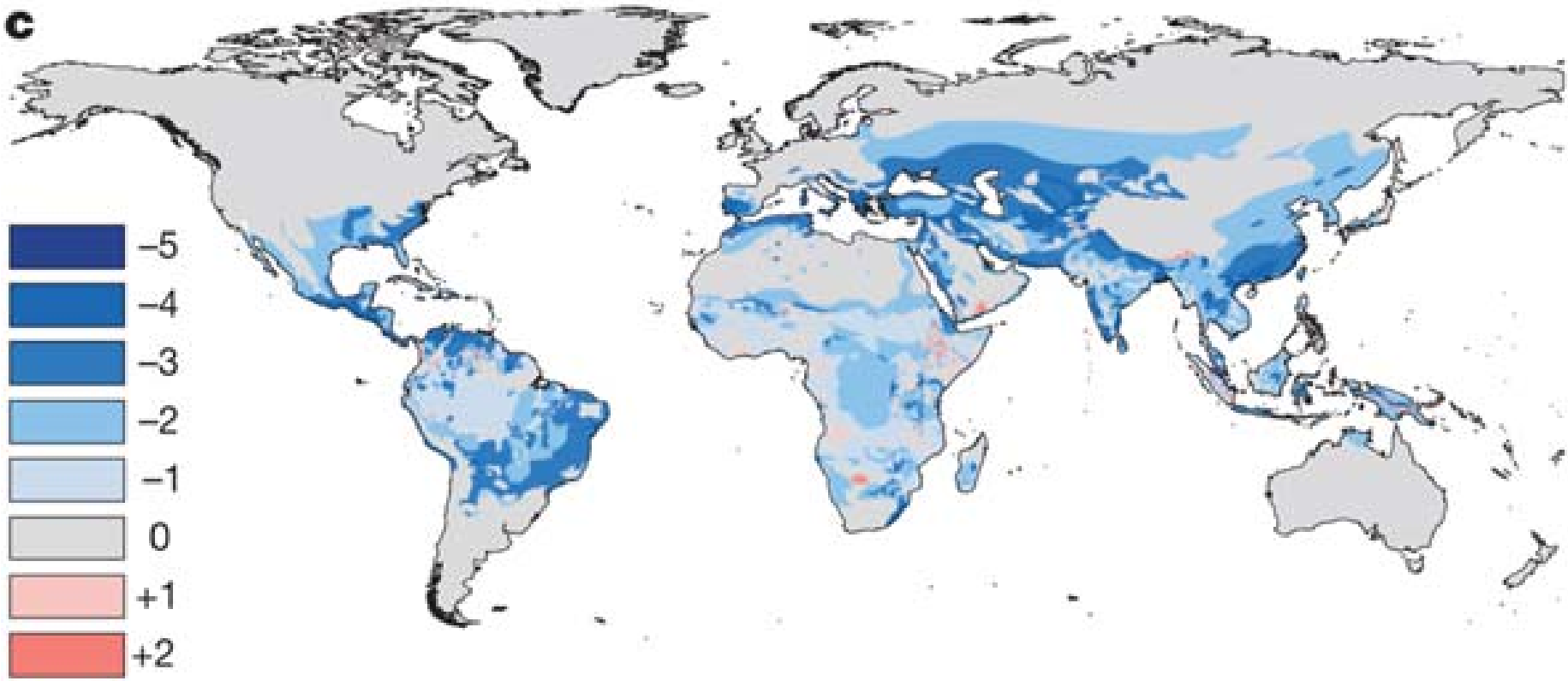


nature

a, Pre-intervention endemicity (approximately 1900) **b**, Contemporary endemicity for 2007 based on a recent global project to define the limits and intensity of current *P. falciparum* transmission

*Source: PW Gething et al. Nature **465**, 342-345 (2010) doi:10.1038/nature09098*

Change in falciparum malaria, 1900 to 2007



nature

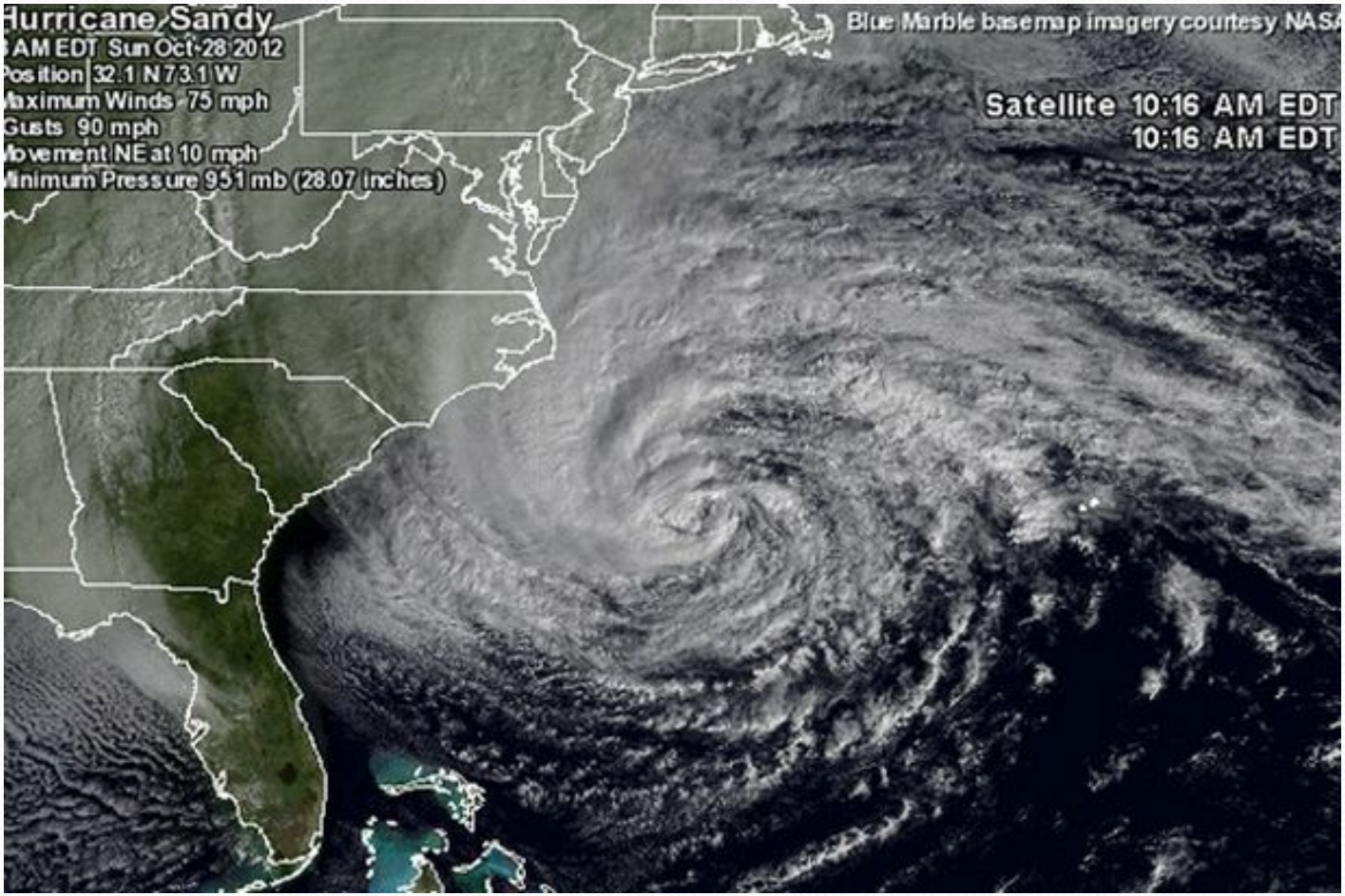
Change in falciparum malaria endemicity, 1900 to 2007. Negative values denote a reduction in endemicity, positive values an increase.

PW Gething *et al. Nature* **465**, 342-345 (2010) doi:10.1038/nature09098

"the proposed future effects of rising temperatures on endemicity are at least one order of magnitude smaller than changes observed since about 1900 and up to two orders of magnitude smaller than those that can be achieved by the effective scale-up of key control measures. Predictions of an intensification of malaria in a warmer world, based on extrapolated empirical relationships or biological mechanisms, must be set against a context of a century of warming that has seen marked global declines in the disease and a substantial weakening of the global correlation between malaria endemicity and climate"

Source: Gething PW, et al. *Nature* 2010; 465: 342–345

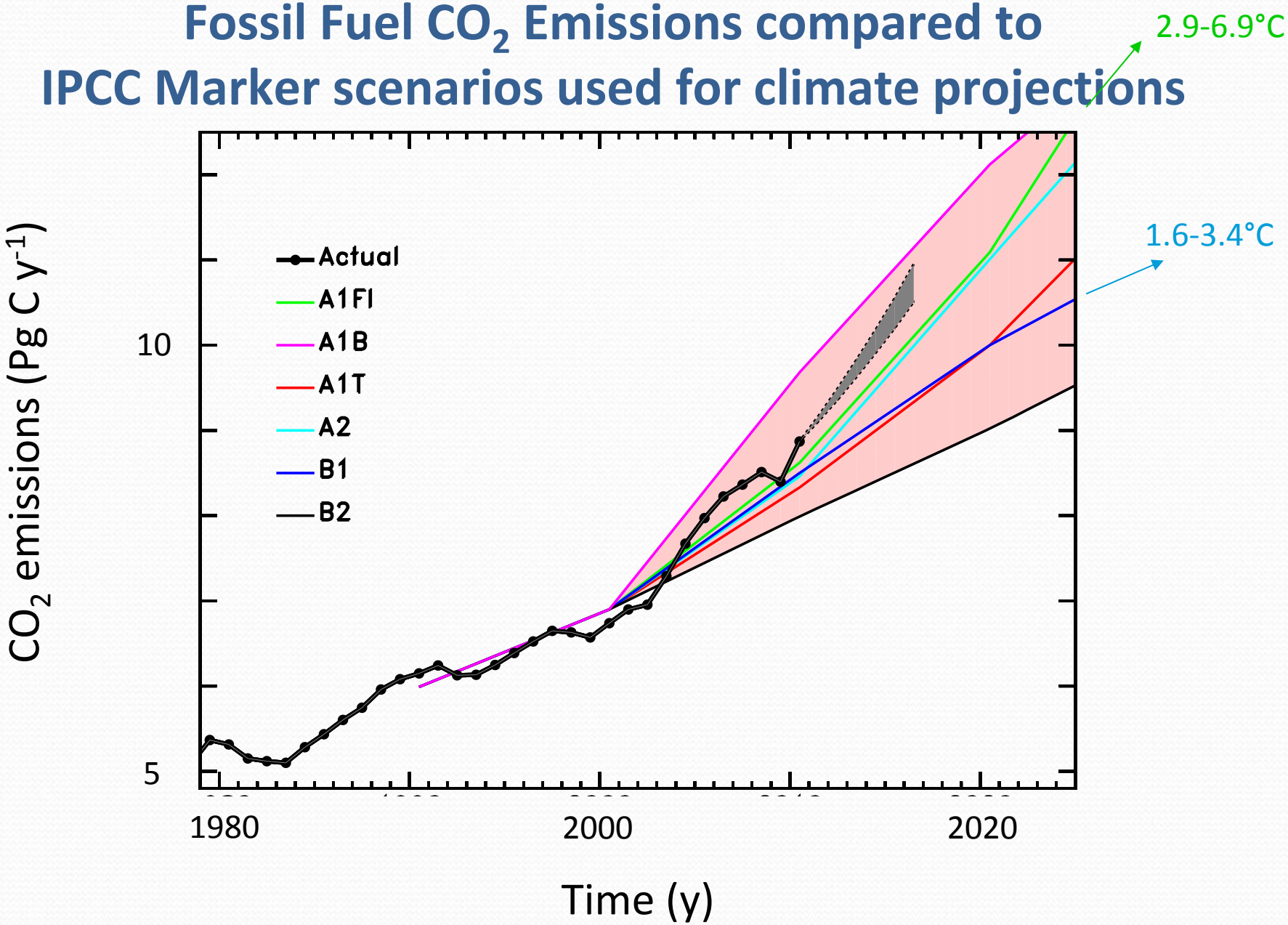
Extreme events can be damaging even with the most sophisticated protection systems



...but contribution of climate change unclear

Avoiding climate change

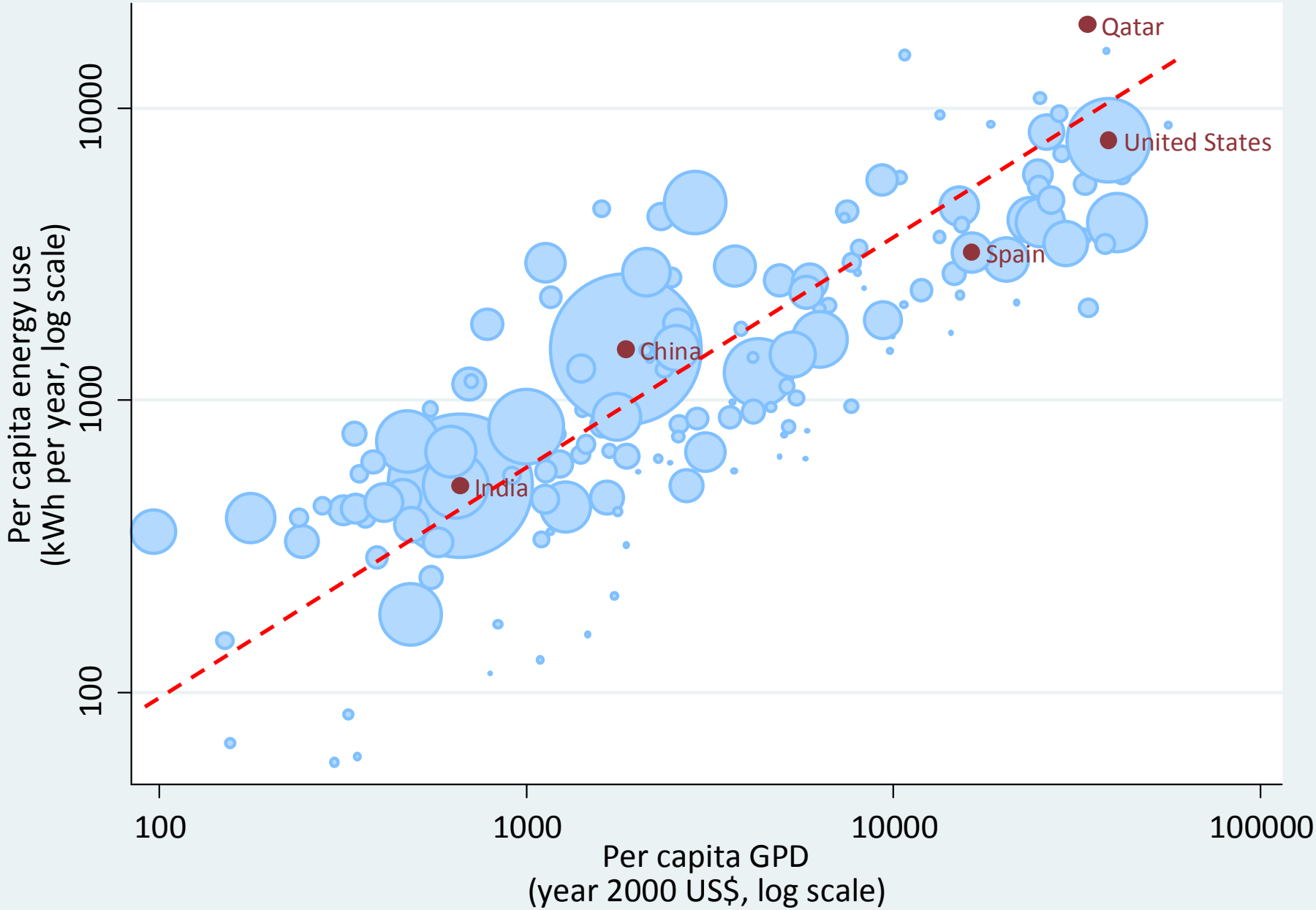
Fossil Fuel CO_2 Emissions compared to IPCC Marker scenarios used for climate projections



Updated from Le Quéré et al (2009) *Nature Geoscience*, using Marker scenarios modified from Raupach et al. PNAS (2007)

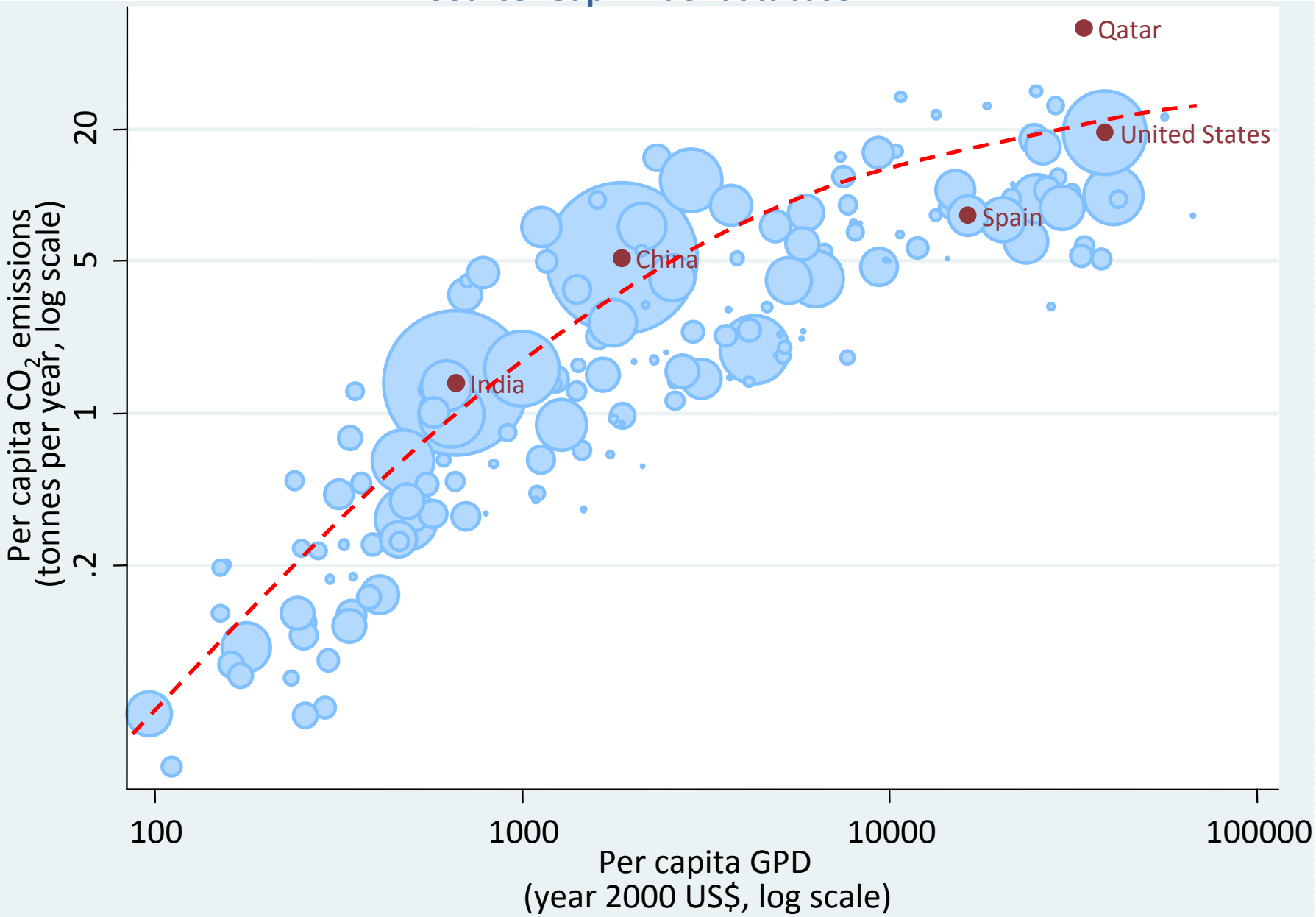
Per capita energy use vs GDP (2007)

Source: Gapminder database



Per capita CO_2 emissions vs GDP (2007)

Source: Gapminder database



Mitigation

- Requires reduction in GHG emissions by ~90% in high income countries by mid century
- Major shifts in all sectors of the economy
- Changes in technology, regulation, (fiscal) incentives, persuasion, cooperation… Efficiency alone is not a solution
- Non-linearities suggest it may already be too late (Lovelock): polar albedo, reversal of Amazonian carbon sink, gas hydrates etc
- Rationale for change needs to be based on nearer-term imperatives: ‘peak oil’, energy security, health

Ancillary (near term) health effects of mitigation actions

Task Force on Climate Change Mitigation and Public Health

Supported by a consortium of funding bodies coordinated by the Wellcome Trust

Department of Health NIHR, Economic and Social Research Council, Royal College of Physicians, Academy of Medical Sciences, US National Institute of Environmental Health Sciences and WHO

Involving over 50 researchers from UK, USA, India, Canada, Australia, Spain, France, New Zealand, WHO Geneva

Study methods

Scenarios

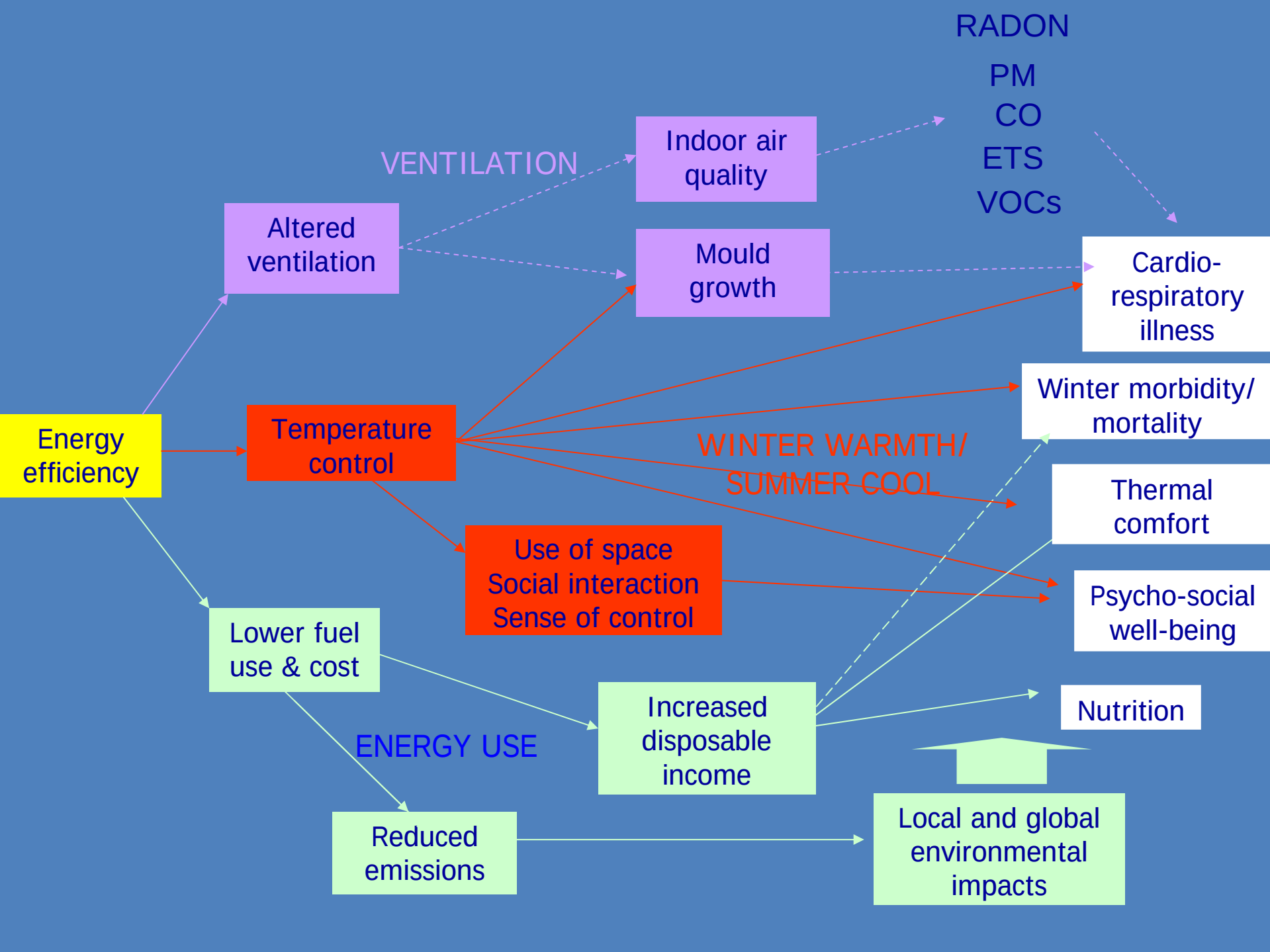
- Interventions of the type and scale needed to achieve 2030 GHG abatement targets
- Case studies from high- and low-income countries
- Health impact calculations based on comparative risk assessment approach (WHO)

Sectors

- Household energy
- Transport
- Electricity generation
- Food and agriculture

HOUSEHOLD ENERGY

Setting	Intervention	Time course	Principal exposures	Main outcomes
UK	Changes to: fabric, ventilation control, fuel source, temperature setting	2010, with and without intervention	Particles Radon ETS Mould Temperature (cold)	Cardio-respiratory disease Lung cancer Cold-related death
India	Improved (clean burning) cookstove programme	150 million stoves over 10 years	Indoor exposure to combustion products	ALRI (children) IHD COPD


RADON
PM
CO
ETS
VOCs
VENTILATION
Indoor air quality
Altered ventilation
Mould growth
Cardio-respiratory illness
Winter morbidity/ mortality
Energy efficiency
Temperature control
WINTER WARMTH/ SUMMER COOL
Thermal comfort
Use of space
Social interaction
Sense of control
Psycho-social well-being
Lower fuel use & cost
Increased disposable income
Nutrition
ENERGY USE
Reduced emissions
Local and global environmental impacts

… in Indian – replacing traditional with modern stoves

Traditional Biomass Stove

Per meal

~15-fold reduction in black carbon and other particles

~10-fold reduction in ozone precursors

~5-fold reduction in carbon monoxide

Gasifier Stove with Electric Blower (battery recharged with cell phone charger)

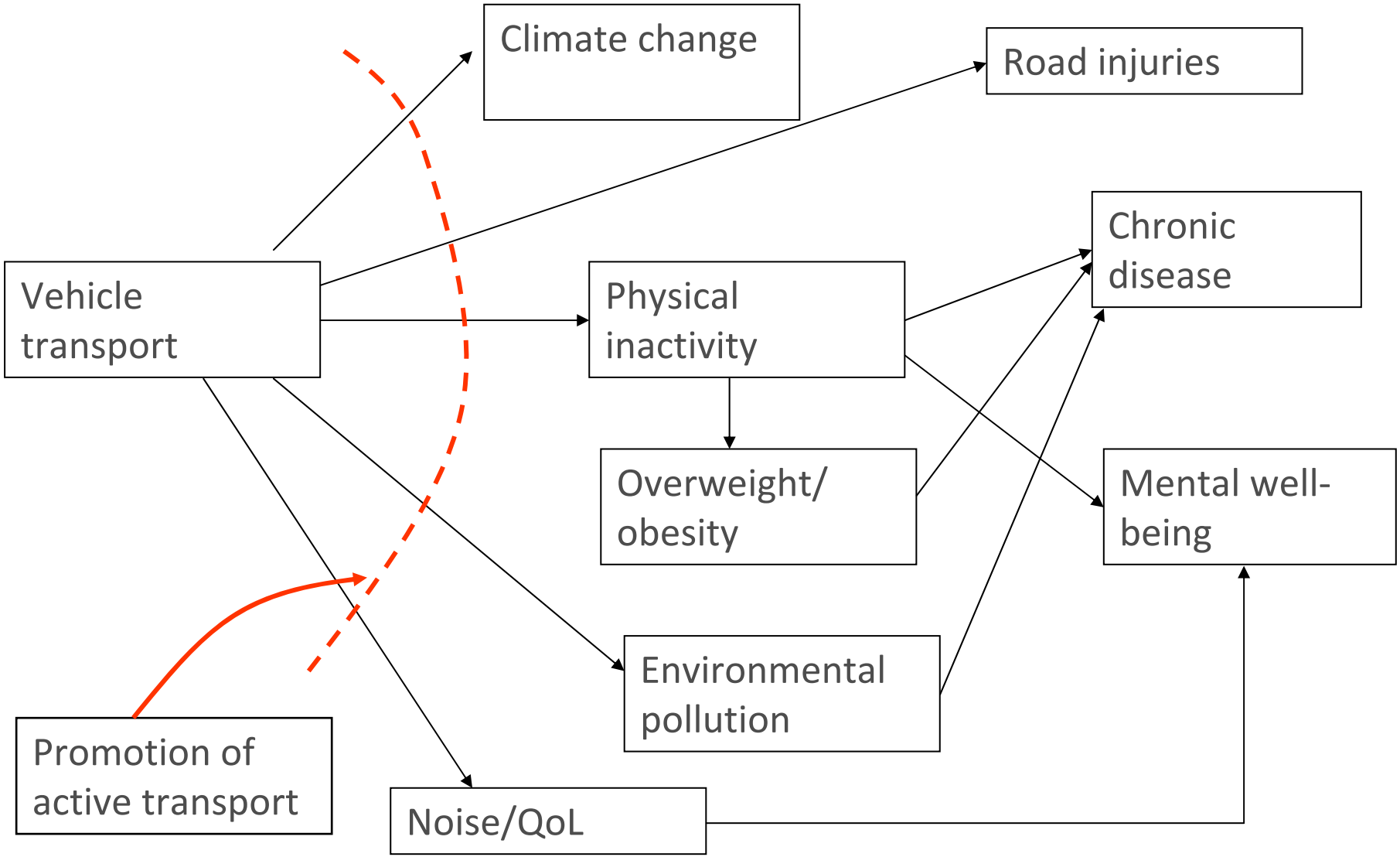
GHG benefits of Indian stove programme

- Reductions in black carbon, methane, ozone precursors could amount to the equivalent of 0.5-1.0 billion tonnes of CO_2 eq over the decade
- Because they are short lived (days), reductions in the emissions would immediately benefit climate, unlike CO2
- Cost <$50 per household every 5 years

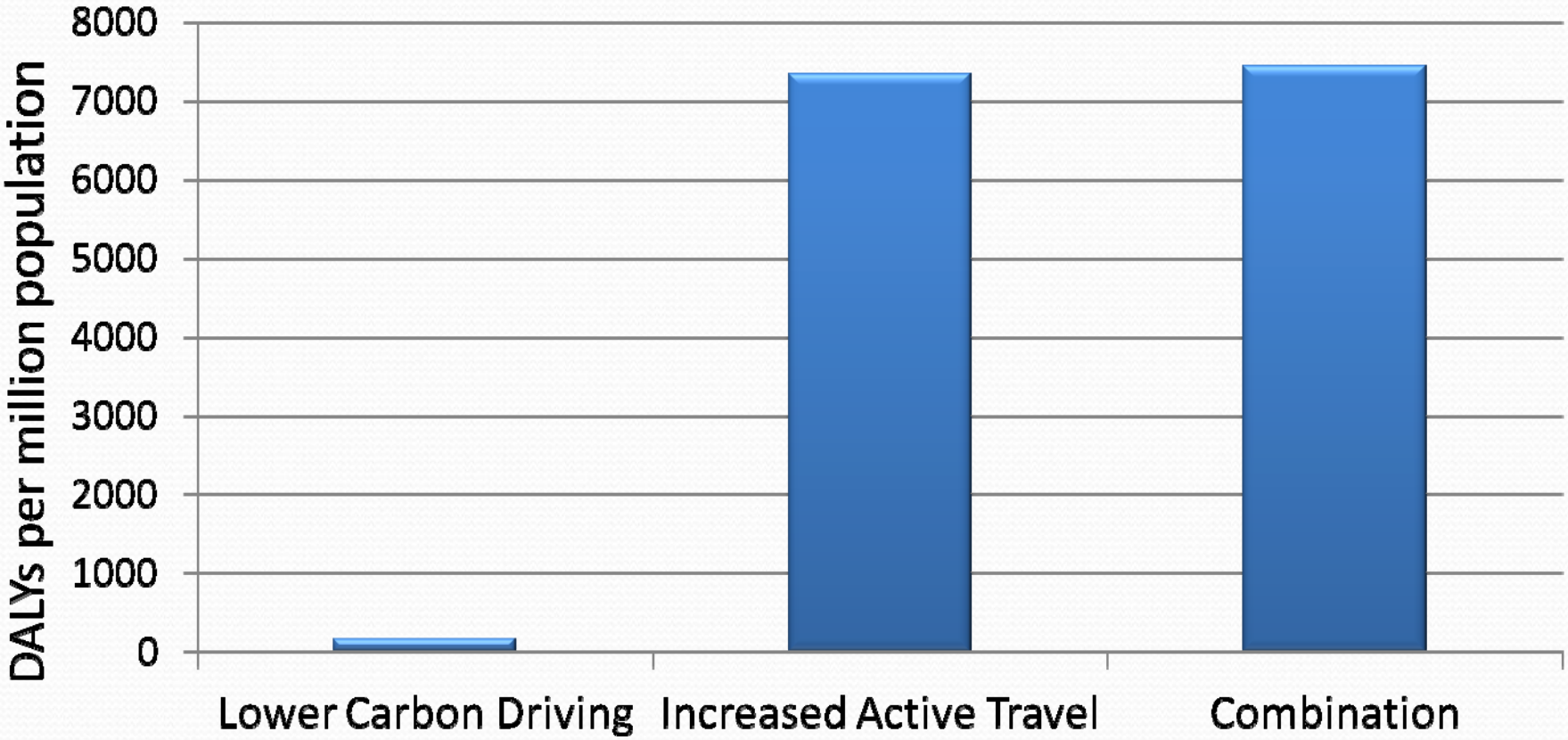
Impact per million of 2010 population in 1 year	UK household energy efficiency (combined improvements)	India programme of improved cookstoves*
DALYs saved	850	12,500
Deaths averted	90	990
Mt-CO_2 (CO_2e) saved	0.7	0.1 - 0.2

* Results based on comparison of 2010 population with and without full implementation of programme

Pathways linking transport and health



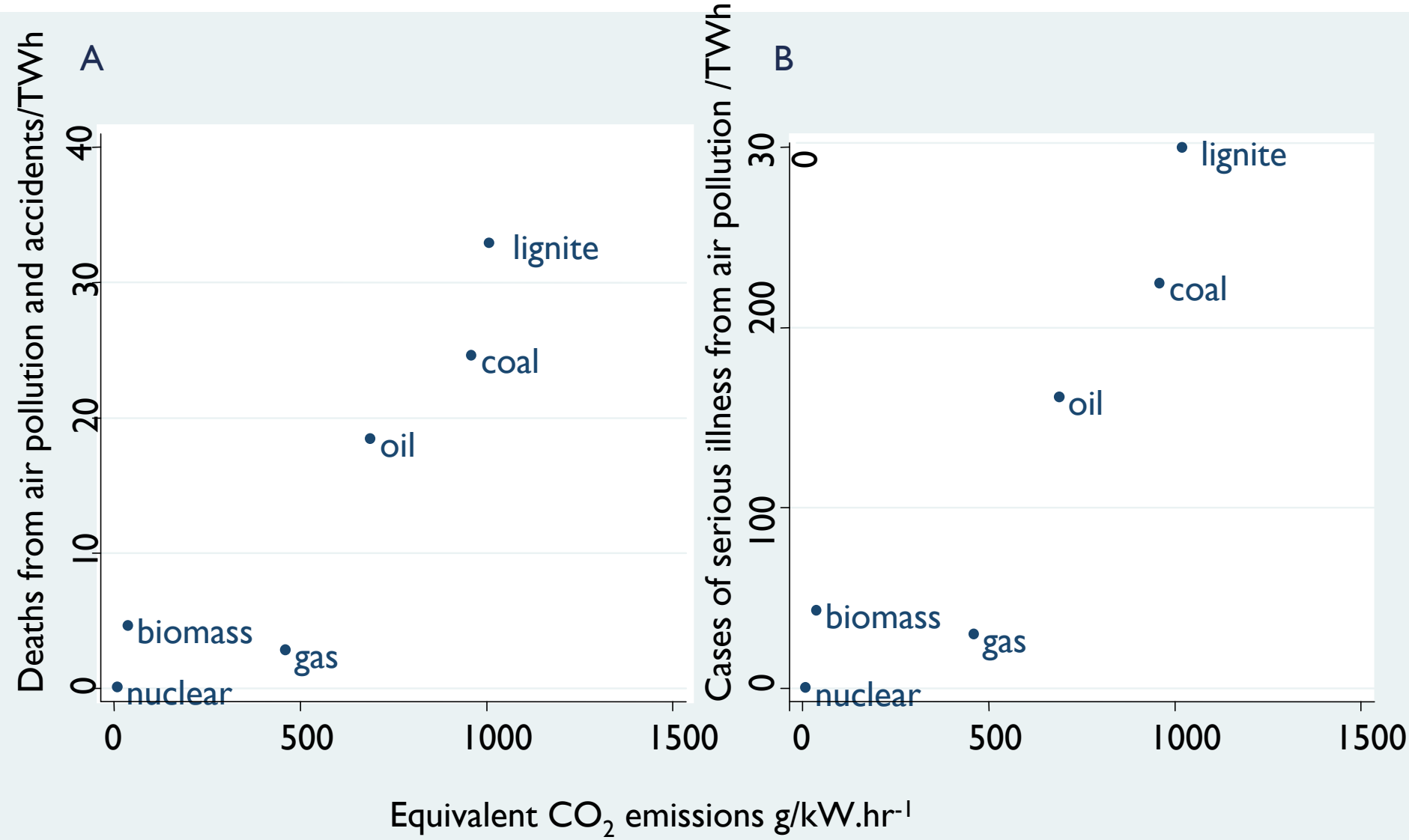
Health benefits in London: alternative scenarios



Health effects by disease (London)

	Change in disease burden	Change in premature deaths
Ischaemic heart disease	10-19%	1440-2210
Cerebrovascular disease	10-18%	870-1270
Dementia	7-8%	200-250
Breast cancer	12-13%	200-210
Road traffic crashes	19-39%	50-90

Air pollution impacts *vs* CO_2 emissions

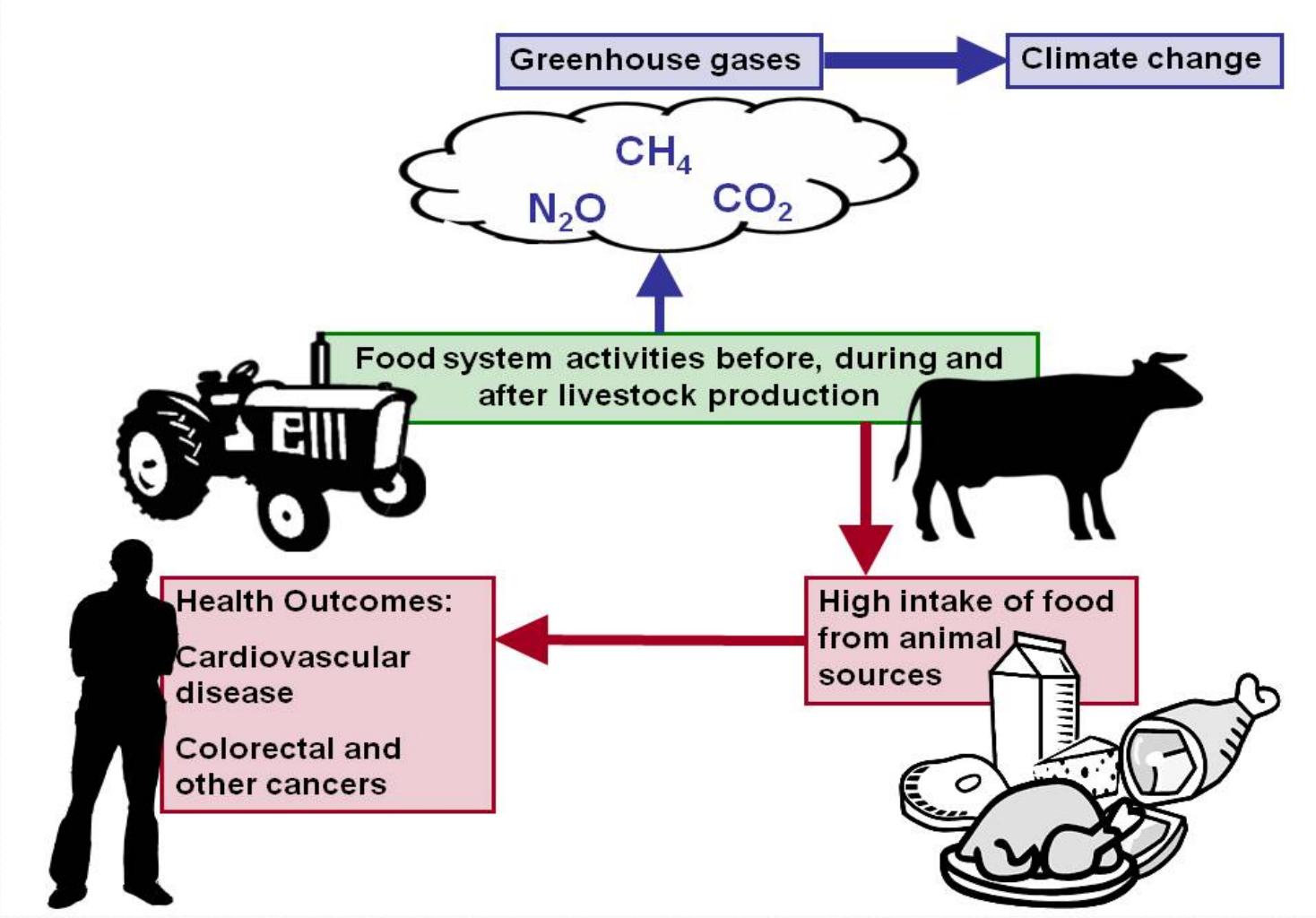


Source: Markandya A, Wilkinson P. *Lancet* 2007

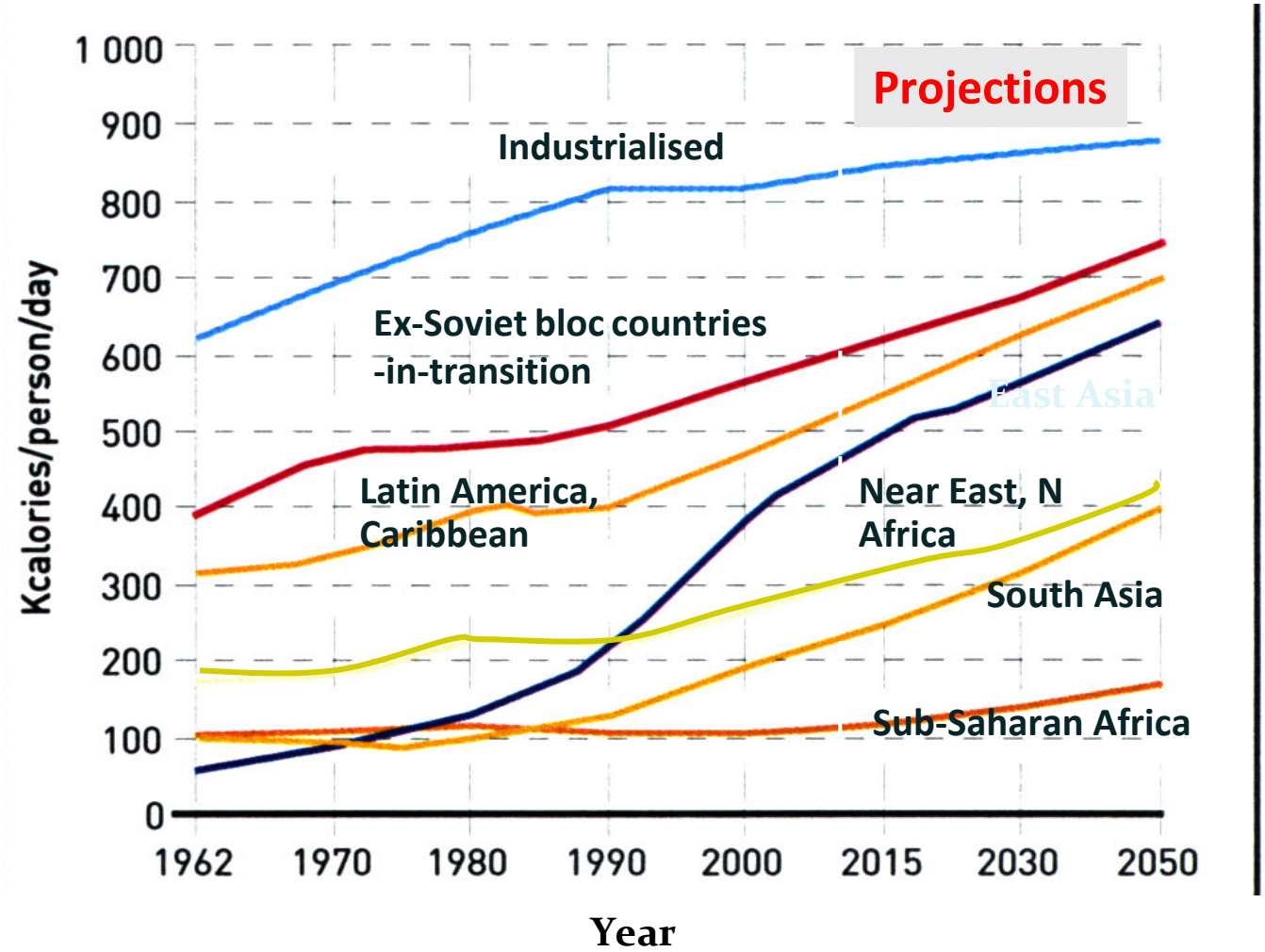
Food and Agriculture Sector

- Source of 10-12% of global greenhouse-gas emissions
- Change in land-use (eg. deforestation) significant contributor to global emissions (adds further 6-17%)
- Total emissions from sector set to rise by up to 50% by 2030
- Four-fifths (80%) of total emissions in sector arise from processes involved in livestock production

Pathways to health

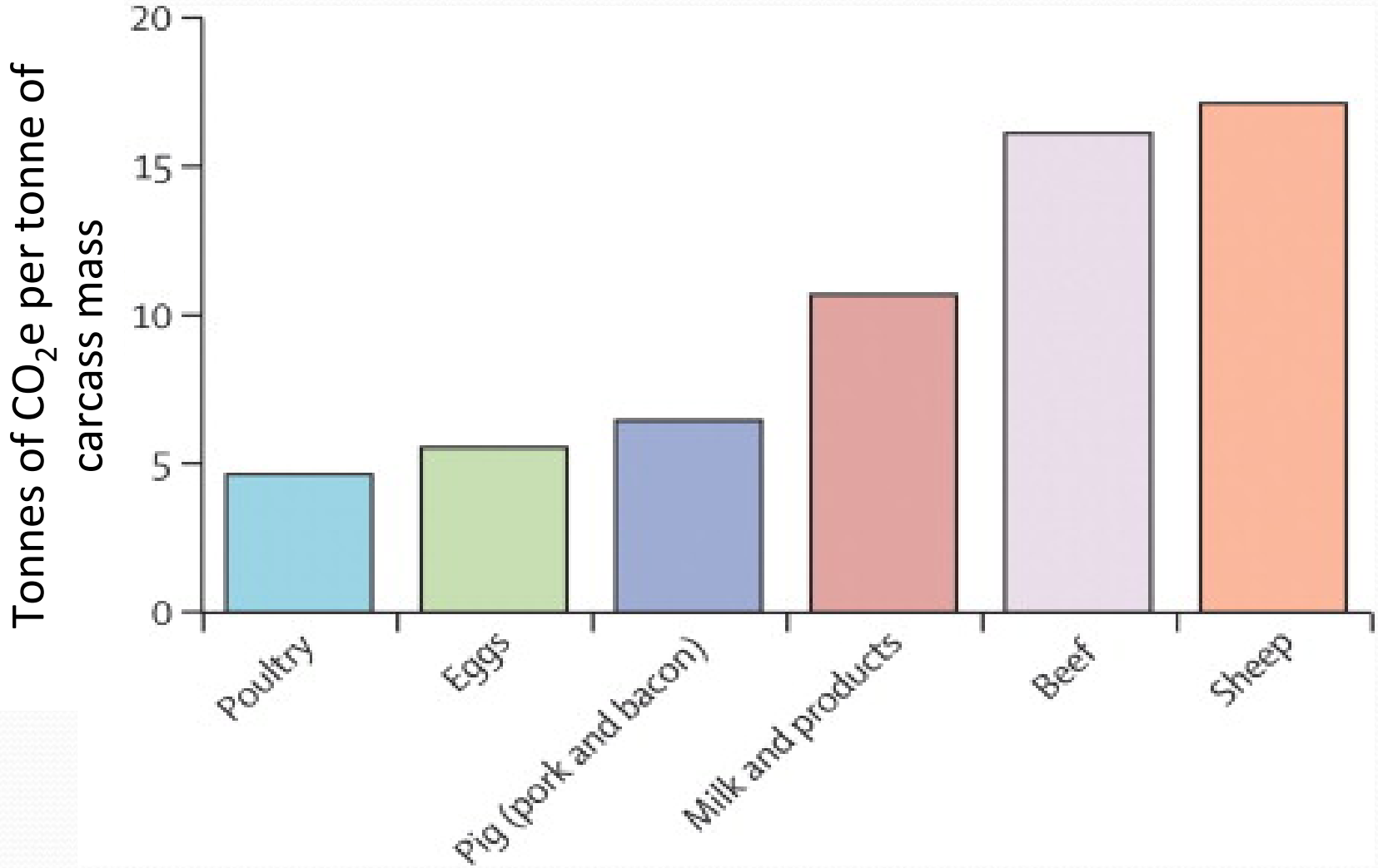


Recent and projected (to 2050) consumption of livestock products



Source: Livestock's Long Shadow: Environmental Issues and Options. Food and Agriculture Organization of the United Nations, Rome, 2007.

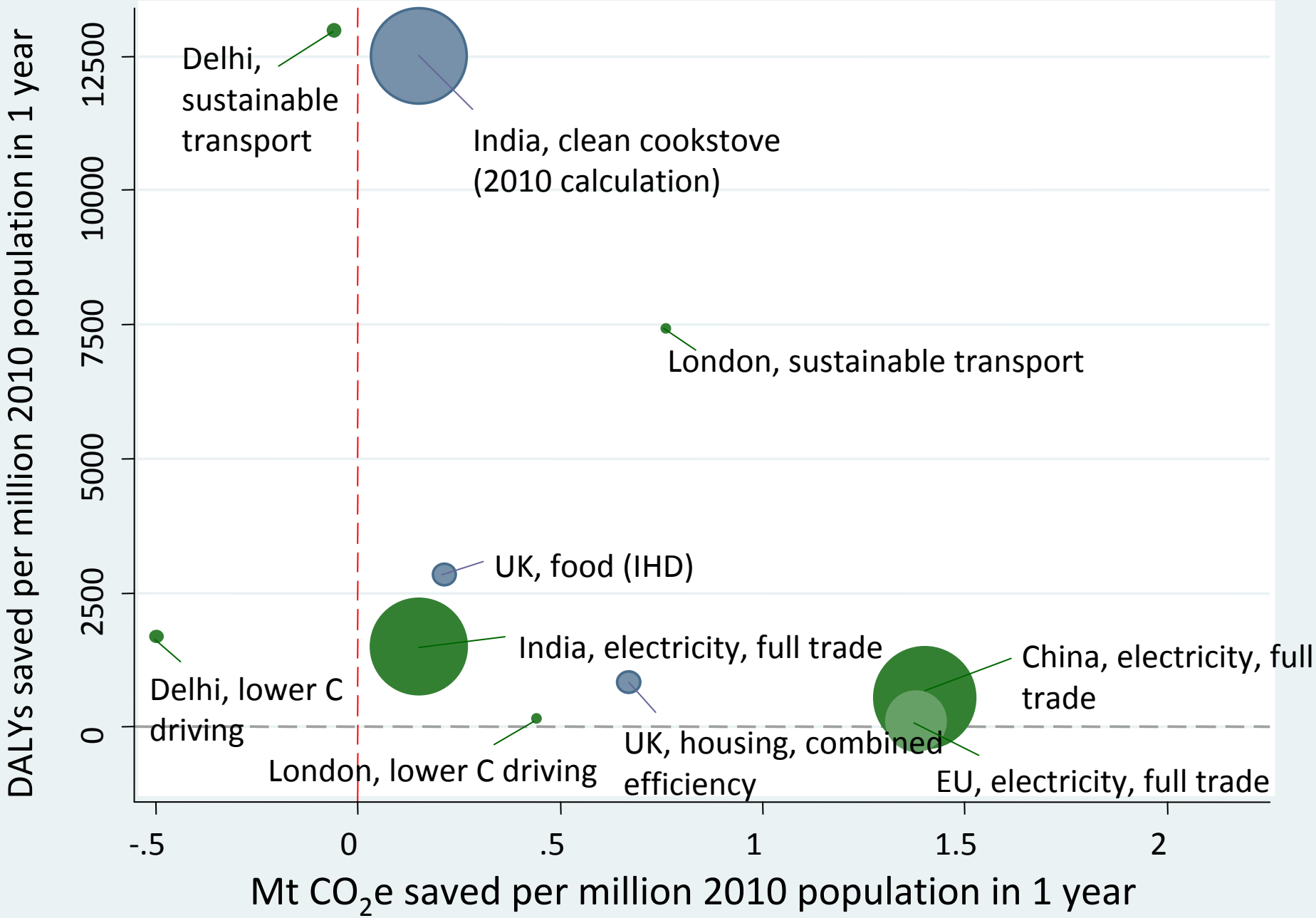
Estimates of total greenhouse-gas emissions for livestock products in the UK



Not including emissions resulting from global change in land use

Case studies: health effects

- Case studies: UK and the city of São Paulo, Brazil
- Assumed: 30% reduction in livestock production and animal source saturated fat consumption
- Outcome: substantial benefits from decreased IHD:
  - UK: ~15%↓ (~ 18,000 premature deaths averted)
  - São Paulo: ~16%↓ (~ 1000 premature deaths averted)


DALYs saved per million 2010 population in 1 year
12500
10000
7500
5000
2500
0
Delhi, sustainable transport
India, clean cookstove (2010 calculation)
London, sustainable transport
UK, food (IHD)
India, electricity, full trade
China, electricity, full trade
Delhi, lower C driving
London, lower C driving
UK, housing, combined efficiency
EU, electricity, full trade
-.5
0
.5
1
1.5
2
Mt CO_2e saved per million 2010 population in 1 year

Conclusions

- Adaptation to the evolving risks of climate change will be needed irrespective of mitigation measures
- There are potentially substantial dividends for health of a transition to a low carbon economy, which provides an added rationale for acceleration of mitigation actions
- Policies that address both public health and climate change are more attractive than focusing on either in isolation