Environmental change and health

Andy Haines

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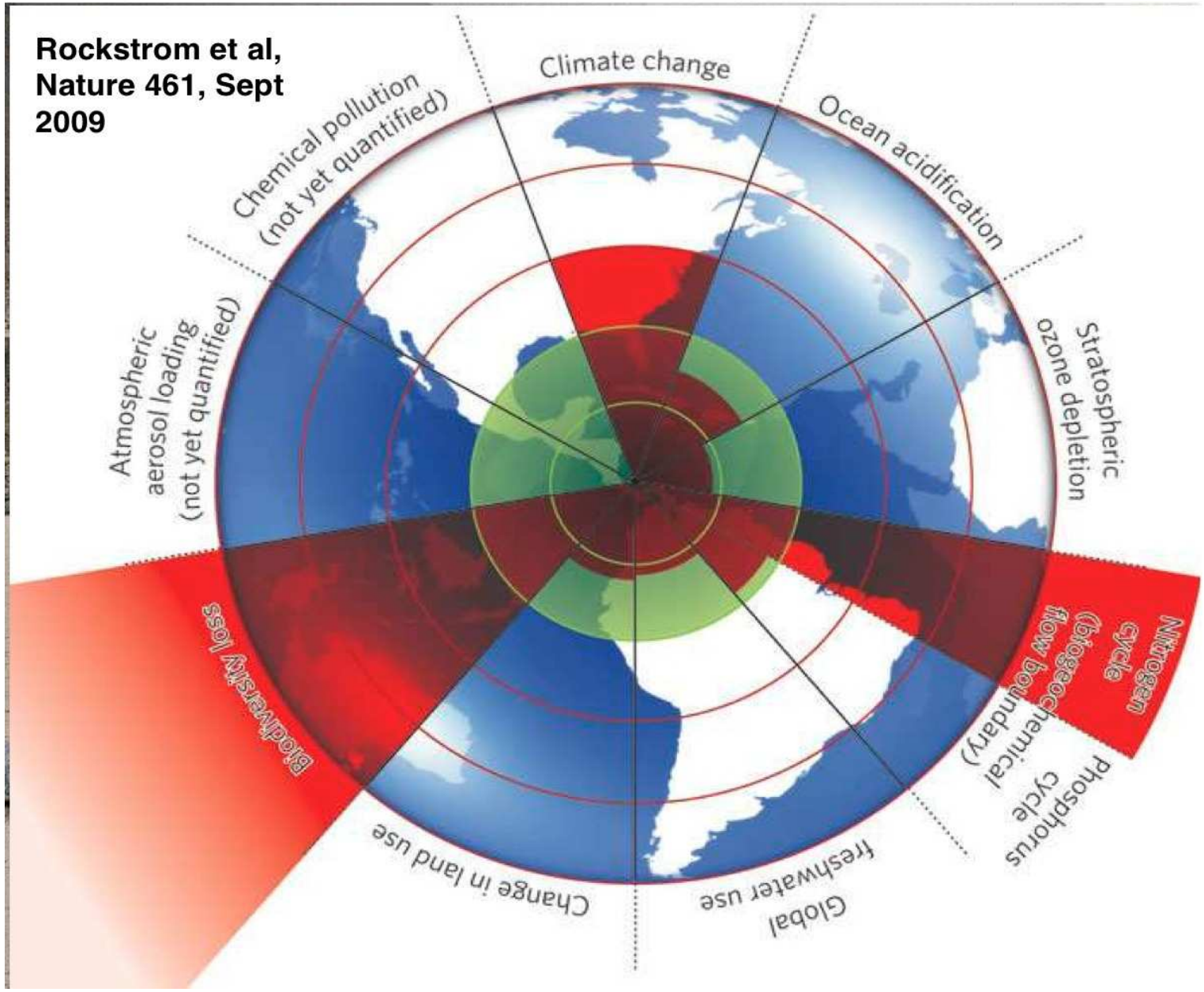
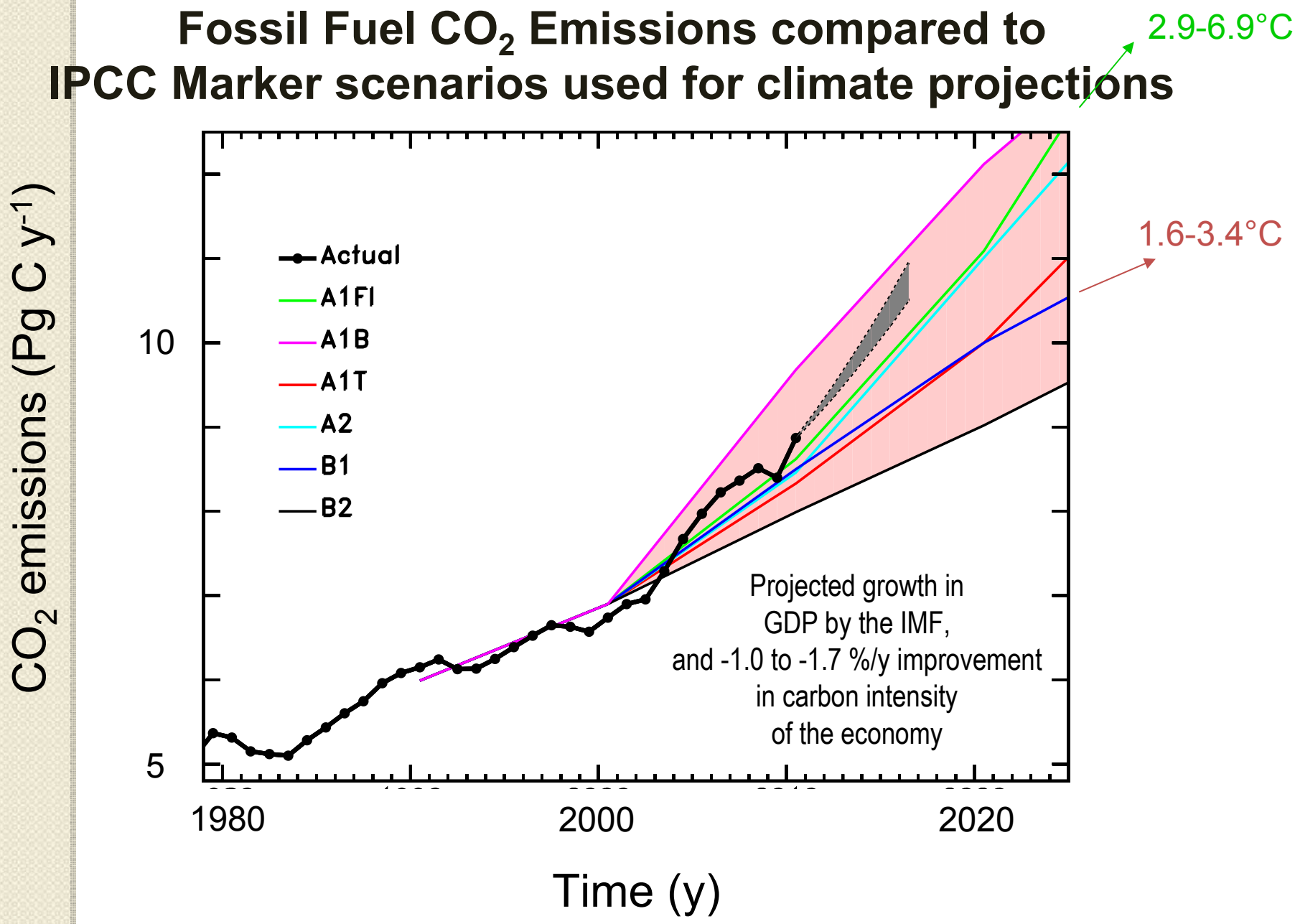
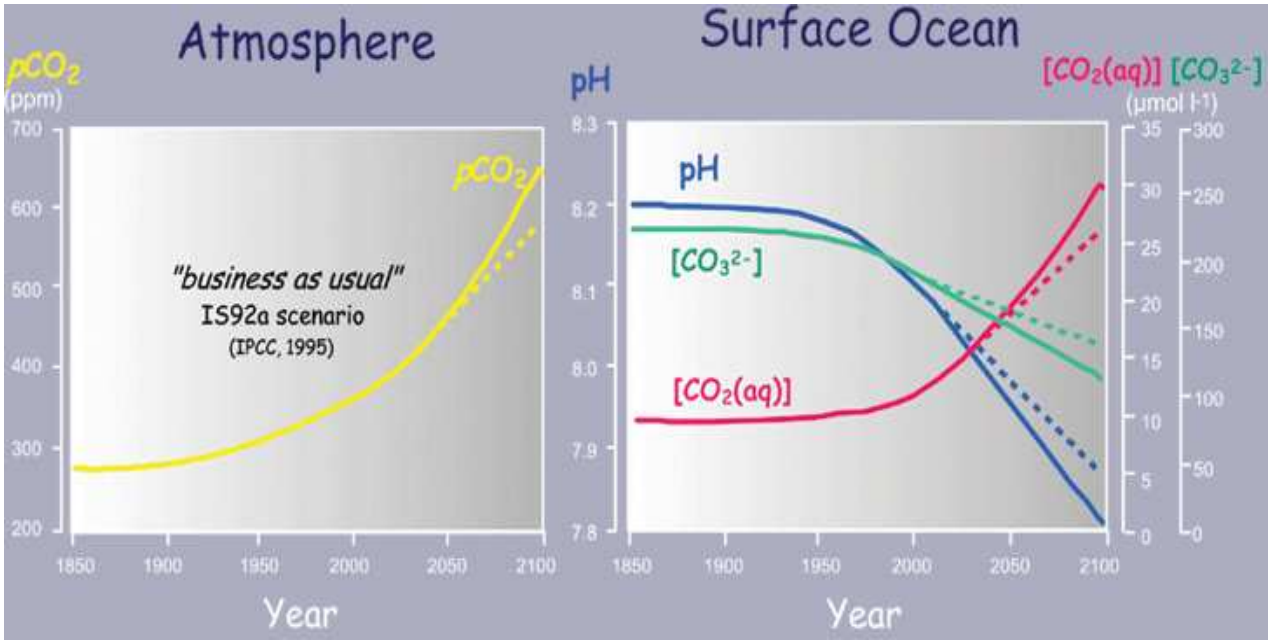


Fossil Fuel CO_2 Emissions compared to IPCC Marker scenarios used for climate projections



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

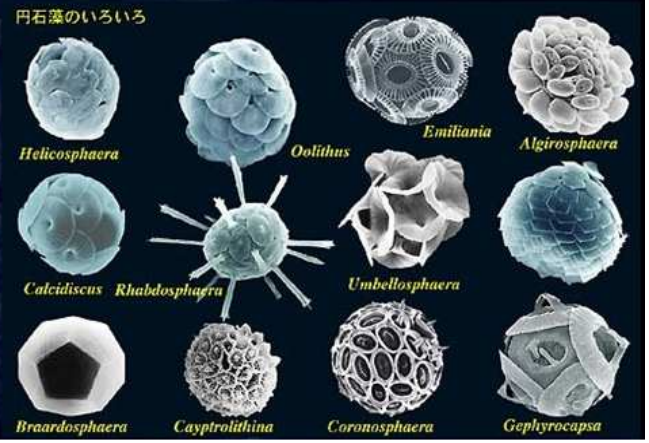
Ocean acidification – a threat to marine biodiversity



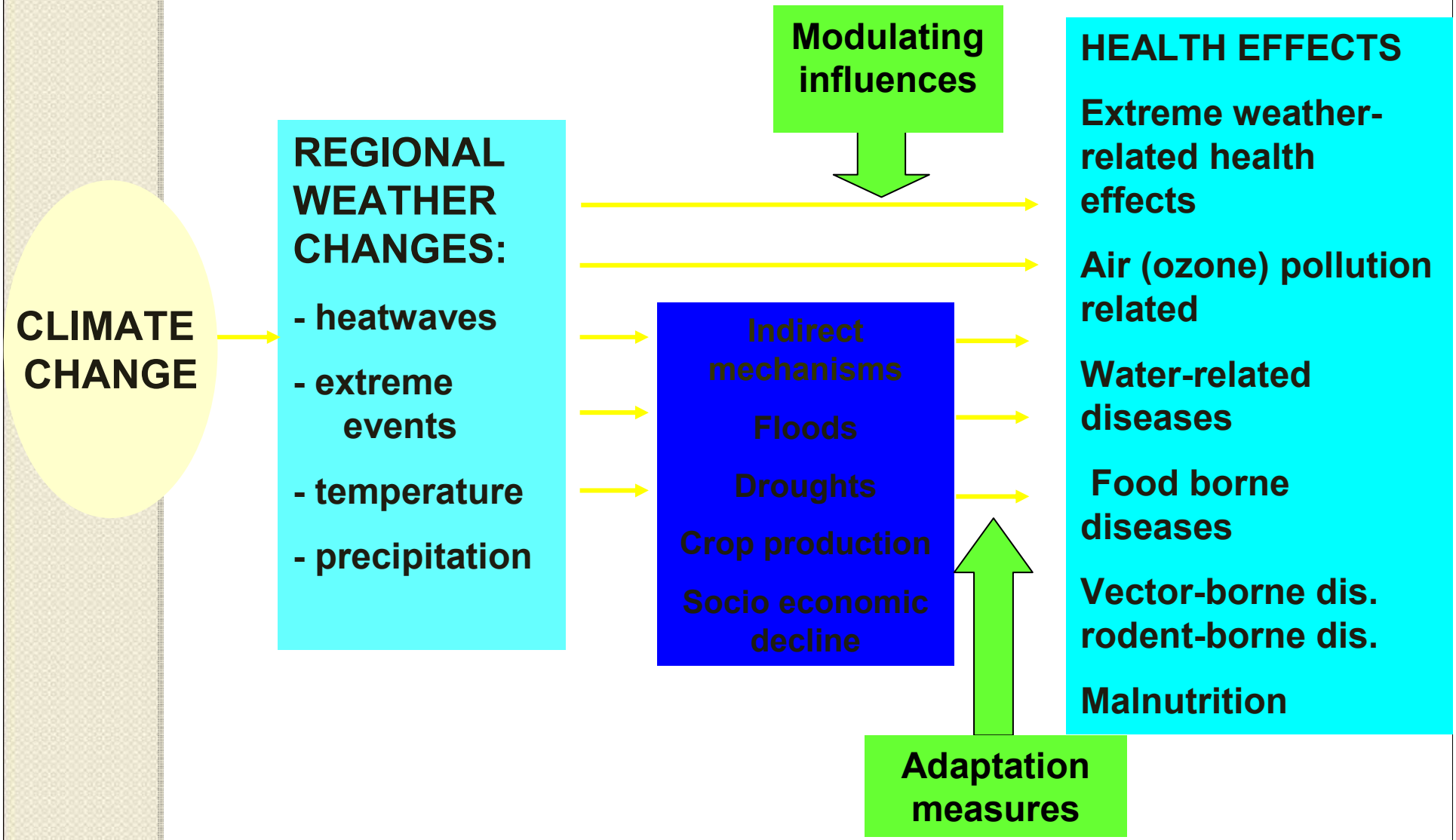
- CO_2 is corrosive to the shells and skeletons of many marine organisms

Corals

Calcareous plankton

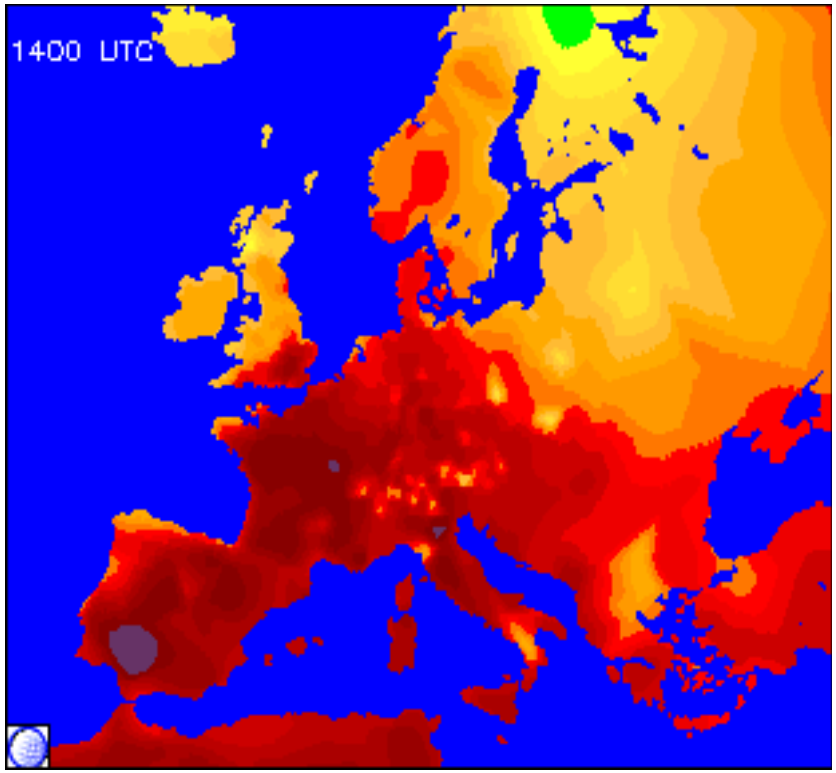


Pathways by which climate change may affect health outcomes (Haines and Patz 2003)



France, August 2003

~14800 deaths (30,000+ in Europe)

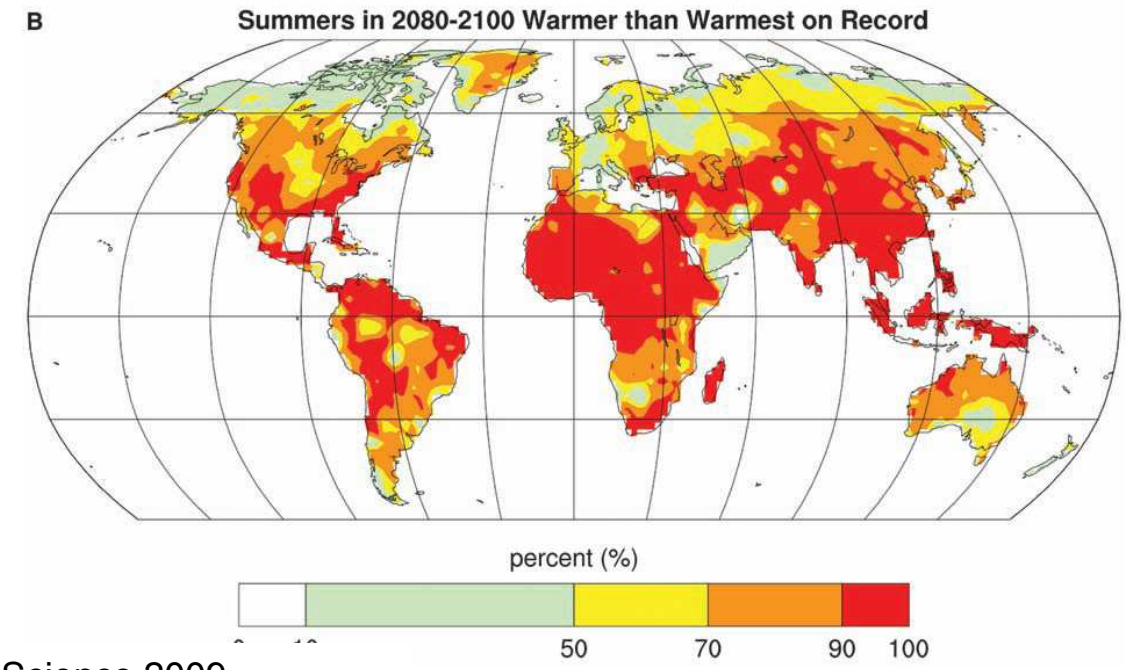


Temperature distribution across Europe on 10 August 2003 at 1500hrs

Exceeding the adaptability limit to climate change due to heat stress

Sherwood and Huber PNAS 2010

'....It would begin to occur with global-mean warming of about on 7 °C, calling the habitability of some regions into question'



D.S.Battisti and R.L. Naylor . Science 2009

Diarrheal disease and rainfall

- Global overview of 36 published reports from LMICs from 1954-2000 (Lloyd, Kovats, Armstrong. Climate Res 2007)
- 4% (1-7%) increase in diarrhoea incidence in children aged <5 per 10 mm /month decrease in rainfall
- Water scarcity is growing - by 2025 more than half of the world's population is projected to live under conditions of severe water stress

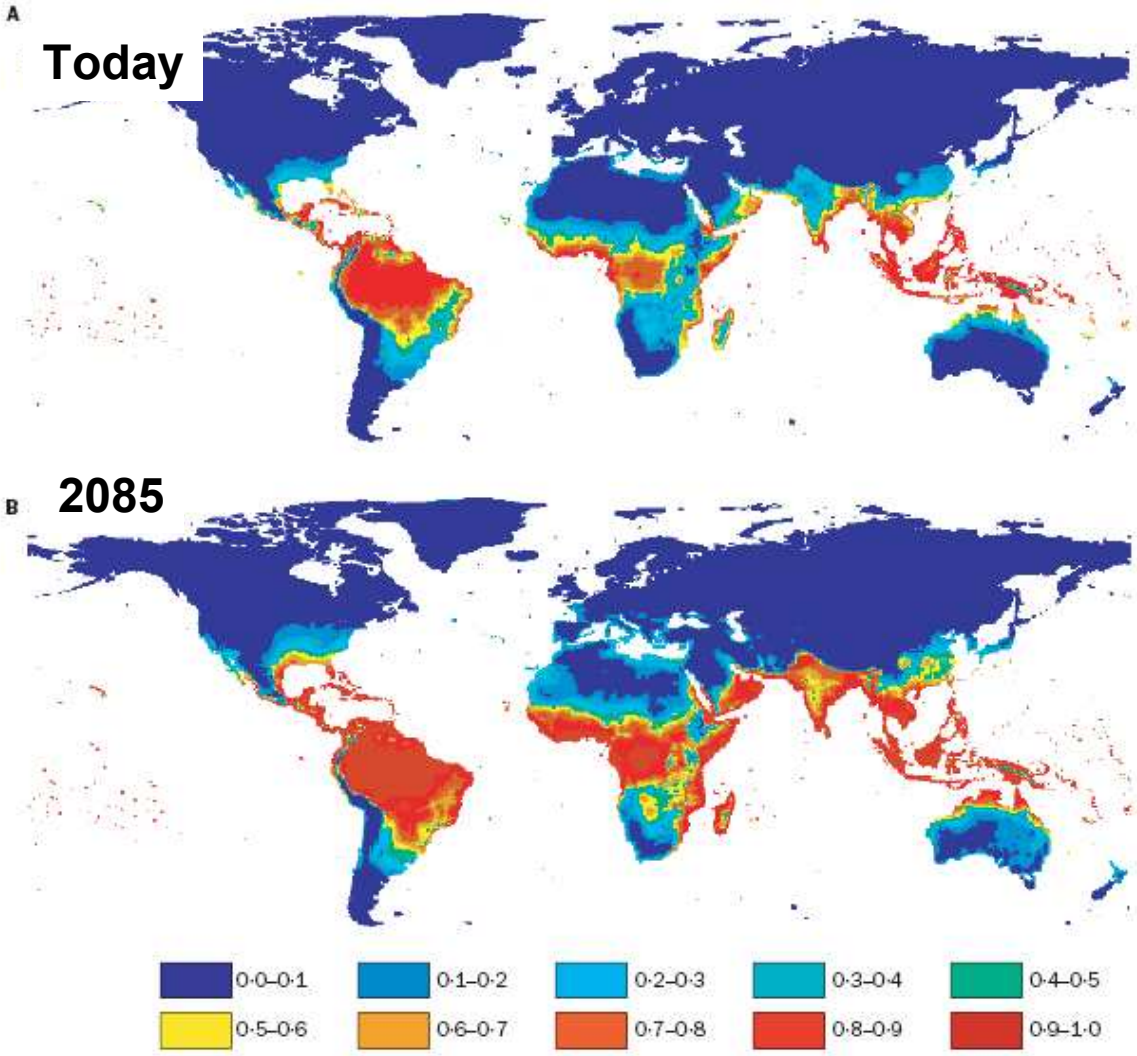
Impacts of climate change on malnutrition

Increased numbers of stunted children

Lloyd S, Kovats RS, Chalabi Z (2011)

Region	Millions of additional children with stunting in 2050 due to climate change	
	NCAR climate scenario	CSIRO climate scenario
South Asia	7	6
Sub-Saharan Africa	9	9

Dengue



Hales et al. 2002

- Global distribution of dengue related to vapour pressure, a measure of humidity
- By 2085 it is estimated 50-60% of the world's population at risk
- Compared with 35% without climate

Many millions more people are projected to be flooded every year due to sea-level rise by the 2080s

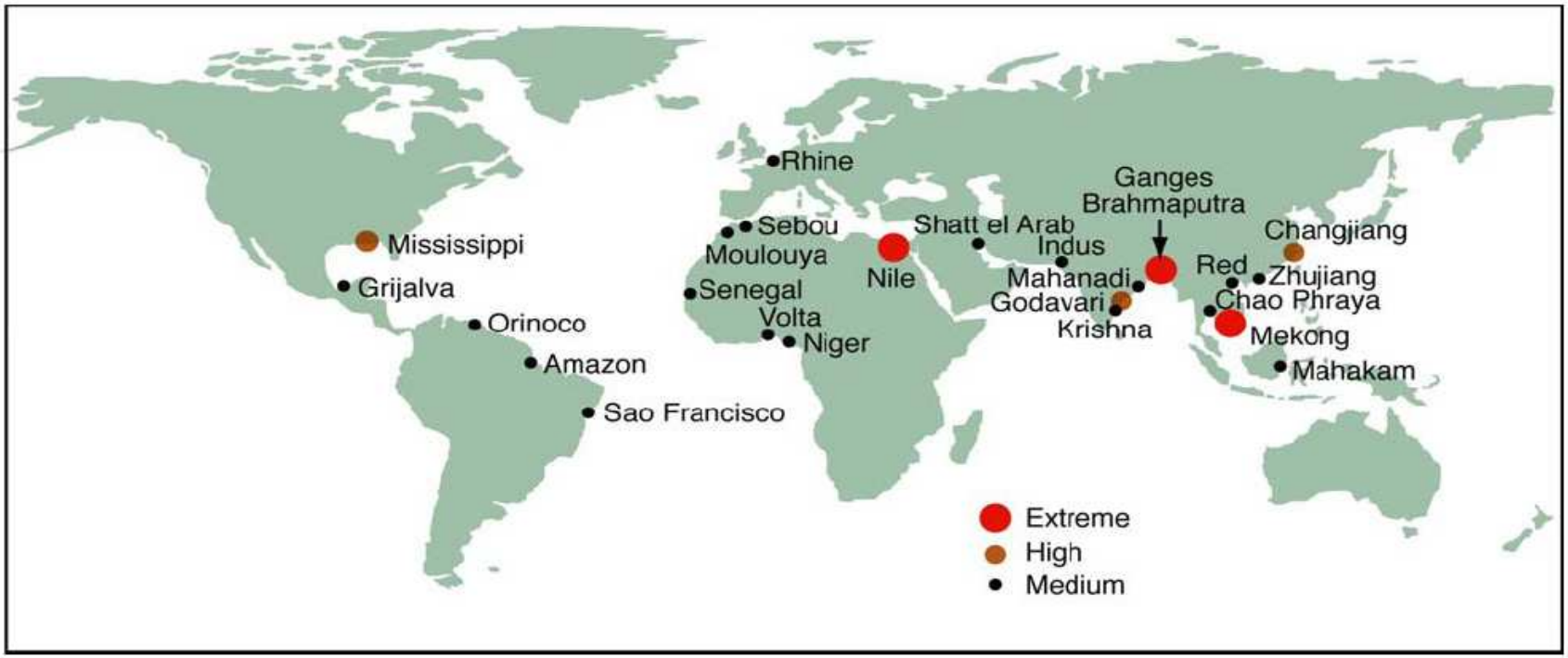


Figure TS-8: Relative vulnerability of coastal deltas as indicated by the indicative population potentially displaced by current sea level trends to 2050 (Extreme ≥ 1 million; high =1 million – 50,000; medium 50,000 – 5000 [B6.3]. Climate change would exacerbate these impacts.

Source: IPCC Wg II, TSI 2007.

2010 – a harbinger of things to come?

Pakistan floods ~ 20 m affected

Chinese floods ~ 12m displaced

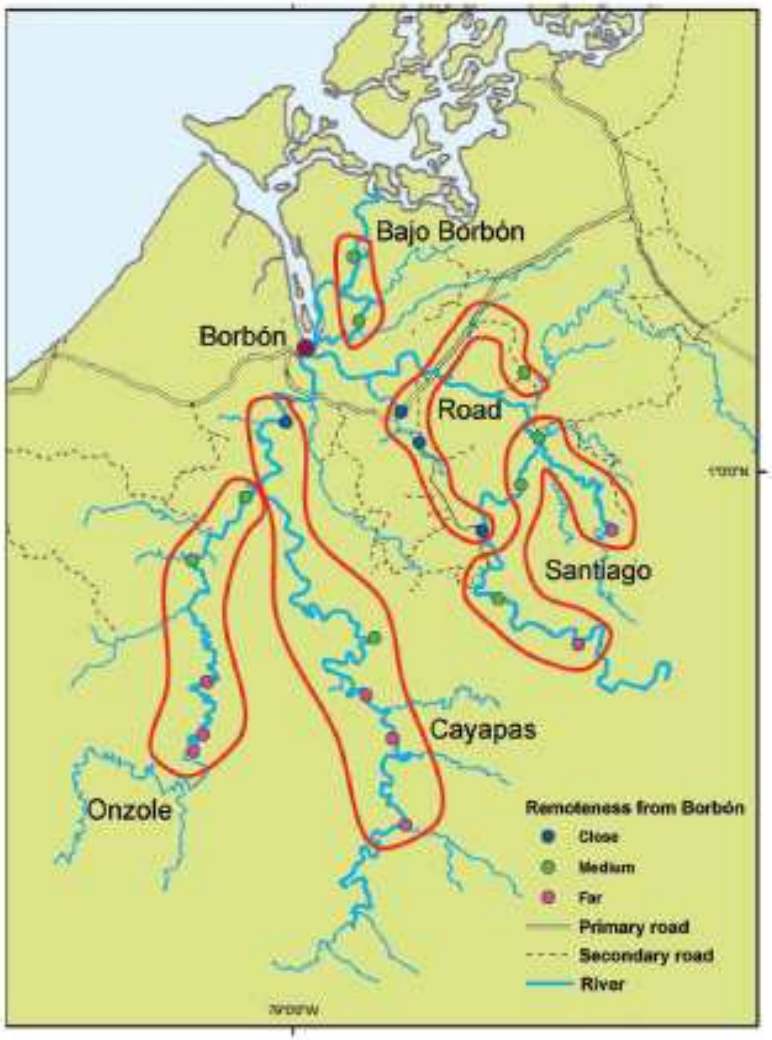
Russian drought and fires –wheat harvest down ~ 30%

56,000 extra deaths in Moscow and Western Russia

***(Munich Re* estimate)**

Record temperatures in 17 countries.

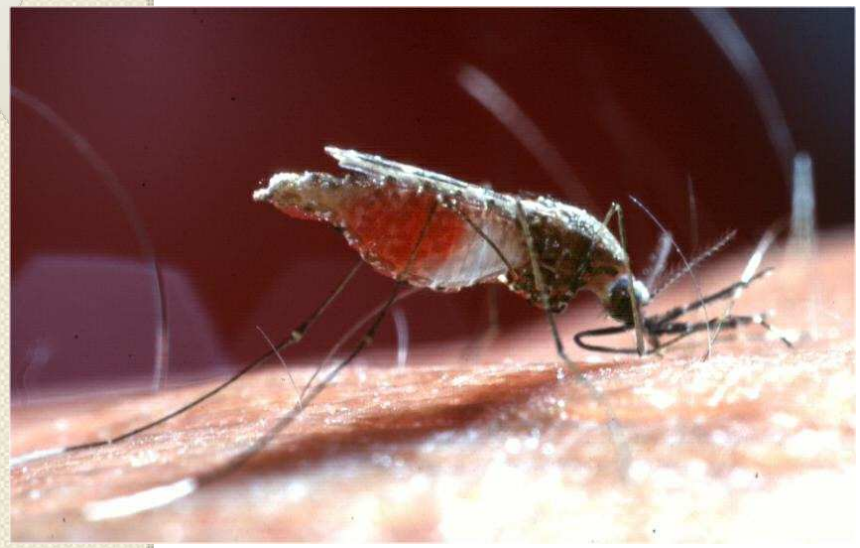
How new roads affect diarrhoeal disease transmission (Eisenberg et al 2006)



Study site in Ecuador

- Case: control study
- RR 2.0 for all cause diarrhoea found in villages near new road
- True for viral, bacterial & protozoan enteric pathogens
- Related to deforestation created during road building & increased movement of people.

Deforestation has created new habitats for Anopheles darlingi in Amazonas



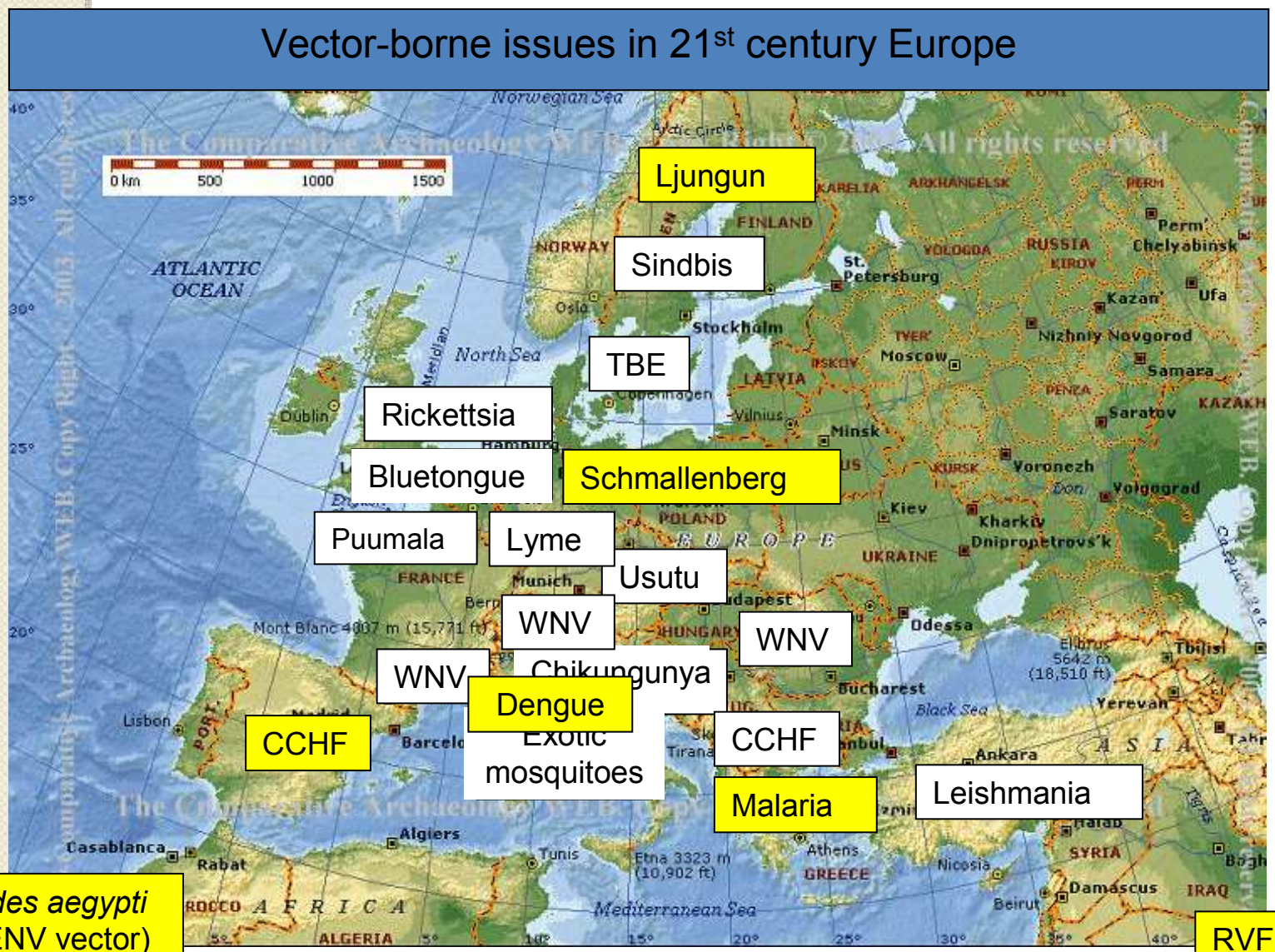
An. darlingi

Major malaria epidemics in South America
Cleared lands are more sunlit and prone to the formation of puddles with more neutral pH which favours larval development

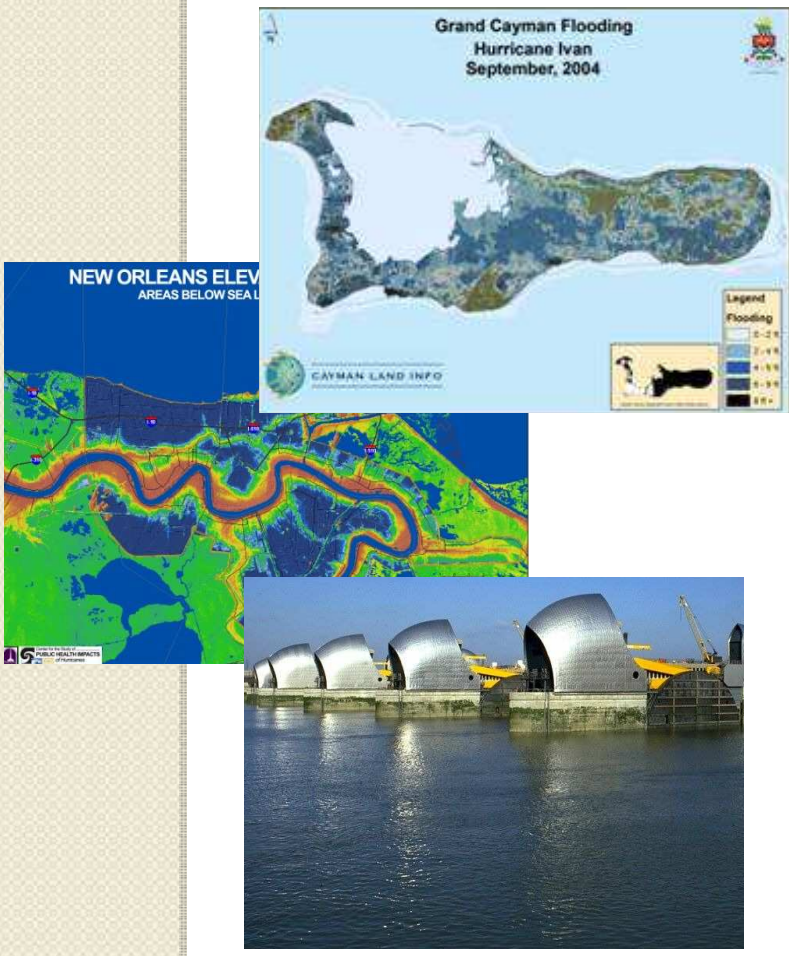
Deforested sites had an A. darlingi biting rate that was more than 278 times higher than for areas that were forested. (Vittor , Patz et al 2006)

Changing face of VBD in 21st century Europe

Medlock J Health Protection Agency



Are there limits to how much we can adapt?…physical, behavioural and technological limits



- Physical limits: small low lying islands e.g. Cayman Islands
- Behavioural limits: influence where we live and why, e.g. New Orleans
- Technological limits: e.g. to the flood defences such as Thames Barrier, London

Conclusions

- Investment needed in research linking environmental and health datasets
- Health effects of adaptation strategies must be assessed
- Health systems need to anticipate and respond to changing patterns of disease from environmental change

Thanks to Prof Steve Lindsay, Dr Jolyon Medlock