Climate Change, Human Health, and the Future of the Developing World

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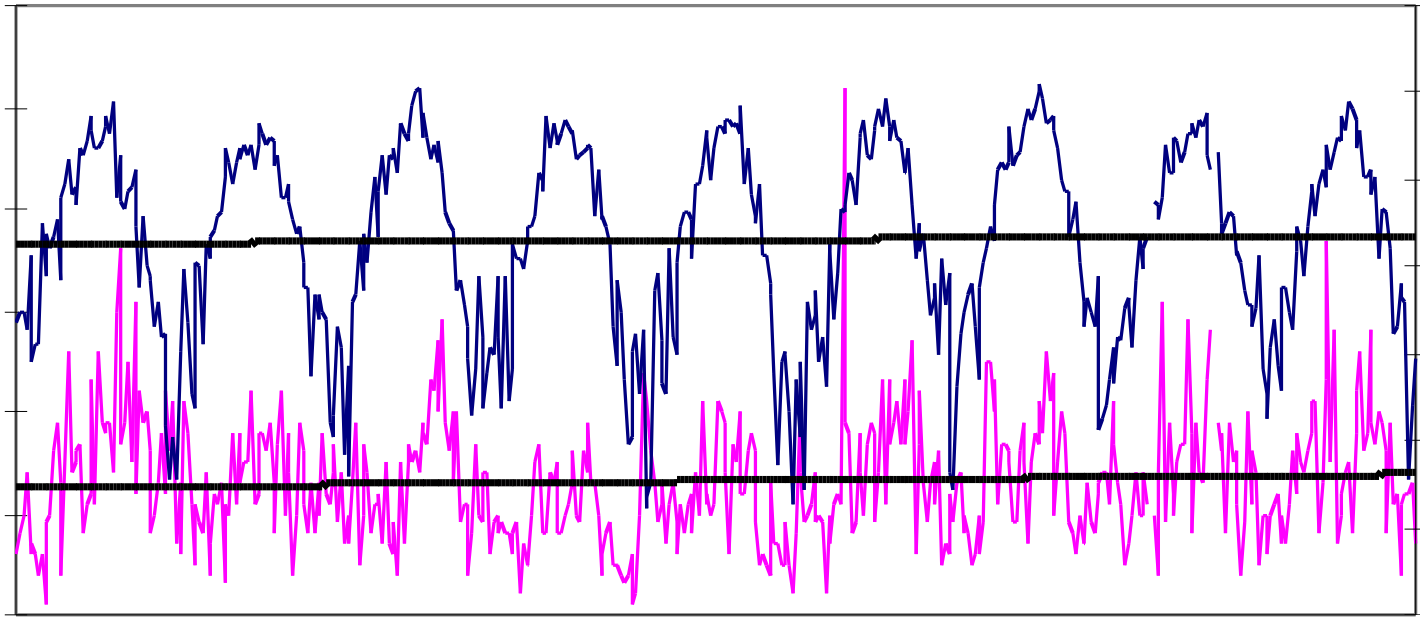
Renewing the Campus

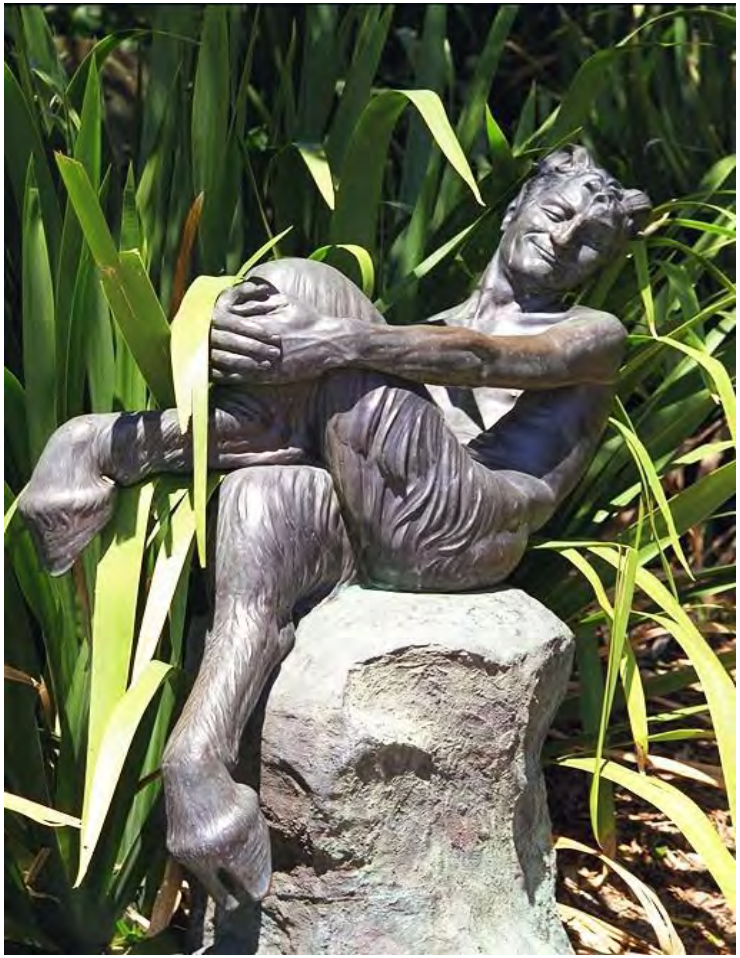
9 October 2009

Seasonal Patterns of Salmonella, 1992-2000



Fleury et al. 2006

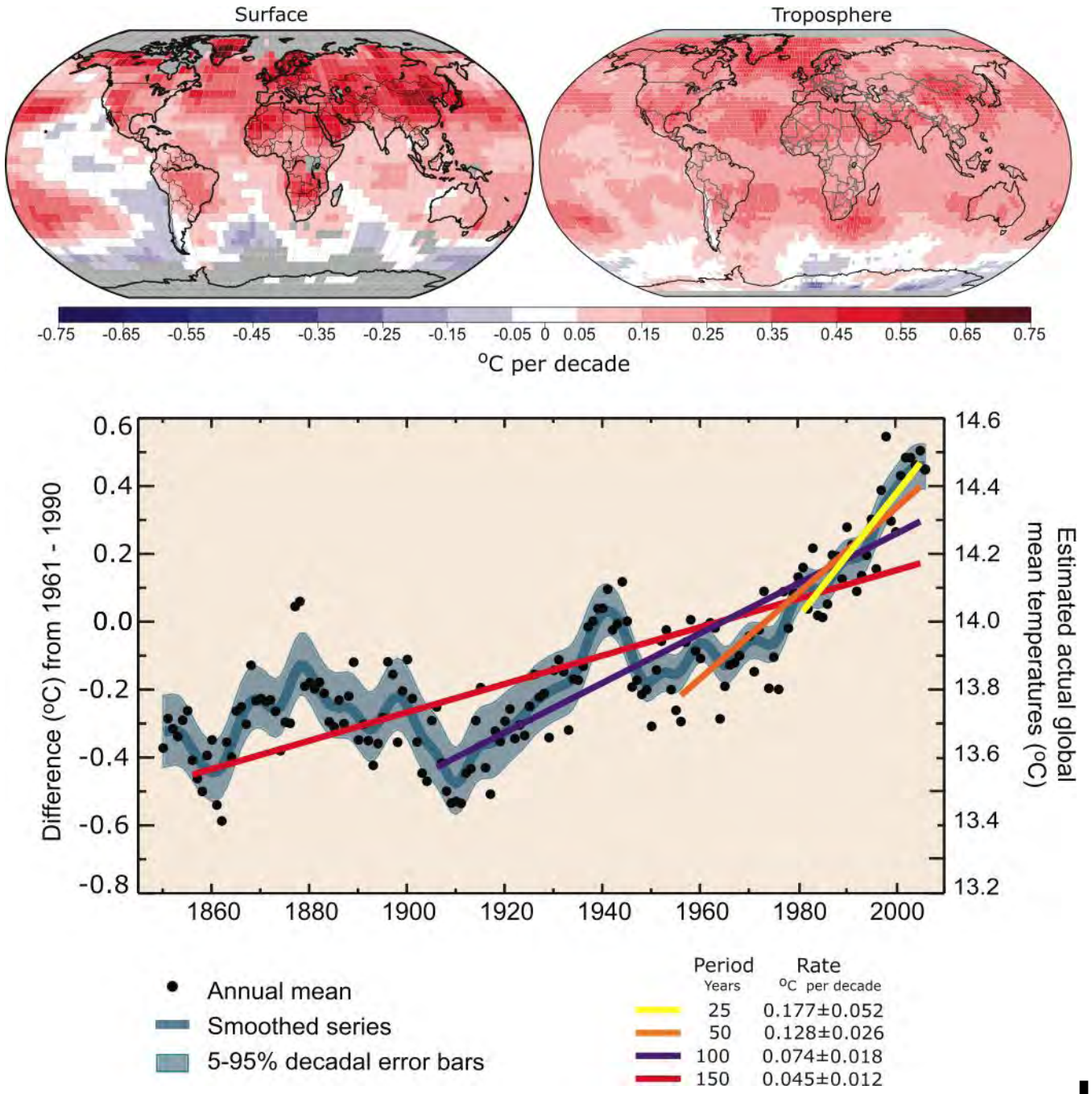
Climate: What You Expect



Weather:
What you get

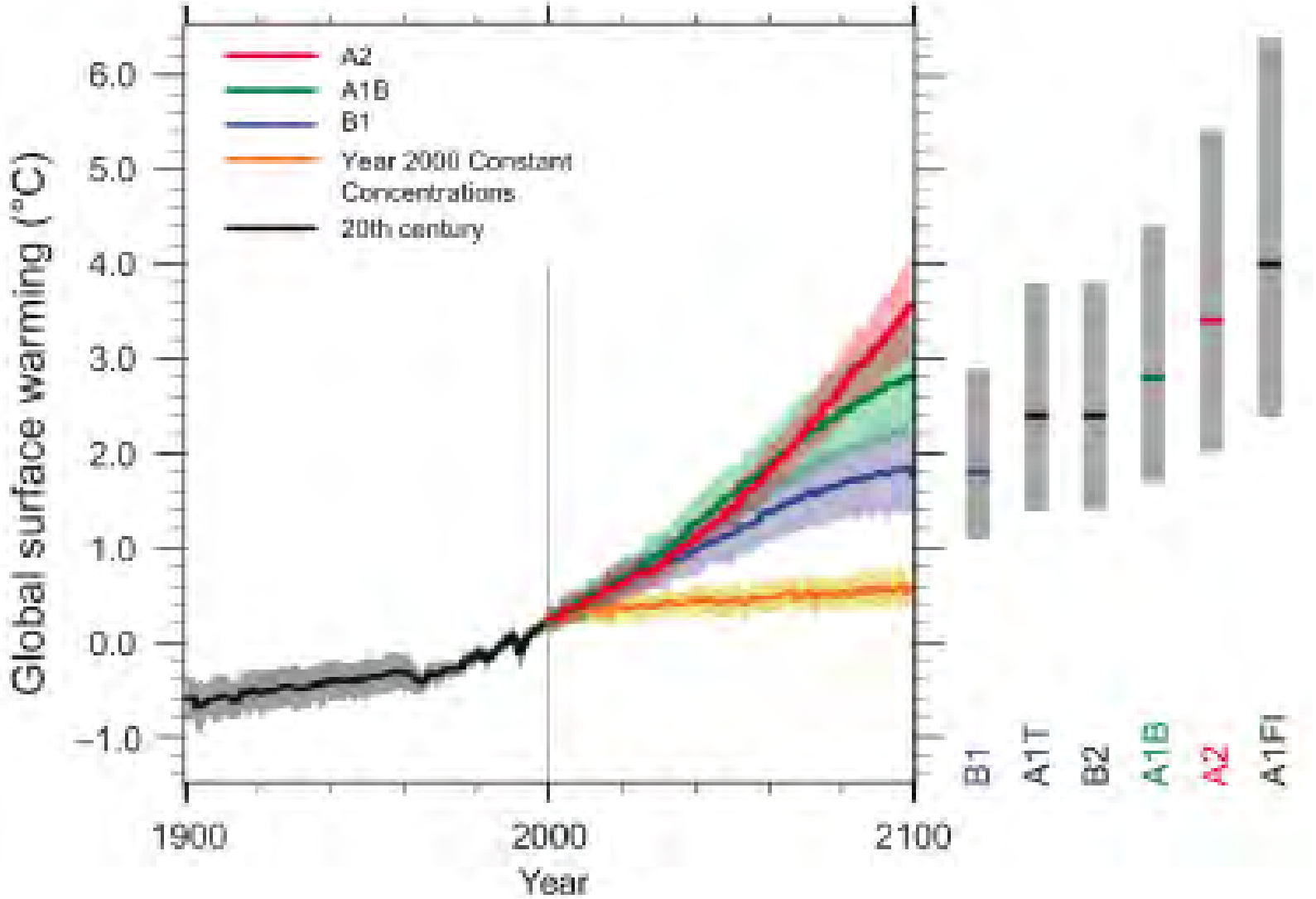
Climate

- Variability
  - Short-term fluctuations around the average weather
  - Includes ENSO (El Nino - Southern Oscillation)
- Change
  - Operates over decades or longer
  - General Circulation Models (GCMs) / Earth System Models (ESMs)
    - Scenarios, NOT predictions
    - Downscaling / spatial issues


Surface
Troposphere
-0.75 -0.65 -0.55 -0.45 -0.35 -0.25 -0.15 -0.05 0 0.05 0.15 0.25 0.35 0.45 0.55 0.65 0.75
°C per decade
Difference (°C) from 1961 - 1990
Estimated actual global mean temperatures (°C)
0.6 0.4 0.2 0.0 -0.2 -0.4 -0.6 -0.8
14.6 14.4 14.2 14.0 13.8 13.6 13.4 13.2
1860 1880 1900 1920 1940 1960 1980 2000
Annual mean
Smoothed series
5-95% decadal error bars
Period Years
Rate °C per decade
25 0.177±0.052
50 0.128±0.026
100 0.074±0.018
150 0.045±0.012

IPCC 2007

Projected Climate Change



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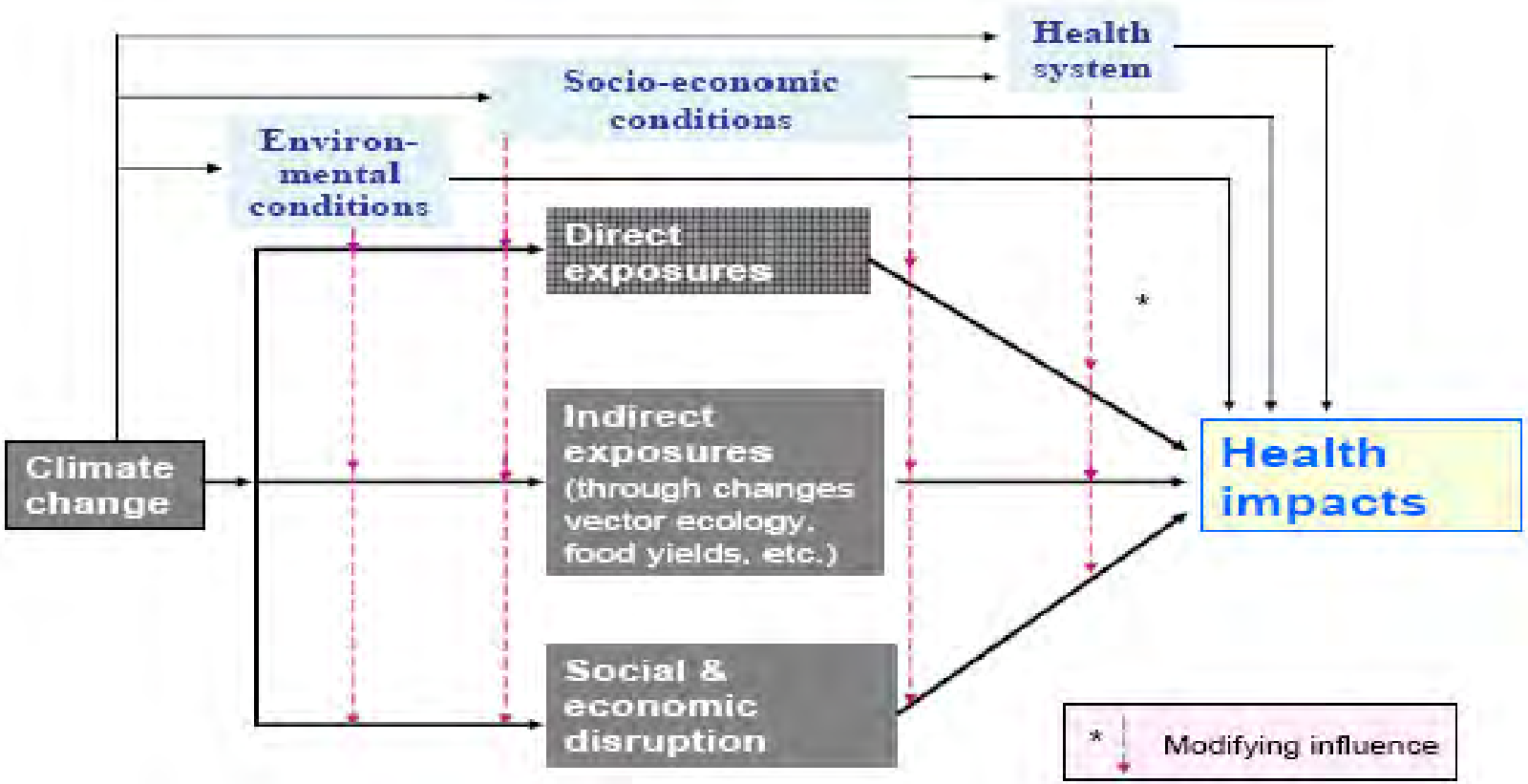
Pathways by Which Climate Change May Affect Human Health



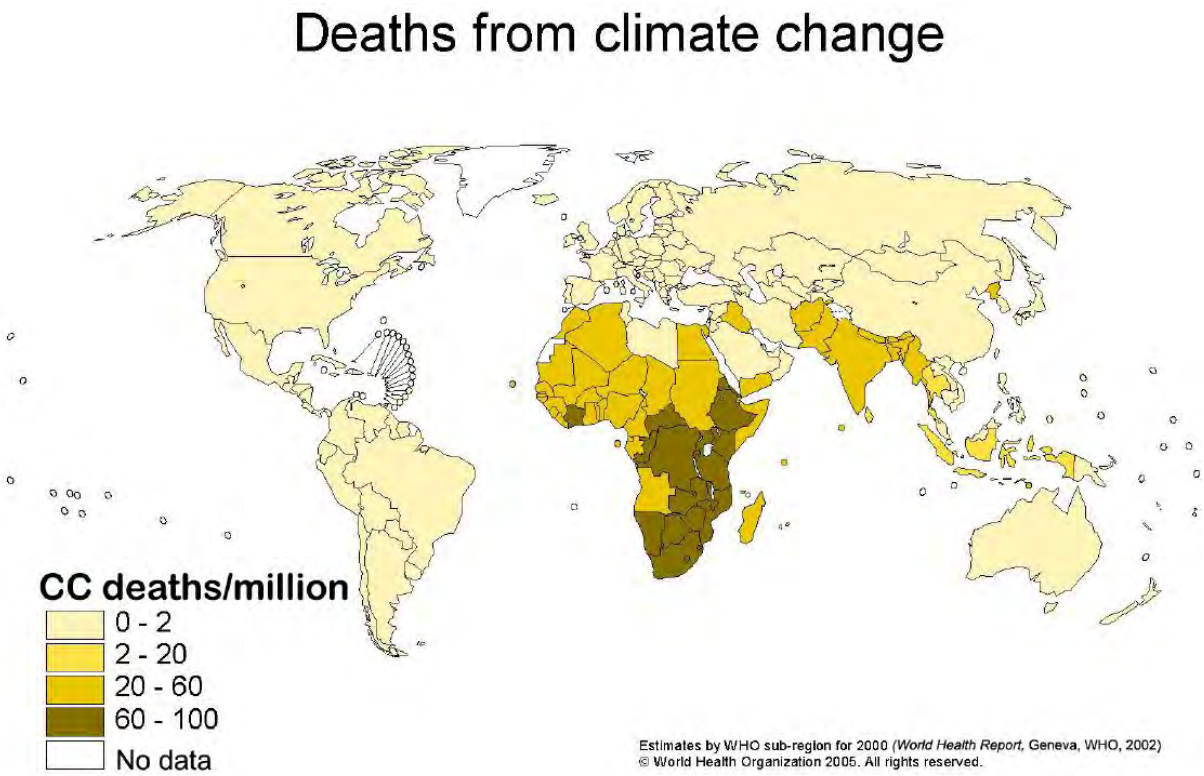
IPCC 2007

Multiple Factors Affect Climate-Sensitive Health Outcomes

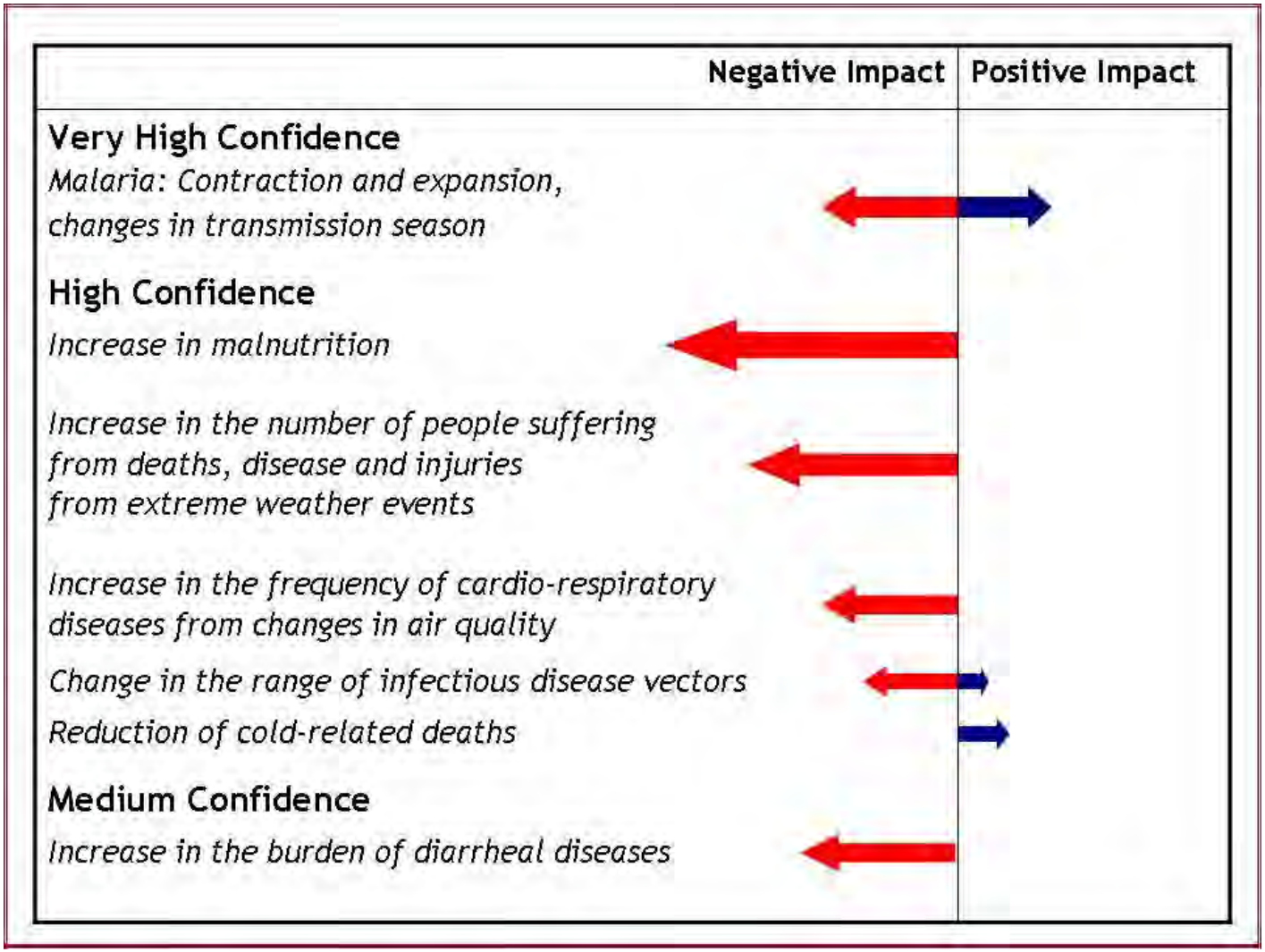
- Biophysical factors
  - Baseline climate
  - Elevation
  - Natural resources (i.e. water bodies)
- Biological sensitivity
  - Concomitant diseases
  - Acquired immunity
  - Genetic factors
- Socioeconomic status

IPCC AR4 Health Impacts of Climate Change

- Emerging evidence of climate change impacts:
  - Altered distribution of some vectors
  - Altered seasonal distribution of some pollen species
  - Increased risk of heatwave deaths



Direction and Magnitude of Climate Change Health Impacts



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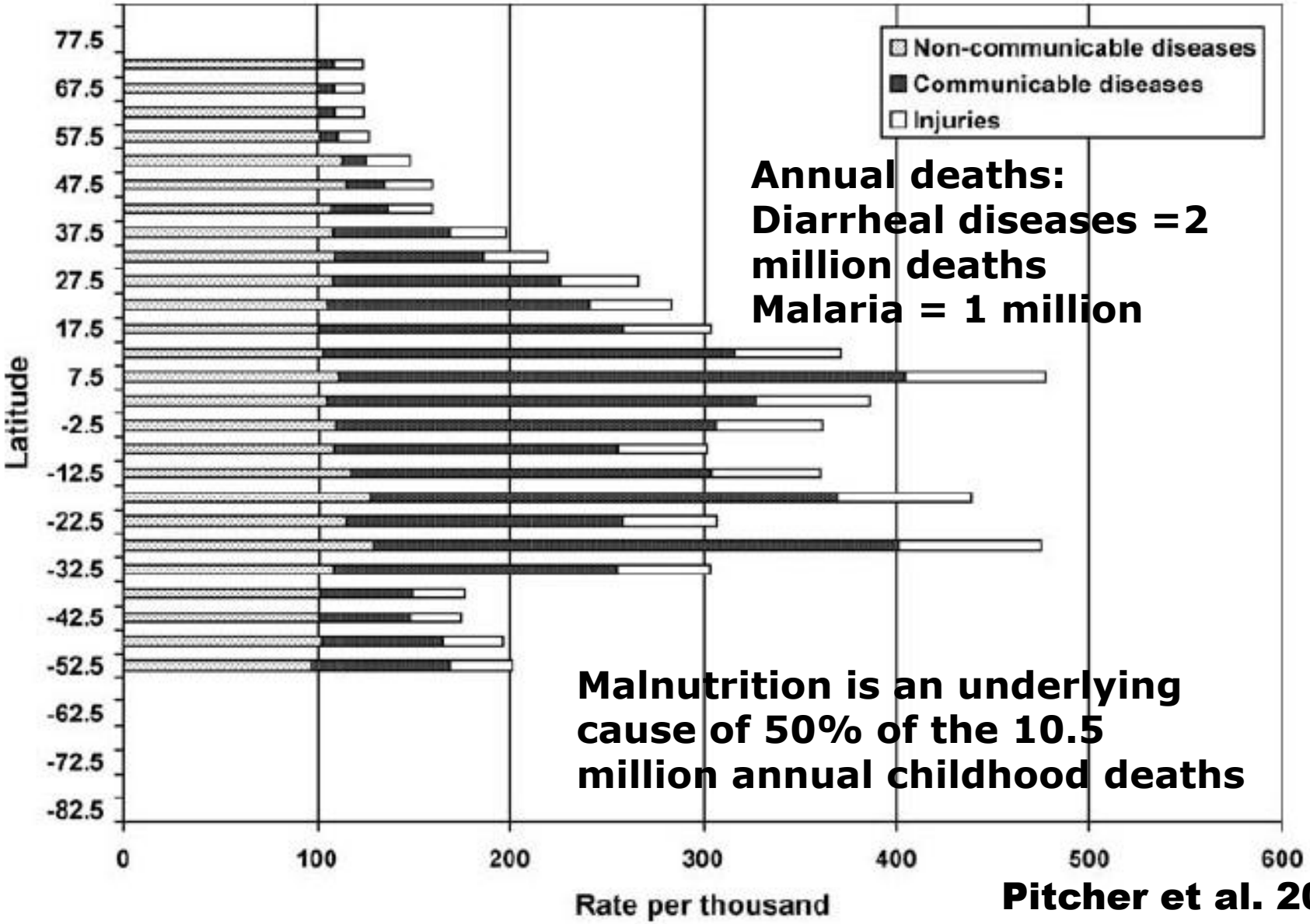
Sum of Years of Life Lost and Years of Life Lived with Disability

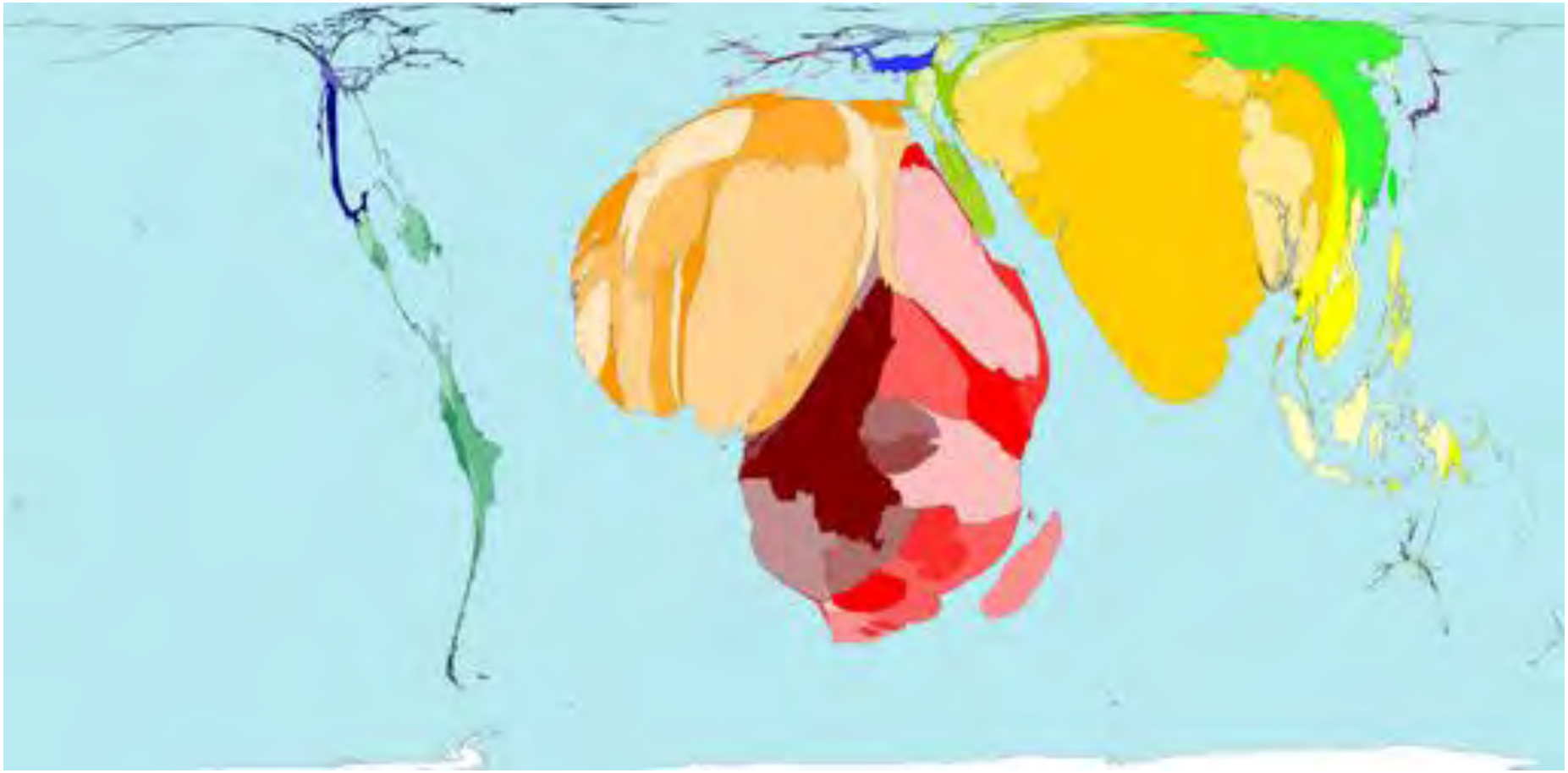


Annual deaths:
Diarrheal diseases =2 million deaths
Malaria = 1 million

Malnutrition is an underlying cause of 50% of the 10.5 million annual childhood deaths

Pitcher et al. 2008

Infant Mortality 1-4 Years



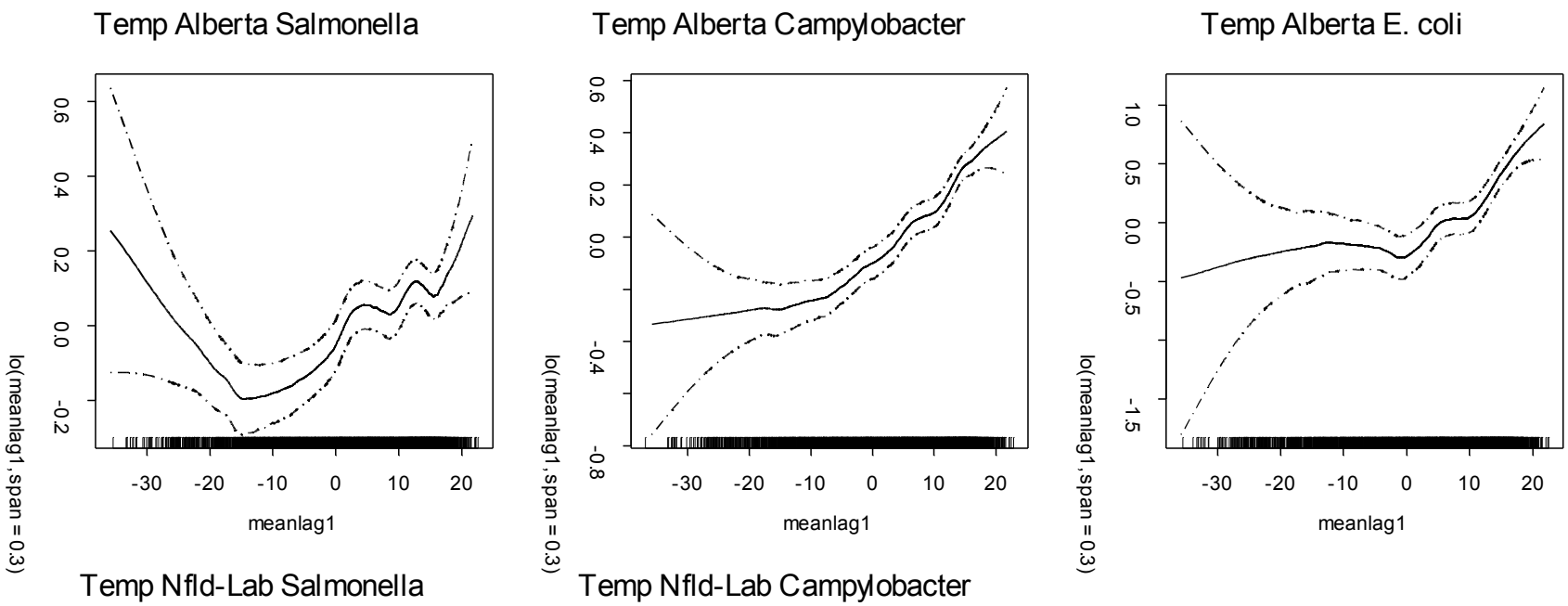
www. Worldmapper.org

Philip Wijmans, LWF/ACT Mozambique, March 2000

Diarrheal Disease

- Diarrheal diseases kill nearly 5,000 children every day
  - It is the 2nd leading killer of children
- Worldwide, 12% of childhood mortality is due to diarrheal disease
  - In many low-income countries, up to 26% of childhood mortality is due to diarrheal disease
- 88% of childhood diarrheal disease attributed to unsafe water, inadequate sanitation, and poor hygiene

Temperature and Enteric Disease



***RR* of *Salmonella* increased by 1.2% per degree above - 10˚C**

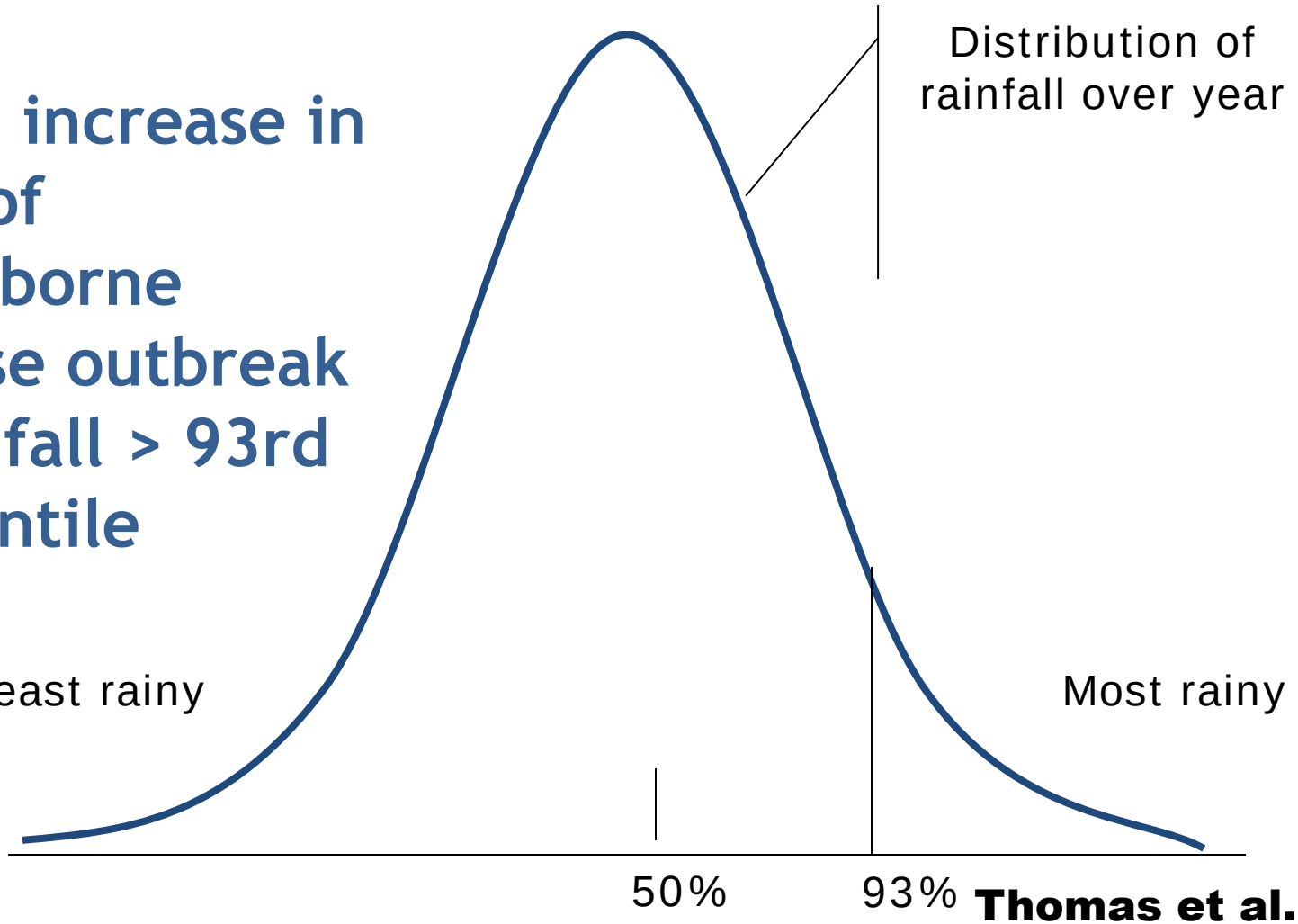
***RR of Campylobacter* increased by 2.2% (4.5% in Newfoundland) per degree above - 10˚C**

***RR of E. coli* increased by 6.0% per degree above - 10˚C**

Fleury et al. 2006

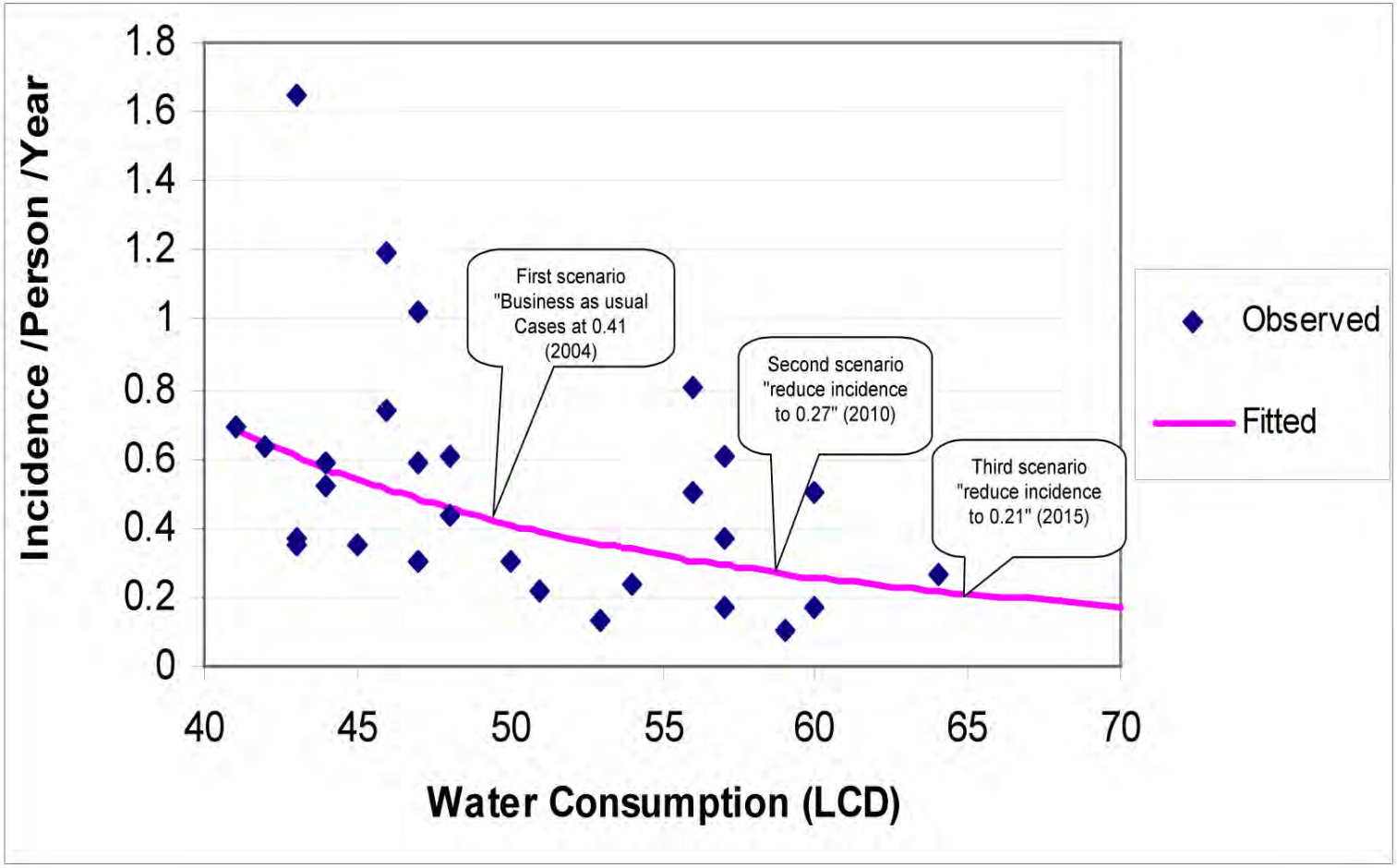
Waterborne Outbreaks and Extreme Events

- 2-fold increase in odds of waterborne disease outbreak if rainfall > 93rd percentile



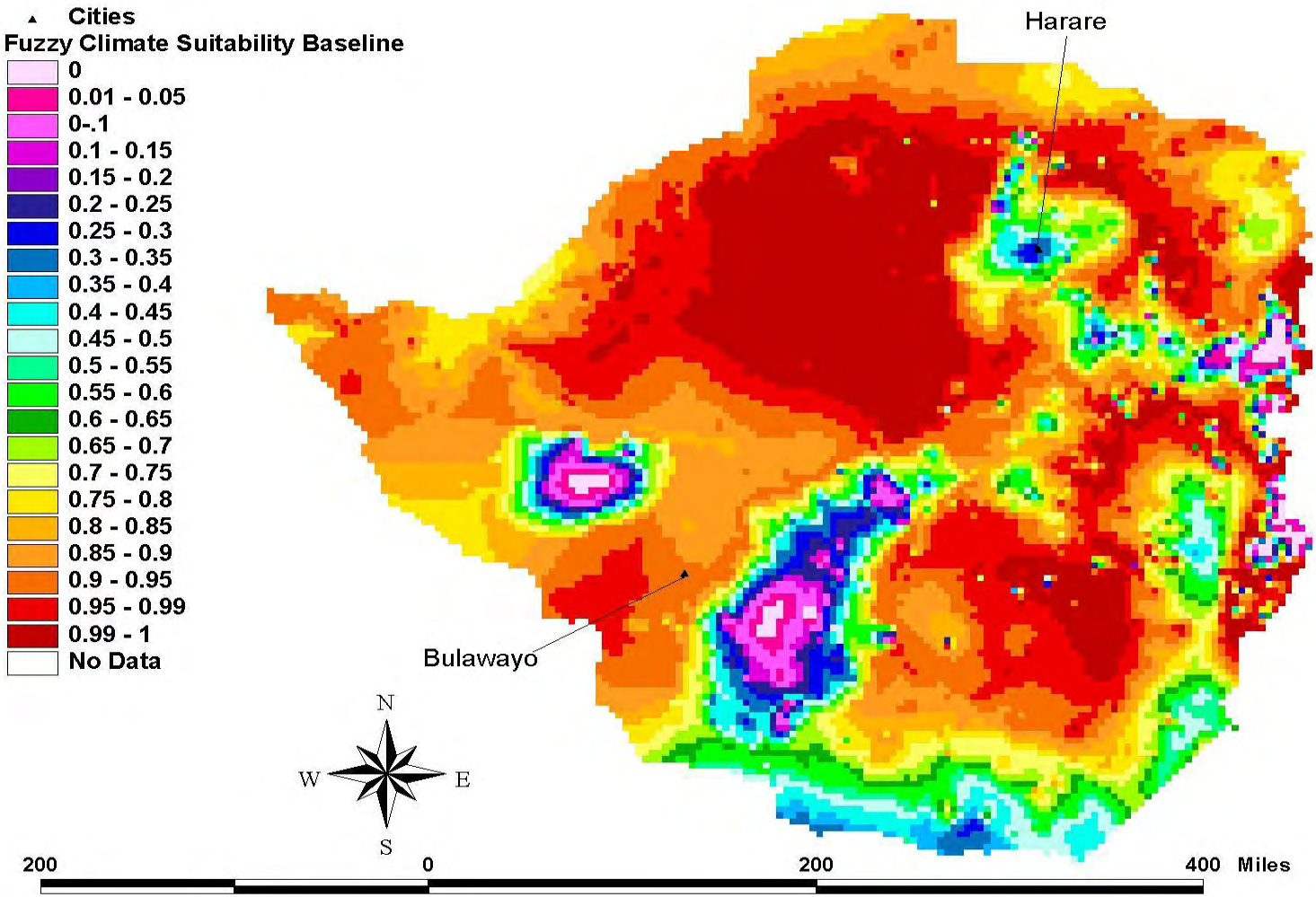
Thomas et al. 2006

Relationship Between Water Availability at the Household Level in Jordan and Diarrheal Disease



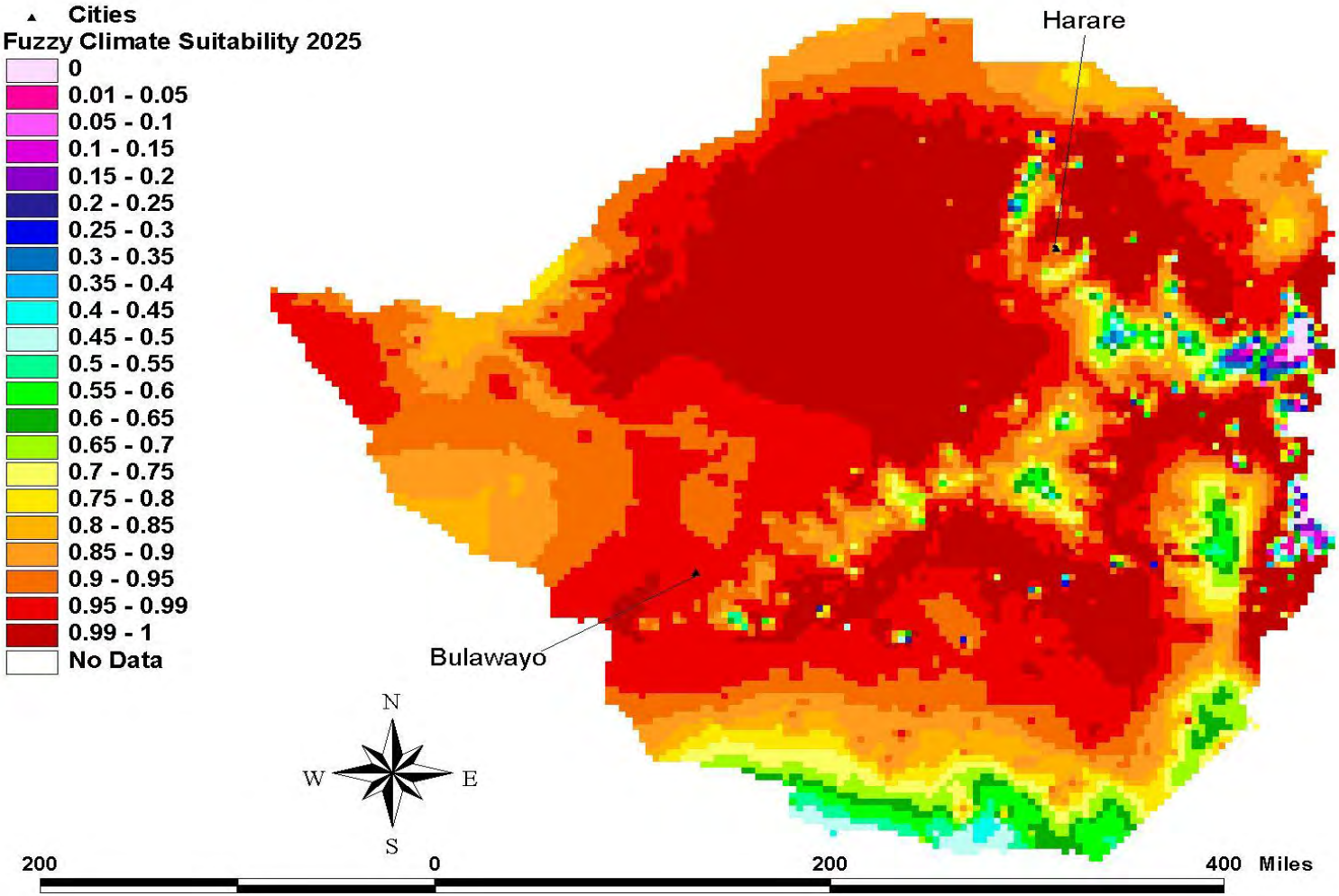
Health and Environment Linkages Initiative, Jordan Country Project, 2005

Baseline



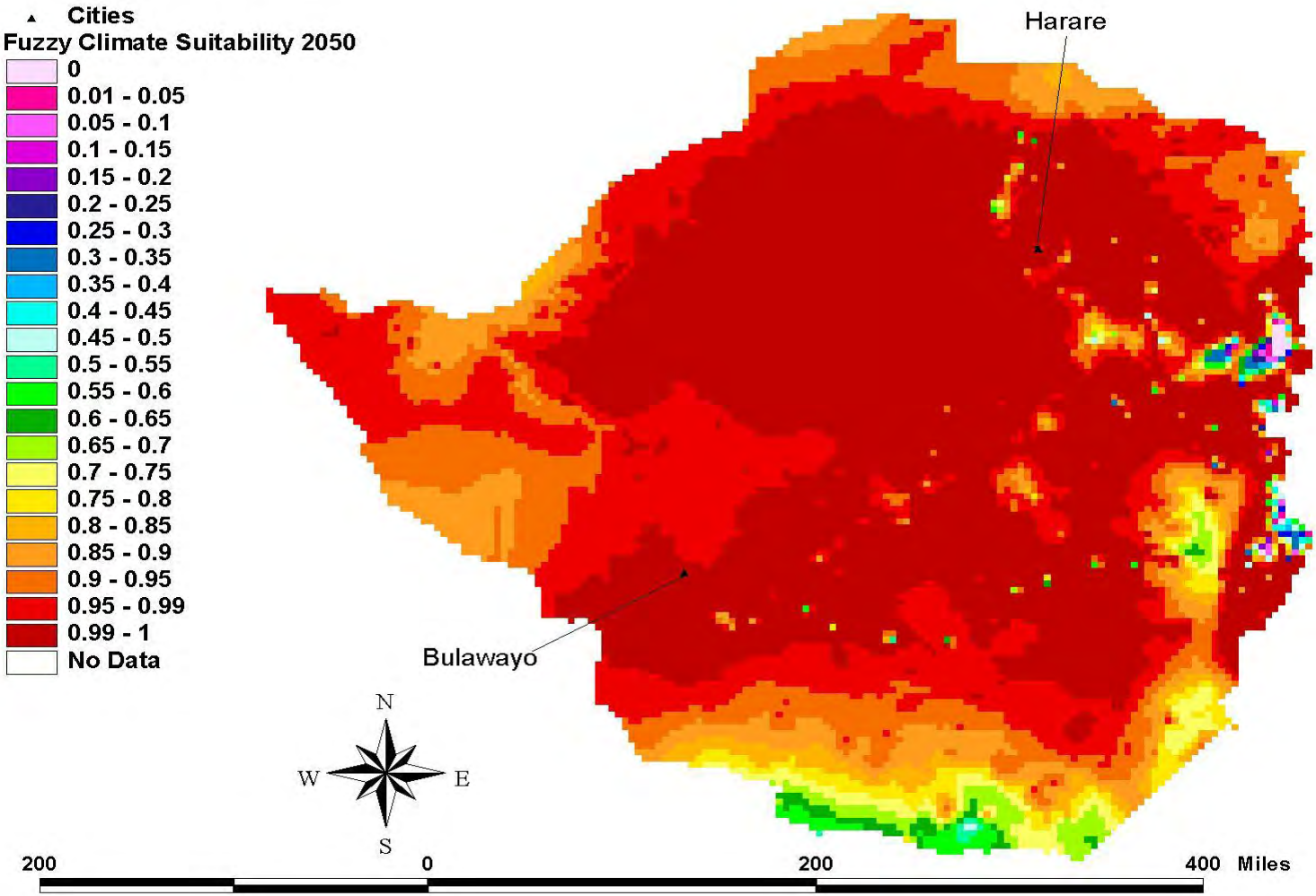
Ebi et al. 2005

2025



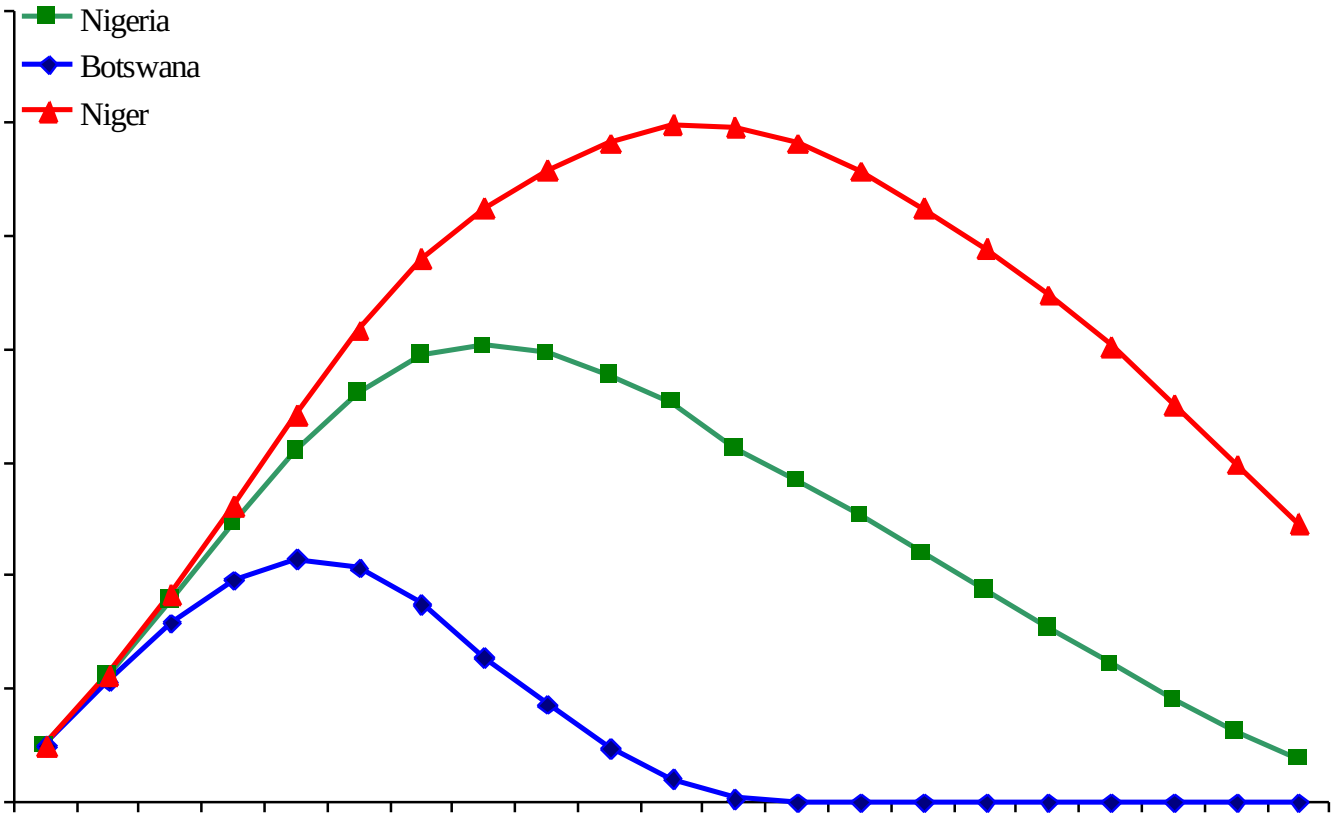
Ebi et al. 2005

2050



Ebi et al. 2005

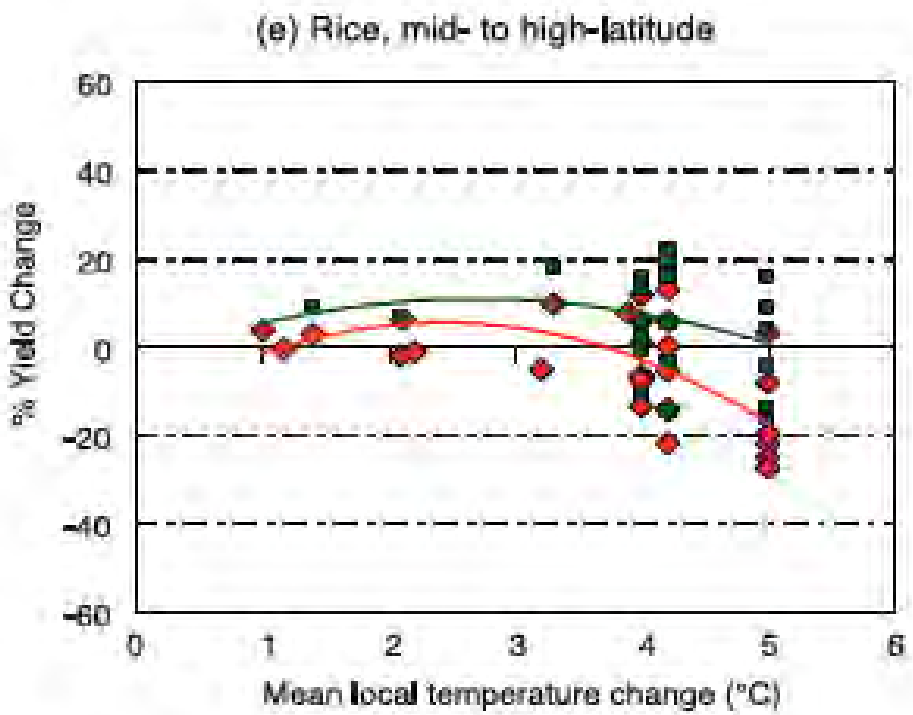
Climate Change-Attributable Malaria Deaths in Botswana, Niger, and Nigeria, SRES A1B

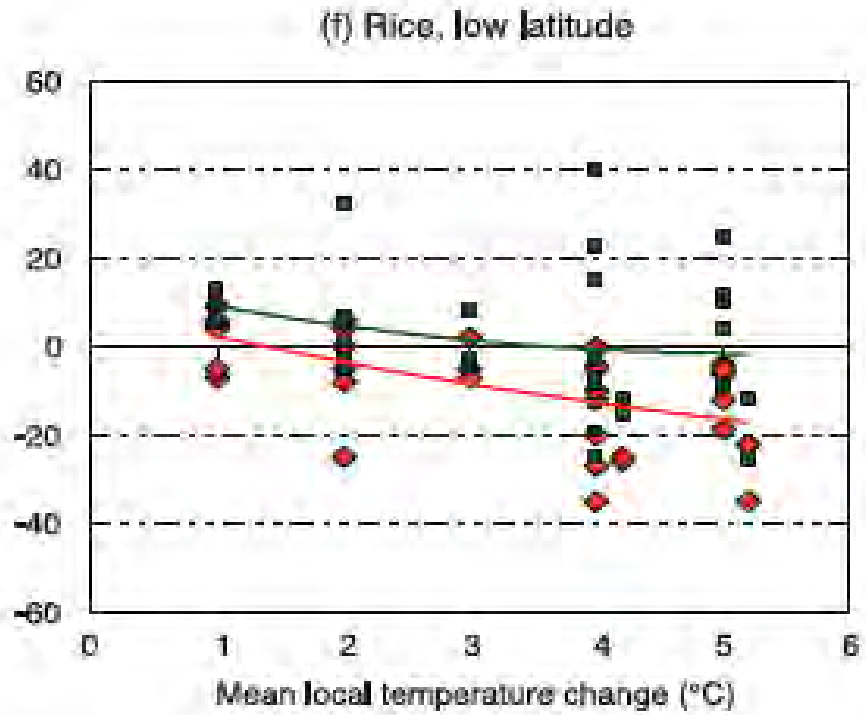


Tol et al. 2007

- Cholera
- Meningococcal meningitis
- Dengue/dengue haemorrhagic fever
- Chikungunya
- African trypanosomiasis
- Yellow fever
- Japanese and St. Louis encephalitis
- Rift Valley fever
- Leishmaniasis
- West Nile virus
- Ross River virus and Murray Valley encephalitis

Sensitivity of Rice Yields to Temperature Change

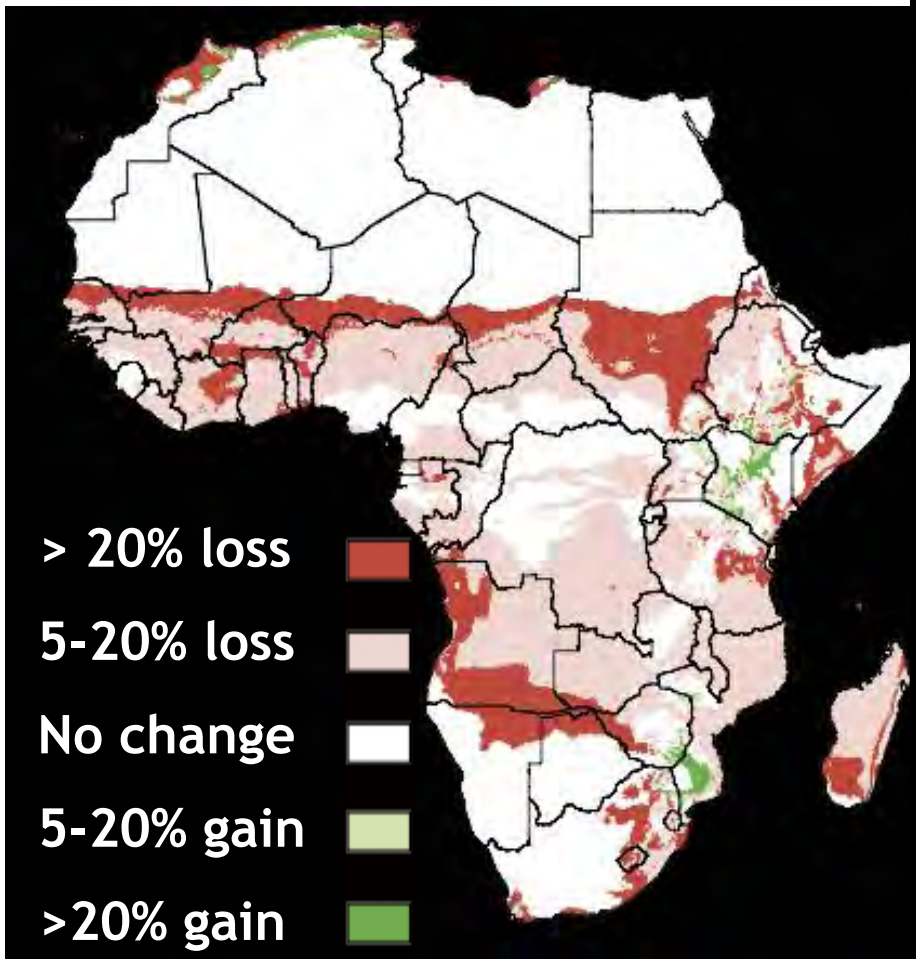




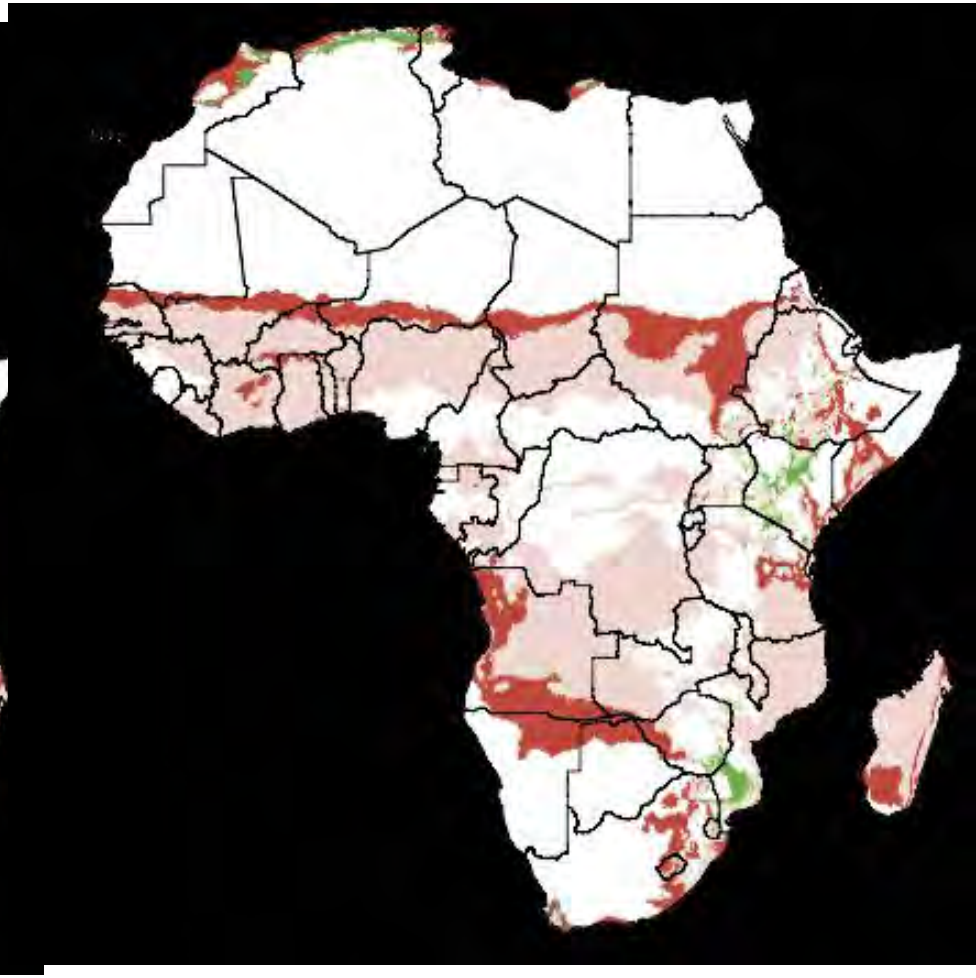
Easterling et al. 2007

Projected Changes in Length of Growing Season, 2050

ECHam4, B1



ECHam4, B2



International Livestock Research Institute, 2006

Climate Change Impacts in 2030 under 750 ppm CO_2 Scenario (thousands of cases)

Estimated costs to treat the climate change-related cases = $3,992 to $12,603 million

	Diarrhea	Malnutrition	Malaria
Total	4,513,981	46,352	408,227
Climate change impacts	131,980	4,673	21,787
% increase	3%	10%	5%

Ebi 2008

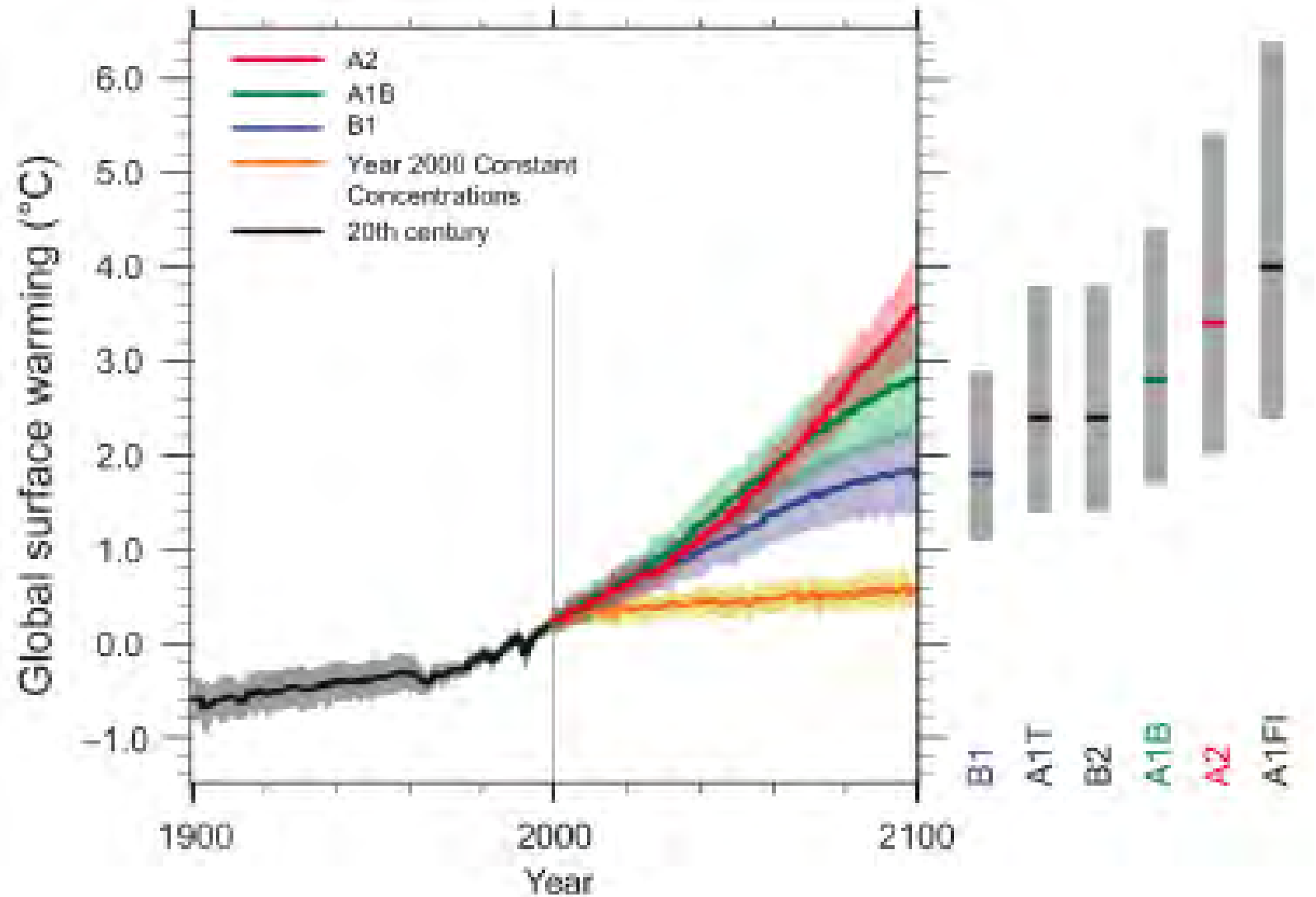
Responding to climate change involves an iterative risk management process that includes both adaptation and mitigation and takes into account climate change damages, co-benefits, sustainability, equity and attitudes to risk

IPCC 2007 Synthesis Report

Prerequisites for Action

- Awareness that a problem exists
- Understanding of the causes
- A sense that the problem matters
- The capability to influence
- The political will to deal with the problem

Climate Change Is About Choice



IPCC 2007

AT THE GATES.

Our safety depends upon official vigilance.

Thank You