

Climate Change, Energy, and Health: Findings from the 2011 Global Energy Assessment

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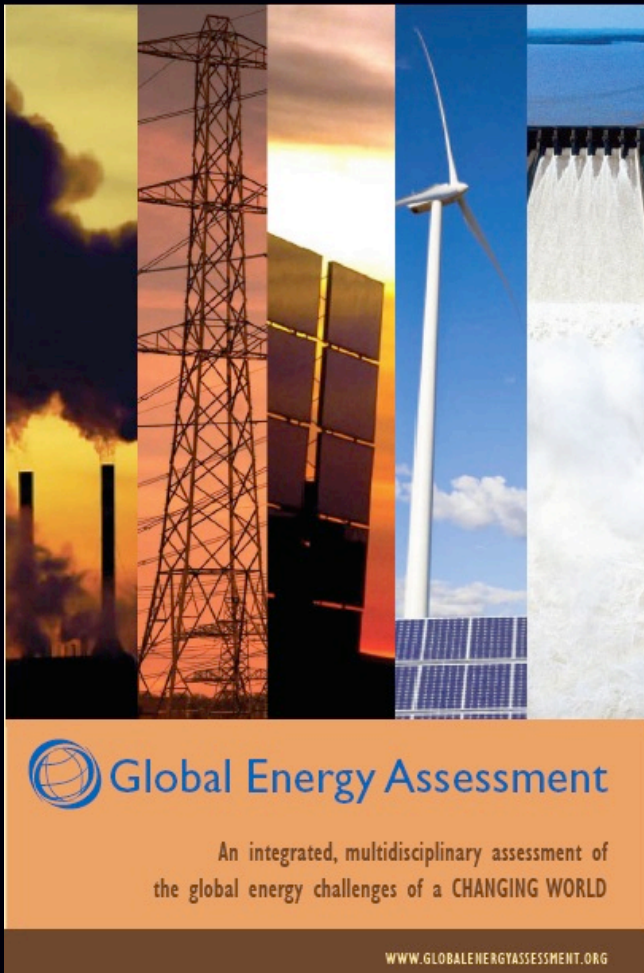
²UC Berkeley Energy and Resources Group

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Overview

- WHAT: is the Global Energy Assessment?
- HOW: does cc* affect health?
- WHEN: and how much will cc impact health?
- WHY: do health co-benefits come from cc mitigation?
- KEY POINTS: if you remember nothing else...

GEA: Overview

- Secretariat:
International Institute for Applied Systems Analysis (IIASA)
- Follow-up to *Energy in a Finite World* (1981), *Energy for Tomorrow's World* (1992), *World Energy Assessment* (2000)
- Includes: summary of knowledge and challenges; new scenarios; analysis of technology options and policy synergies.
- Focus on:
 - Providing “energy services,” rather than energy carriers
 - How to end energy poverty
 - Energy for sustainable development
 - Innovation and strategic economic investment

GEA: 2011 “Energy and Health” Chapter

Authors

- Kalpana Balakrishnan (Sri Ramachandra University, India)
- Colin Butler (Australian National University, Australia)
- Ian Fairlie (Int’l Consultant on Radiation in the Environment, UK)
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Funding: International Institute for Applied Systems Analysis (IIASA)

GEA: “Energy and Health” —What Else is Included?

- Household Energy Systems
- Occupational Effects of Energy Systems
- Community and Regional Effects
- Routine Health Impacts from Nuclear Fuel Chain
- Emerging Energy Systems
- Energy Efficiency
- Today: Global Climate Change; Co-Benefits

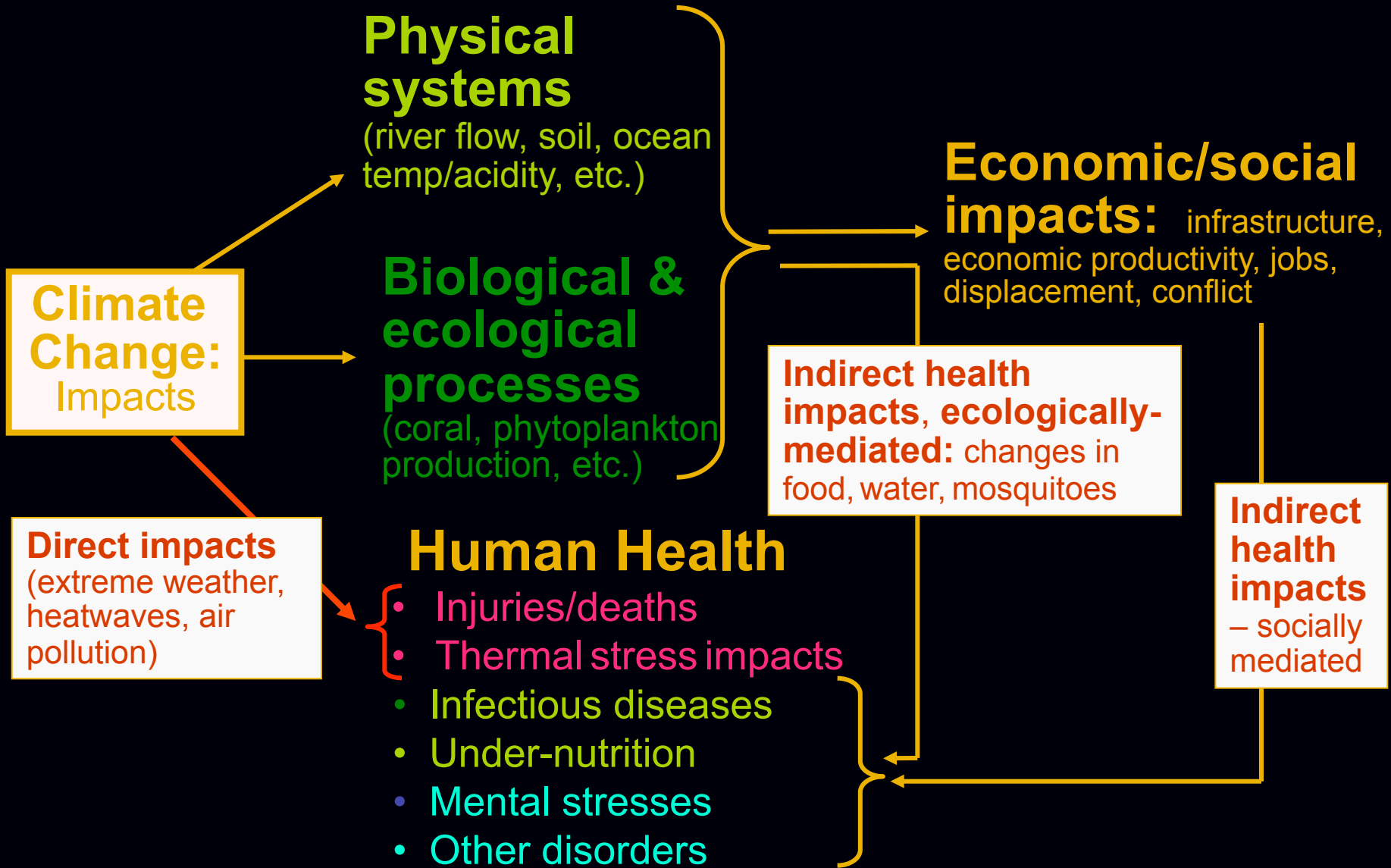
Why Study Climate and Health?

- Health impacts “reasonably attributable” to climate change **have already occurred** and continue to occur.
 - Rise in extreme weather events -> deaths and ill-health
 - Drying -> bad crop yields -> adverse mental health effects
- Recognizing risks to human health **strengthens rationale** for rapid abatement of climate-active pollutants (CAP).
- Human health can be a “**canary**” (ie early indicator of change)
- Given this, can build case for **adaptation** if we think more change is coming.
- **Moral case**: most deaths are/will occur among children in developing countries.

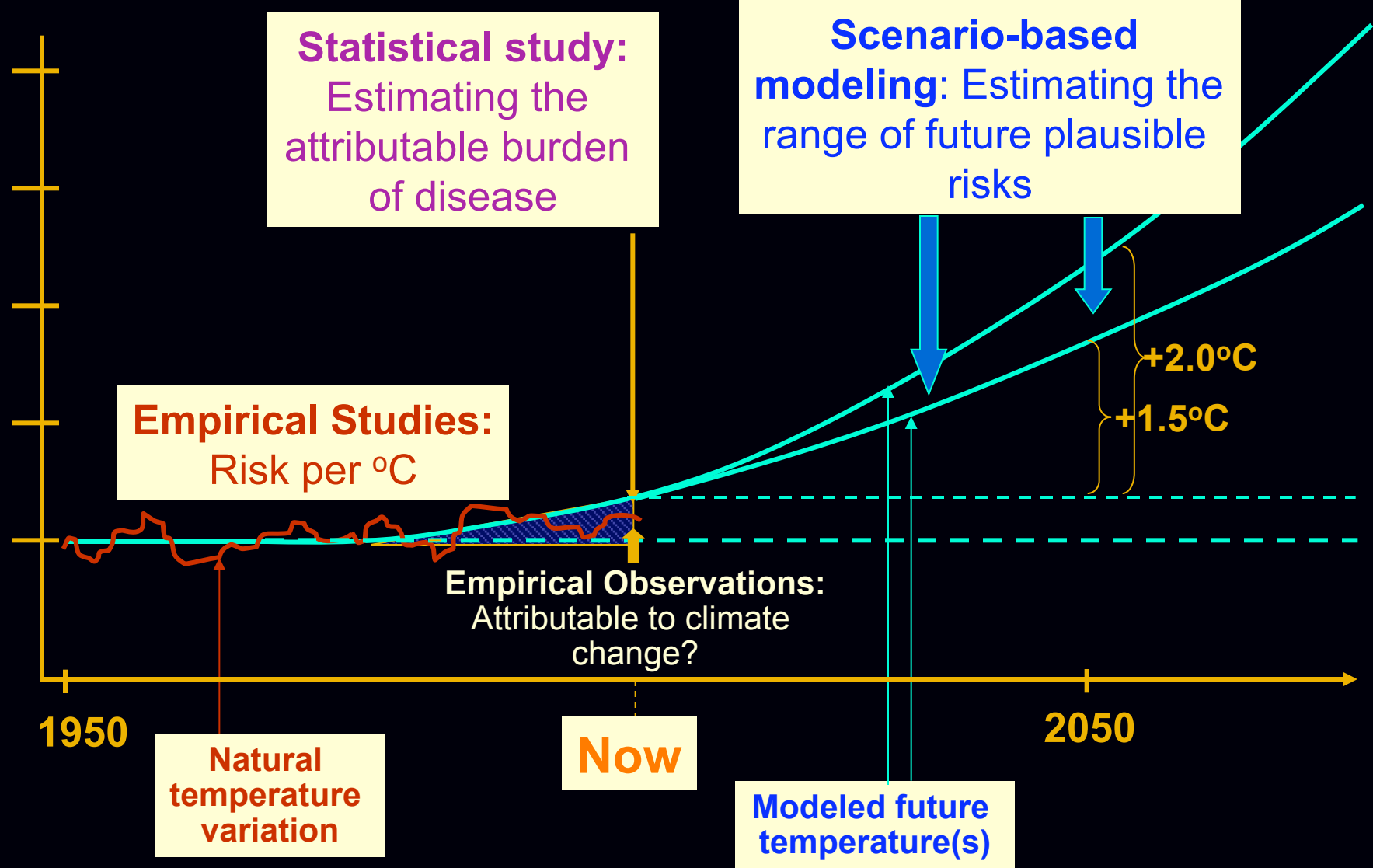
How Does CC Affect Health? Categories of Risks

- **Direct impacts:** heatwaves, extreme events, urban air pollutants, etc.
- **Ecologically-mediated:** food yields, water flows, infectious-disease vectors and intermediate-host animal ecology
- More **diffuse impacts:** e.g. mental health problems in failing farm communities, displaced groups, disadvantaged indigenous and minority ethnic groups, etc.
- Consequences of **tension and conflict**, due to CC-related declines in basic resources (water, food, timber, living-space)

How Does CC Affect Health? Pathways



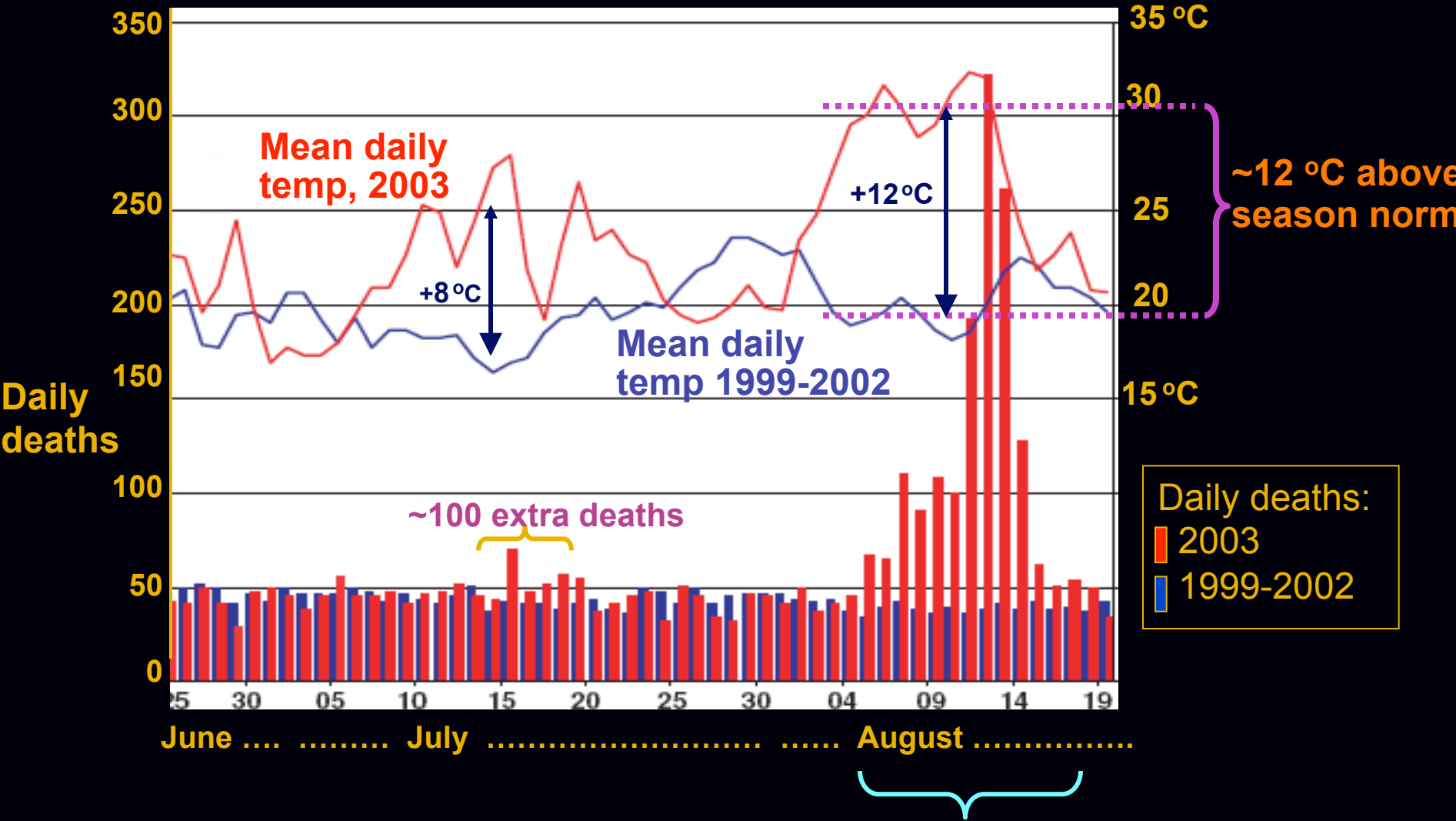
When and How Much: Health Risk Assessments (past, present, future)



How Does CC Affect Health? Impacts Now

- Sea level rise: 3 mm/yr global average (50% greater than in 1980s)
 - Already endangering food yields, freshwater supplies, physical safety in small low-lying island states.
- Temperature extremes become more frequent
 - Leads to ground-level ozone formation; increased incidence of strokes/heart attacks in vulnerable; mood and behavior changes.
 - Example: Paris Heat Wave, 2003

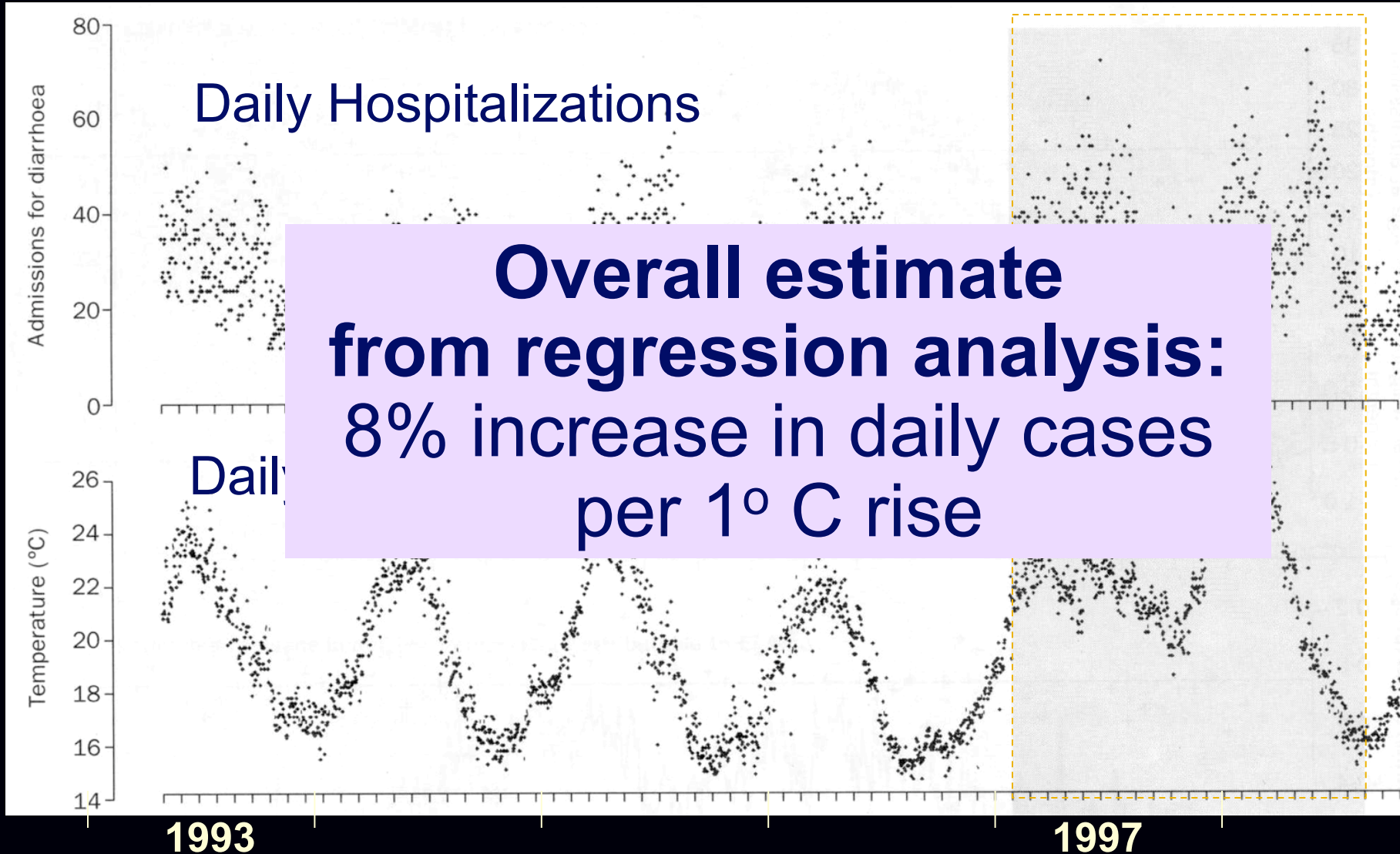
Empirical: Paris Heatwave, Aug 2003, Daily Mean Temps and Deaths



Source: Vandentorren, AJPH, 2004

~ 900 extra deaths during heatwave

Empirical: Daily Hospitalizations for Diarrhea, by Daily Temp: Lima, Peru

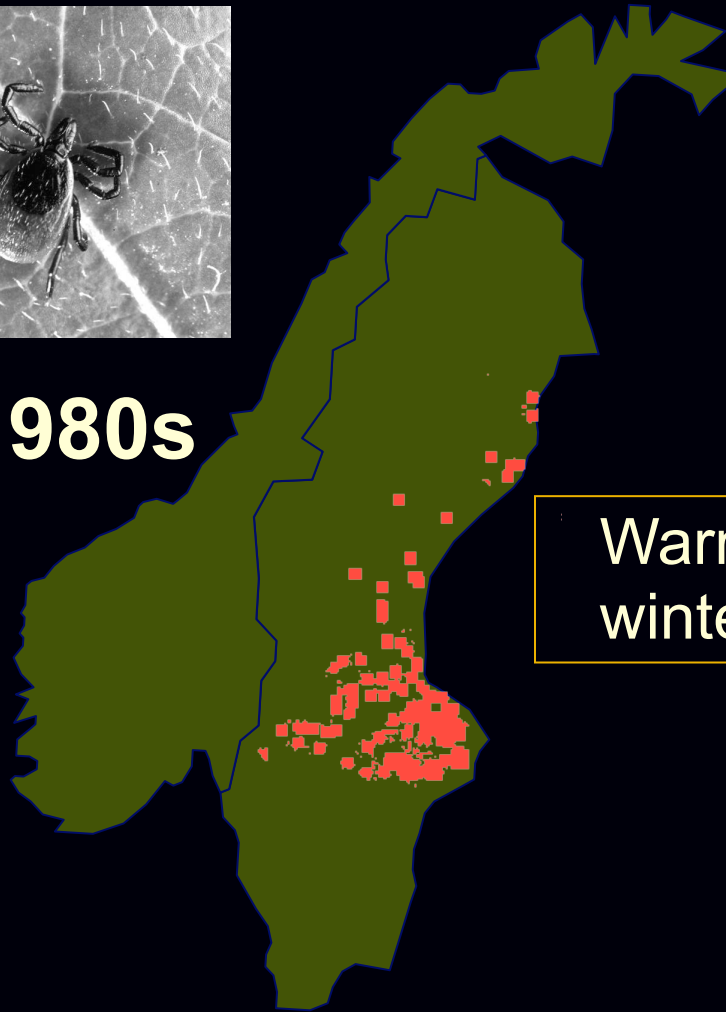


Empirical: Sweden—Tick-borne Encephalitis

Spread of *Ixodes ricinus* tick to higher latitudes (and altitudes)

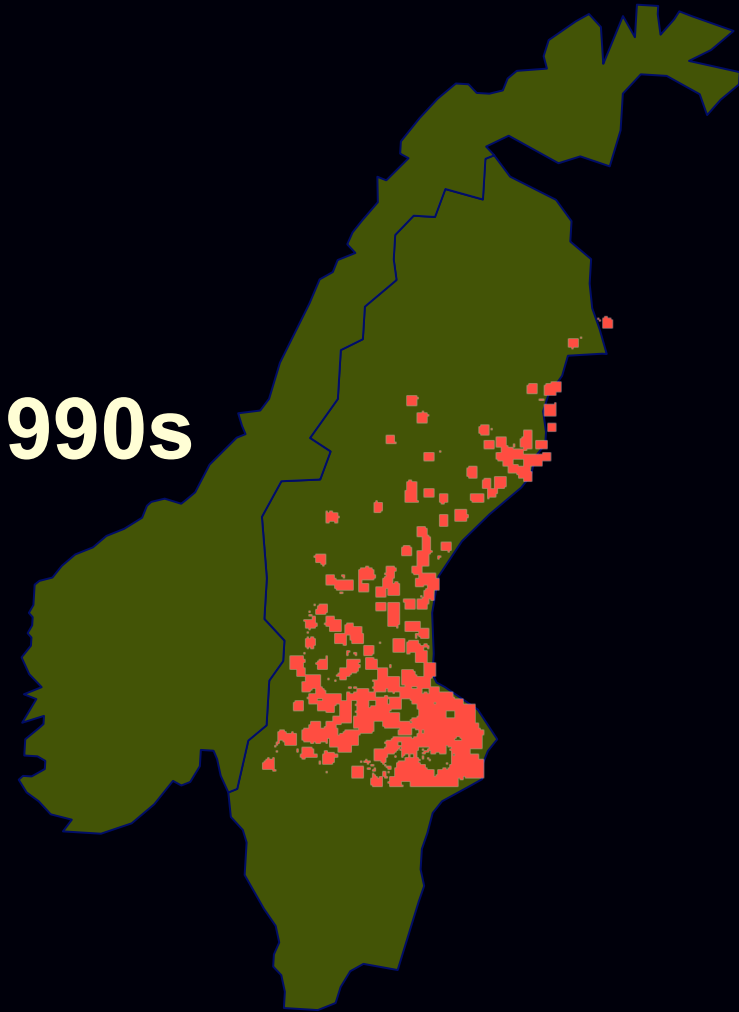


1980s

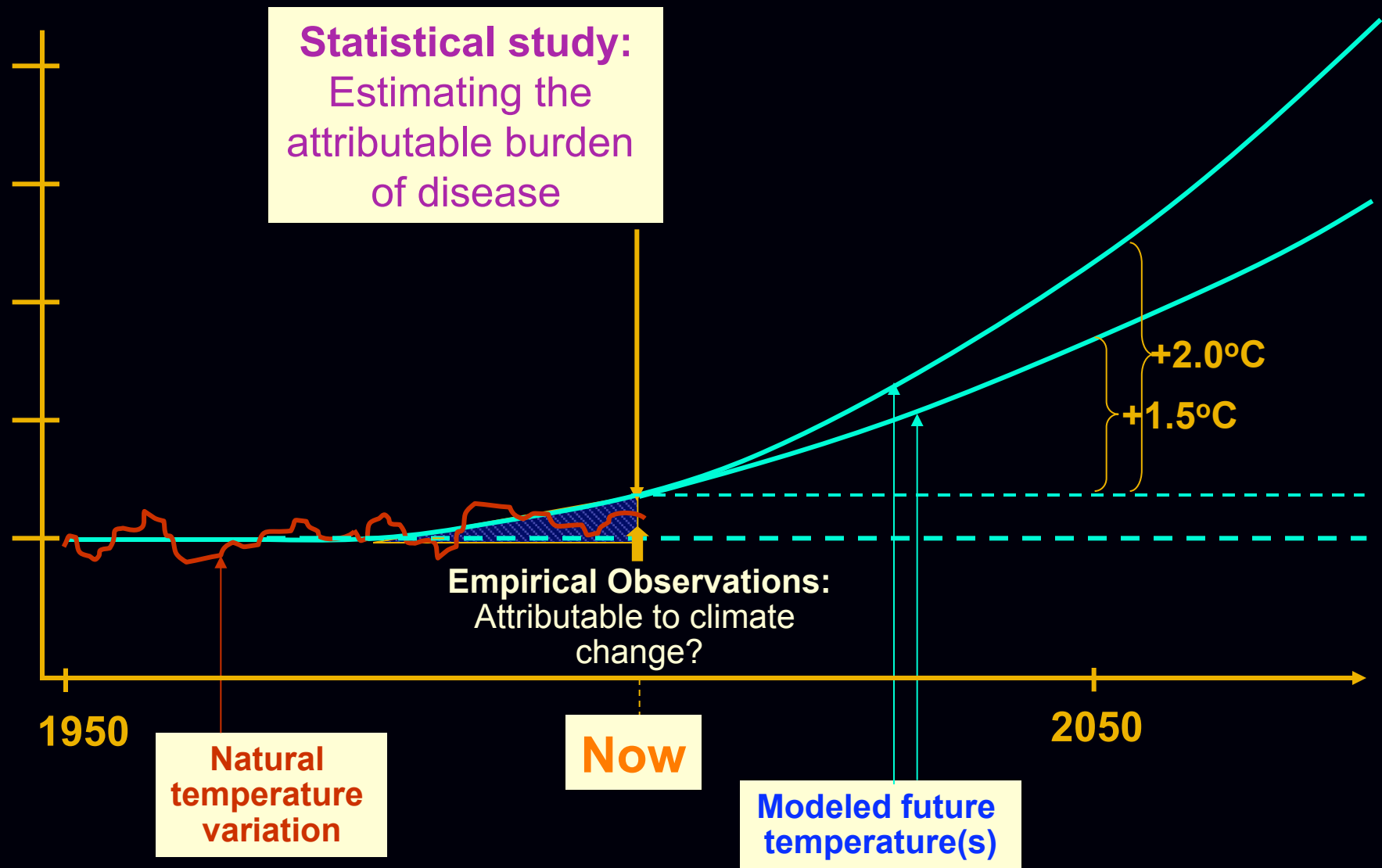


Warmer
winters

1990s



When and How Much: Health Risk Assessments (past, present, future)



Statistical: Comparative Risk Assessment

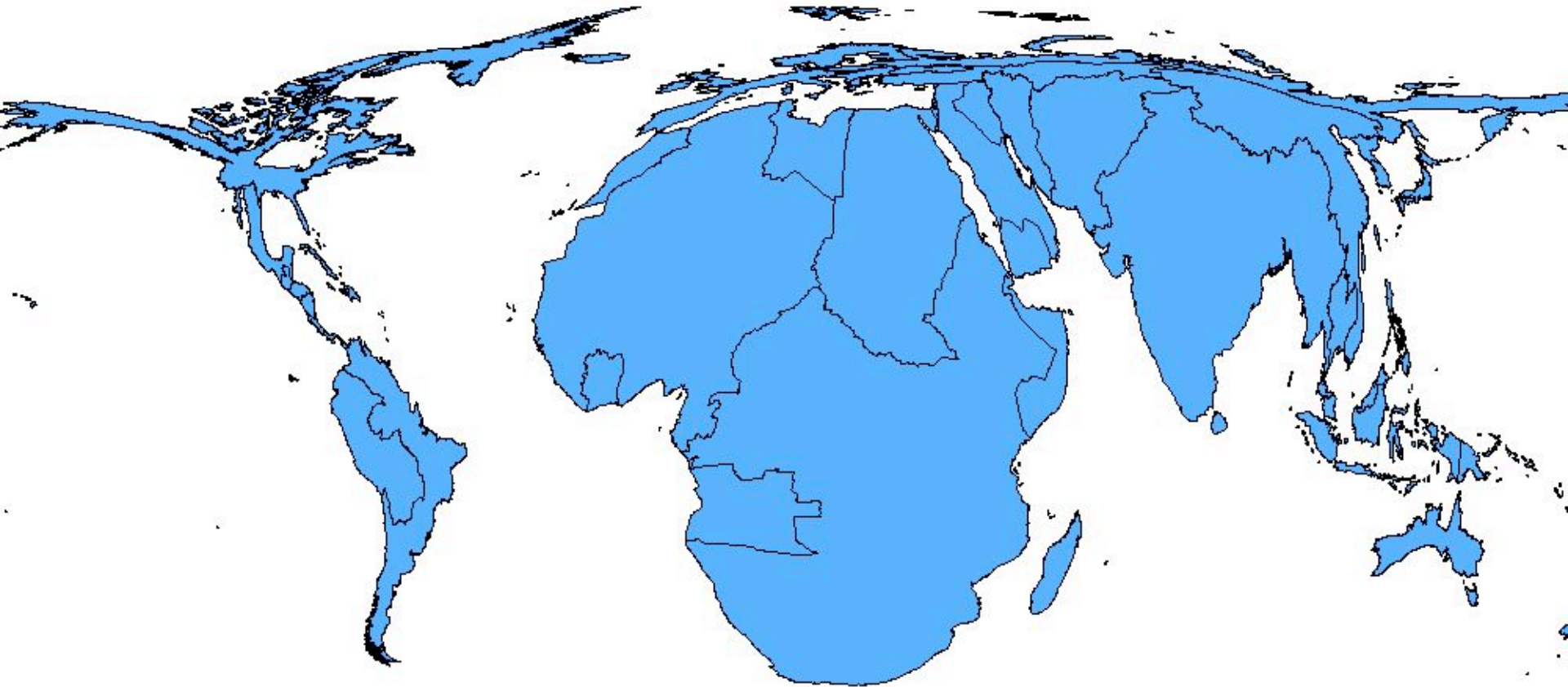
- Part of the Global Burden of Disease project organized by the World Health Organization; published 2004
- Begins with known exposure-response relationships for climate, with evidence from various regions:
 - Diarrheal disease, malaria, malnutrition, deaths due to flooding, and cardiovascular events/deaths due to heat.
 - Not included: asthma, infectious disease during extreme events, pollen levels, population movement etc.
- Use climate models to estimate “climate change exposure” in future years.
- Results expressed in 1) premature deaths, 2) DALYs*

Statistical: CRA Results

- In 2000: 0.4% of global DALYs and 0.3% of premature deaths
 - About 150,000 deaths, with 99% in developing countries
- 88% of loss of DALYs (to climate change) occur in children under 5 in developing countries.
- Estimated that climate change burden will double in 2020; while population grows 25% over same time period.
 - Malnutrition will play strongest role in increase

Deaths Attributable to Climate Change: Year 2000

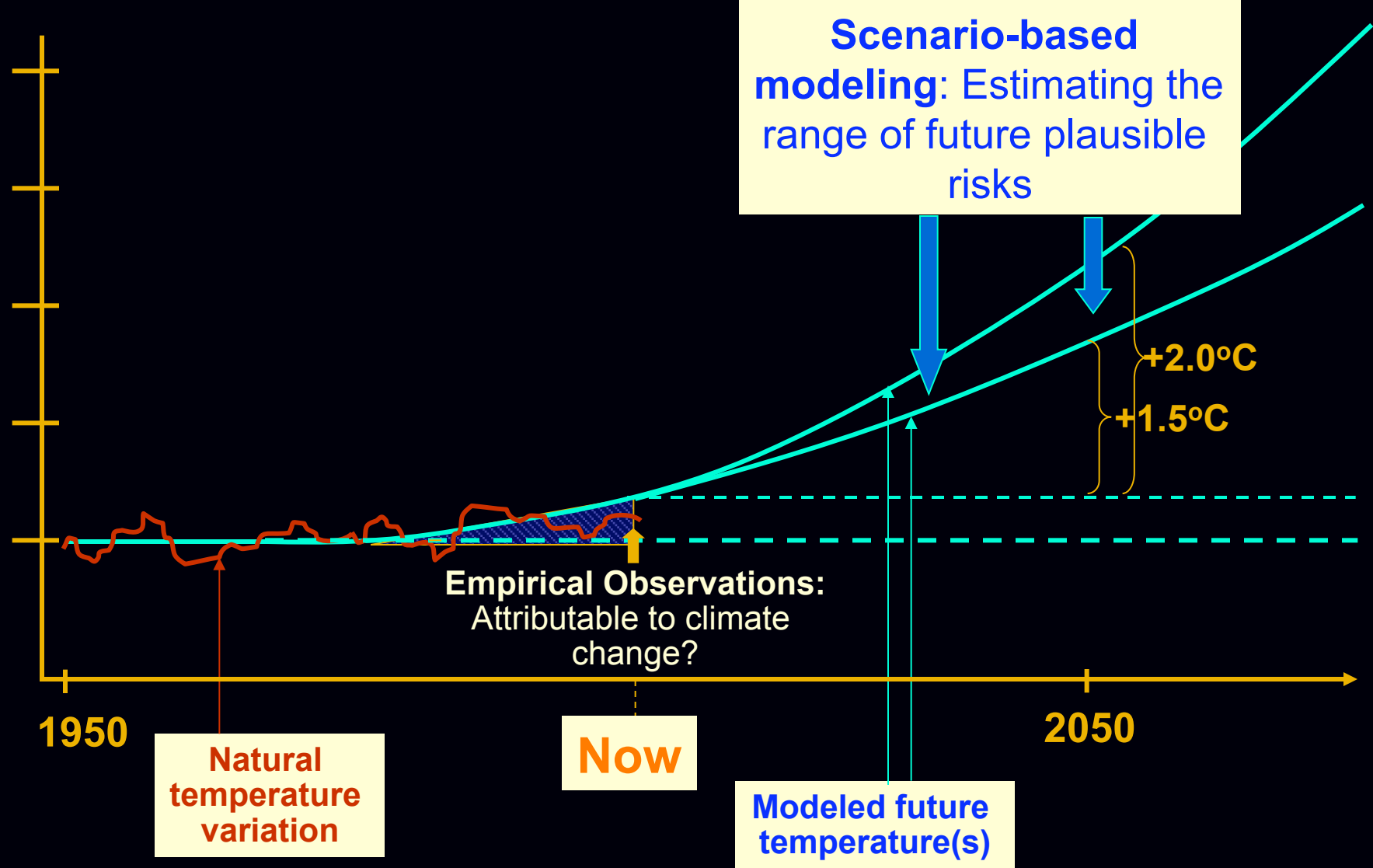
Estimated annual deaths due to climate change from: **malnutrition** (~80K), **diarrhoea** (~50K), **malaria** (~20K), **flooding** (~3K)



14 WHO statistical regions scaled by estimated annual mortality (in 2000) due to change in climate since ~1970. Selected major causes of death.

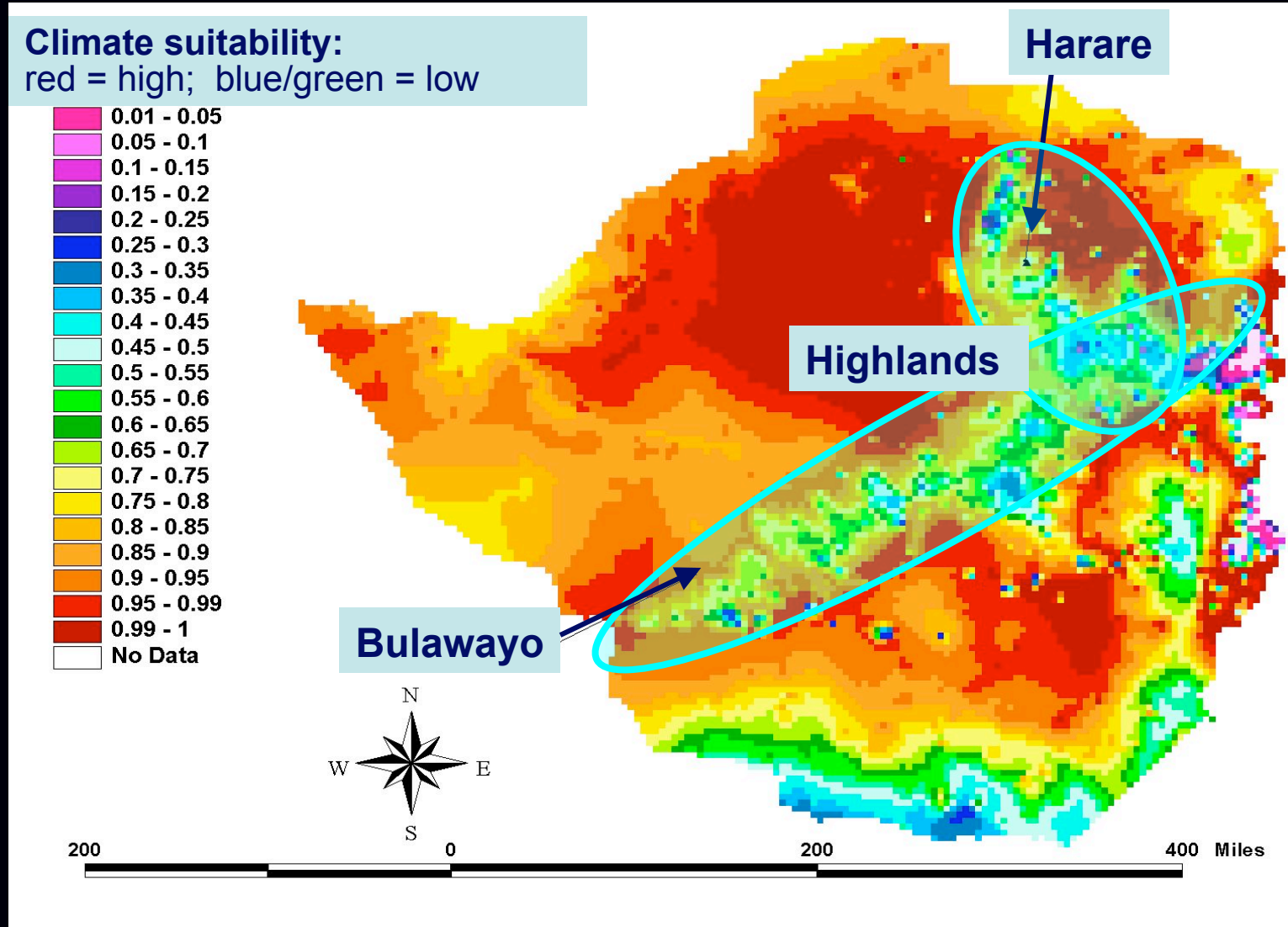
Source: Patz, Gibbs et al, 2007: based on McMichael, Campbell-Lendrum, et al, 2004

When and How Much: Health Risk Assessments (past, present, future)



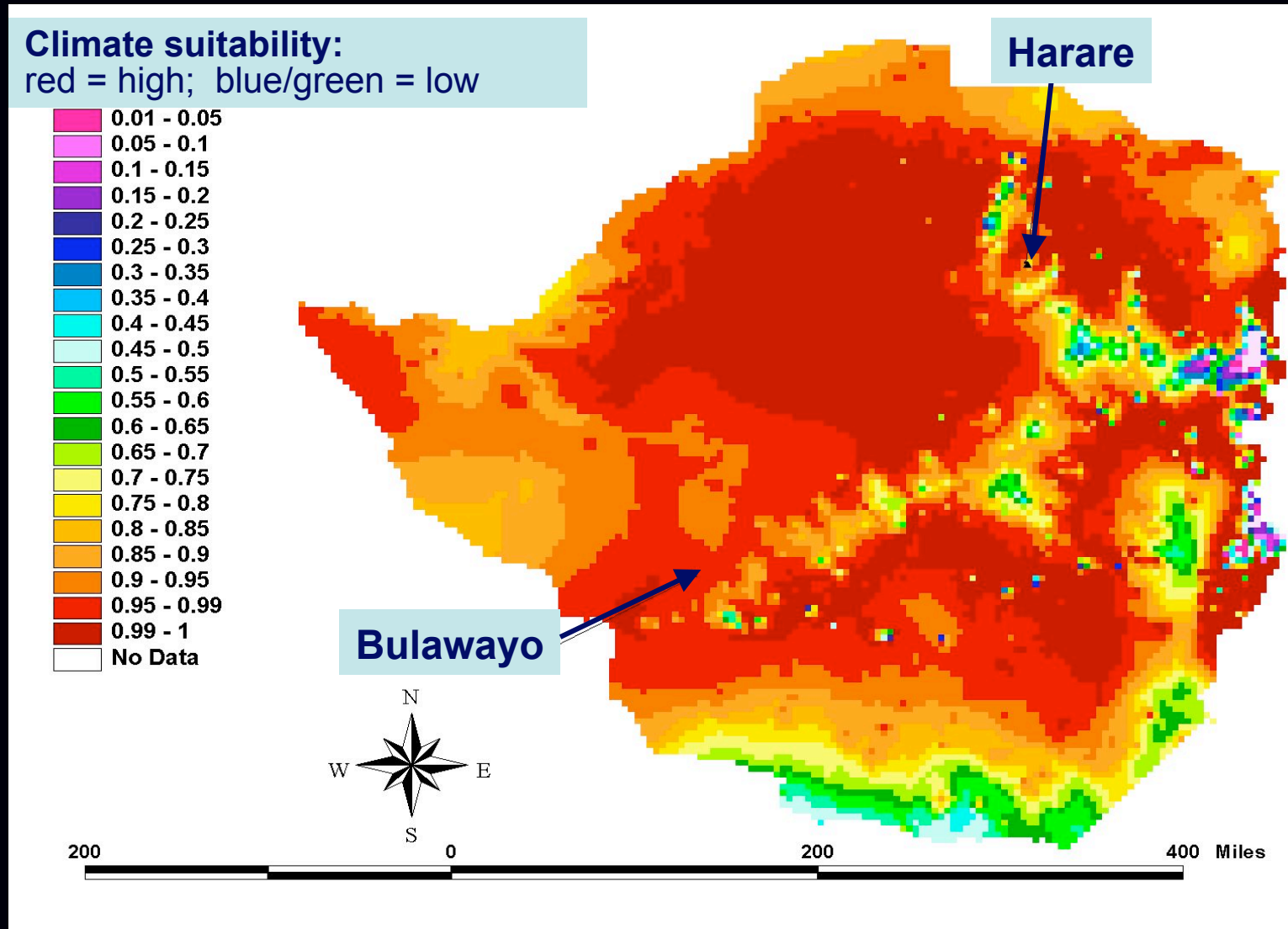
Scenario-Based: Potential Malaria Transmission in Zimbabwe

Baseline 2000 2025 2050



Scenario-Based: Potential Malaria Transmission in Zimbabwe

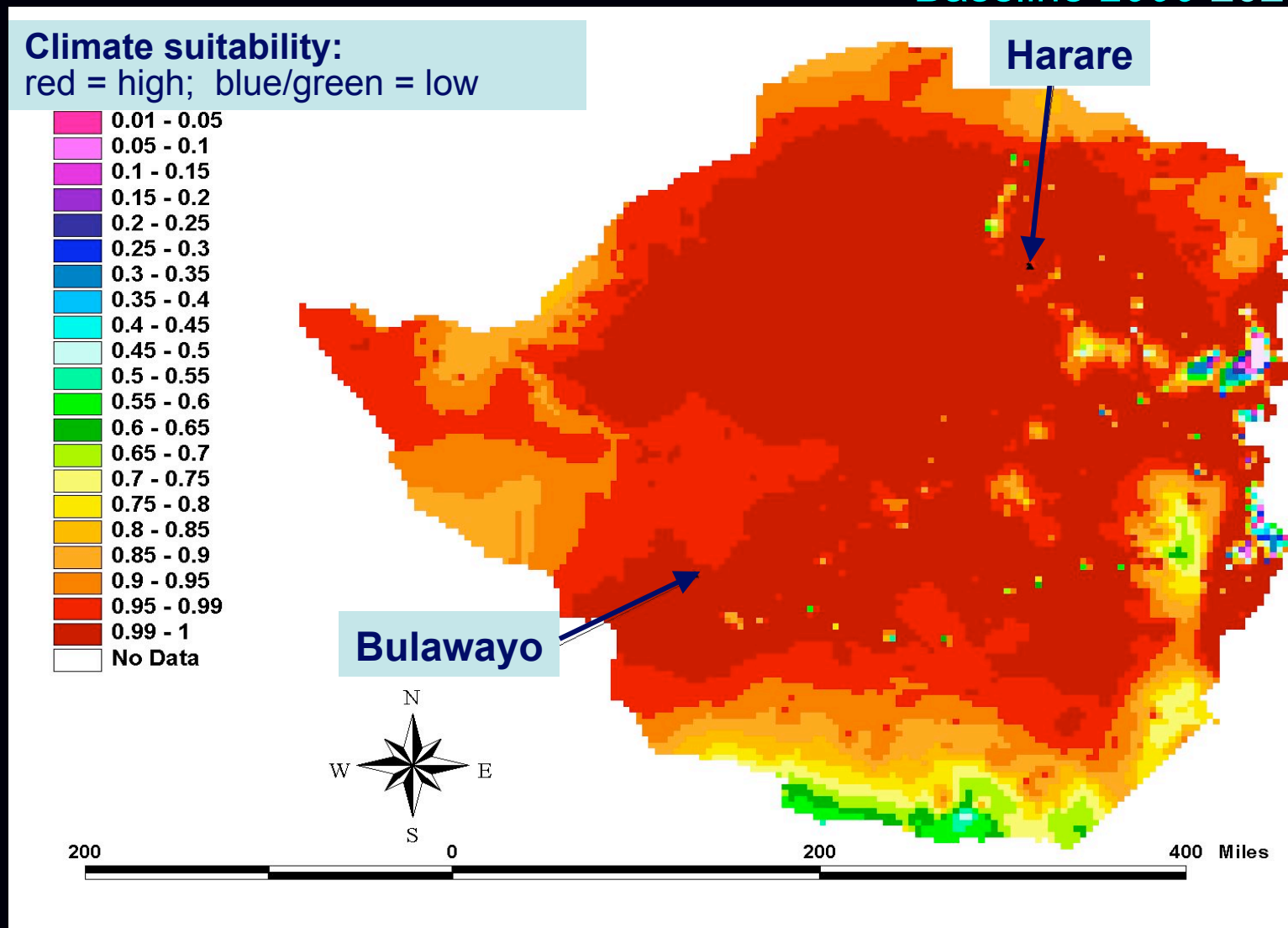
Baseline 2000 2025 2050



Scenario-Based: Potential Malaria Transmission in Zimbabwe

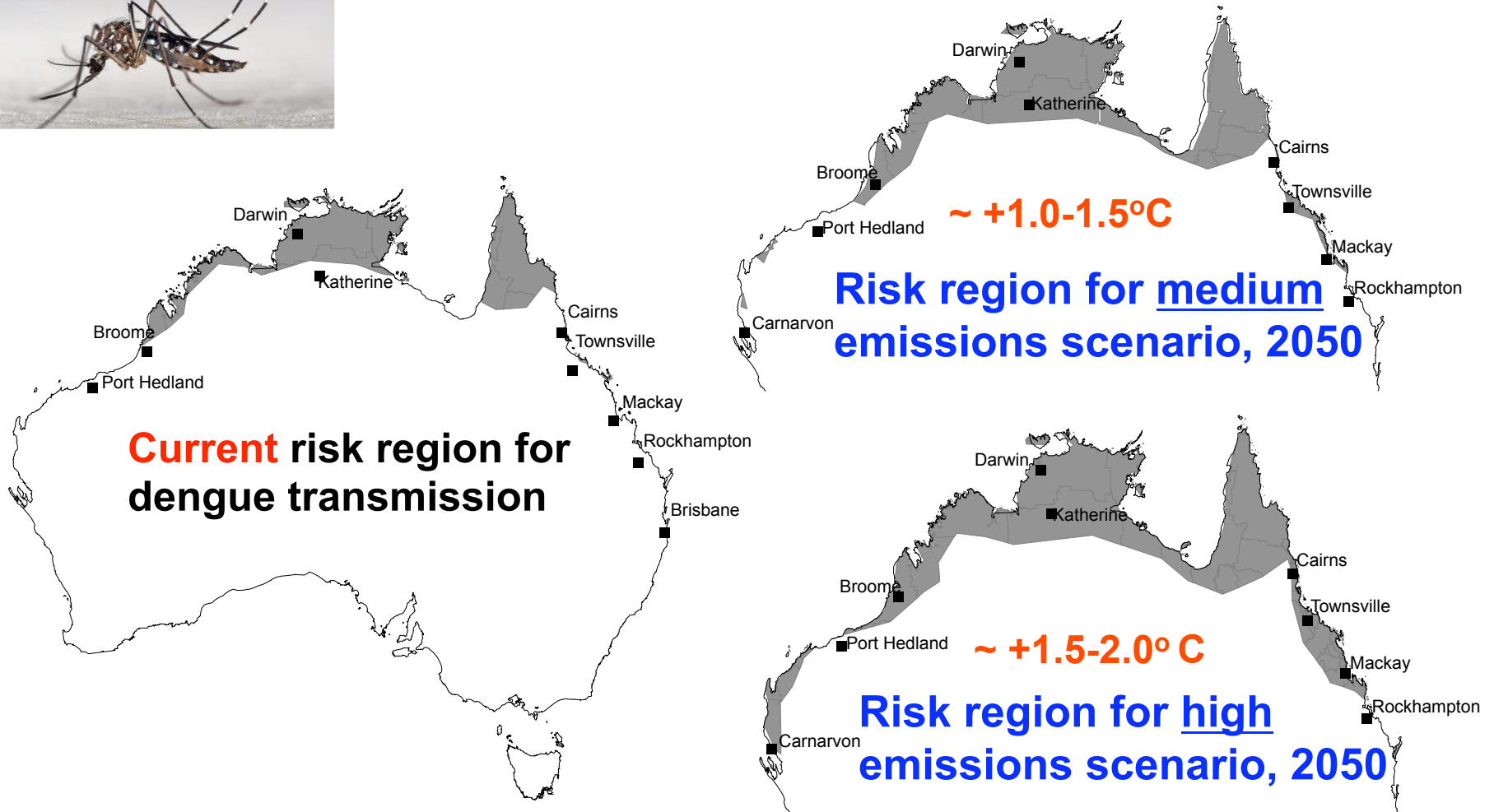


Baseline 2000 2025 2050

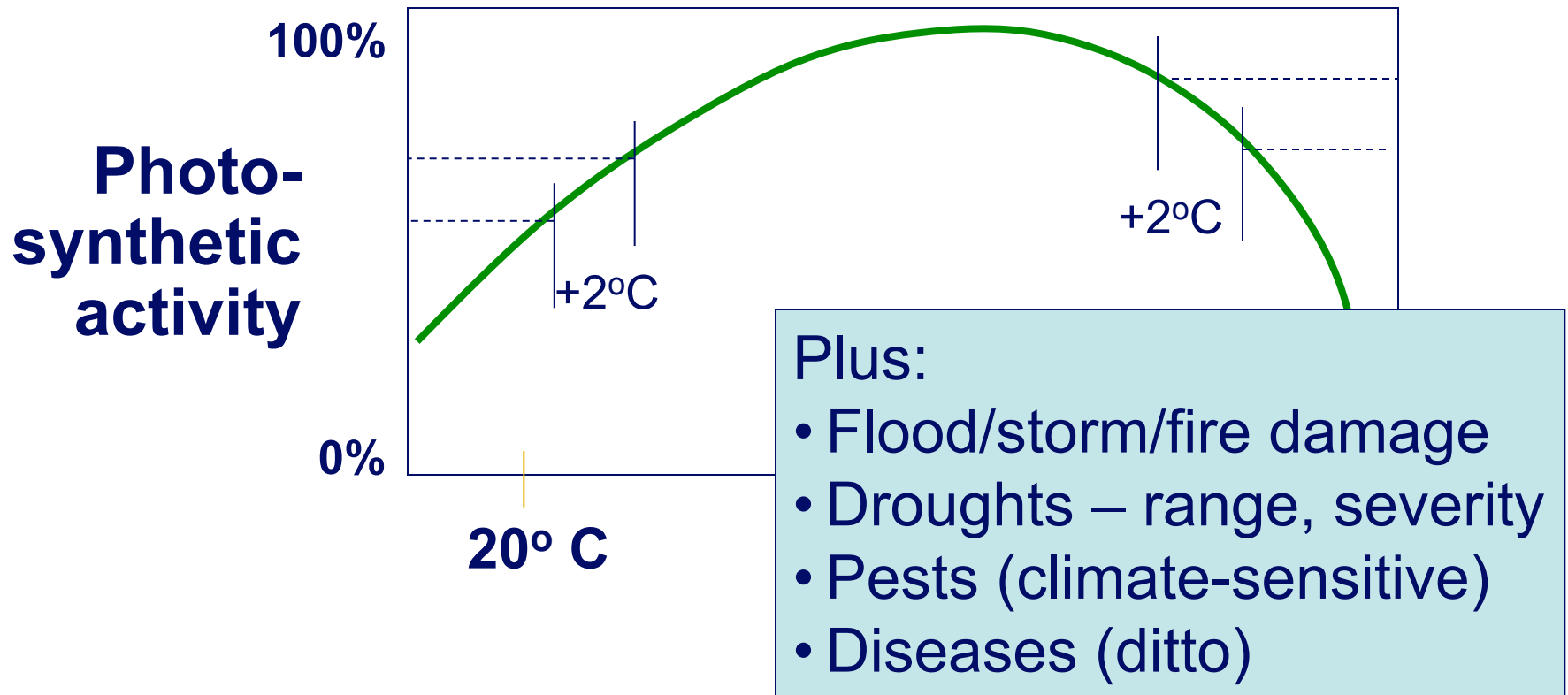


Scenario-Based: Dengue in Australia

Estimated 'receptive' region for *Ae. aegypti* mosquito vector (2050)

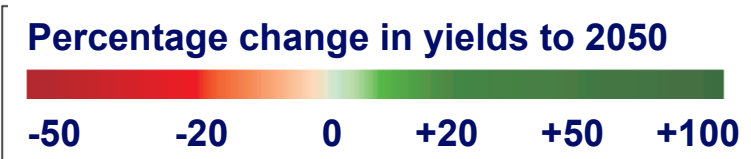
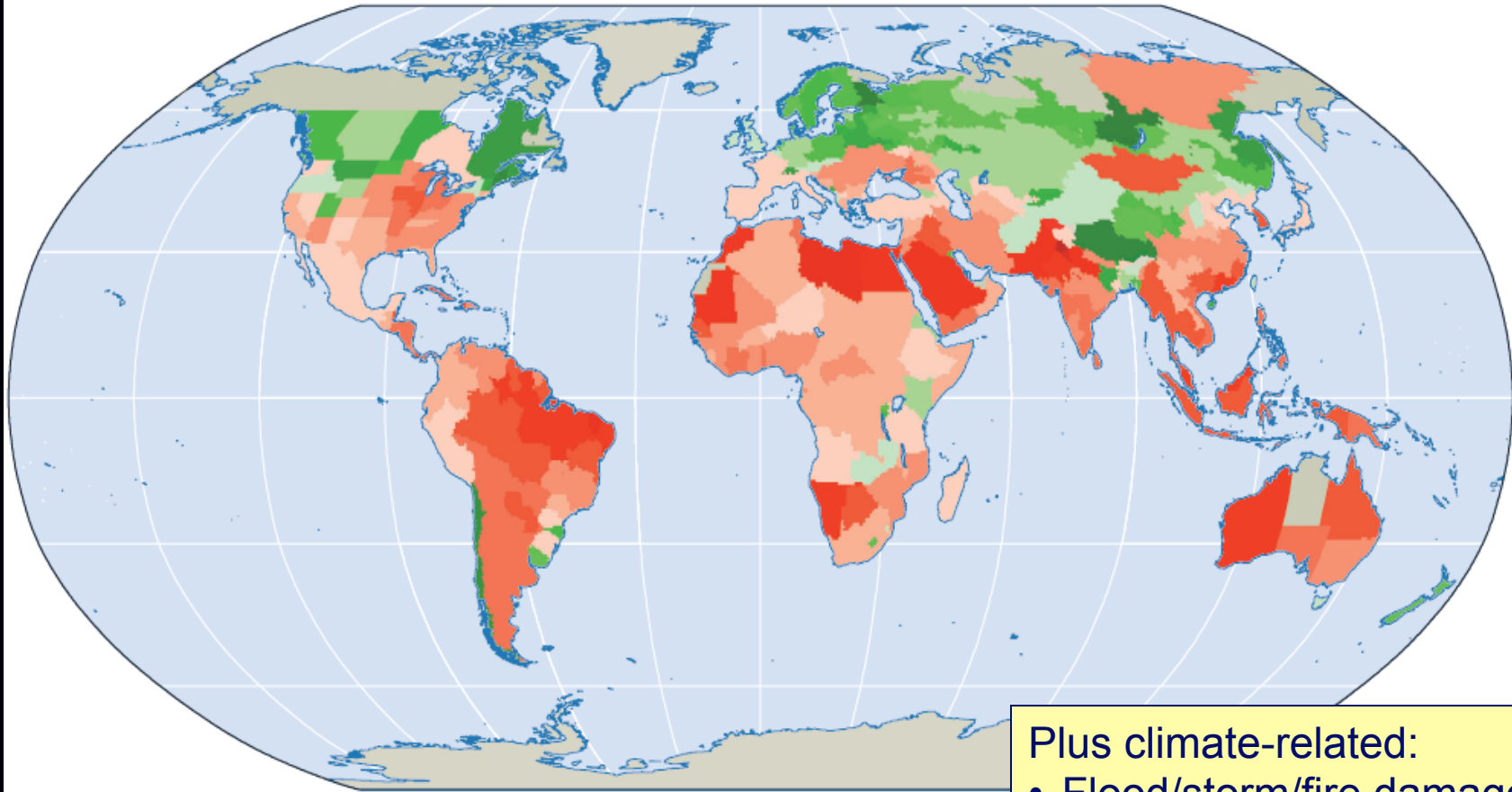


Food Yields: General Relationship of Temperature and Photosynthesis



Globally averaged estimate: +0.5°C reduces crop yields by 3-5%.

Modeled Changes in Cereal Grain Yields, to 2050



- Plus climate-related:
- Flood/storm/fire damage
 - Droughts – range, severity
 - Pests (climate-sensitive)
 - Infectious diseases (ditto)

On the bright side: health “co-benefits”

- Reducing fossil fuel use for power production:
 - Improves air quality; reduces respiratory and cardio disease.
- Increasing use of mass transit, cycling and walking:
 - Increases physical activity, reduces obesity, stimulates social contact.
- Promoting women’s control over their fertility worldwide:
 - Reduces maternal and child mortality, assists in meeting Millennium Development Goals
- NOTE: not all climate mitigation strategies align well with health goals.
 - Eliminating “cooling” particulate mixes will help meet health goals, but will not help mitigate climate change.

Key points

- Most impacts of CC on health will be **adverse**. CC will **exacerbate** existing health problems.
- CC will make it **more difficult** to 1) improve health in low-income countries and 2) reduce persistent health inequities.
- WHO estimates that **malnutrition**—among children in developing countries—was the largest cause of ill-health and premature death in 2000.
- “Broad agreement”: as CC progresses, the largest burdens will come from **indirect effects** (malnutrition, infectious disease, conflict and displacement).
- Mitigation policies will, in general, create local health benefits (“**health co-benefits**”)—a further incentive to take action on CC.
- Health sector must be a part, but not the whole, response to health and climate concerns, especially vis a vis **adaptation**.

Acknowledgements

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Questions/comments welcome: zoe.chafe@berkeley.edu

**Avoiding the
Unmanageable**

Mitigation and Adaptation

**Managing the
Unavoidable**