

**Exponent<sup>®</sup>**

# **Climate Change and Human Health**

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**Whoever would study medicine aright must learn of the following subjects. First, he must consider the effect of each of the seasons of the year and the differences between them.**

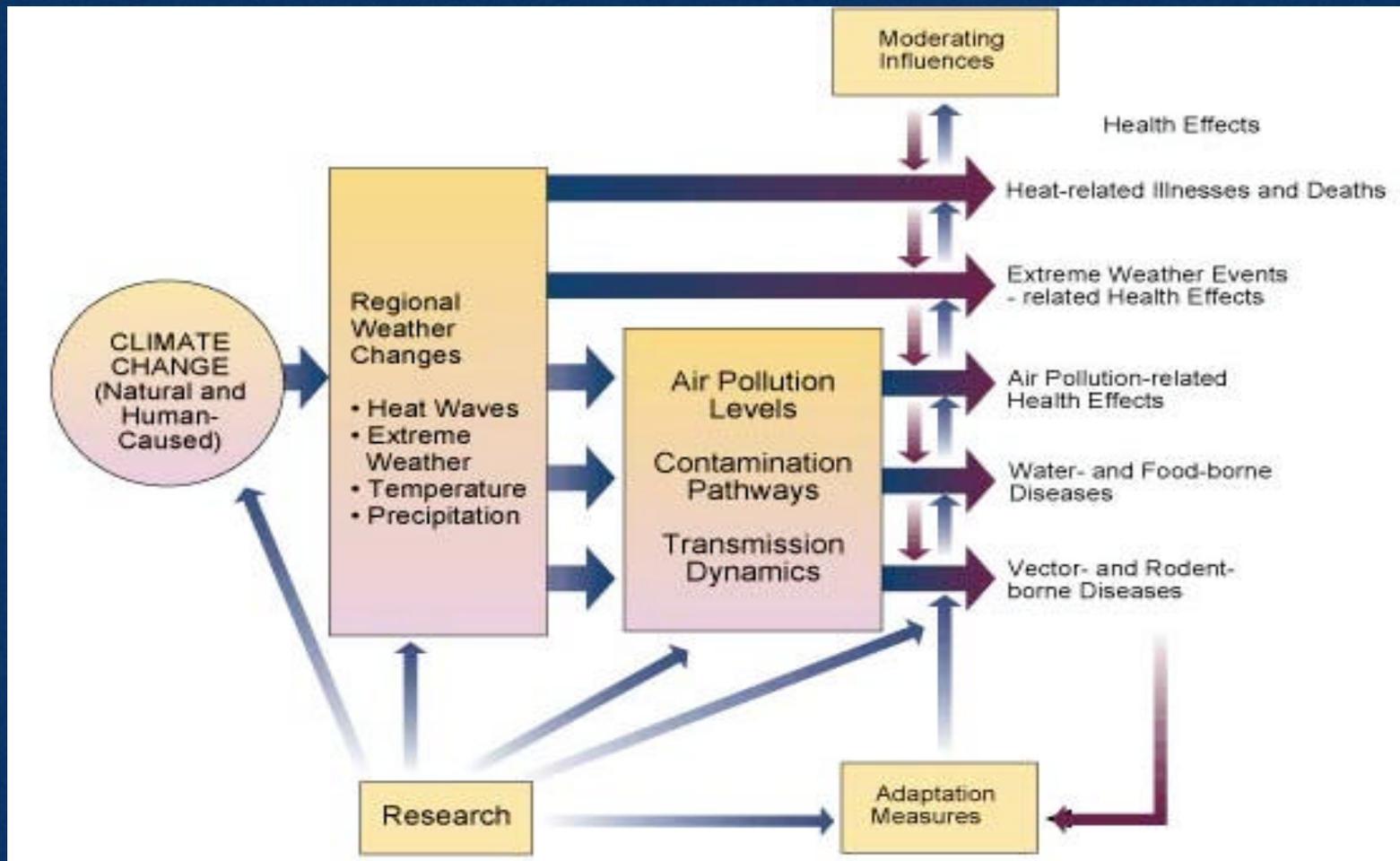
**Hippocrates, 4th Century**

# IPCC WGII –Potential Health Impacts

- Increase in the geographic range of potential transmission of **malaria & other vector-borne diseases**
- Increase in **heatwaves**, often exacerbated by increased humidity & urban air pollution
- Any increase in **flooding** could increase drowning, diarrheal & respiratory diseases
- Increase in water- and **food-borne diseases**

*The severity of impacts will depend on the capacity to adapt & its effective deployment*

# Potential Health Effects of Climate Variability and Change



# Drivers of Health Issues

- **Population density**
- **Urbanization**
- **Public health infrastructure**
- **Economic and technologic development**
- **Environmental conditions**
- **Populations at risk**
  - **Poor**
  - **Children**
  - **Increasing population of elderly residents**
  - **Immunocompromised**

# Public Health Adaptation to Climate Change

- **Existing risks**
  - **Modifying existing prevention strategies**
  - **Reinstitute effective prevention programs that have been neglected or abandoned**
  - **Apply win/win or no-regrets strategies**
- **New risks**

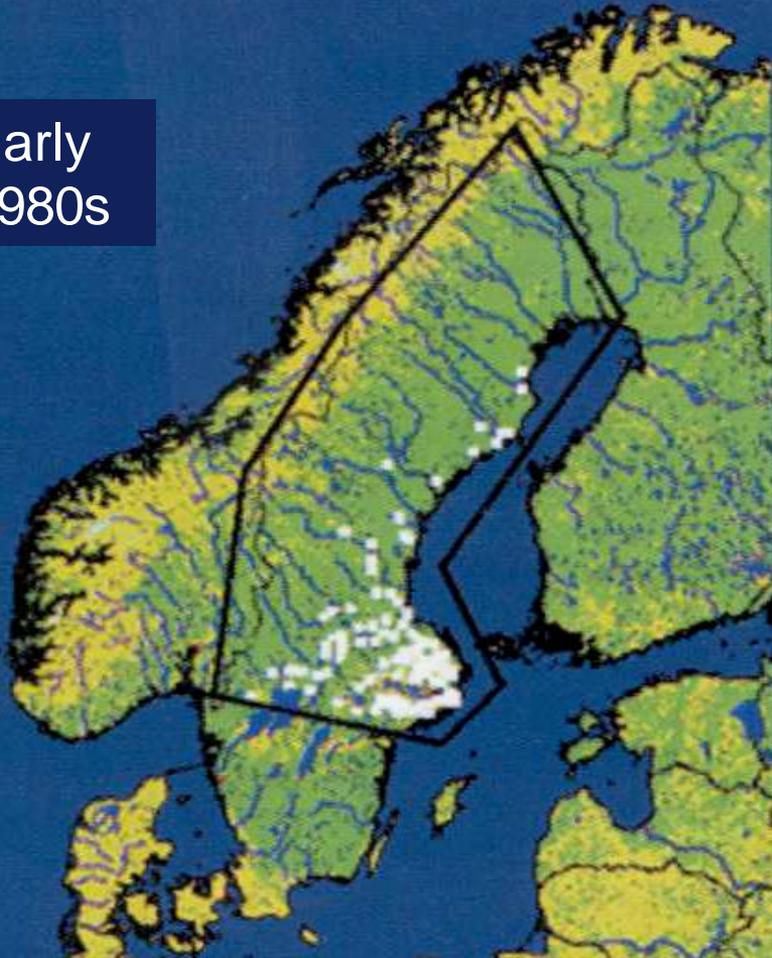
# Questions for Designing Adaptation Policies & Measures

- **Adaptation to what?**
- **Is additional intervention needed?**
- **What are the future projections for the outcome? Who is vulnerable?**
  - **On scale relevant for adaptation**
- **Who adapts? How does adaptation occur?**
- **When should interventions be implemented?**
- **How good or likely is the adaptation?**

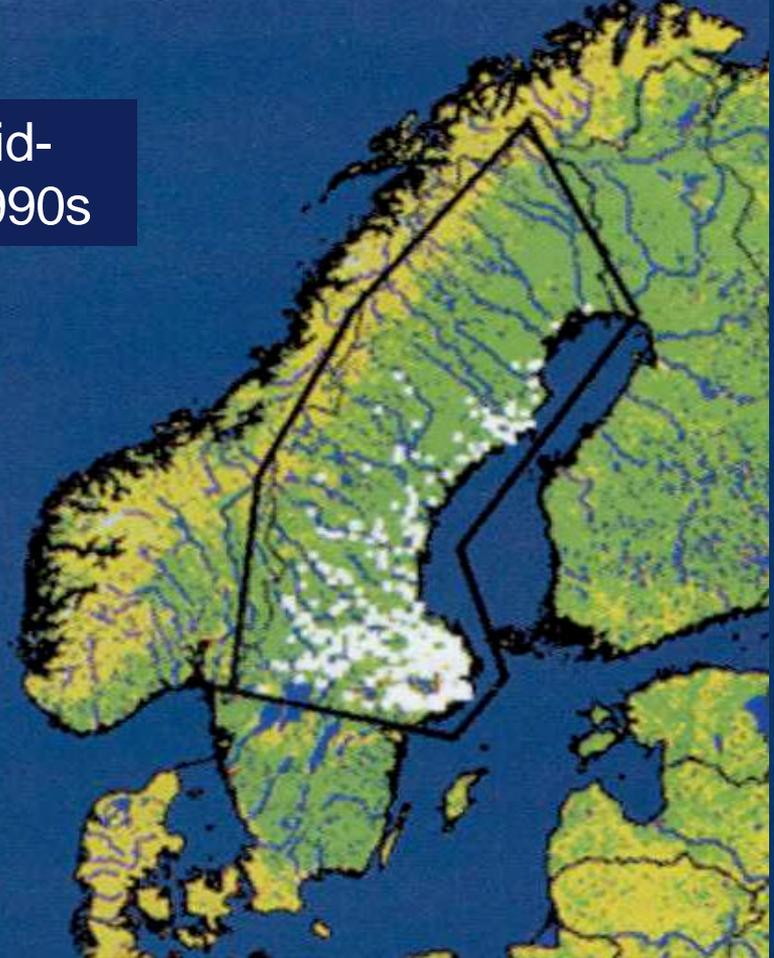
# Tick-borne Encephalitis, Sweden

1990s vs. 1980s

Early  
1980s



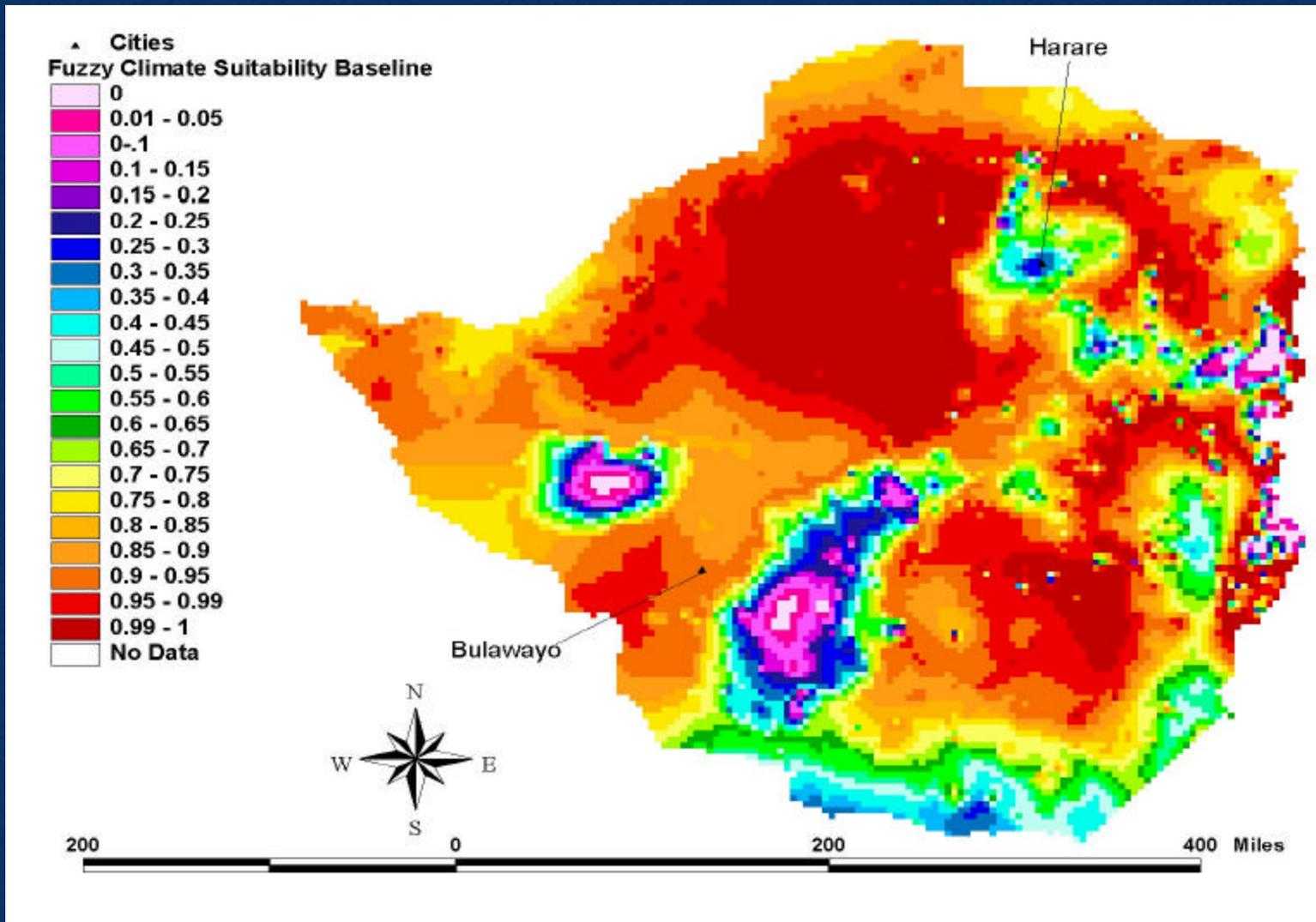
Mid-  
1990s



# Potential Effects of Climate Change on Malaria in Zimbabwe

- **Dramatic change in geographic distribution of stable seasonal malaria**
- **The increase in suitability is attributable to mean temperature in the highlands and precipitation in the lowlands in the south**
- **Largest overall change in suitability in the highlands (where temperature currently limits distribution) -- majority of population lives in highlands**

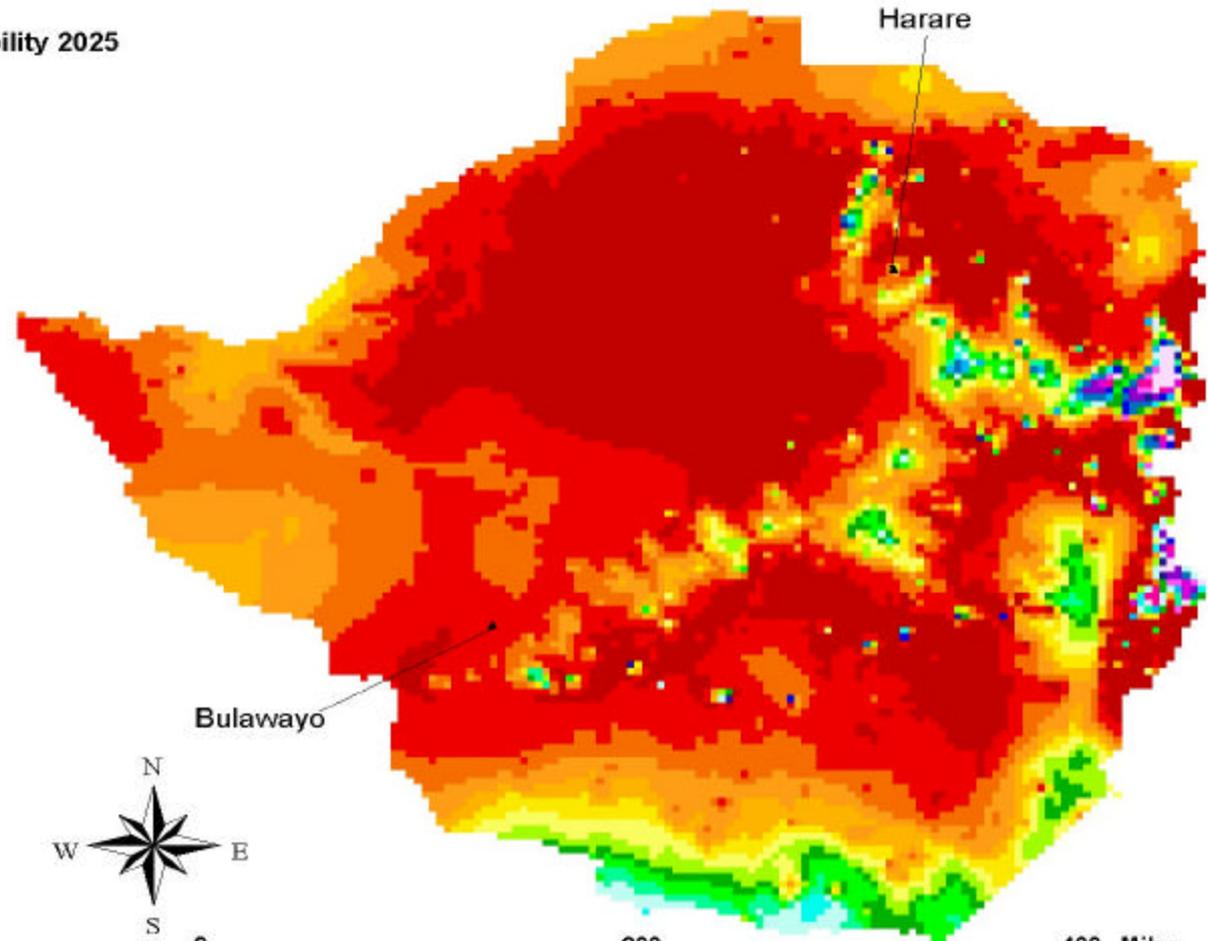
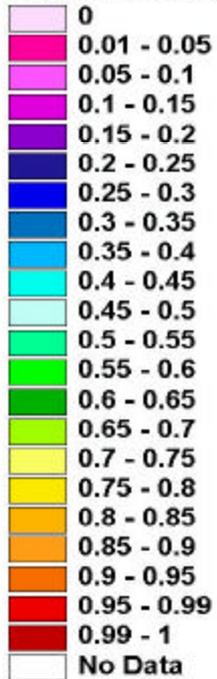
# Baseline



# 2025

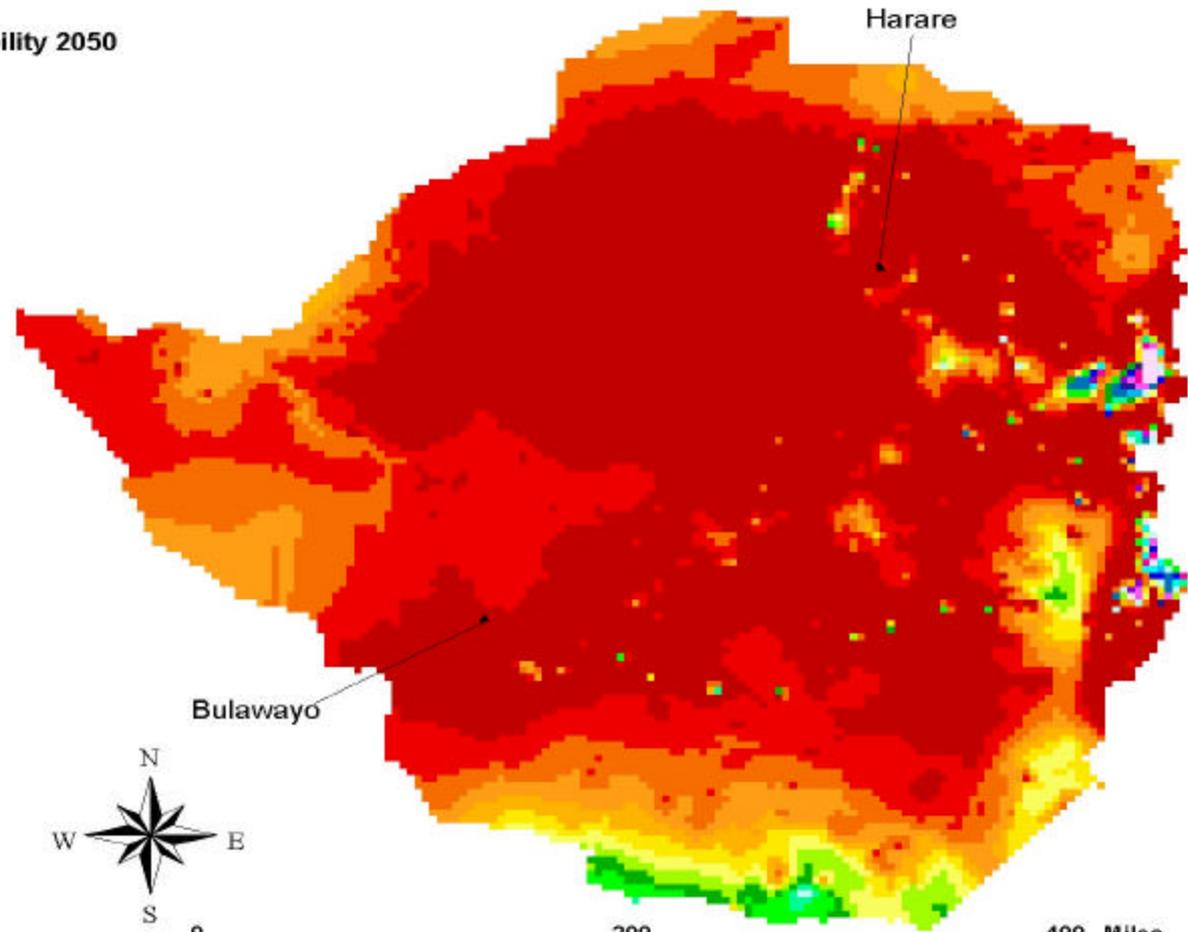
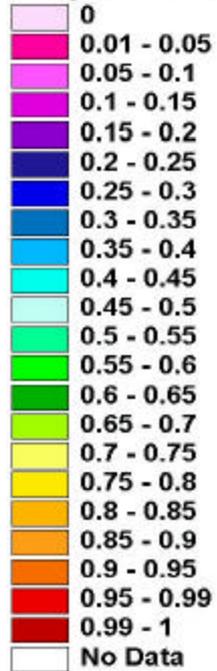
▲ Cities

Fuzzy Climate Suitability 2025



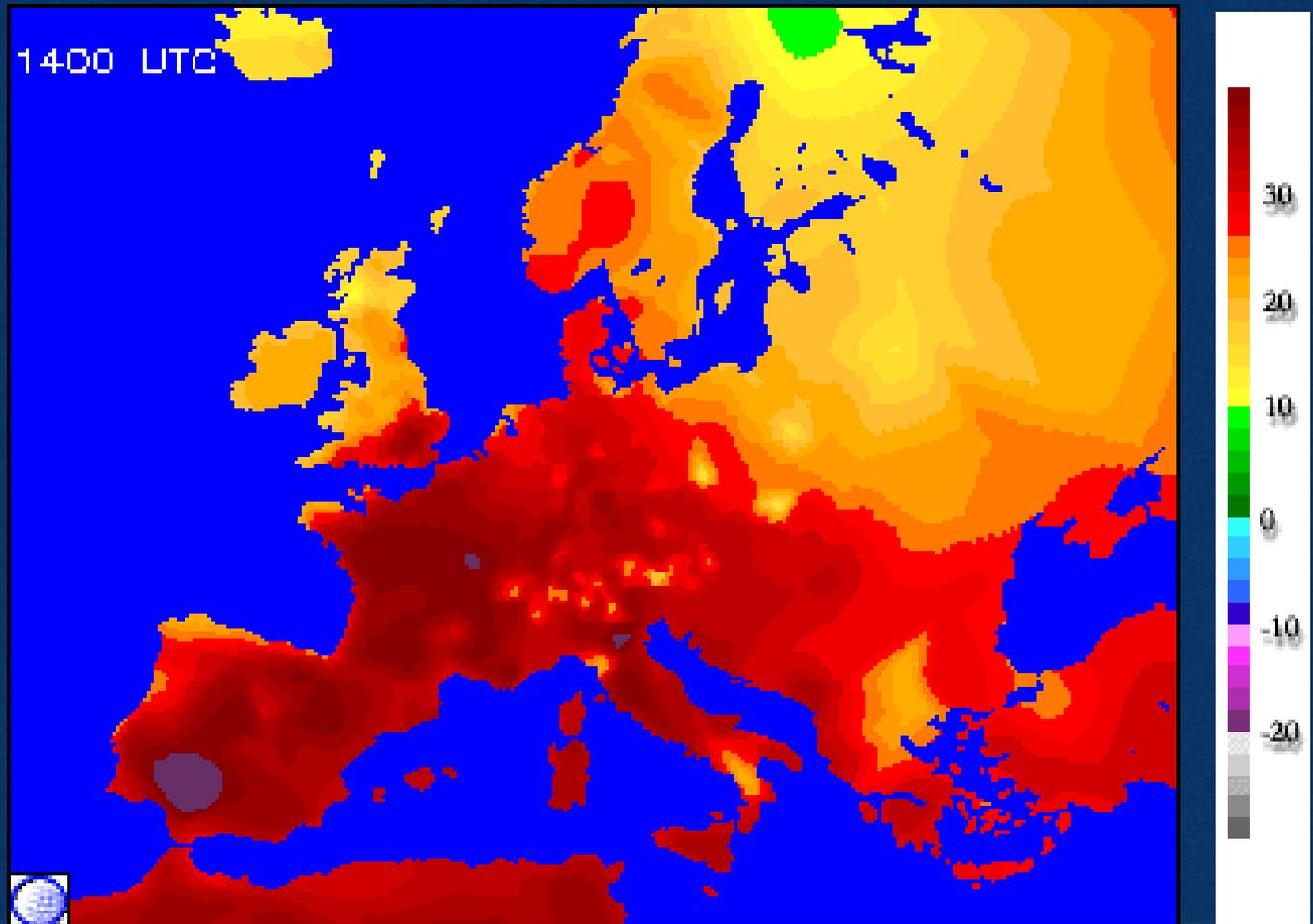
# 2050

▲ Cities  
Fuzzy Climate Suitability 2050



# Maximum Temperature August 10, 2003

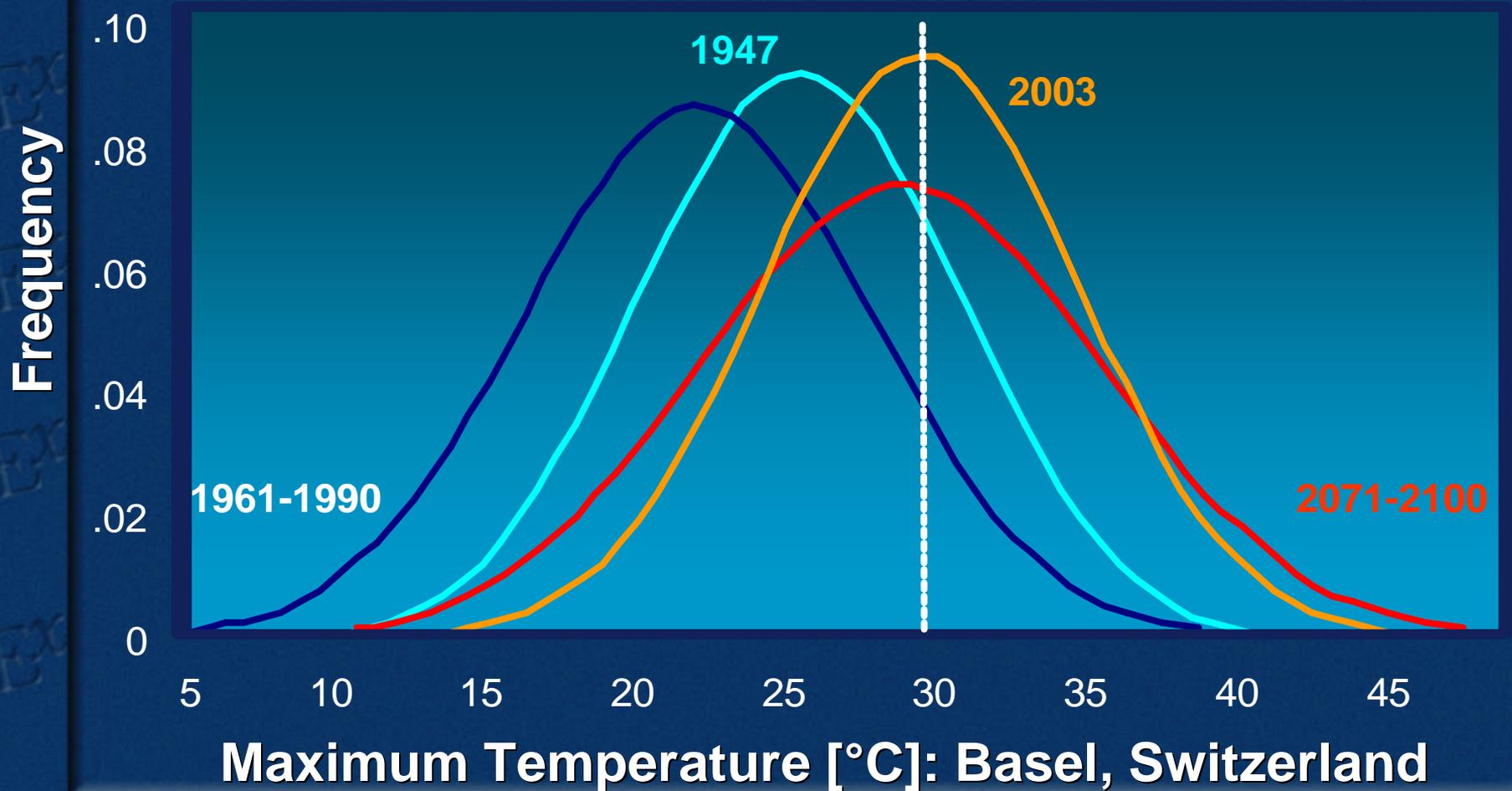
Excess  
Mortality  
France  
14,800  
Portugal  
1,316



# Both Heat and Air Pollution Contributed to Excess Mortality

- **UK**
  - Temperature record of 38.5 °C
  - 2045 excess deaths in England and Wales of which 21-38% were estimated to have been due to elevated ozone and PM10 concentrations (Stedman 2004)
- **Netherlands**
  - No temperature records broken; highest temperature 35°C
  - Estimated 1000-1400 excess heat-related deaths of which 400-600 may have been due to elevated ozone and PM10 concentrations (Fisher et al. 2004)

# 2003: The Shape of Things to Come?



# Potential Health Impacts of Floods

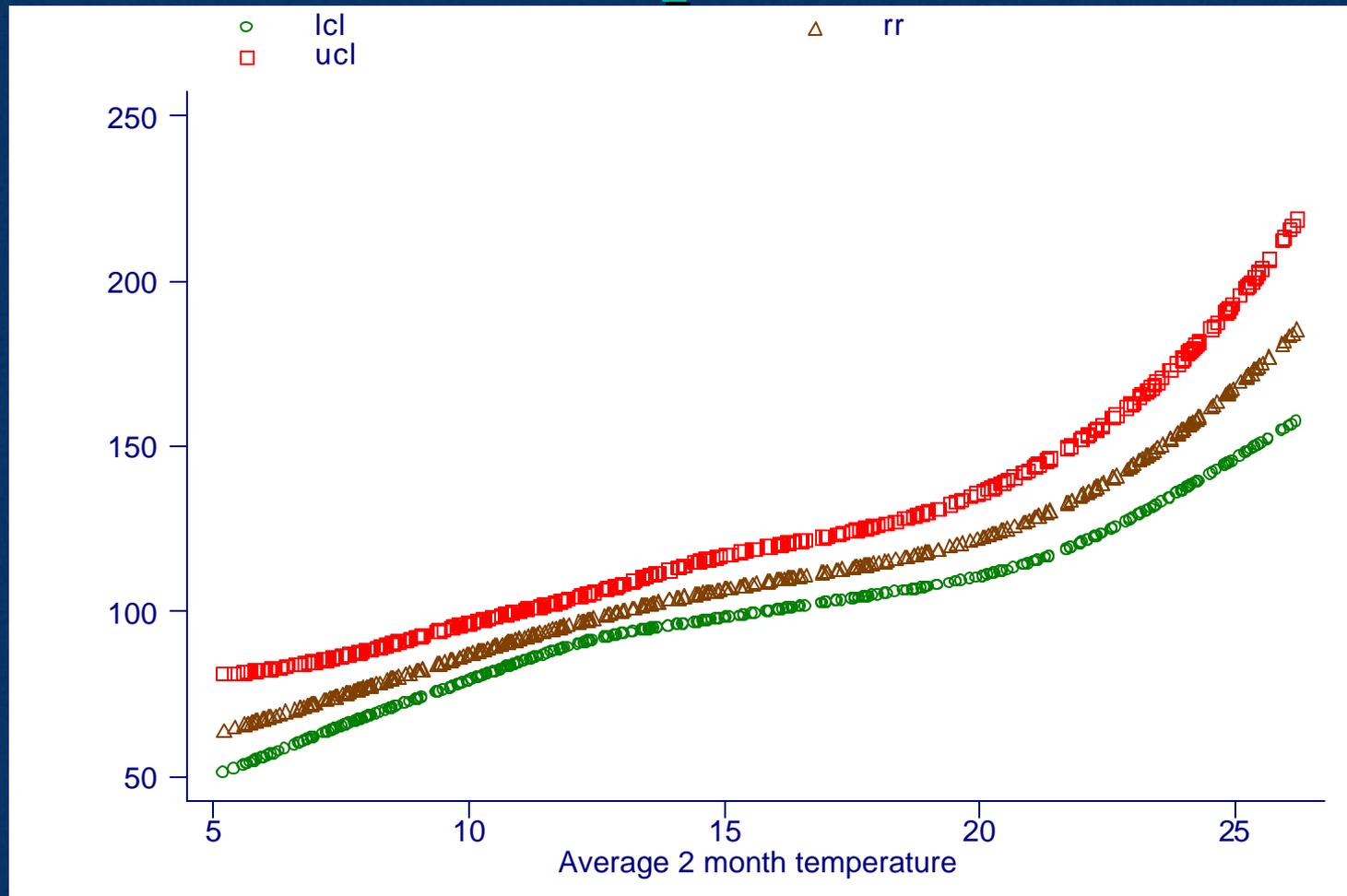


- Immediate deaths and injuries
- Non specific increases in mortality
- Infectious diseases-leptospirosis, hepatitis, diarrhoeal, respiratory, and vector-borne diseases
- Exposure to toxic substances
- Mental health effects
- Increased demands on health systems

# Historic Dresden 2002



# Association Between Temperature (°C) and Salmonella in Spain



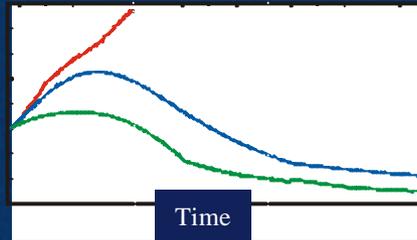
# Estimating the Global Health Impacts of Climate Change

Campbell-Lendrum et al. 2003

- What will be the **total** potential health impact caused by climate change (2000 to 2030)?
- How much of this could be avoided by reducing the risk factor (i.e. stabilizing greenhouse gas (GHG) emissions)?

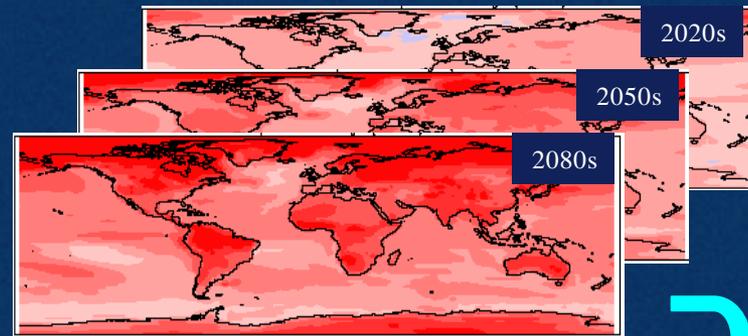
# Comparative Risk Assessment

Greenhouse gas emissions scenarios



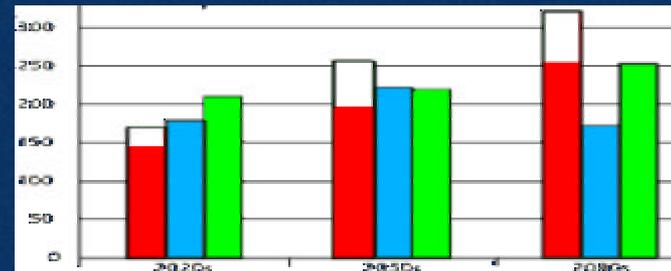
Global climate modelling:

Generates series of maps of predicted future climate



Health impact model:

Estimates the change in relative risk of specific diseases



# Criteria for Selection of Health Outcomes

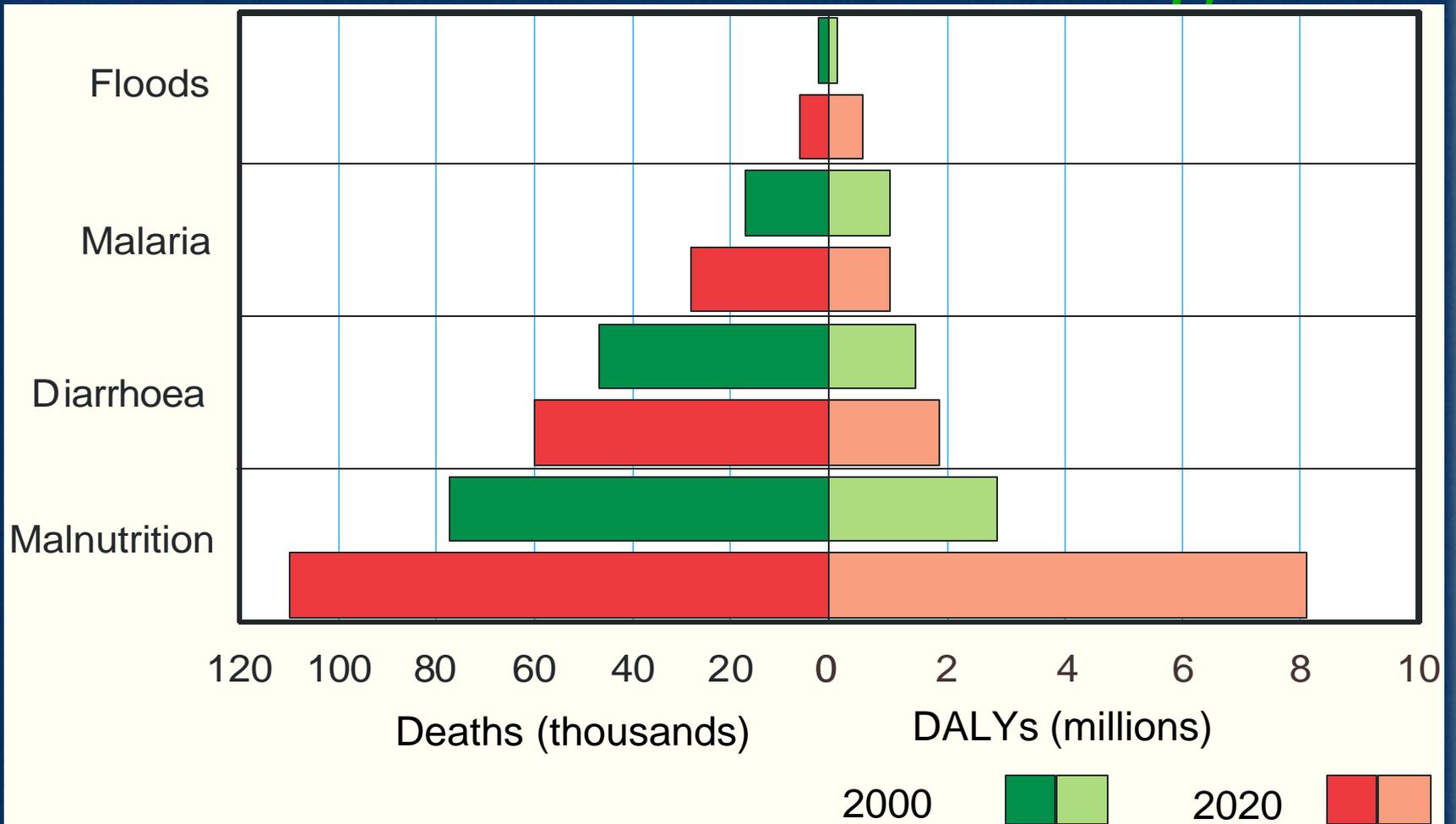
- Sensitive to climate variation
- Important global health burden
- Quantitative model available at the global scale
  - Malnutrition (prevalence)
  - Diarrhoeal disease (incidence)
  - VBD - dengue and *Falciparum* malaria
  - Inland and coastal floods (mortality)
  - Heat and cold related CVD mortality

# **Exposure: Alternative Future Projections of GHG Emissions**

- **Unmitigated current GHG emissions trends**
- **Stabilization at 750 ppm CO<sub>2</sub>-equivalent**
- **Stabilization at 550 ppm CO<sub>2</sub>-equivalent**
- **1961-1990 levels of GHGs with associated climate**

**Source: UK Hadley Centre models**

# Estimated Death and DALYs Attributable to Climate Change



# Conclusions

- **Climate change may already be causing a significant burden in developing countries**
- **Unmitigated climate change is likely to cause significant public health impacts out to 2030**
  - Largest impacts from diarrhea, malnutrition, & VBD
- **Uncertainties include:**
  - Uncertainties in projections
  - Effectiveness of interventions
  - Changes in non-climatic factors

**Thank you**

