



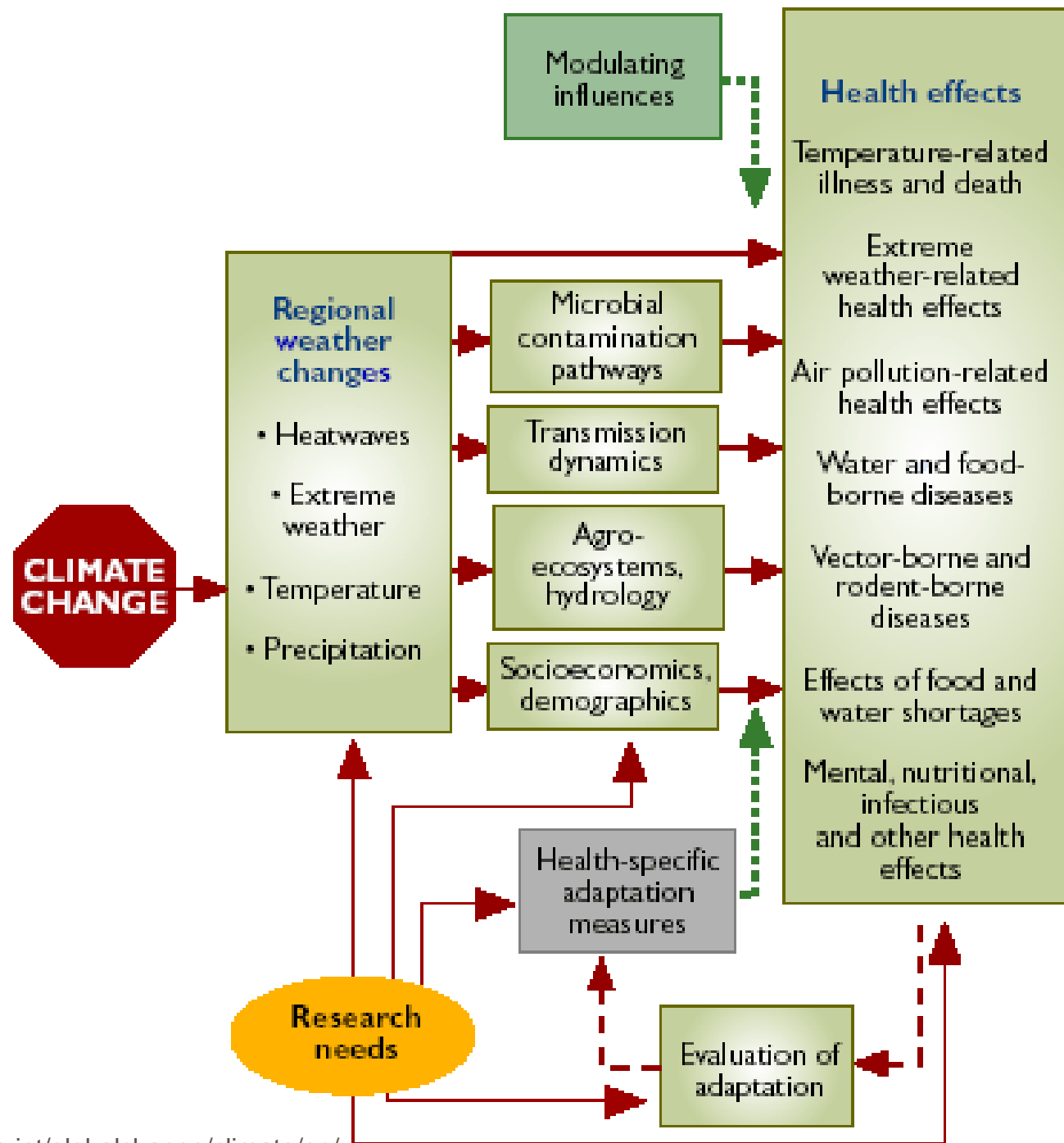
# **Human Health Consequences of Global Climate Change**

**Kristie Willett, PhD**  
**[kwillett@olemiss.edu](mailto:kwillett@olemiss.edu)**

# Overview

- Stress related health problems
- Increased infectious disease
- Extreme events
- Increased # of poor
- Agricultural yields decreased – hunger







# Higher Temps = More Stress

Heatwave deaths in Midwestern cities may soar

CITY	CURRENT DEATHS IN PRESENT CLIMATE	2020 *CLIMATE AVERAGE DEATHS	2050 *CLIMATE AVERAGE DEATHS
Buffalo, NY	33	34.3	55.3
Chicago, IL	191	400.7	497.3
Cleveland, OH	29	39	52.3
Detroit, MI	110	162.7	219
Indianapolis, IN	36	55.7	70
Kansas City, MO	49	115	127.3
Minneapolis, MN	59	129.3	174.7
Pittsburgh, PA	39	54	79.7
St. Louis, MO	79	160	185.3

Numbers derived from averages from three models -- United Kingdom Meteorological Model, Global Fluid Dynamics Laboratory Model, and Max Planck Institute for Meteorology Model. Population and metropolitan areas standardized to current levels. Lives spared due to warmer winters estimated to be negligible. Adapted from Laurence S. Kalkstein and J. Scott Greene. <http://www.sierraclub.org/globalwarming/health/weather.asp>

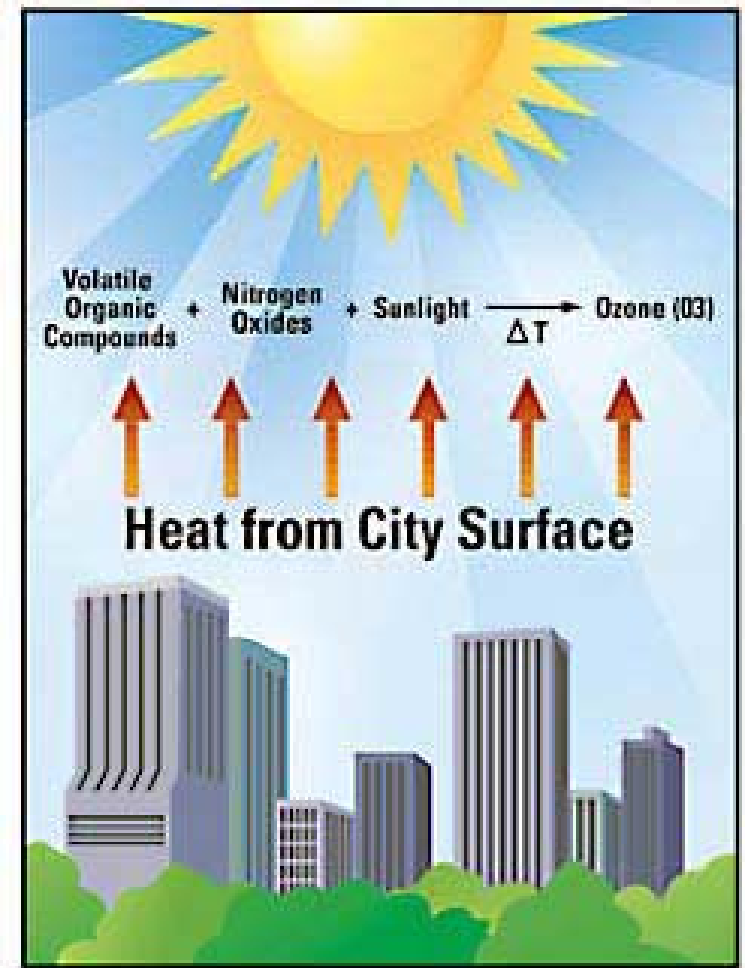


# Heat Stress

- Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat.
- Historically, from 1979-2003, excessive heat exposure caused 8,015 deaths in the United States.
- Those at Risk:
  - Infants and children up to four years of age are sensitive to the effects of high temperatures and rely on others to regulate their environments and provide adequate liquids.
  - People 65 years of age or older may not compensate for heat stress efficiently and are less likely to sense and respond to change in temperature.
  - People who are overweight may be prone to heat sickness because of their tendency to retain more body heat.
  - People who overexert during work or exercise may become dehydrated and susceptible to heat sickness.
  - People who are physically ill, especially with heart disease or high blood pressure, or who take certain medications, such as for depression, insomnia, or poor circulation, may be affected by extreme heat.
  - Access to air conditioning?

# Heat and Air Quality

- Under certain conditions, "excessive heat" also can increase the rate of ground-level ozone formation, or smog, presenting an additional threat to health and ecosystems within and downwind of cities.







# Ozone Health Effects

- Ozone can irritate lung airways and cause inflammation;
- Repeated exposure to ozone pollution for several months may cause permanent lung damage;
- Even low-level exposure can result in aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses; and
- Studies have linked hospital admissions and emergency room visits to ground-level ozone exposure.

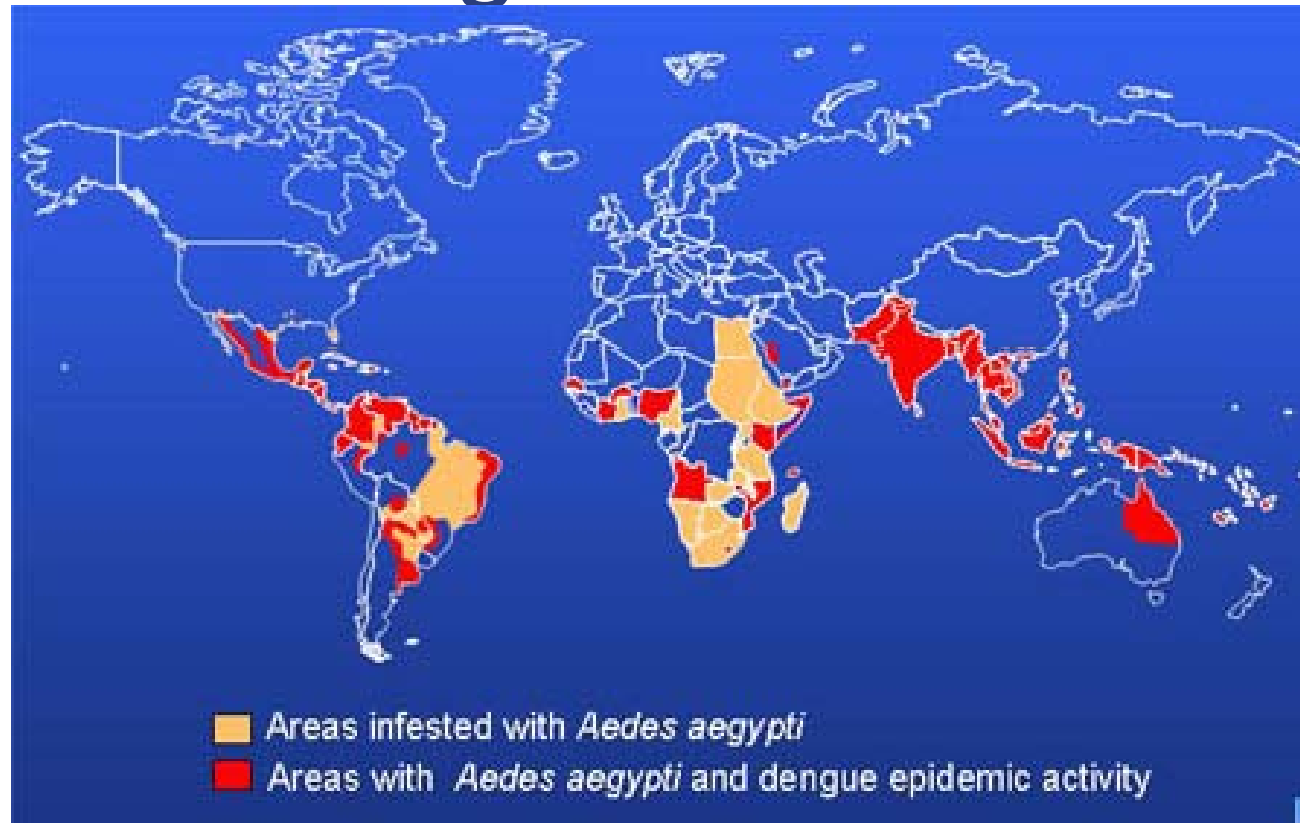
# Increased Infectious Disease

- Mosquitos
  - Dengue Fever
  - Malaria
- Ticks
  - Lyme
- Snail
  - Schistosomiasis
- Water
  - Cholera





# Dengue Fever



- In 2005, dengue is the most important mosquito-borne viral disease affecting humans; its global distribution is comparable to that of malaria, and an estimated 2.5 billion people live in areas at risk for epidemic transmission.
- Infections produce a spectrum of clinical illness ranging from a nonspecific viral syndrome to severe and fatal hemorrhagic disease. NO VACCINE



# Malaria

- Malaria is a mosquito-borne disease caused by a parasite. People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. Each year 350-500 million cases of malaria occur worldwide, and over one million people die, most of them young children in sub-Saharan Africa.
- <http://gis.hhs.gov/website/mrisk9/viewer.htm>  
CDC interactive Map

	Country	Province	City Name	City Population	City Altitude	Risk in City	Risk in Country	Recommended Prophylaxis
	Iraq	Ninawa	al-Mawsil	1,000,000 to 5,000,000	252	Yes	Risk in Basrah province and in areas at ...	Chloroquine

# Schistosomiasis

- Infection occurs when your skin comes in contact with contaminated fresh water in which certain types of snails that carry schistosomes are living.
- Fresh water becomes contaminated by *Schistosoma* eggs when infected people urinate or defecate in the water. The eggs hatch, and if certain types of snails are present in the water, the parasites grow and develop inside the snails.
- Within days after becoming infected, you may develop a rash or itchy skin. Fever, chills, cough, and muscle aches can begin within 1-2 months of infection.
- For people who are repeatedly infected for many years, the parasite can damage the liver, intestines, lungs, and bladder.
- Not found in the United States, 200 million people are infected worldwide.



# Lyme Disease

- Lyme disease is caused by the bacterium and is transmitted to humans by the bite of infected blacklegged ticks.
- Typical symptoms include fever, headache, fatigue, and a characteristic skin rash. If left untreated, infection can spread to joints, the heart, and the nervous system.







# Cholera

- Cholera is an acute, diarrheal illness caused by infection of the intestine with the bacterium *Vibrio cholerae*.
- Approximately one in 20 infected persons has severe disease characterized by profuse watery diarrhea, vomiting, and leg cramps.
- In these persons, rapid loss of body fluids leads to dehydration and shock. Without treatment, death can occur within hours.
- In an epidemic, the source of the contamination is usually the feces of an infected person. The disease can spread rapidly in areas with inadequate treatment of sewage and drinking water.
- The cholera bacterium may also live in the environment in brackish rivers and coastal waters. Shellfish eaten raw have been a source of cholera, and a few persons in the United States have contracted cholera after eating raw or undercooked shellfish from the Gulf of Mexico.



# Extreme Events

- **Drought**
  - Land degradation, crop and livestock loss, wild fires, water shortage, population migrations (refugees), malnutrition
- **Flood**
  - Land degradation, crop and livestock loss, water contamination, erosion, mold, pressure on infrastructure, property loss, water and food-borne diseases
- **Hurricanes/Cyclones**
  - See above, insurance issues
- **Sea level rise**
- **= Displaced People...Unrest...Poverty**

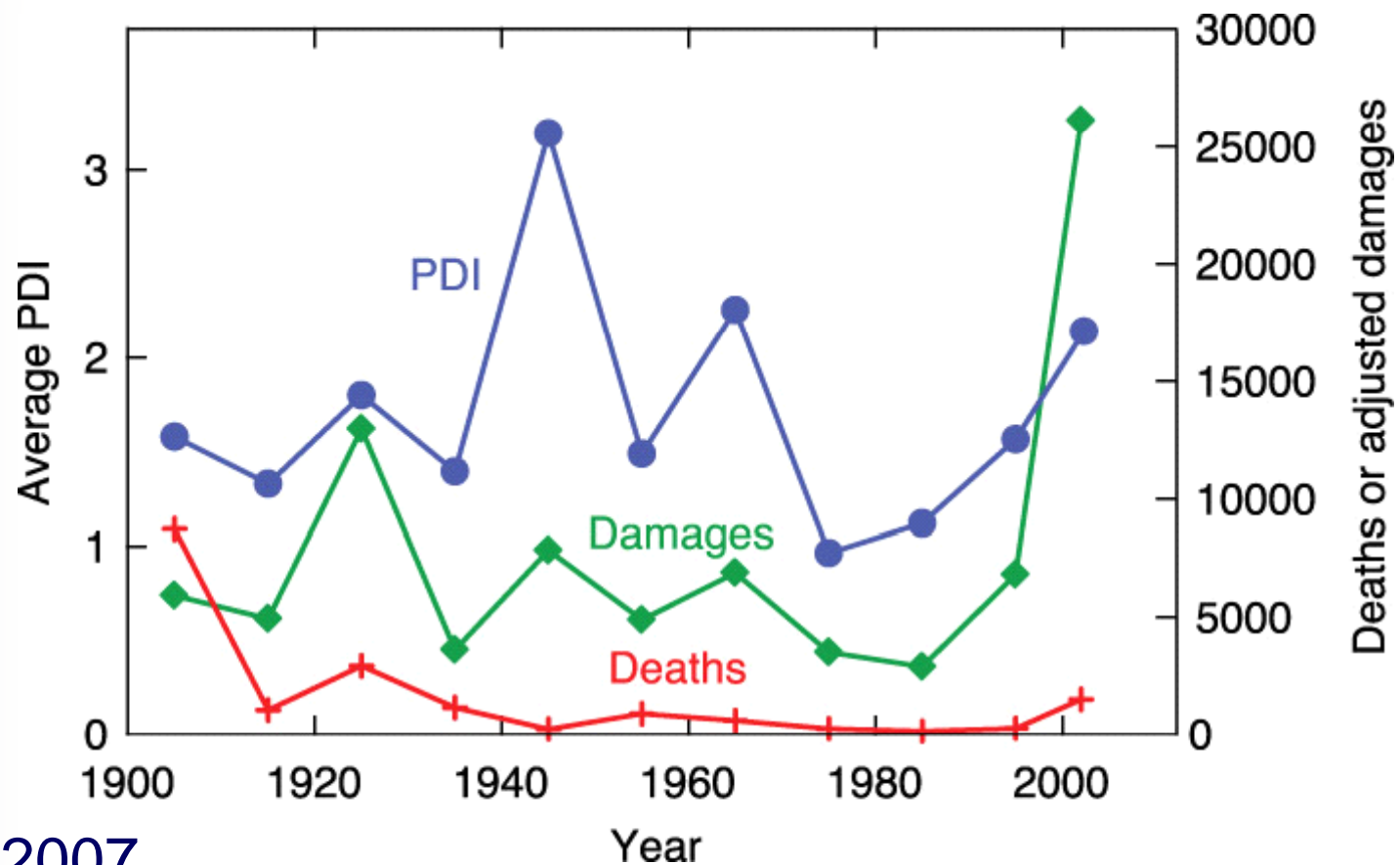




# Coastal Living

- In a 2000 report, the World Resources Institute stated: "In 1995, over 2.2 billion people - 39 percent of the world's population - lived within 100 km of a coast, an increase from 2 billion people in 1990. The coastal area accounts for only 20 percent of all land area." According to 2002 data from the NOAA, over 50 percent of people in the United States live within 50 miles of the ocean or Great Lakes.

# Decadal average hurricane total dissipated energy (PDI), loss of life, and inflation-adjusted economic damages (thousands of US\$) from hurricanes making landfall in the continental USA



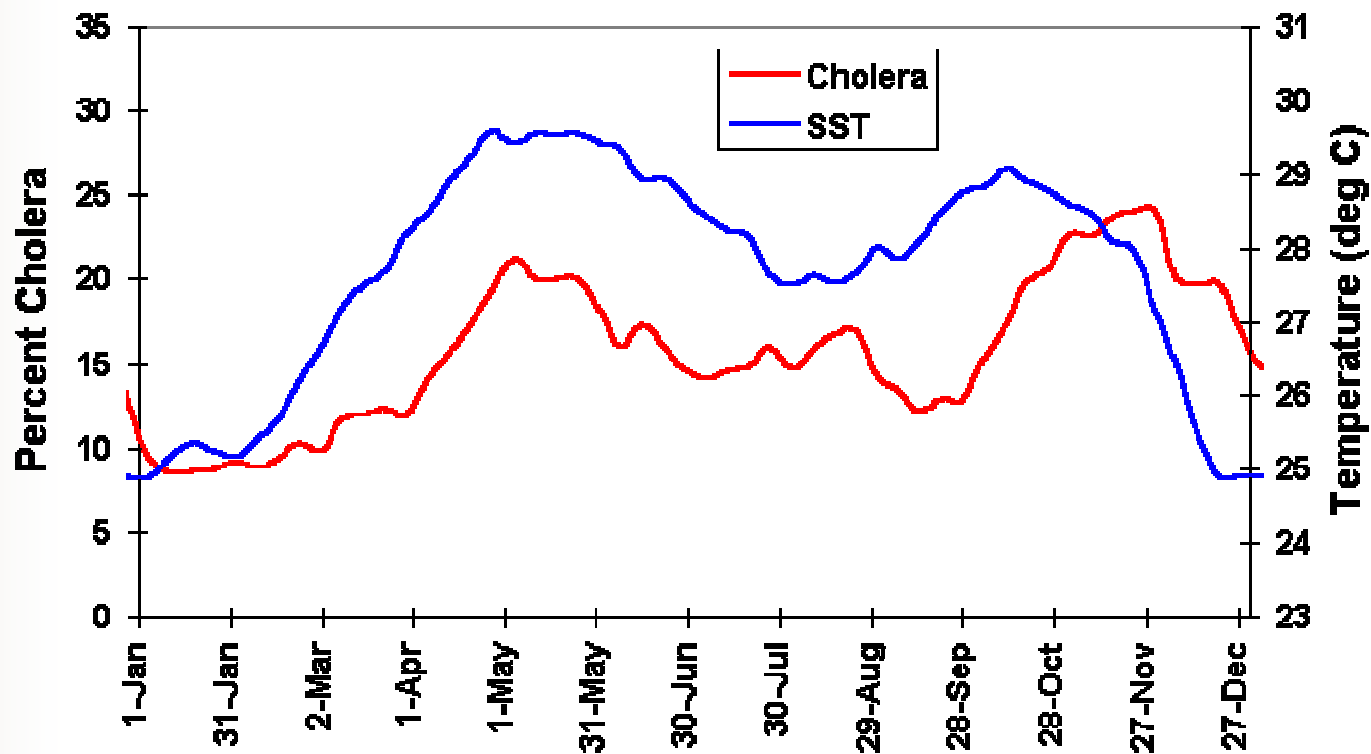
# Example - Bangladesh

- Aid poured into Bangladesh as the death toll from Cyclone Sidr spiralled above 3,000, with fears that thousands more bodies have yet to be found. Nov. 2007
- Cyclone Sidr, which produced winds of 150mph, demolished houses, crops, trees and shrimp farms. Disaster officials put the number of homes destroyed at more than 750,000.
- In 1991, more than 130,000 people died in a storm of similar size and strength.
- Recent estimates of Bangladesh's population range from 142 - 159 million, (7<sup>th</sup> most populous nation in the world). With a land area of 144,000 km<sup>2</sup> (94<sup>th</sup>), it has the highest population density in the world.
- Its per capita income in 2006 was US\$2300 (on purchasing power parity basis)



Bangladesh

# Remote Sensing of Cholera: 1994 SST and Cholera Plot












Epidemics in 1990s and again in 2002

<http://geo.arc.nasa.gov/sge/health/projects/cholera/cholera94.html> – Rita Colwell

# Summary

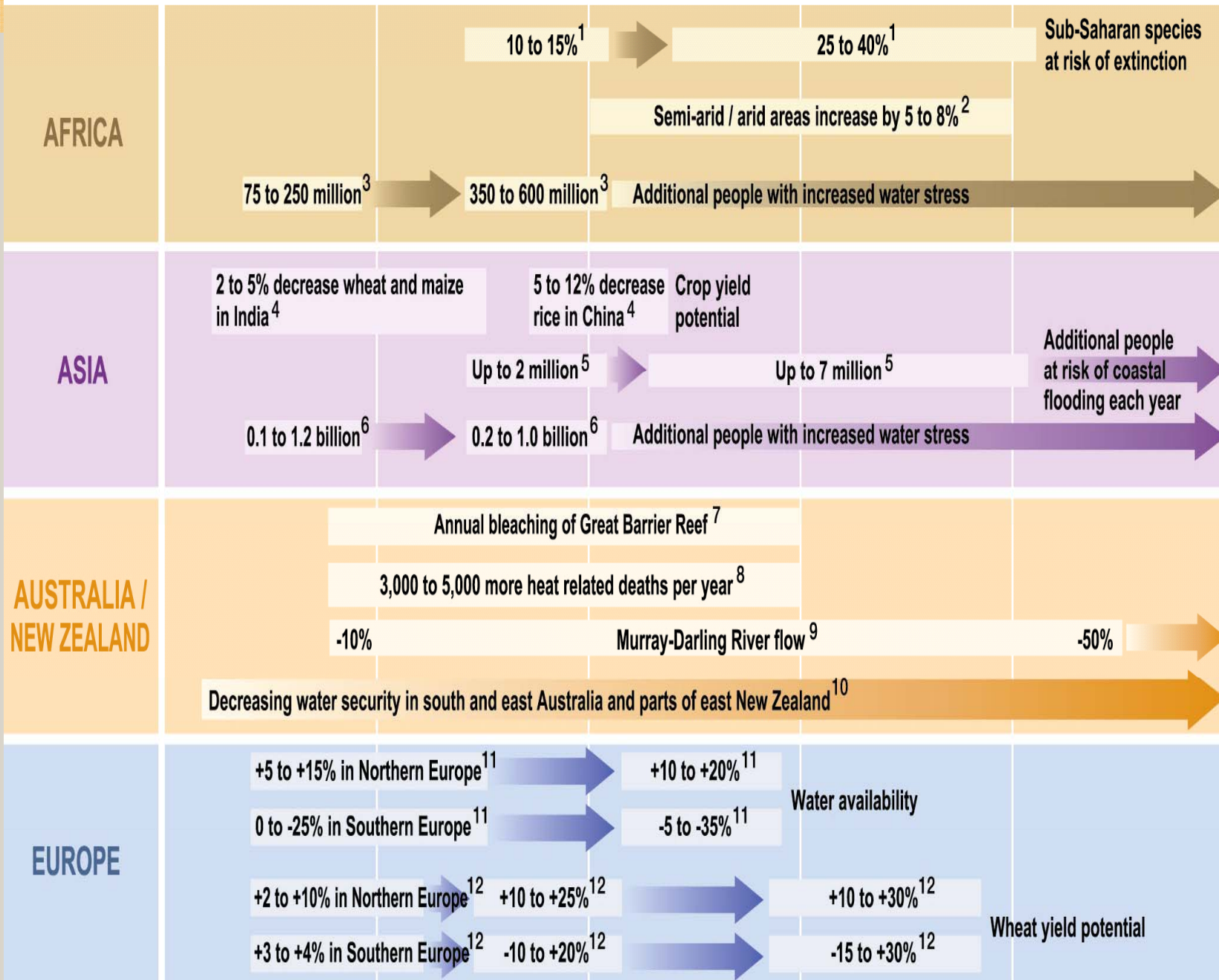
## ■ From IPCC

	Negative impact	Positive impact
<b>Very high confidence</b> Malaria: contraction and expansion, changes in transmission season		
<b>High confidence</b> Increase in malnutrition		
Increase in the number of people suffering from deaths, disease and injuries from extreme weather events		
Increase in the frequency of cardio-respiratory diseases from changes in air quality		
Change in the range of infectious disease vectors		
Reduction of cold-related deaths		
<b>Medium confidence</b> Increase in the burden of diarrhoeal diseases		

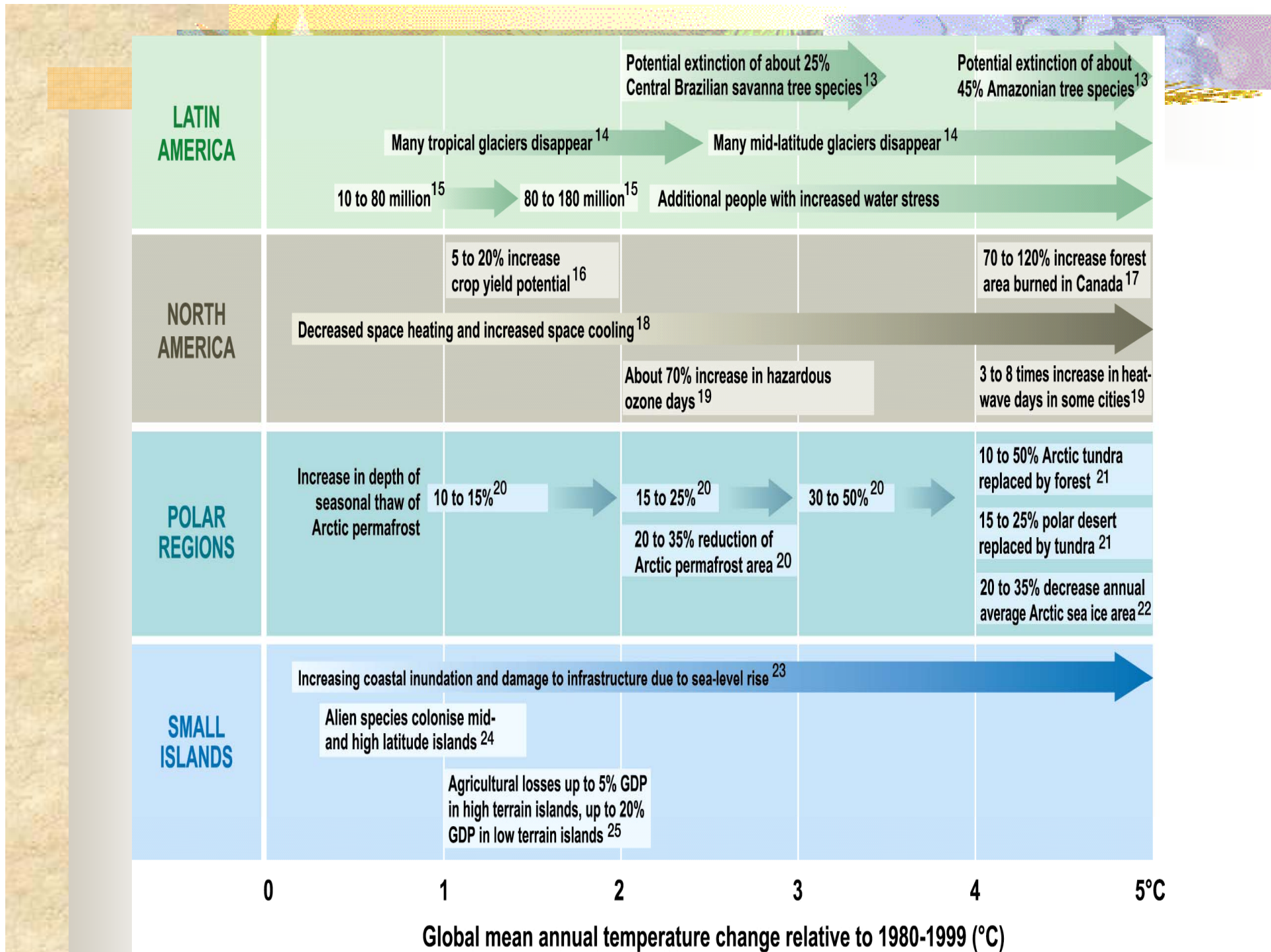


# Global mean annual temperature change relative to 1980-1999 (°C)

0 1 2 3 4 5°C







Global mean annual temperature change relative to 1980-1999 (°C)



# References

- Climate change and human health - risks and responses. Summary. WHO, 2003, ISBN 9241590815
- IPCC Working Group II Report  
<http://www.ipcc-wg2.org/index.html>
- US EPA  
<http://www.epa.gov/climatechange/>
- CDC disease fact sheets