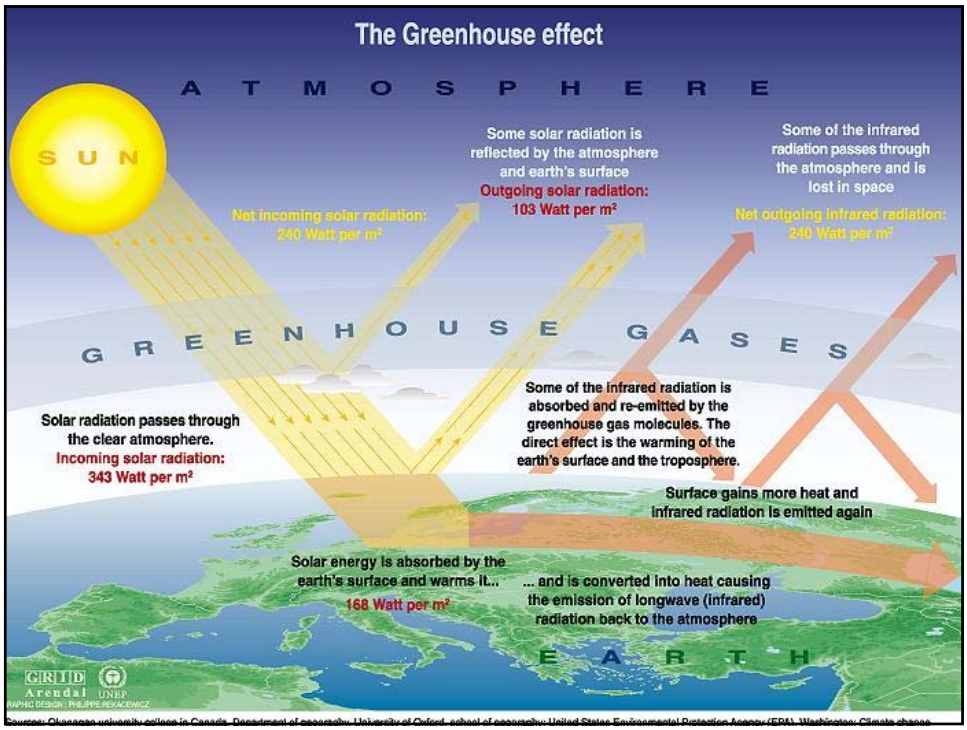
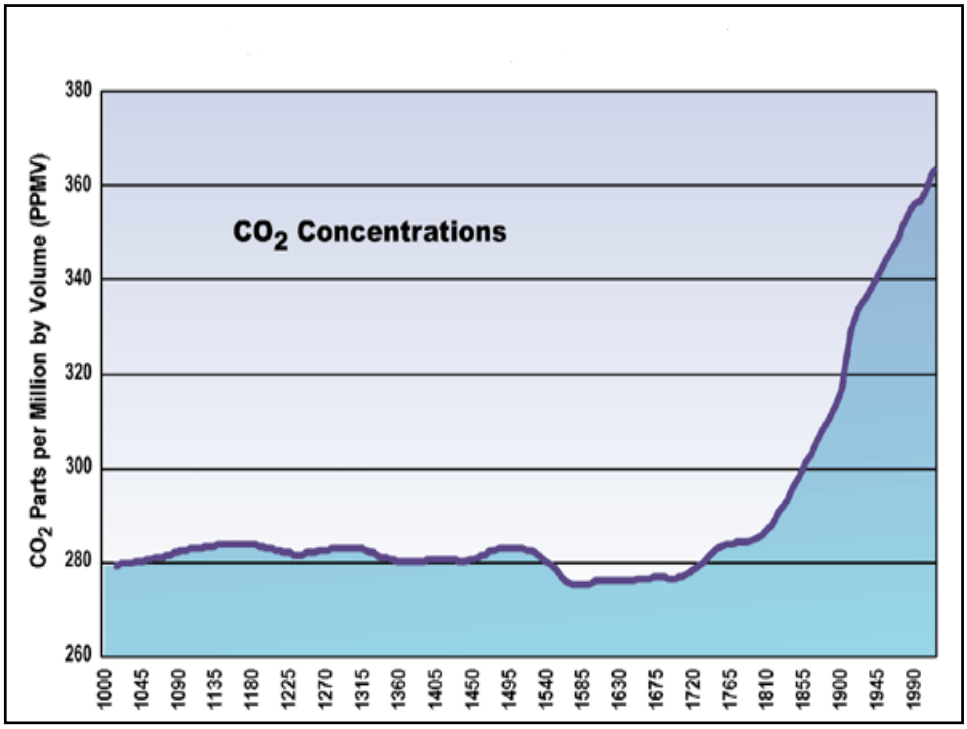
Climate Change and Human Health: The Public Health Response

George Luber, PhD
National Center for Environmental Health
Centers for Disease Control and Prevention



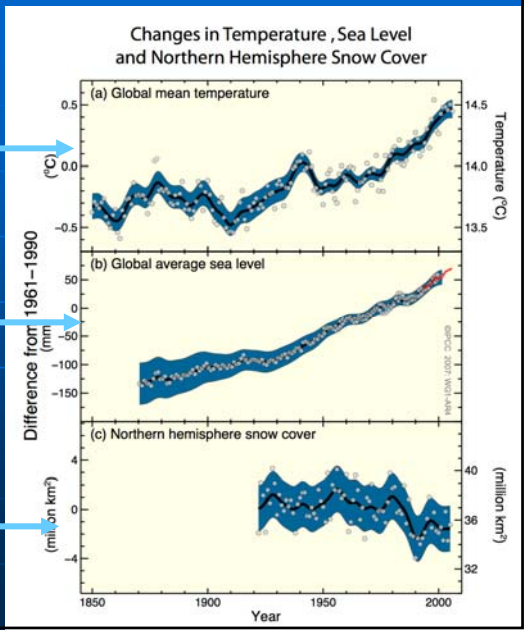


Direct Observations of Recent Climate Change

Global mean temperature

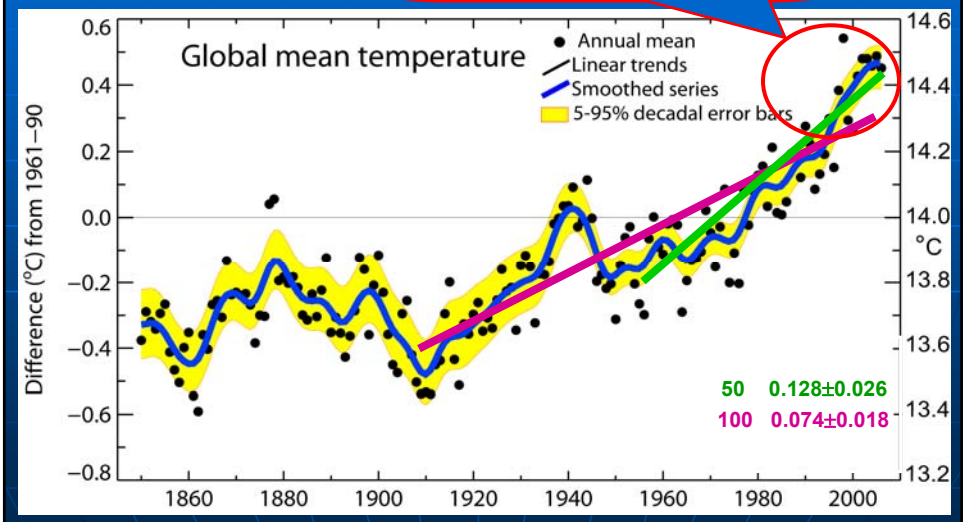
Global average sea level

Northern hemisphere Snow cover



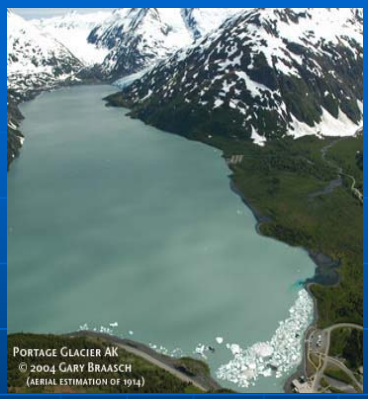
Global mea

Warmest 12 years:
1998, 2005, 2003, 2002, 2004, 2006, 2001, 1997, 1995, 1999, 1990, 2000



1875 2004

Pasterze Glacier, Austria



1914 2004

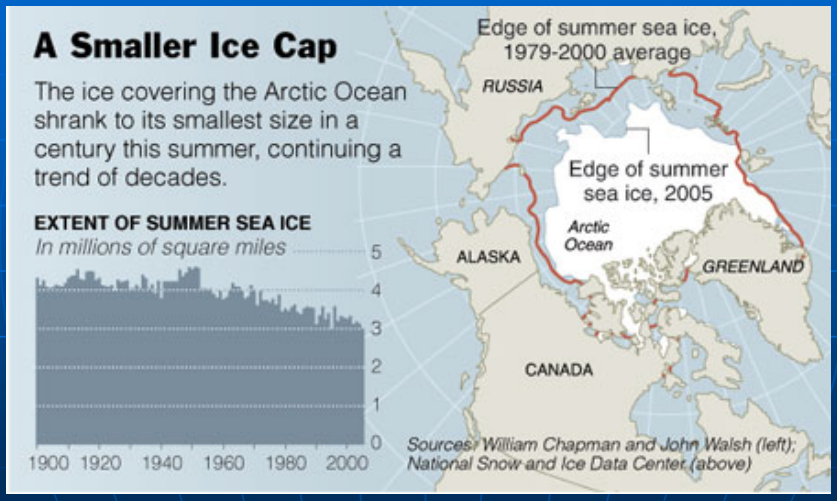
Portage Glacier, Alaska

Glacier loss

Glacier Bay National Park, 1941. The glacier is 2,000 feet thick.
USGS photo, available www.coasttocoastam.com/shows/2005/01/29.html

Glacier Bay National Park, 2004. Receding glacier, new vegetation since 1941.
Photo: USGS/Bruce Molnia, available www.coasttocoastam.com/shows/2005/01/29.html

Polar ice cap shrinkage, 1979-2005



New York Times, 29 September 2005, p 1

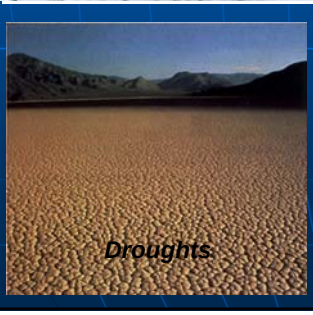
Impacts of Climate Change: IPCC Projections to 2100

- Higher temperatures: 1.1 – 6.4 °C (2.0 – 11.5 °F) mean global surface temperature rise
- Rising sea-levels: 0.18 - 0.59 m (7.1 – 23.2 inches)
- More severe precipitation extremes (storms and droughts)

SOME PROJECTIONS OF FUTURE CHANGES IN CLIMATE (IPCC 2007)

- *Very likely* that heat waves, and heavy precipitation events will become more frequent
- *Likely* that tropical cyclones will become more intense, with larger peak wind speeds and more heavy precipitation

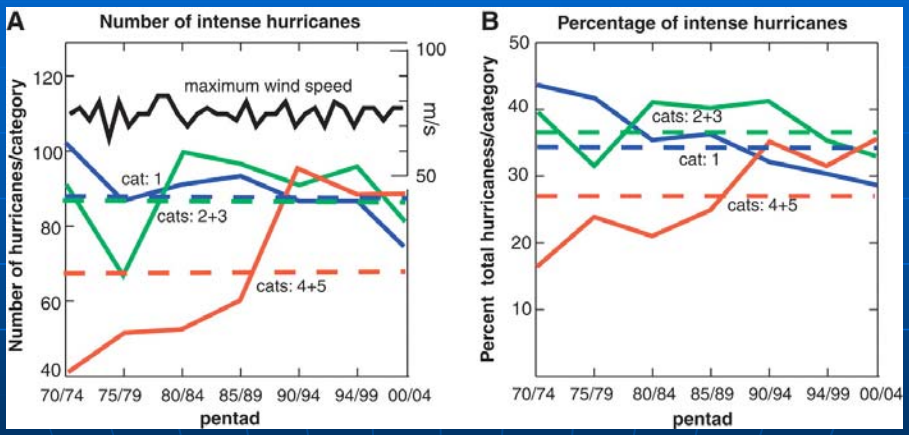
Extreme Weather Events



Possible Effects of Climate Change on Extreme Weather Events

- May alter frequency, timing, intensity, duration of events.
- The relationship between climate change and extreme weather events is not well understood.

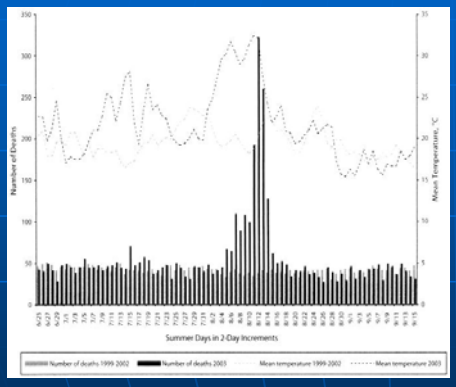
Severe weather events, 1972-2004



Hurricane intensity (Saffir-Simpson scale categories 1 to 5), global, 1970-2004, including number of storms by category (A) and proportion of storms in each category (B). Bold curve in (A) is the maximum global hurricane wind speed (in m/sec). Dashed lines show the 1970–2004 average numbers in each category. Source: Webster et al., *Science*

European heat wave, 2003

TIME LINE (FRANCE)



Vandentorren et al. Mortality in 13 French cities during the August 2003 heat wave. *Am J Public Health 2004; 94(9):1518-20.*

CONFIRMED MORTALITY

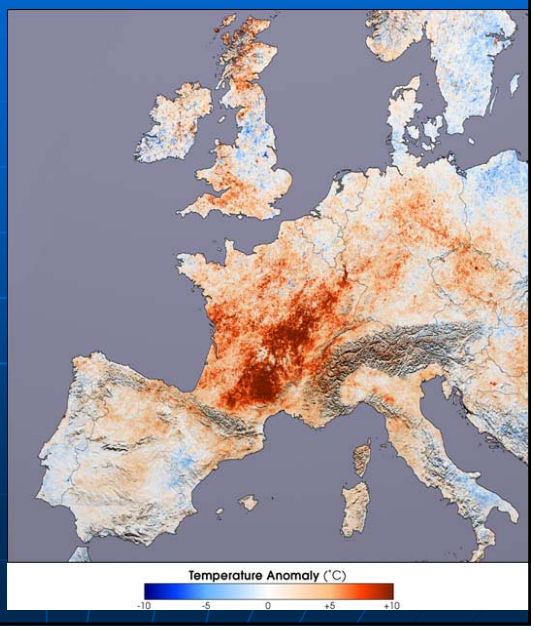
UK	2,091
Italy	3,134
France	14,802
Portugal	1,854
Spain	4,151
Switzerland	975
Netherlands	1,400-2,200
Germany	1,410
TOTAL	29,817-30,617

Haines et al. Climate change and human health: Impacts, vulnerability and public health. *Public Health* 2006;120:585-96.

France, 2003

14,000+ dead in France

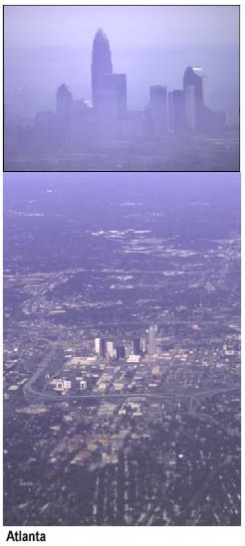
- Many were elderly in nursing homes
- CDC assistance was requested



Possible Effects of Climate Change on Air Pollution

May increase

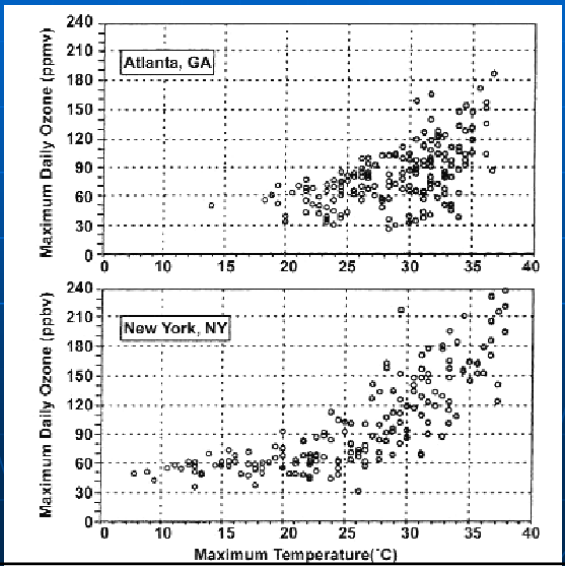
- **Emission of particulate matter**
- **Concentrations of ozone**
- **Deposition of acidic materials**


Atlanta

Maximum Daily Ozone Concentrations vs. Maximum Daily Temperature

Atlanta

New York



Health Effects of Air Pollution

- Damages lung tissue
- Exacerbates respiratory disease
- Reduces lung function
- Aggravates cardiovascular disease

Allergies

Global Warming May Be Spurring Allergy, Asthma

Dr. Ziska's Ragweed Loves Carbon Dioxide; Toxic Pollen in Cities?

WSJ.com THE WALL STREET JOURNAL. ONLINE
Dow Jones Sites As of Thursday, May 3, 2007

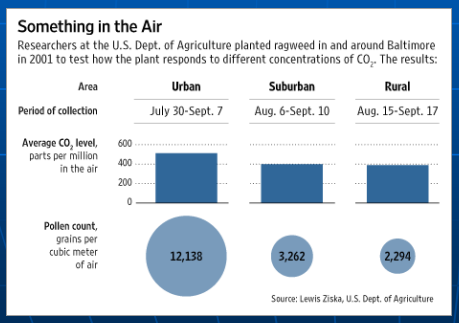
By GAUTAM NAIK
May 3, 2007; Page A1

There's growing scientific evidence that global climate change is linked to the dramatic rise in allergies and asthma in the Western world.

Studies have found that a higher level of carbon dioxide turbocharges the growth of plants whose pollen triggers allergies. In 2001 Lewis Ziska planted ragweed -- the main cause of hay fever in the fall -- at urban, suburban and rural sites near Baltimore. The plots had the same seeds and soil and were watered in the same way. Yet the downtown plants soon exploded in size, flowering earlier and producing five times the pollen of rural plants. The city pollen was a lot more toxic, too. The likely cause? The city plants experienced warmer temperatures and 20% more carbon dioxide, the effect of more cars and pollution.

Ragweed

- Genus *Ambrosia*
- ↑ CO_2 and temperature → ↑ pollen counts, longer growing season



Source: Ziska et al., *J Allerg Clin Immunol* 2003;111:290-95;
Graphic: *Wall Street Journal*, 3 May 2007.

Poison Ivy

- *Toxicodendron radicans*
- ↑ CO_2 leads to
  - ↑ photosynthesis
  - ↑ water use efficiency
  - ↑ growth
  - ↑ biomass
  - More allergenic urushiol
- Greater CO_2 stimulation than most other woody species

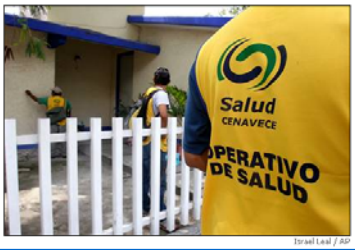
Source: Mohan et al. *PNAS* 2006;103:9086-89.

msnbc
A Fuller Spectrum of News

Home » Health » Infectious Diseases

Deadly dengue fever surging in Mexico

Mosquito-control teams dispatched to springtime tourist areas



A anti-dengue brigade, belonging to the municipal health department mark a home after checking for standing water or other areas where mosquitoes breed in the resort city of Cancun, Mexico.

Israel Leal / AP

Associated Press
Updated: 4:57 p.m. ET March 30, 2007

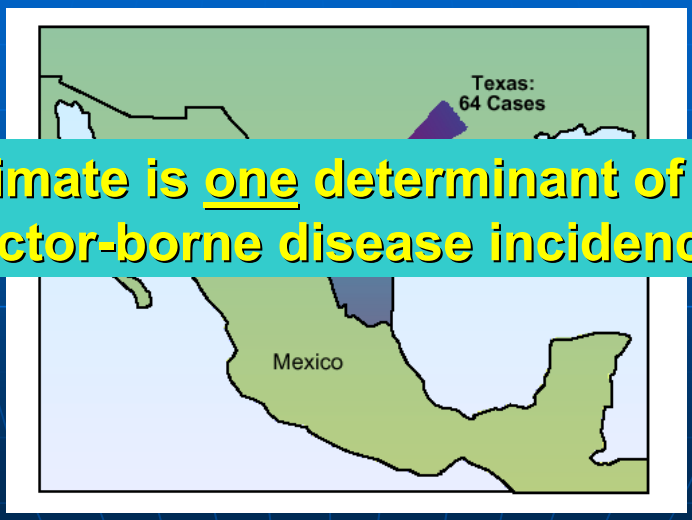
The deadly hemorrhagic form of dengue fever is increasing drastically in Mexico, and experts predict a surge throughout Latin America fueled by climate change, migration and faltering mosquito eradication efforts.

Overall dengue cases have increased by more than 600 percent in Mexico since 2001, and worried officials are sending special teams to tourist resorts to spray pesticides and remove garbage and standing water where mosquitoes breed ahead of the peak Easter Week vacation season.

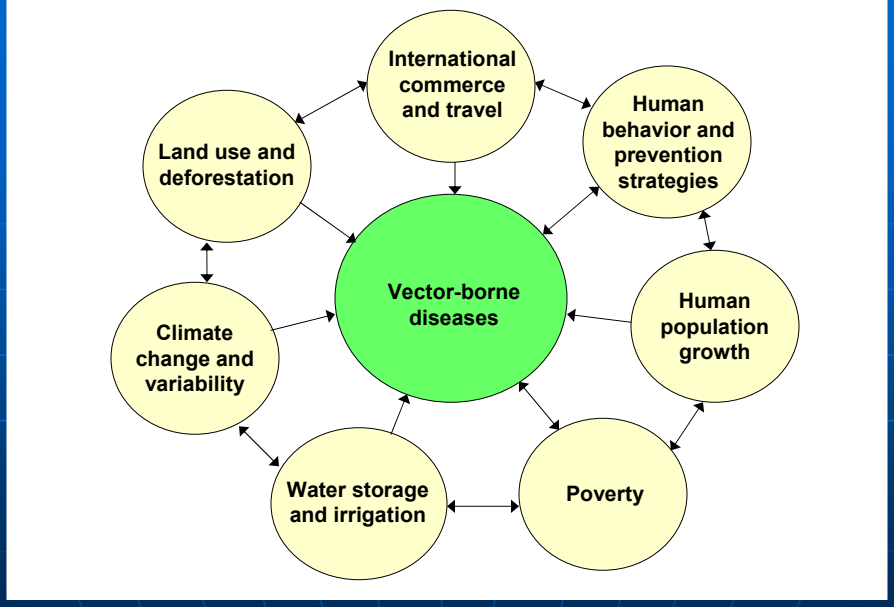
The Intergovernmental Panel on Climate Change, made up of the world's leading climate scientists, predicted in March that global warming and climate change would cause an upsurge in dengue. In Mexico, officials say longer rainy seasons already are leading to more cases.

"It used to be seasonal, in the hottest, wettest months, and now in some regions we are seeing it practically all year," said Joel Navarrete, an epidemiologist with the Mexican Social Security Institute.

Reported Cases of Dengue 1980-1999



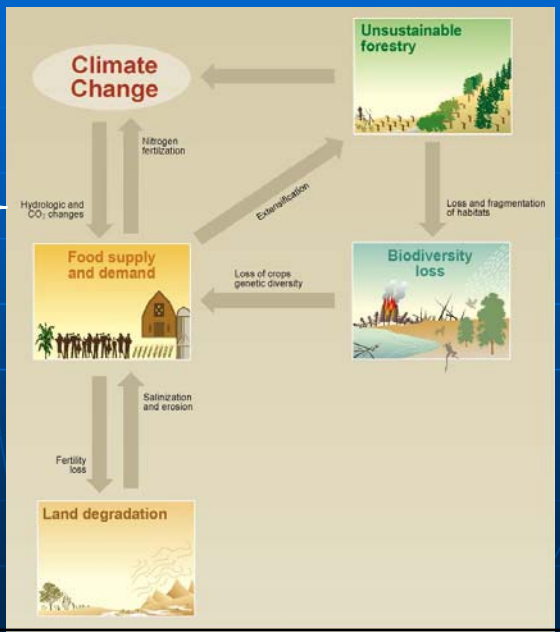
Climate is <u>one</u> determinant of vector-borne disease incidence



Modified from Sutherst R.W. Clin Micribiol Rev 2004;17:136-73

Climate change and food security

Temperature
Precipitation
CO_2 levels
Plant diseases
Plant pests
Animal diseases



Cereal yield: Developed vs. Developing Countries, 2060

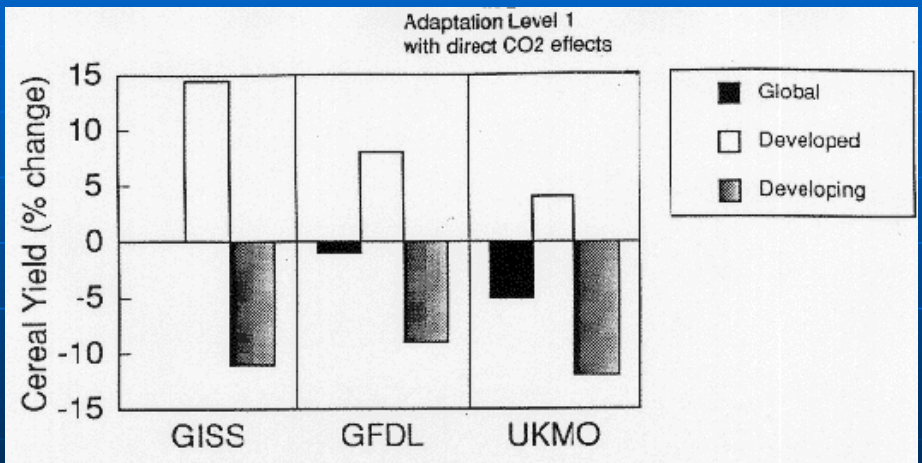


Figure 4. Predicted change in cereal production in 2060 in developed and developing countries, and at the global level. Three climate model scenarios are also compared. These values based on farmer Adaptation Level 1 response to climate change (minor adjustments), and an assumption of positive direct effects of CO_2 on yields. Source: Rosenzweig and Parry (1993).

Potential Health Effects of Climate Change

Climate Change:

- **Temperature rise**
- **Sea level rise**
- **Hydrologic extremes**

HEAT	Heat stress, cardiovascular failure
SEVERE WEATHER	Injuries, fatalities
AIR POLLUTION	Asthma, cardiovascular disease
ALLERGIES	Respiratory allergies, poison ivy
VECTOR-BORNE DISEASES	Malaria, dengue, encephalitis, hantavirus, Rift Valley fever
WATER-BORNE DISEASES	Cholera, cryptosporidiosis, campylobacter, leptospirosis
WATER AND FOOD SUPPLY	Malnutrition, diarrhea, harmful algal blooms
MENTAL HEALTH	Anxiety, despair, depression, post-traumatic stress
ENVIRONMENTAL REFUGEES	Forced migration, civil conflict

Adapted from J. Patz

Other Considerations

- There will be significant regional variation in the effects of climate change
- There will be significant variation in the demographic groups effected by climate change

Public Health Role

- Despite existing breadth of organizations and sectors with initiatives on climate change
- Despite the likelihood of anticipated health effects of climate change

Public health effects of climate change remain largely unaddressed

CDC
Environmental Health

"Because we anticipate that as climate changes, there will be health consequences…We believe there are unpredictable health consequences that will occur and our job is to anticipate what they might be, to make sure that we have systems in place that can detect them, and, most importantly, that we take steps now to be able to help mitigate whatever those harms are.
We're just at the very beginning of this, but we've already convened on climate change and health consequences and we are at the table."

--Dr. Julie Gerberding, Director, CDC

Testimony before the House Appropriations Committee, Subcommittee on Interior, Environment and Related Agencies, Hearing on Fiscal Year 2008 Appropriations: Interior and Environment, March 2, 2007

TOWARD A PUBLIC HEALTH FRAMEWORK FOR ADDRESSING CLIMATE CHANGE

Guiding principles, both practical and ethical:

- Public Health Prevention Framework
- Co-Benefits and synergies
- Environmental Justice
- Complexity/Ecosystems thinking

CDC Environmental Health

A PUBLIC HEALTH FRAMEWORK FOR ADDRESSING CLIMATE CHANGE

Guiding principles:

Public Health Prevention Framework:

- Primary prevention: aims to prevent the onset of injury or illness
  - Corresponds with *mitigation*—efforts to slow, stabilize, or reverse climate change by reducing greenhouse gas emissions.
- Secondary and Tertiary Prevention: aims to diagnose disease early in order to control its advance and reduce the resulting morbidity
  - Corresponds with *adaptation*—efforts to anticipate and prepare for the effects of climate change, and thereby to reduce the associated health burden.

CDC Environmental Health

Public Health role in Primary prevention (mitigation)

Mitigation efforts will largely occur in sectors other than health, however public health can:

- Reduce GHG emissions in our own operations (health care settings)
- Assess health implications of various mitigation strategies
- Educate the public and policymakers on health benefits of mitigation approaches.

CDC Environmental Health

Public Health Adaptations

Correspond closely to conventional public health practices.

These can include:

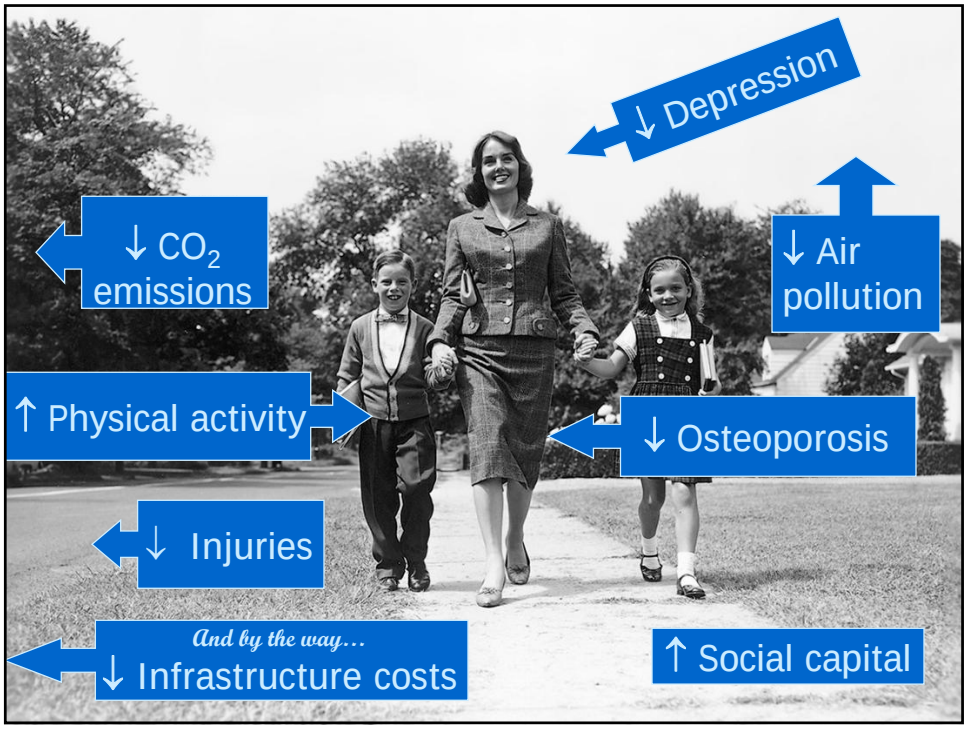
- Track and monitor disease (surveillance)
- Enhance emergency response capacity
- "Weatherize" communities

A PUBLIC HEALTH FRAMEWORK FOR ADDRESSING CLIMATE CHANGE

Guiding principles:

Co-benefits and synergies

- Efforts to mitigate or adapt to the effects of climate change frequently yield other health benefits, both direct and indirect.



Climate Change Synergies

Heat wave plans using "buddy systems"	↑ social capital, ↑ community resiliency
↓ vehicular travel	↓ car crashes, ↓ air pollution
↑ fuel efficiency	↓ air pollution
Locally grown food	↓ pesticide loading, ↓ fuel
Energy-efficient buildings	↓ operating costs
Alternative energy sources	Business opportunities

A PUBLIC HEALTH FRAMEWORK FOR ADDRESSING CLIMATE CHANGE

Guiding principles:

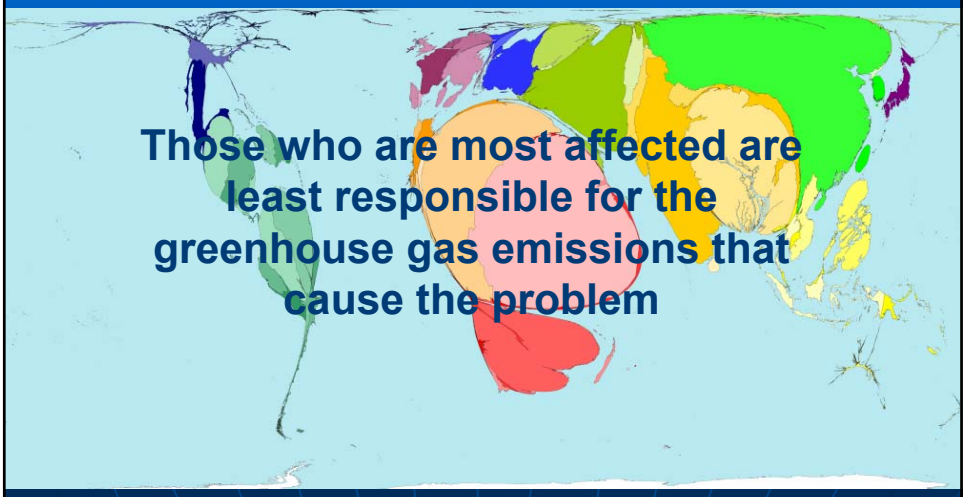
Environmental Justice

Climate change will disproportionately threaten certain populations, especially poor people and members of ethnic and racial minority groups

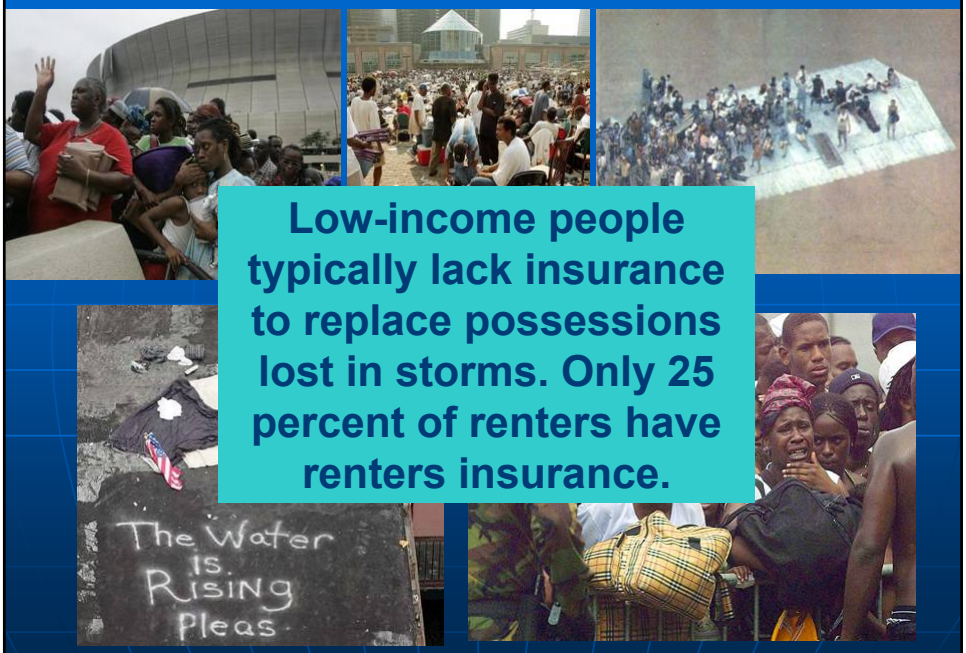
CDC
Environmental Health

Carbon Emissions 2000

Persons killed by disasters: 1975 - 2004



Those who are most affected are least responsible for the greenhouse gas emissions that cause the problem

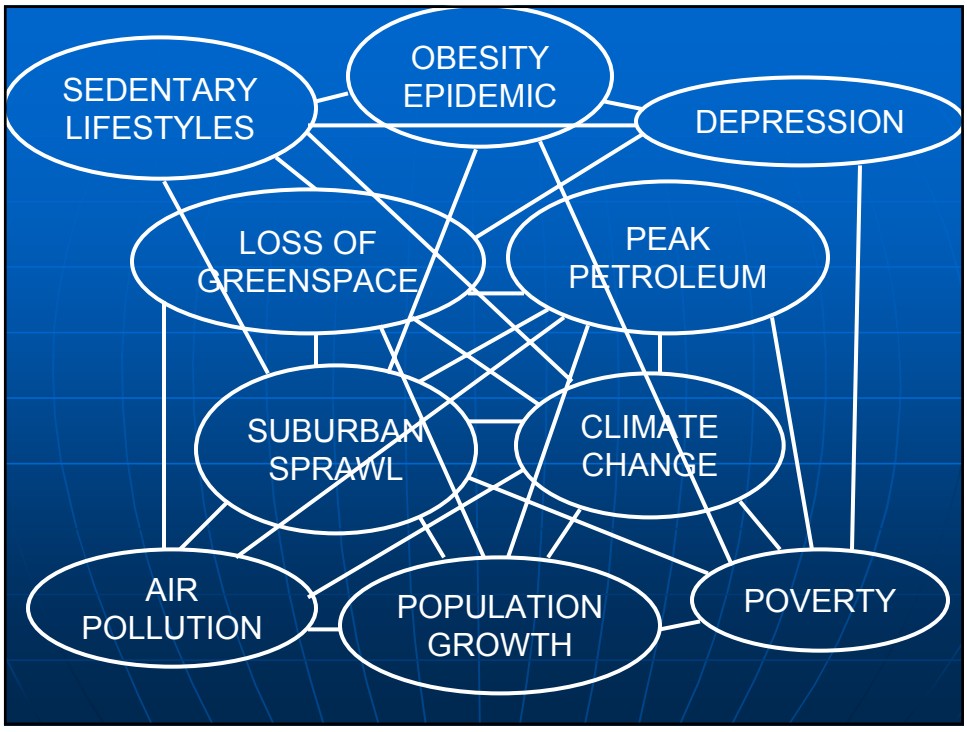


Low-income people typically lack insurance to replace possessions lost in storms. Only 25 percent of renters have renters insurance.

A PUBLIC HEALTH FRAMEWORK FOR ADDRESSING CLIMATE CHANGE

Guiding principles:

Complexity and Ecosystems thinking



CDC's Priority actions for Climate Change

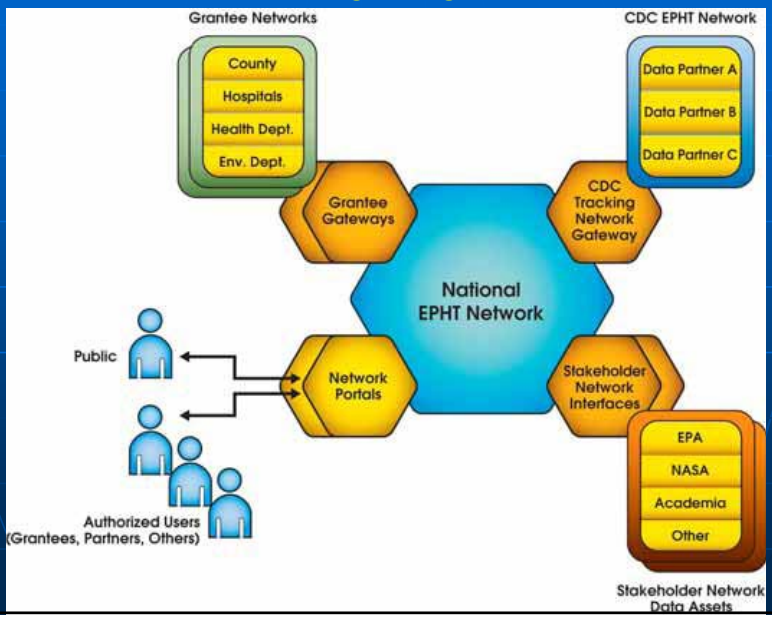
- A set of "priority actions" that guide the public health approach
- Emerged from recommendations to the CDC Climate Change Workgroup during the January 2007 meeting
- Forms the cornerstone for CDC's policy on Climate Change
  http://www.cdc.gov/nceh/climatechange/

CDC's Priority health actions for climate change

#1 Track data on environmental conditions, disease risks, and disease occurrence related to climate change.

- Will require *enhancement and expansion* of national disease surveillance systems and the *integration* of infectious and environmental disease information systems

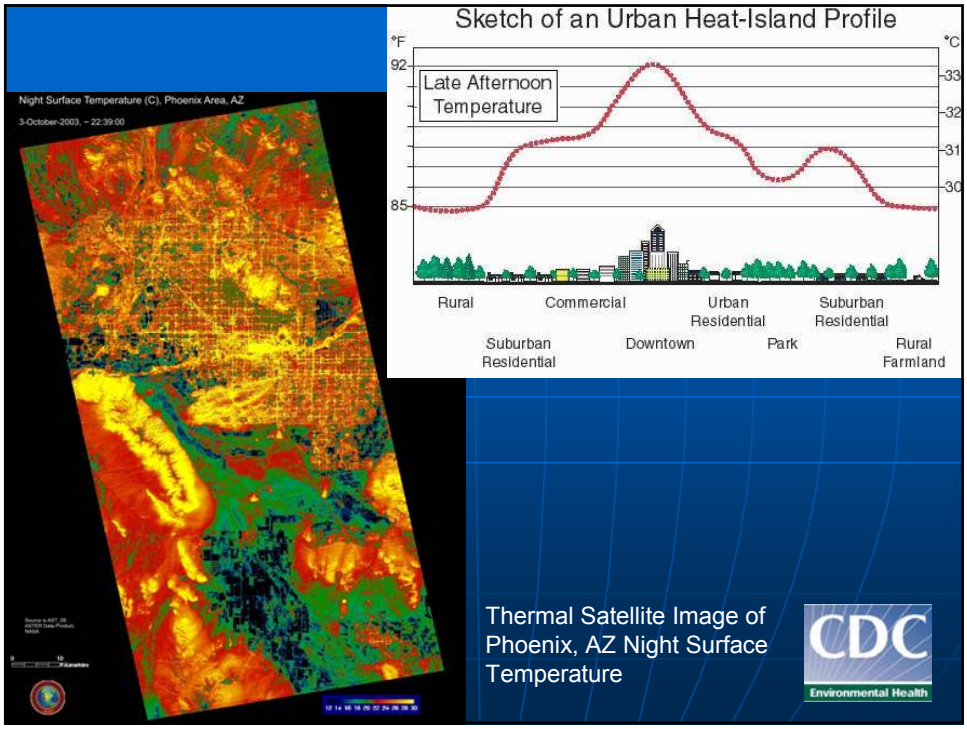
CDC's National Environmental Public Health Tracking Program



CDC's Priority health actions for climate change

#2 Expand capacity for modeling and forecasting health effects that may be climate-related.

CDC Environmental Health



CDC's Priority health actions for climate change

#3 Enhance the science base to better understand the relationship between climate change and health outcomes.

Sponsor extramural research,
Centers of Excellence in Climate Change

ASU
National Center of Excellence
on SMART Innovations for Urban Climate + Energy
SUSTAINABLE MATERIALS AND RENEWABLE TECHNOLOGIES

CDC's Priority health actions for climate change

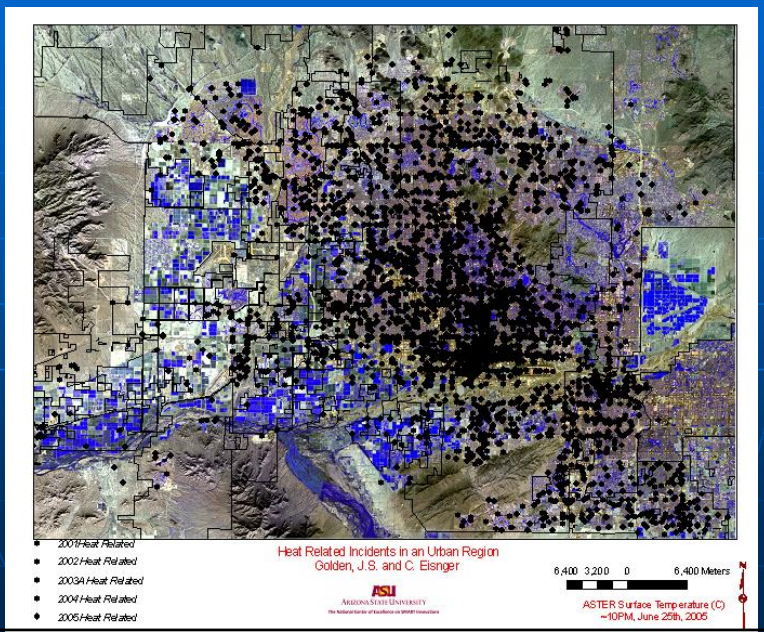
#4 Identify locations and population groups at greatest risk for specific health threats, such as heat waves.

Examples:

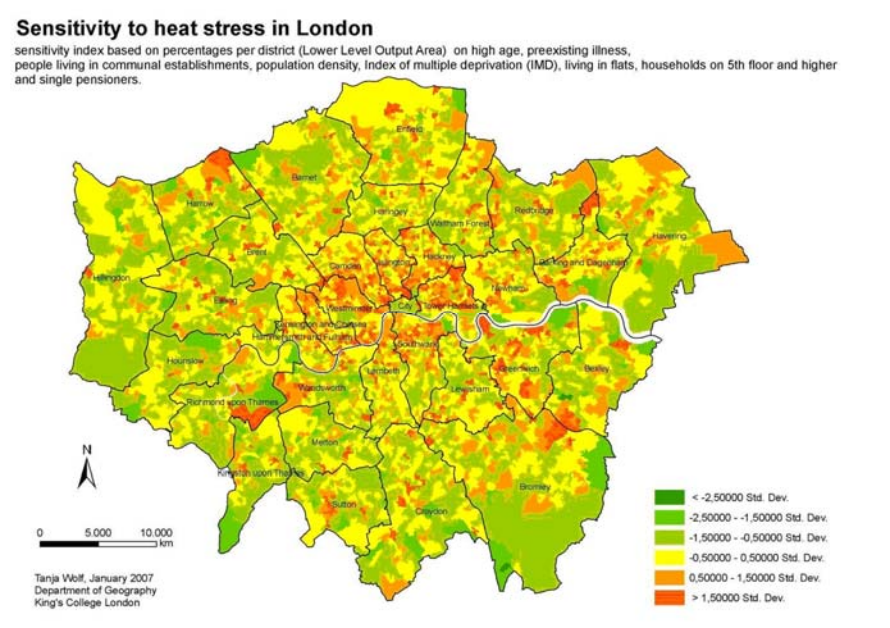
Epidemiologic investigations

Vulnerability mapping

Location of Heat-related medical incidents



Composite Vulnerability Map



CDC's Priority health actions for climate change

#5 Communicate the health-related aspects of climate change, including risks and ways to reduce them, to the public, decision makers, and healthcare providers.

CDC
Environmental Health


Sun
Summer heat waves will melt polar ice caps and result in...
OCEANS RISING 150 FT.
...& flooding coastal areas
WILL YOUR CITY SURVIVE?
SHOCKING MAP INSIDE SHOWS DANGER ZONES INCLUDING:
New York • Miami • Boston • Vancouver • San Diego • Mobile
San Francisco • Houston • Philadelphia • Baltimore • Halifax
New Orleans • Long Beach • Providence • Savannah • Galveston
CDC
Environmental Health

Image courtesy of Jonathan Patz.

washingtonpost.com

Climate Change Scenarios Scare, and Motivate, Kids

By Darragh Johnson
Washington Post Staff Writer
Monday, April 16, 2007; Page A01

The boy has drawn, in his third-grade class, a global warming timeline that is his equivalent of the mushroom cloud.

"That's the Earth now," the 9-year-old says, pointing to a dark shape at the bottom. "And then," he says, tracing the progressively lighter stripes across the page, "it's just starting to fade away."

BBC NEWS

Last Updated: Tuesday November 14 2006 11:15 GMT
E-mail this to a friend Printable version

Climate change is kids' top fear

How we're damaging the environment is more of a worry to you than getting a girl or boyfriend, says a survey.

The results showed three quarters of 11 to 14-year-olds worry about climate change, compared to 41% who are worried about going out with someone.

And it looks like you lot aren't just all talk - 63% turn off the lights when you leave a room, 82% of you recycle, and 75% say we should recycle more.

The survey quizzed 1,554 kids on their views on the

Health Warning

Heat Wave

Go to an air conditioned place during a heat wave.

Heat waves can kill you. A heat wave is when the temperature is over 90 degrees for 3 days or longer. During heat waves, many people die or get very sick. Your body may not be able to stay cool if you do not have air conditioning or your electricity goes off. People who are over 65 with other health problems are in the most danger. Going to a cooler place, even for 2 or 3 hours a day, gives your body a chance to cool down. **This can save your life.**

If you are over 65, you may be in danger even if you do not feel hot.

- Look at a thermometer to see the temperature in your home or apartment.
- Some prescription drugs make it harder to stay cool or know when you are too hot.
- Check on your older neighbors and relatives to make sure their home is cool.

Spend two to three hours in air conditioning during the hottest part of the day. Cool places include:

- public libraries
- malls
- senior centers
- air-conditioned homes of friends/relatives
- emergency cooling centers

If you need a ride,

- Ask for help. Call your local bus service or health department for information on getting to an Emergency Cooling Center.
- You may also ask a friend, relative, or church for help.
- In an emergency, always call 911.

Protect Yourself and Your Family

CDC Environmental Health

Priority health actions for climate change

#6 Develop partnerships with other government agencies, the private sector, nongovernmental organizations, universities, and international organizations

CDC Environmental Health

Priority health actions for climate change

#8 Provide technical advice and support to partners in developing and implementing response plans for health threats.

CDC Environmental Health

Excessive Heat Events (EHE) Guidebook

- Assists in the development of city-specific heat response plans
- Provides guidance on:
  - Options for defining EHE conditions
  - How to assess local vulnerability
  - EHE notification and response actions that work

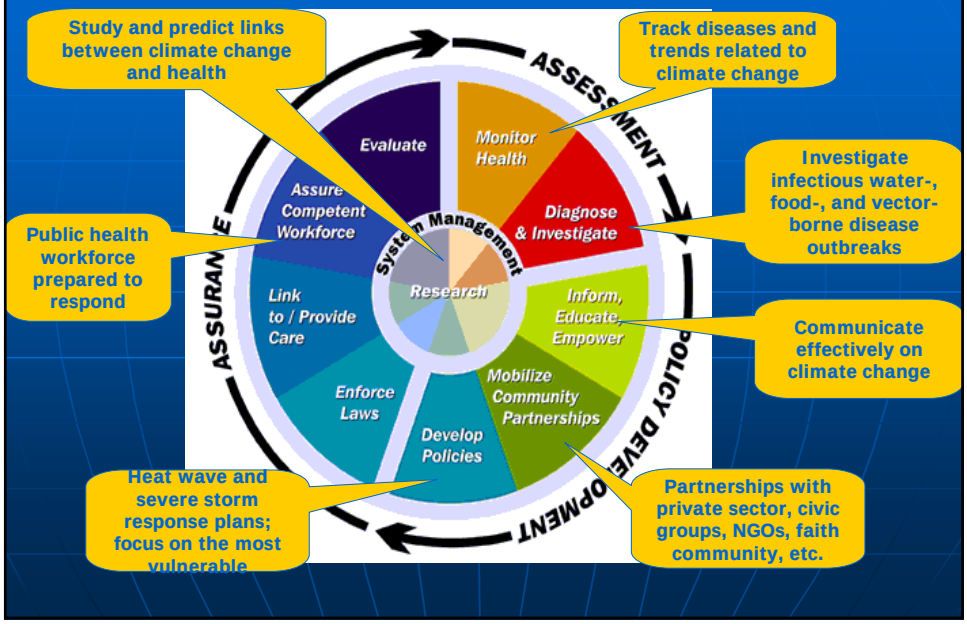
CDC Environmental Health

Priority health actions for climate change

#7 Promote workforce development by ensuring the training of a new generation of competent, experienced public health staff to respond to the health threats posed by climate change.

TEPHINET
Training Programs in Epidemiology and Public Health Interventions NETwork

Adaptation strategies for health



Conclusions

- Climate change is a mainstream issue
- Climate change is a public health issue
- Opportunity costs of not taking action are high
- There are effective, science-based activities and messages for public health to conduct and deliver

Thank You

Contact:
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Associate Director for Global Climate Change, Acting
National Center for Environmental Health

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