

The Health Consequences of a Changing Climate



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***MDPH Symposium on Climate Change Impacts in
Southeastern Massachusetts, April, 2013***



Presentation Objectives

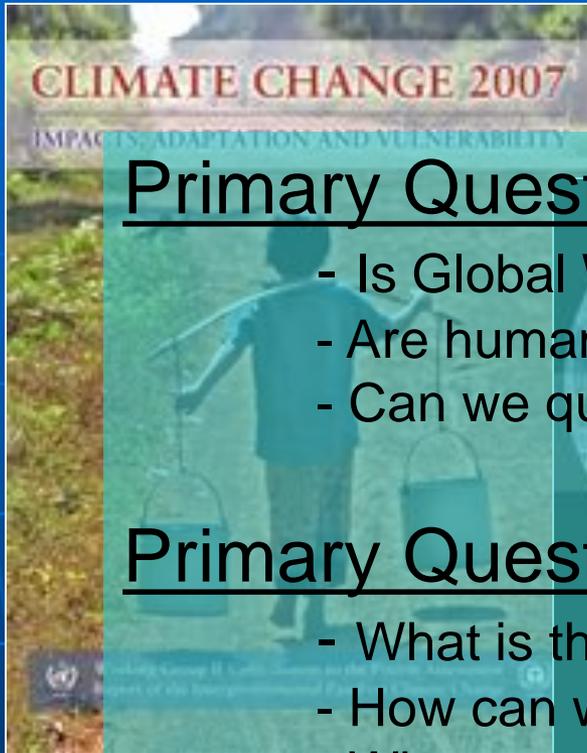
Review the evidence for climate change and its health consequences

Summarize the *DRAFT* findings of the 3rd US National Climate Assessment's Health and Northeast Chapters

Describe efforts at CDC to prepare for the health implications of climate change.



Intergovernmental Panel on Climate Change (IPCC) 2007 Landmark Reports

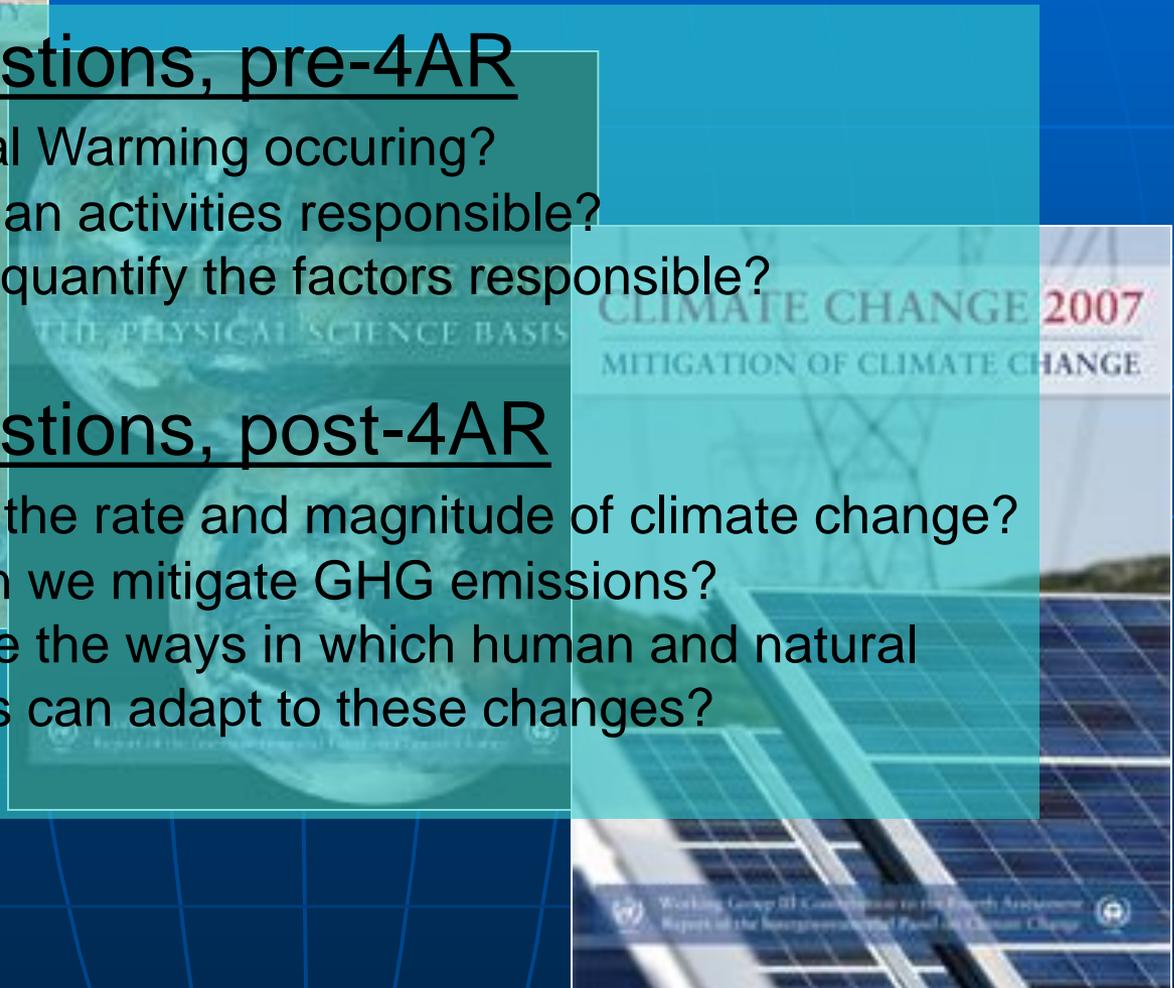


Primary Questions, pre-4AR

- Is Global Warming occurring?
- Are human activities responsible?
- Can we quantify the factors responsible?

Primary Questions, post-4AR

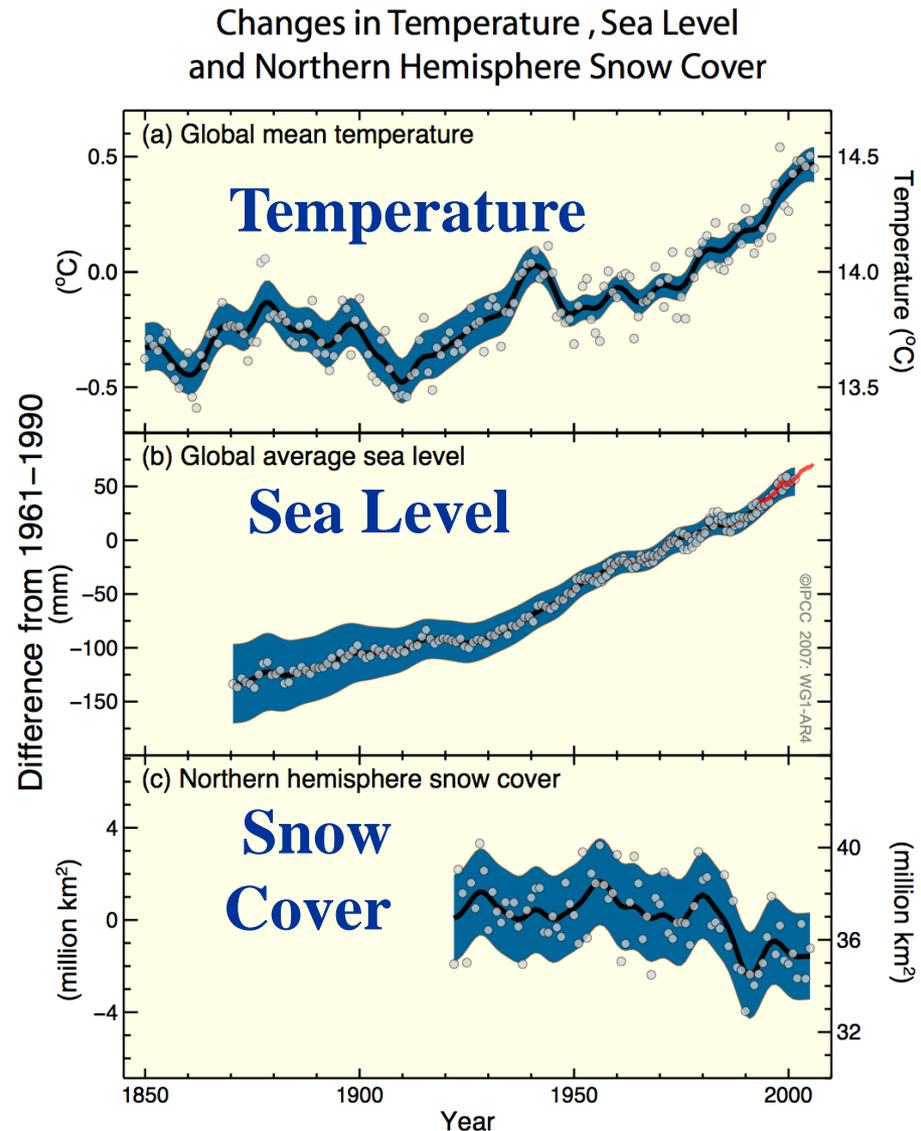
- What is the rate and magnitude of climate change?
- How can we mitigate GHG emissions?
- What are the ways in which human and natural systems can adapt to these changes?



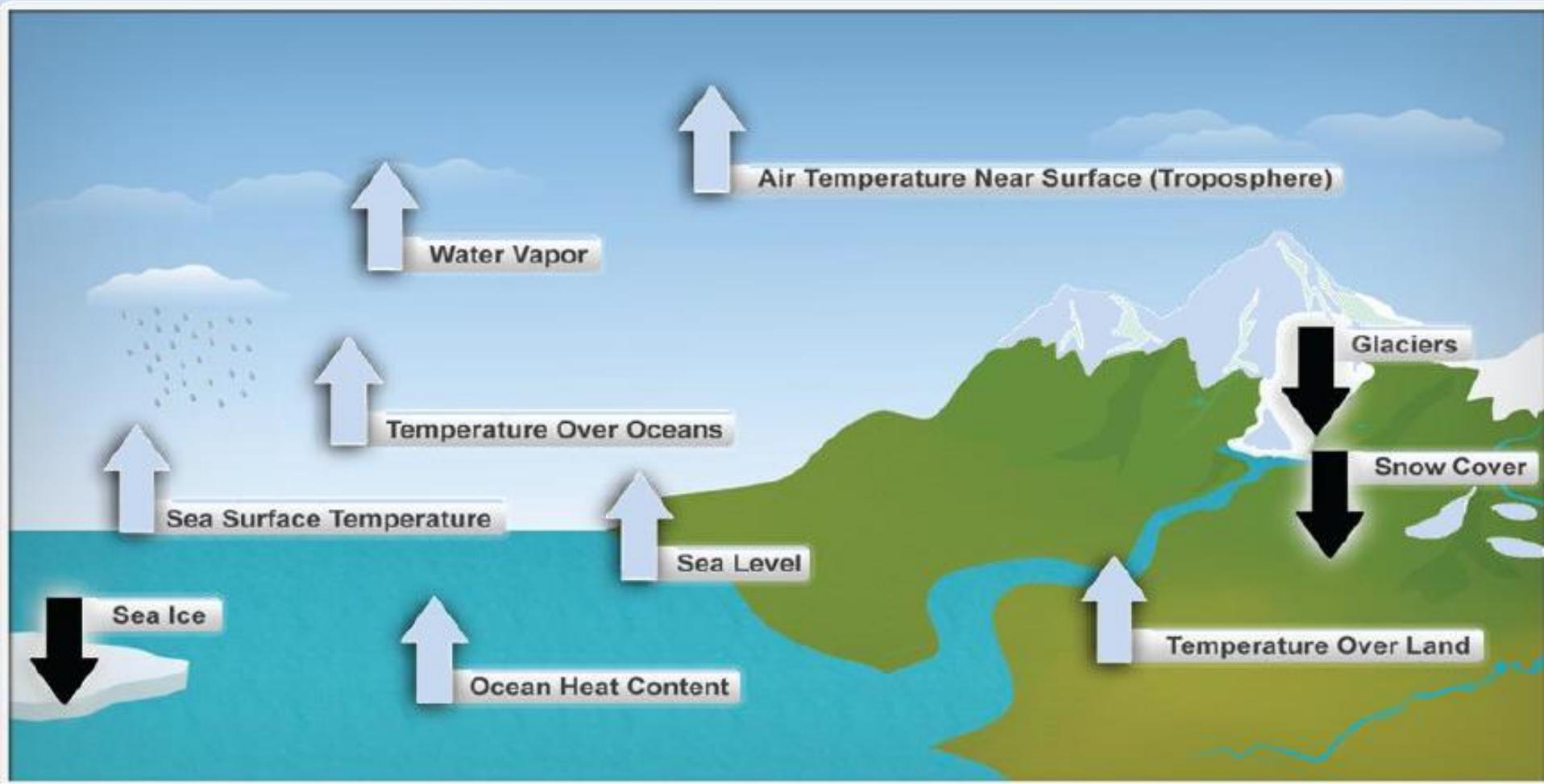
Climate Change is Happening Now: Findings of the IPCC 4AR

- Warming is unequivocal; most of the warming of the past 50 years is very likely (90%) due to increases in greenhouse gases.
- Physical and biological systems on all continents and oceans already affected by climate changes.
- Already committed to more warming (next few decades); choices about emissions affect the longer term more and more.

(IPCC 2007)

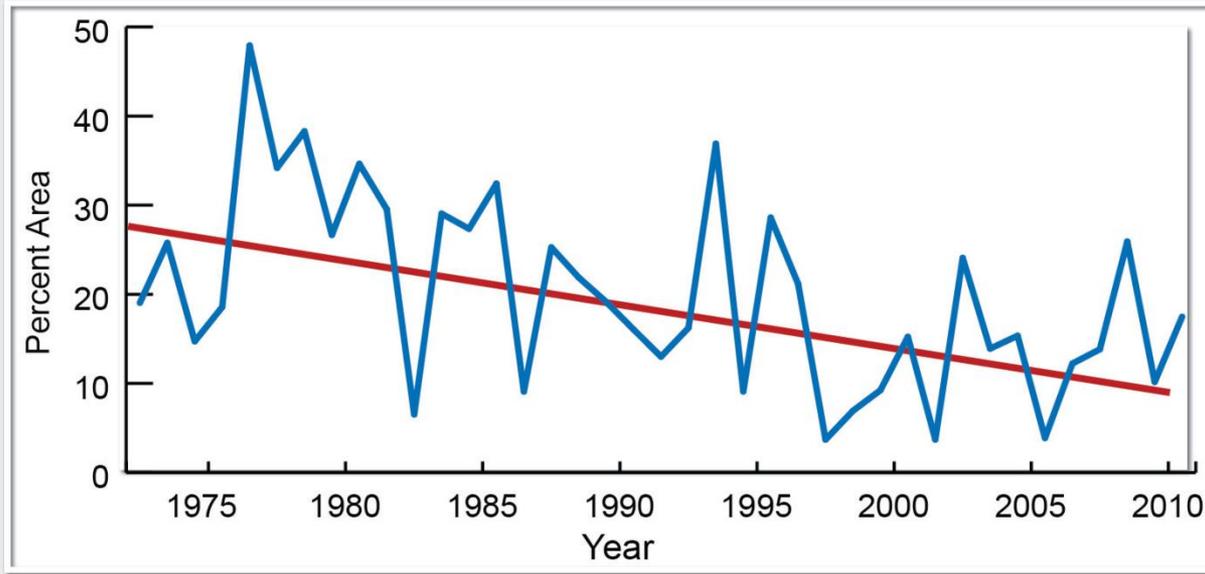


Ten Indicators of a Warming World



One Local Effect of Climate Change

Great Lakes Ice Coverage Decline



Lake Superior



March 2003



March 2012

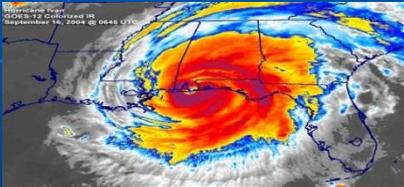
Some Projections of Future Changes in Climate (IPCC 2007)



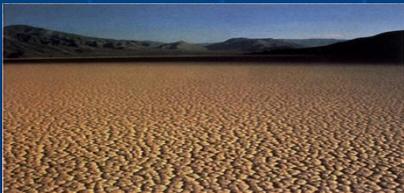
- Very likely that heat waves, will become more intense and frequent. [> 90% probability]



- Very likely that heavy precipitation events will become more frequent. [> 90% probability]



- Likely that tropical cyclones will become more intense, with larger peak wind speeds and more heavy rainfall [> 66% probability]

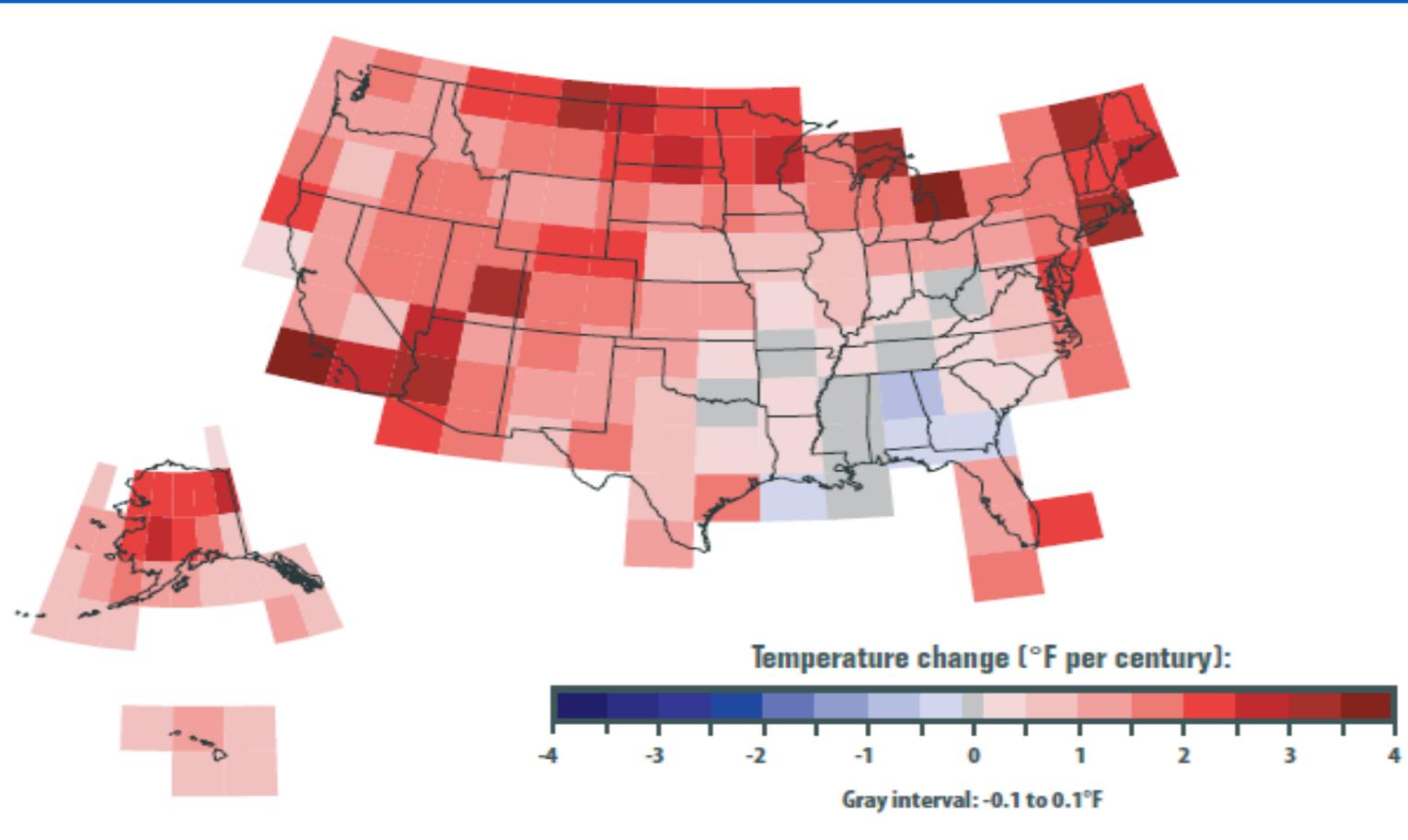


- Likely increase in dry days and areas affected by drought. [> 66% probability]



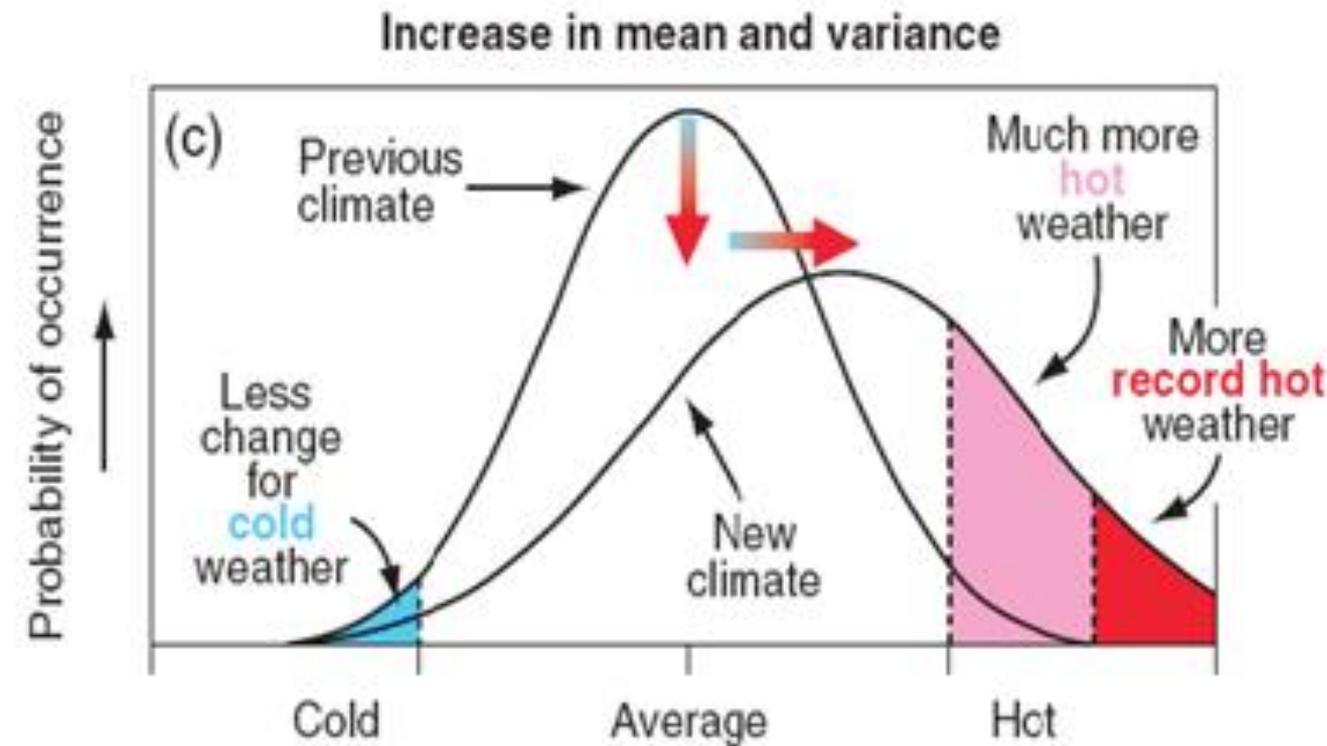
- Likely increase in incidence of storm related extremely high sea level [> 66% probability]

Warming has varied significantly by region (observed record)



**Rates of
Temp.
Change
1901-
2008**

Increase in the frequency of Extreme Weather



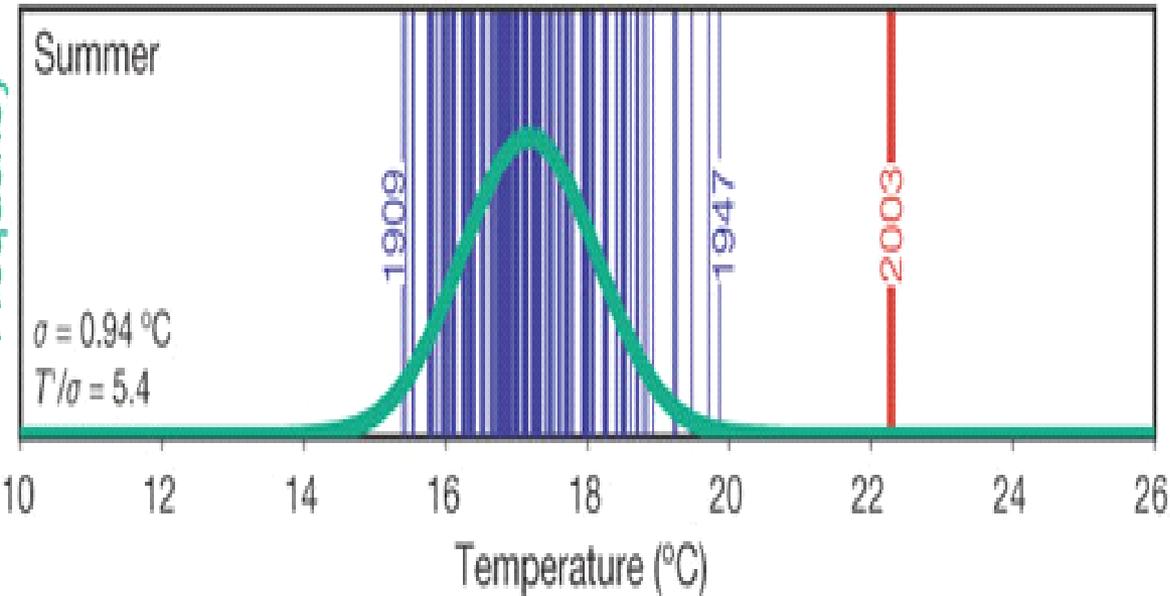
Not only changes in Mean (temp., precip.) but also increases in Extremes

IPCC 4AR 2007

"If you take the basketball court and raise it a foot, you're going to see more slam-dunks. Not every dunk is due to raising the floor, but you'll start seeing them happen more often than they ought to."
- Climatologist Michael Mann explaining current weather changes.

Some Extreme Events will be well beyond historical experience

European Heat Wave of 2003



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. *Public Health* 2006;120:585-96.

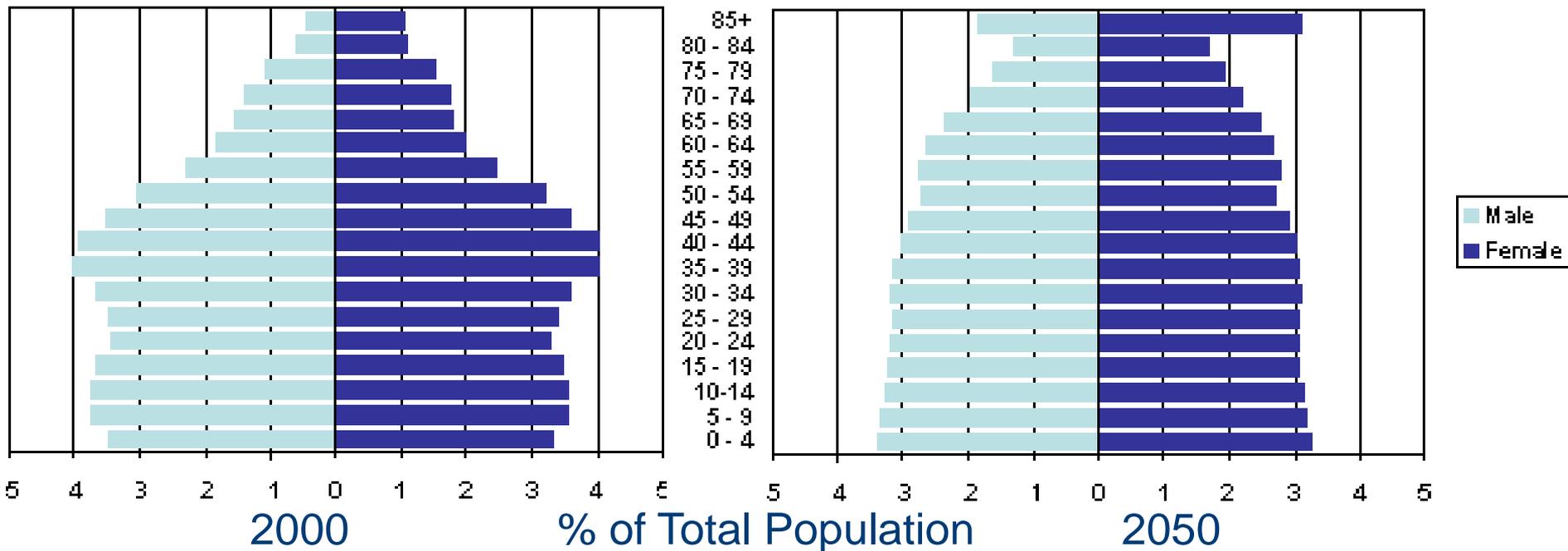
Vandentorren et al. *Am J Public Health* 2004; 94(9):1518-20.



Climate Change and Urban “Built” Environments

- Cities and climate are coevolving in a manner that will place more populations at risk:
- Increase in vulnerable populations:
 - Today, more than half of the world’s population lives in cities, up from 30% in 1950.
 - By 2100 there will be 100 million more people > 65 years old (relative to 2000) (Ebi et al. 2006).
- Intensification of exposures: Urban heat islands and stagnant air masses

Population Pyramids of the U.S. 2000 and 2050 (Interim Projections from 2000 Census)



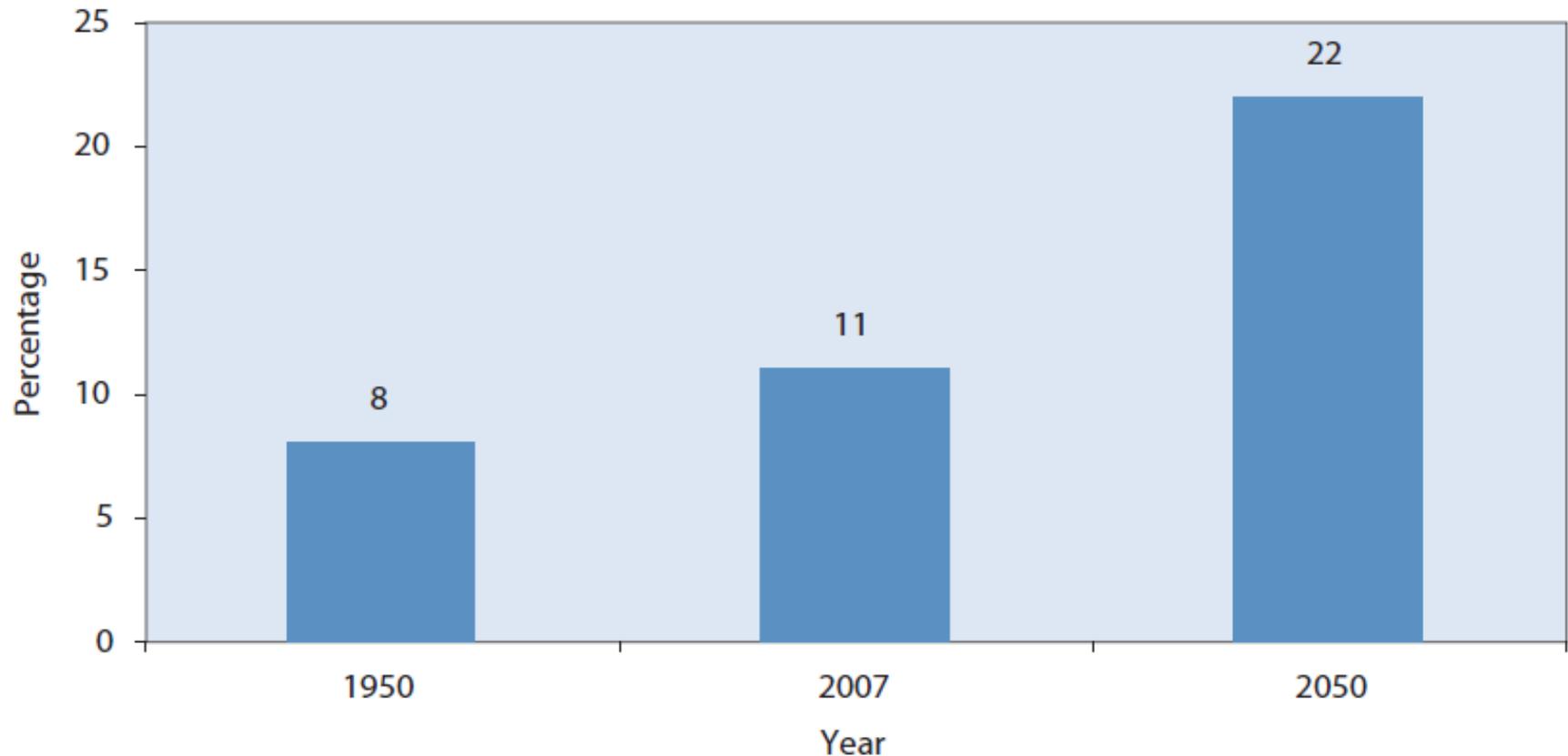
Data source: Census Population Projections

<http://www.census.gov/ipc/www/usinterimproj/>

Trend: Global Population over Age 60

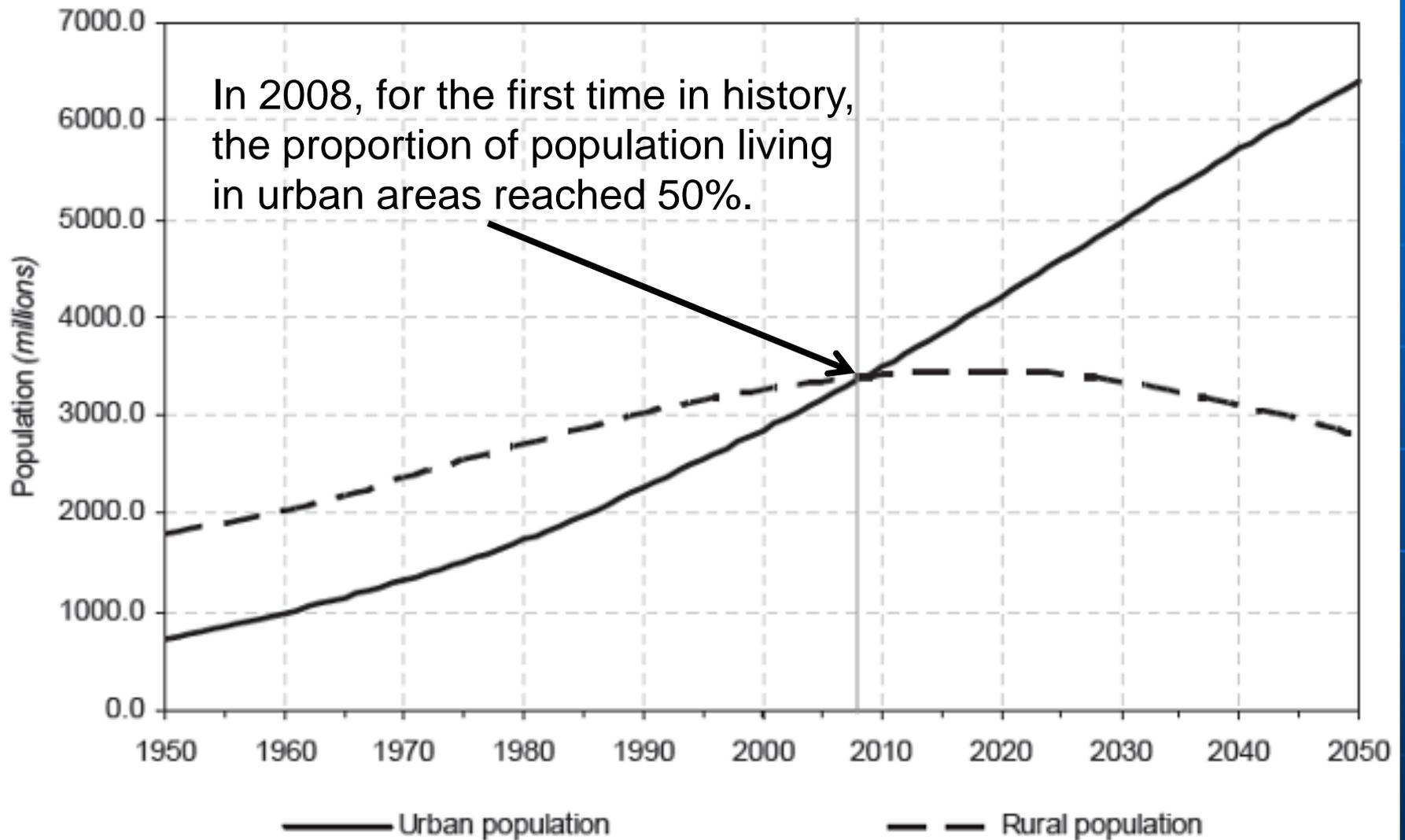
Figure I

Proportion of population 60 years or over: world, 1950-2050



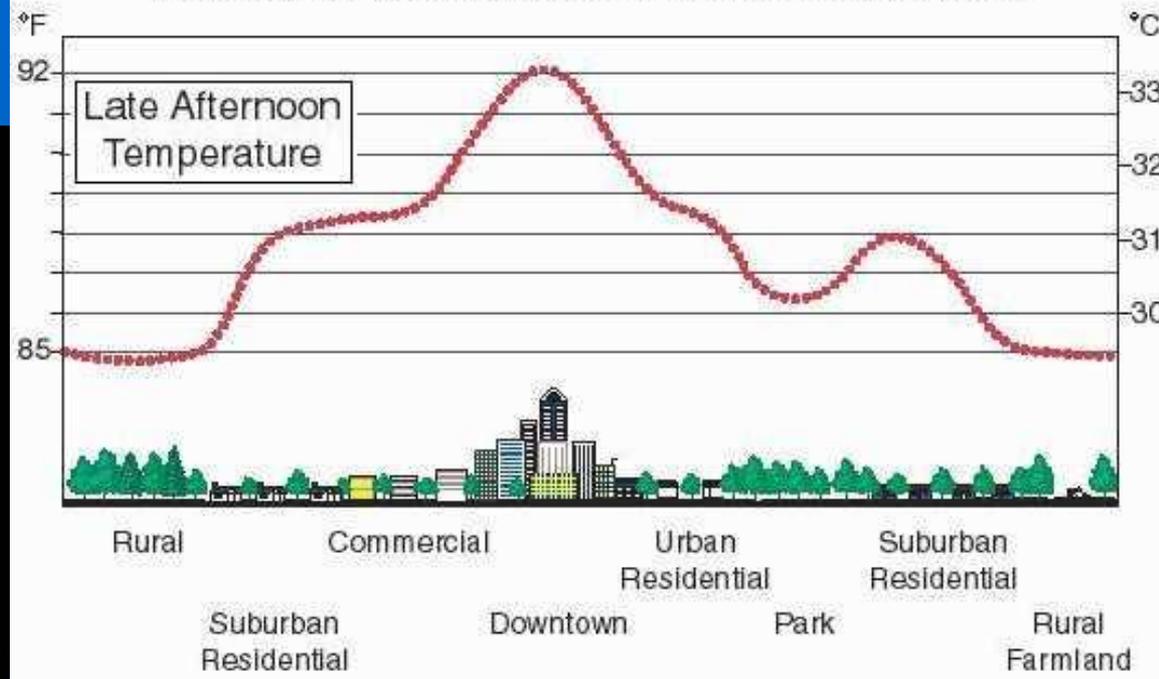
Source: United Nations *World Population Ageing, 2007*

Figure I.1. Urban and rural populations of the world, 1950-2050



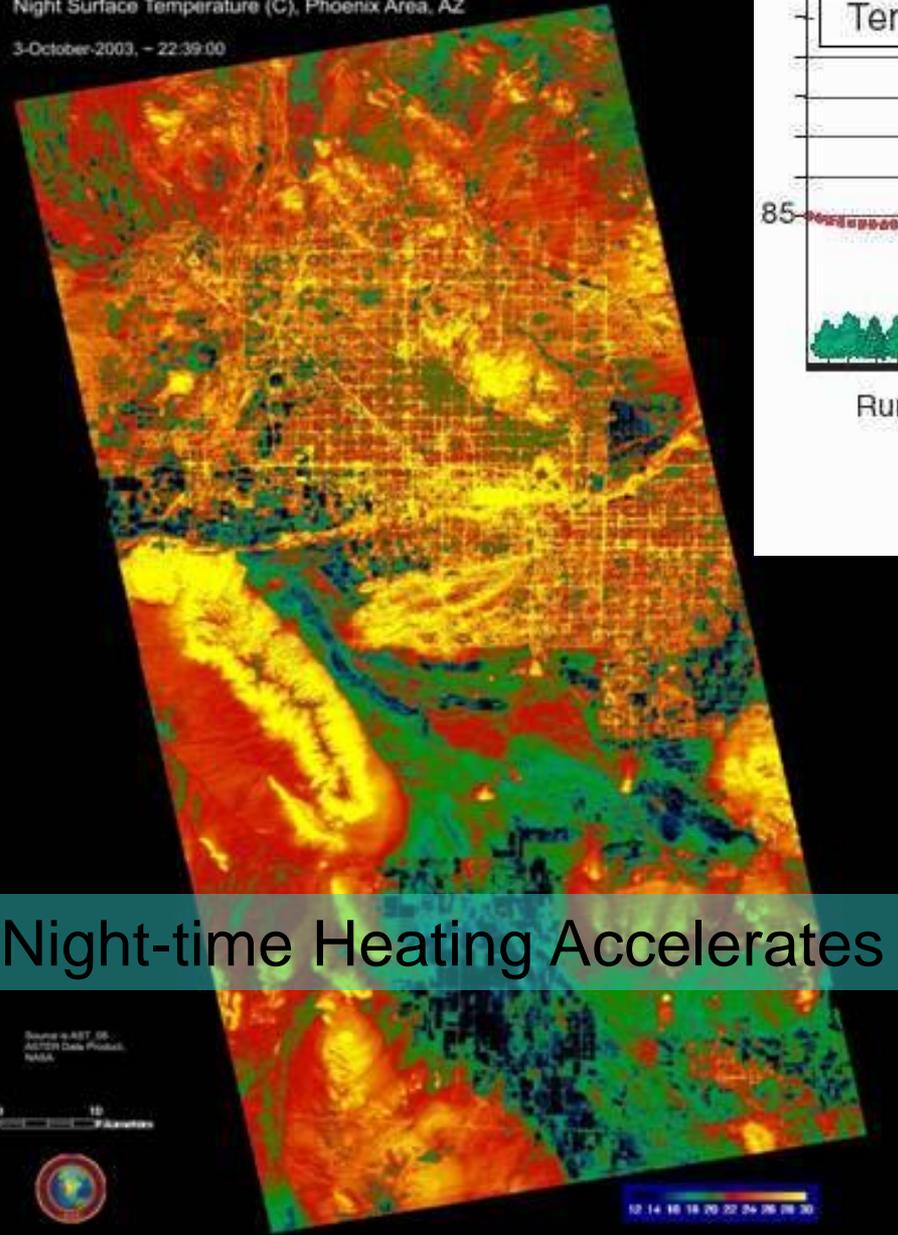
Source: United Nations World Urbanization Prospects, 2008

Sketch of an Urban Heat-Island Profile



Night Surface Temperature (C), Phoenix Area, AZ

3-October-2003, - 22:39:00



Urban Heat Island
can add 7° – 12° F

Night-time Heating Accelerates

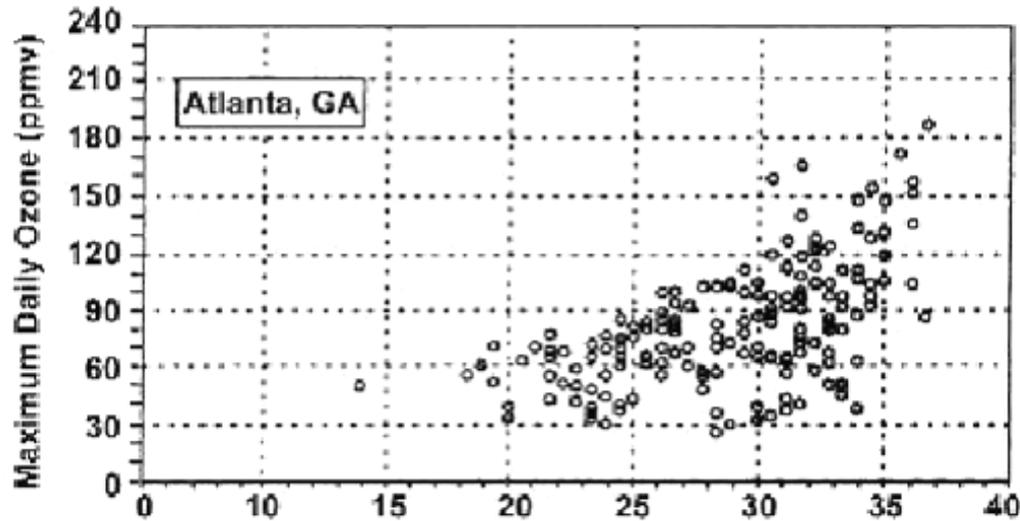
Thermal Satellite Image of
Phoenix, AZ Night Surface
Temperature



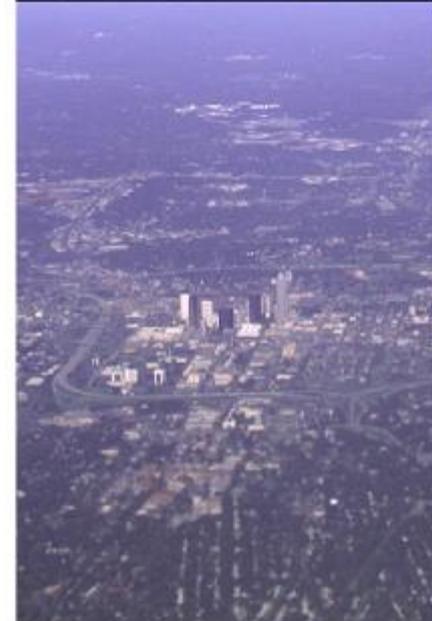
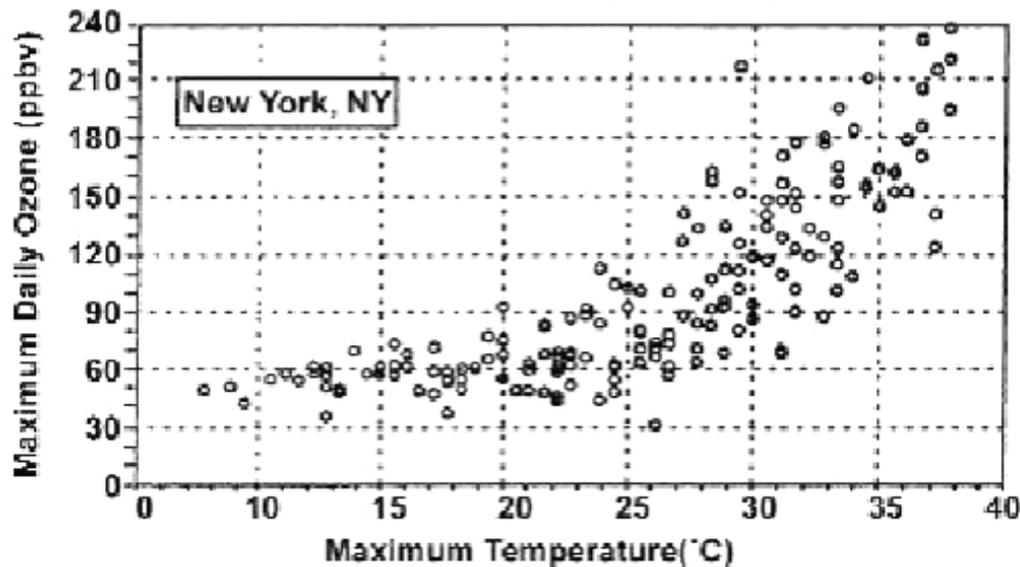
Heat Island Impacts on Air Pollution

Maximum Daily Ozone Concentrations vs. Maximum Daily Temperature

Atlanta



New York



Atlanta

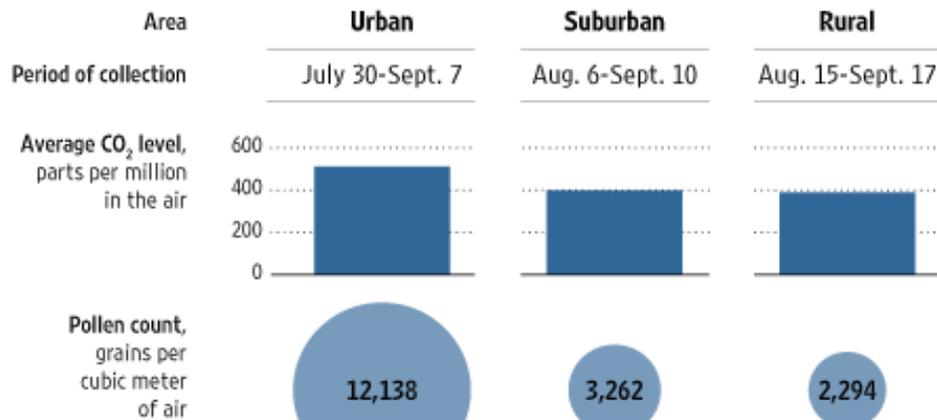
Heat Island and CO₂ Dome impact on Urban Aeroallergens

- Ragweed
- ↑ CO₂ and temperature → ↑ pollen counts, longer growing season



Something in the Air

Researchers at the U.S. Dept. of Agriculture planted ragweed in and around Baltimore in 2001 to test how the plant responds to different concentrations of CO₂. The results:



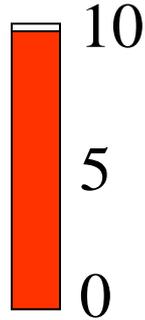
Source: Lewis Ziska, U.S. Dept. of Agriculture

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

Climate projections: *Heavy Precipitation*

Facts from Climate Models and Theory

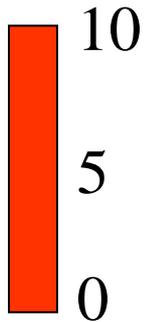
- Increasing levels of greenhouse gases warm the climate and lead to increases in *very heavy* precipitation events



“Confidence Index”

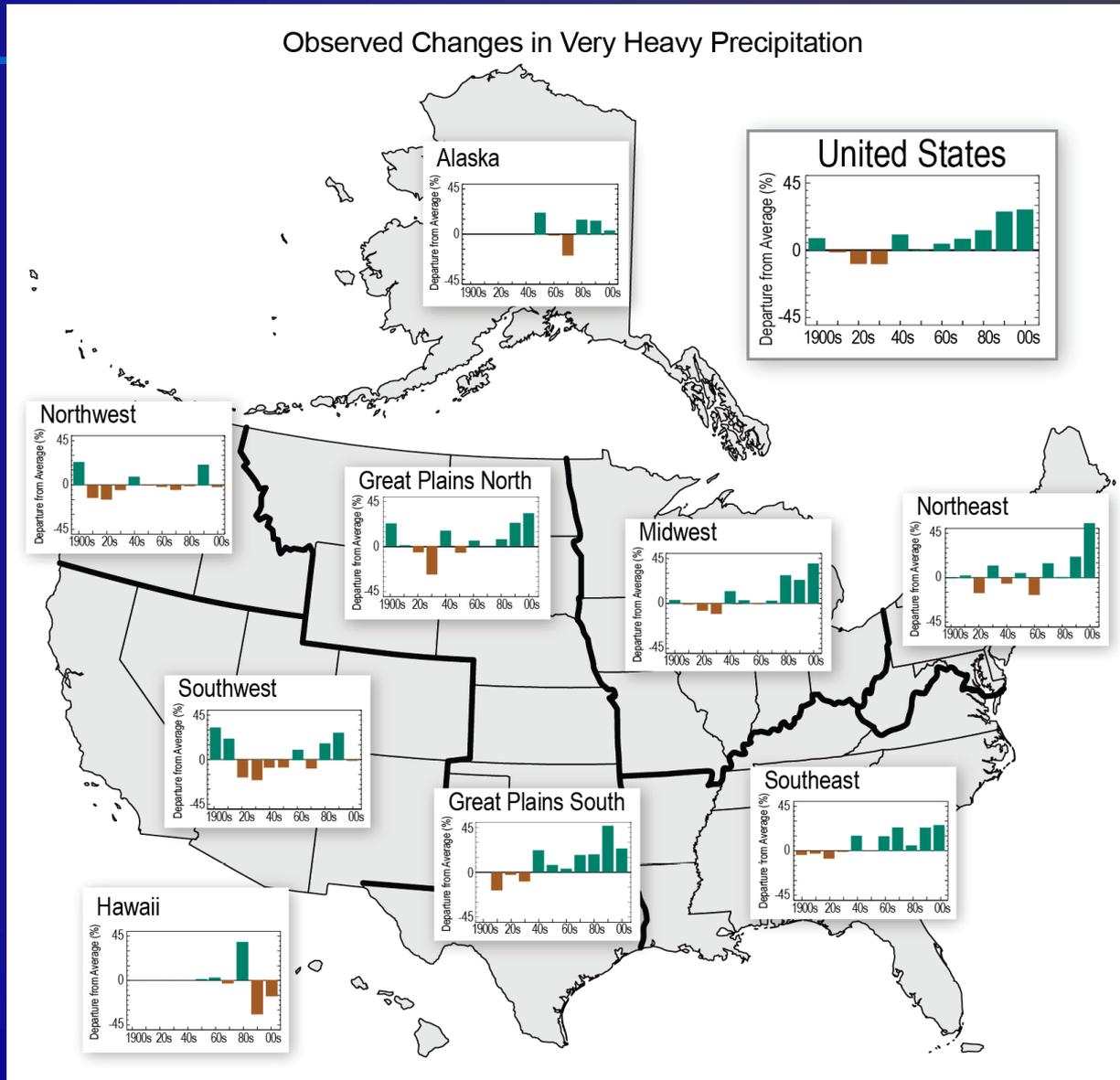


Why: Increasing air temperatures result in a greater amount of water vapor in the air



“Confidence Index”

Observed Increases in Very Heavy Precipitation (heaviest 1% of all events) — 1901 to 2011



Source: Walsh et al. 2013: Draft NCA Report, Chapter 2: Our Changing Climate



Extreme Precipitation and Waterborne Disease Outbreaks in the US: 1948 -1994

- **67%** of waterborne disease outbreaks were preceded by precipitation above the 80th percentile (across a 50 yr. climate record), $p < 0.001$
- **51%** of outbreaks were preceded by precipitation above the 90th percentile, $p < 0.002$
- Surface water-related outbreaks correlated with heavy precip in the month of outbreak; groundwater-related outbreaks lagged 2 months following extreme precipitation.

Heavy and Water-borne Disease:

Milwaukee 1993

Cryptosporidiosis epidemic

405,000 cases, 54 deaths

Preceded by heaviest rainfall in 50 years (Curriero et al., 2001)

\$31.7 million in medical costs

\$64.6 million in lost productivity

(Corso et al., 2003).

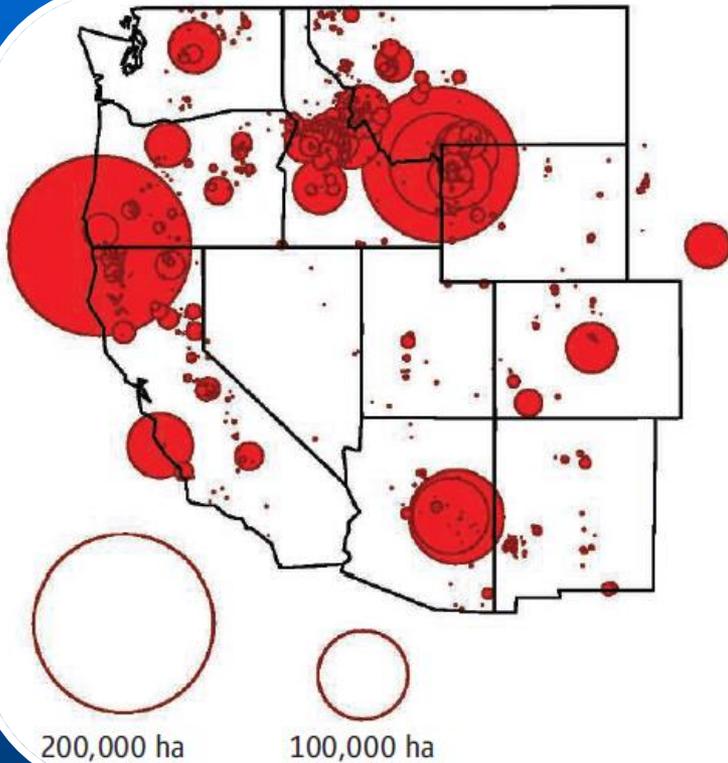


Direct Effects of Hydrologic Extremes

↑ drier climates → forest fires and smoke

■ Since 1970

- Wildfire season in US West has increased by 78 days
- Average duration of fires has increased 5 fold



Wildfire activity Since 1970

Westerling et al. Warming and earlier spring increase western U.S. forest wildfire activity
Science. 2006 Aug
18;313(5789):940-3



Wildfire forces out thousands of Californians - Photo 14 of 16

The Station Fire is visible Saturday night from the mountains near the Rose Bowl in Pasadena in a photo from iReporter Tammy Alsterlind. Courtesy Tammy Alsterlind



HIDE CAPTIONS

Mortality and Morbidity from Wildfire Smoke

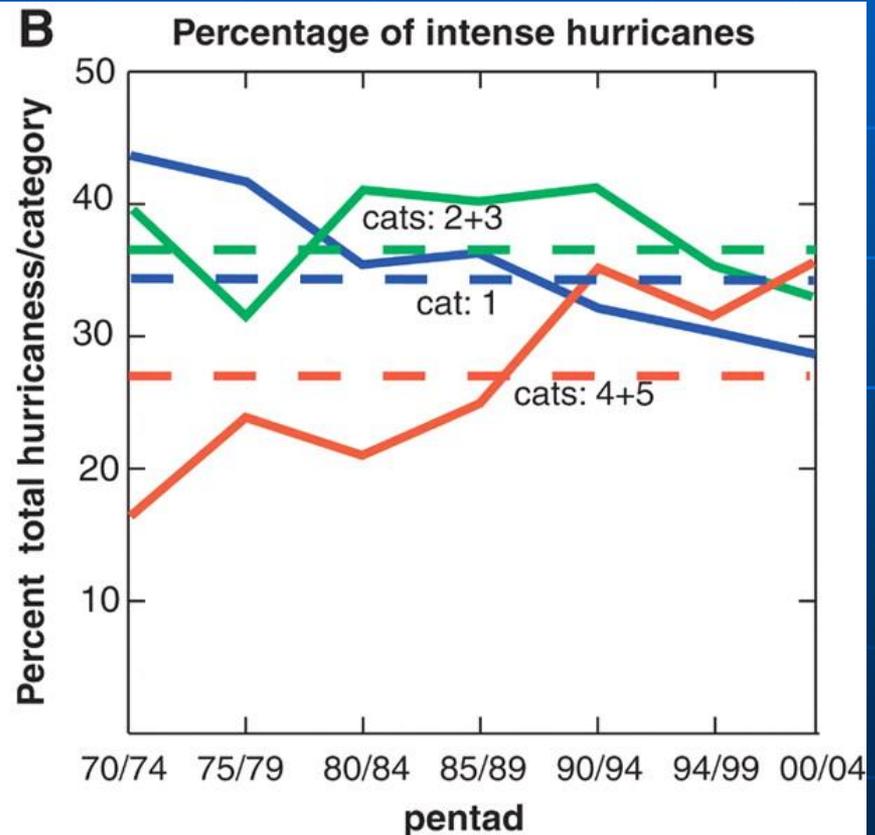
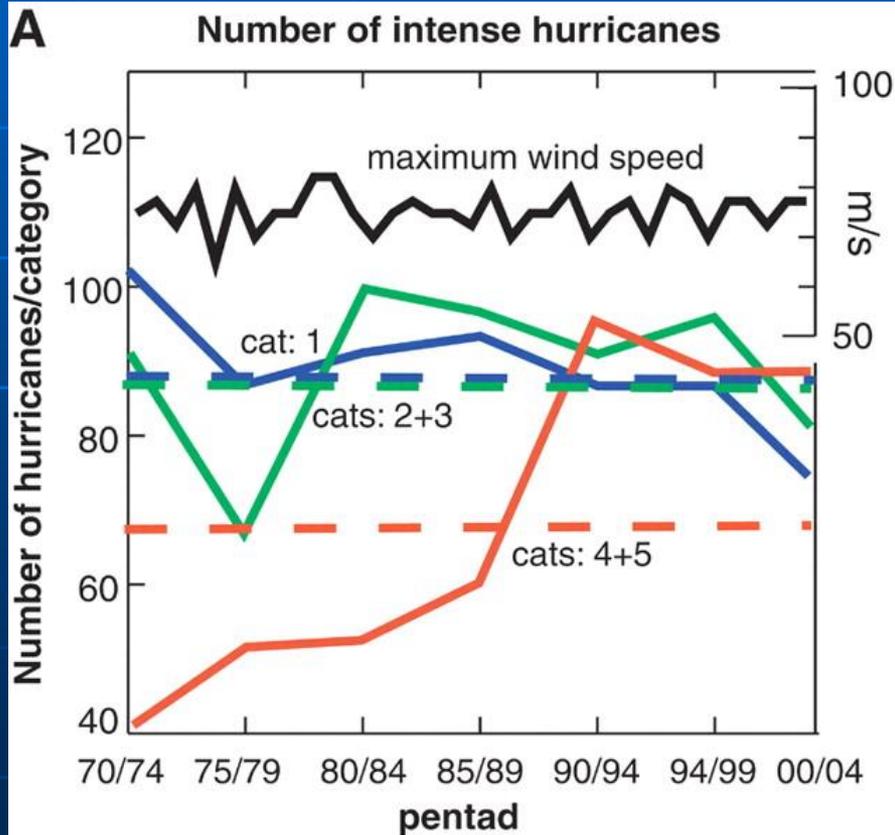
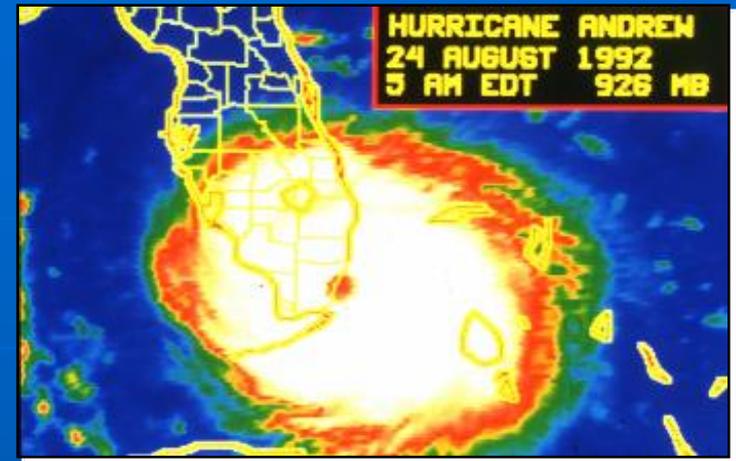
- An increase of $10\mu\text{g}/\text{m}^3$ in PM_{10} from wildfires resulted in approximately 1% increase in mortality^(1,2,3)

- During Australian bushfires
 - Overall mortality rose 5%
 - Hospital admissions for respiratory illnesses increased from 3-5%⁴

1. Morgan G et al. Effects of bushfire smoke on daily mortality and hospital admissions in Sydney, Australia. *Epidemiology*. 2010 Jan;21(1):47-55.
2. Sastry N. Forest fires, air pollution, and mortality in southeast Asia. *Demography*. 2002 Feb;39(1):1-23.
3. Hanninen OO. Population exposure to fine particles and estimated excess mortality in Finland from an East European wildfire episode. *J Expo Sci Environ Epidemiol*. 2009 May;19(4):414-22.
4. Johnston F et al. Extreme air pollution events from bushfires and dust storms and their association with mortality in Sydney, Australia 1994-2007. *Environ Res*. 2011 Aug;111(6):811-6.

Tropical Cyclones

- \uparrow sea-surface temperatures \rightarrow \uparrow tropical cyclone intensity and \uparrow the height of storm surges



Harmful Algal Blooms (Red-tides)

Enhanced by:

- Increased water temps
- Nutrient runoff
- Upwelling events



got ciguatera?

Have you ever become sick from eating fish caught offshore in Texas? If you answered YES, contact us at

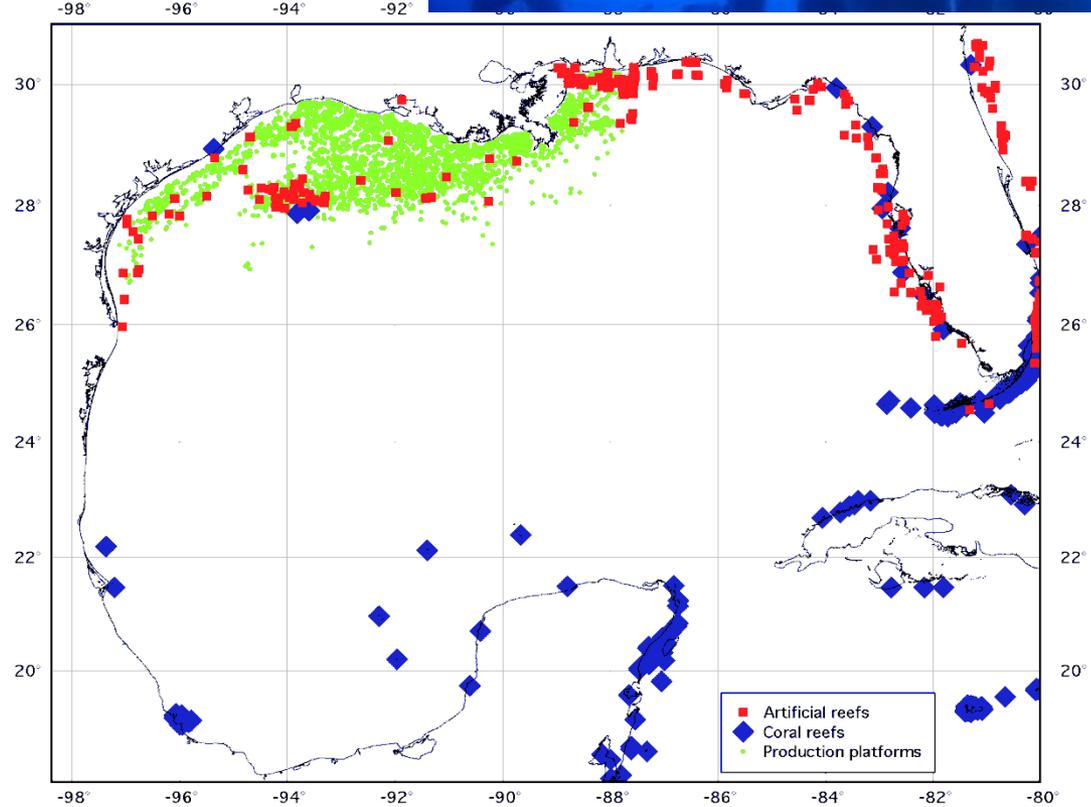
1-888-474-5929

We'd like to talk with you about your symptoms.
E-mail us for more information at ciguatera@cdc.gov
or visit www.cdc.gov/nceh/ciguatera.



This study is a
collaboration of
the Texas Marine
Science Institute
and the
Centers for Disease
Control and
Prevention

Ciguatera Fish Poisoning on Texas Coast Oil Rigs



Scale: 1:13021480 at Latitude 0°

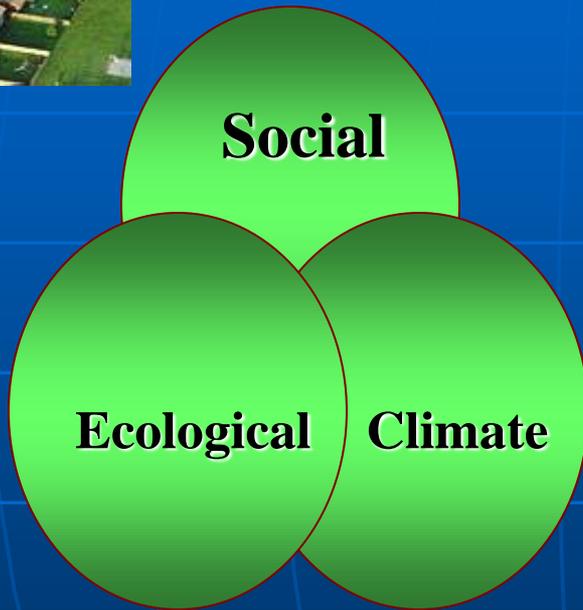
HEALTH PROFESSIONALS AND SCIENTISTS WARN OF SPREADING INFECTIOUS DISEASES.

Global Warming's greatest

Prediction:

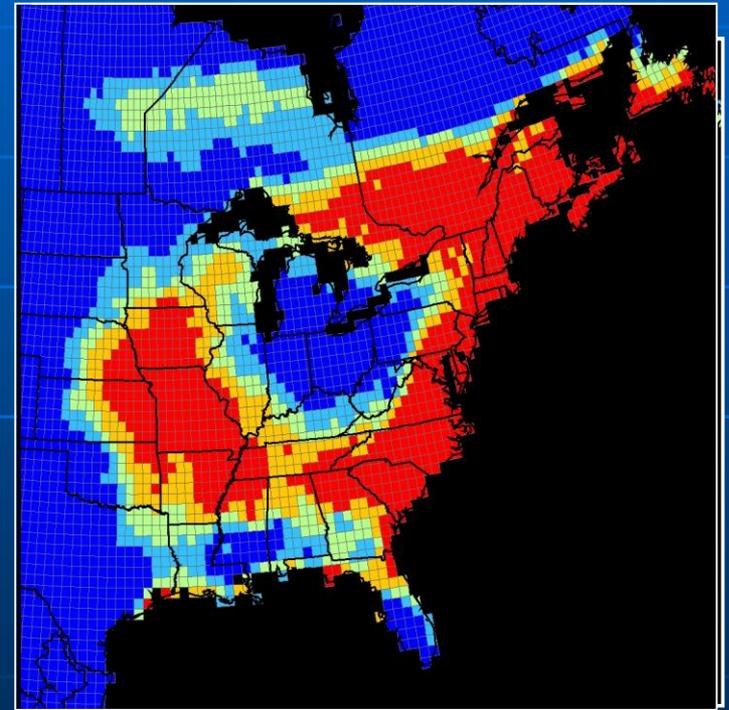
Because of Climate
Change, Vector
distributions will
increase in
latitude and altitude

Lyme Disease



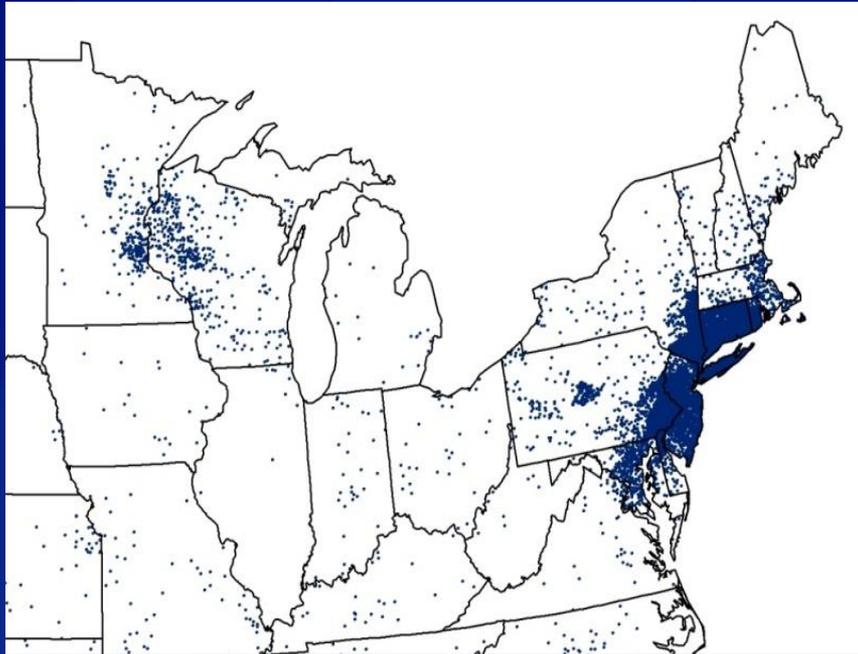
Range of suitable conditions for *Ixodes scapularis*, the Lyme disease vector.

TODAY  2080

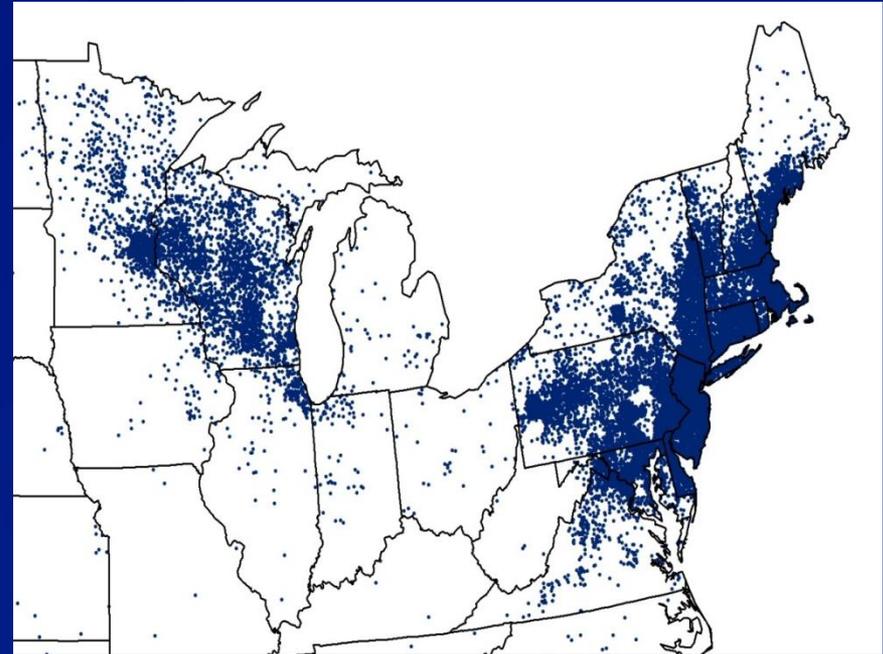


Source: Brownstein JS, Holford TR, Fish D. A climate-based model predicts the spatial distribution of the Lyme Disease vector *Ixodes scapularis* in the United States. *Environ Health Persp* 2003;111(9):1152-57.

Lyme Disease U.S. Case Distribution – 16 year Trend



1996



2011

Some surprises are in store



PNAS

Proceedings of the National Academy of Sciences of the United States of America www.pnas.org

PNAS | December 7, 2004 | vol. 101 | no. 49

A rare genotype of *Cryptococcus gattii* caused the cryptococcosis outbreak on Vancouver Island (British Columbia, Canada)

S. E. Kidd^{*††}, F. Hagen[§], R. L. Tschärke[¶], M. Huynh[†], K. H. Bartlett[‡], M. Fyfe^{||}, L. MacDougall^{||}, T. Boekhout^{§**}, K. J. Kwon-Chung[¶], and W. Meyer^{*†,††}

Discussion

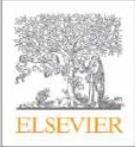
Until the recent emergence of cryptococcal infection on Vancouver Island, *C. gattii* had been considered to be restricted to areas with tropical and subtropical climates (2). The identification of large-scale colonization of *C. gattii* in the environment occurring in a temperate climate zone indicates a striking change in the distribution of this species. Furthermore, the identification of the *C. gattii*

Factors in Disease Emergence

- **Genetic and biological factors**
 - Microbial adaptation and change
 - Human susceptibility to Infection
- **Physical environmental factors**
 - **Climate and weather**
 - Economic development and land use
- **Ecological factors**
 - Changing ecosystems
 - Human demographics and behavior
- **Social, political, and economic factors**
 - International travel and commerce
 - Poverty and social inequity
 - War and famine
 - Lack of political will
 - Intent to harm



Mental Health: Post-Disaster



Clinical Psychiatry News

www.clinicalpsychiatrynews.com

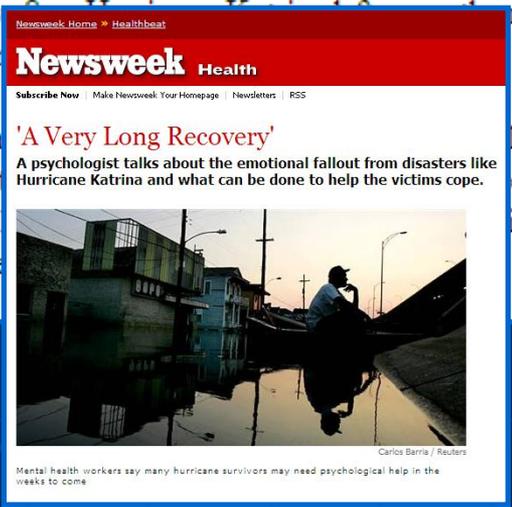
VOL. 33, No. 10 The Leading Independent Newspaper for the Psychiatrist—Since 1973 OCTOBER 2005

Mental Health Problems From Katrina Persist

By Dorie Turner
Associated Press
Thursday, November 9, 2006; Page A12

ATLANTA, Nov. 9 (AP) — Hurricane Katrina's impact on gutted houses and empty streets along the Gulf Coast is still being felt.

The most devastating and destroyed more than a year ago. A discussion Wednesday



Newsweek Home | Healthbeat

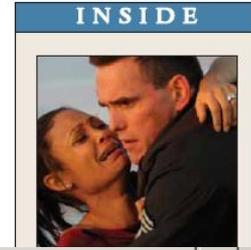
'A Very Long Recovery'

A psychologist talks about the emotional fallout from disasters like Hurricane Katrina and what can be done to help the victims cope.



Carlos Barria / Reuters

Mental health workers say many hurricane survivors may need psychological help in the weeks to come.



Katrina Survivors' Psychiatric Needs Unpredictable

'Cascade of disasters' magnifies trauma.



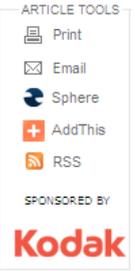
TIME IN PARTNERSHIP WITH CNN

HOME U.S. WORLD BLOGS BUSINESS & TECH HEALTH & SCIENCE ENTERTAINMENT

Is New Orleans Having a Mental Health Breakdown?

By RUSSELL MCCULLEY/NEW ORLEANS Tuesday, Aug. 01, 2006

Over the past several months, psychiatrist James Barbee has witnessed a disturbing trend among his patients in New Orleans — a noticeable slide from post-Katrina anxiety to more serious, and harder to treat, cases of major depression. At the same time, the city's system for dealing with mental health care is suffering a major breakdown of its own. "People are just wearing down," says Barbee. "There was an initial spirit about bouncing back and recovering, but it's diminished over time, as weeks have become months."



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Mental health: Anticipatory

BBC NEWS

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."

The Boston Globe

HOME / LIFESTYLE / GREEN LIVING

Climate change takes a mental toll

By [Emily Anthes](#)

Globe Correspondent / February 9, 2009

Email | Print | Single Page | [Yahoo! Buzz](#) | [ShareThis](#)

The Boston Globe

Last year, an anxious, depressed 17-year-old boy was admitted to the psychiatric unit at the Royal Children's Hospital in Melbourne. He was refusing to drink water. Worried about drought related to climate change, the young man was convinced that if he drank, millions of people would die. The

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.

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

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

Loss of Cultural Resources Impacts Mental Health

Moving a traditional village site: Shishmaref,

Gravesite erosion



Ancient graves pulled to sea



Human remains ... dragged to sea

By SEBASTIAN LANDER
in Alaska

Published: 03 May 2008

[Add a comment \(5\)](#)



ANCIENT graveyards are being dragged out to sea as climate change accelerates erosion in

MULTIMEDIA

[Grave danger in the Arctic](#)

RELATED STORIES

Alaska's not on

Potential Health Effects of Climate Change

Climate Change:

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



- ➔ Heat stress, cardiovascular failure
- ➔ Injuries, fatalities
- ➔ Asthma, cardiovascular disease
- ➔ Respiratory allergies, poison ivy
- ➔ Malaria, dengue, encephalitis, hantavirus, Rift Valley fever
- ➔ Cholera, cryptosporidiosis, campylobacter, leptospirosis
- ➔ Malnutrition, diarrhea, harmful algal blooms
- ➔ Anxiety, despair, depression, post-traumatic stress
- ➔ Forced migration, civil conflict



National Climate Assessment

U.S. Global Change Research Program

Draft Findings on Health from the 3rd US National Climate Assessment



National Climate Assessment: GCRA (1990), Section 106

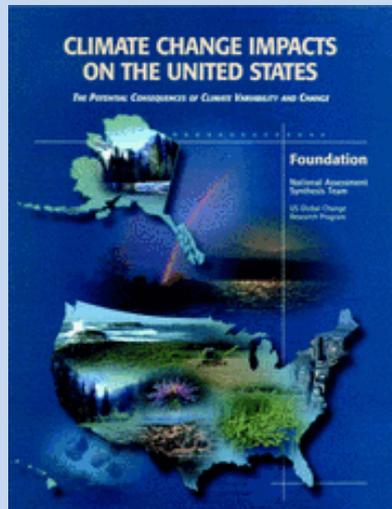
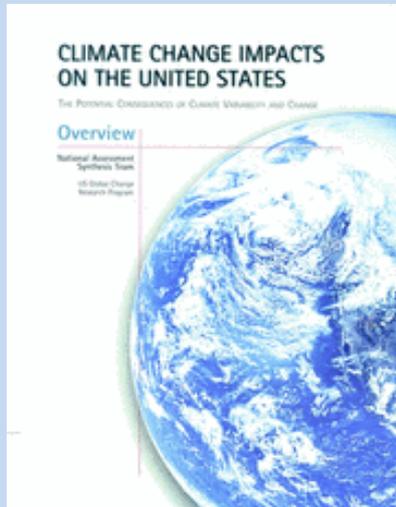
...not less frequently than every 4 years, the Council... shall prepare... an assessment which –

- **integrates, evaluates, and interprets** the findings of the Program (USGCRP) and discusses the scientific uncertainties associated with such findings;
- **analyzes the effects of global change** on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and
- analyzes current trends in global change, both human-induced and natural, and **projects major trends for the subsequent 25 to 100 years.**

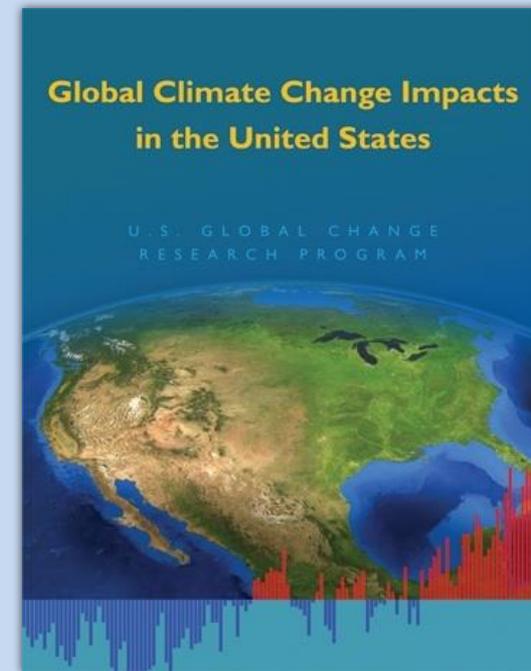


Previous National Climate Assessments

Climate Change Impacts on the United States (2000)



Climate Change Impacts in the United States (2009)



<http://nca2009.globalchange.gov/>



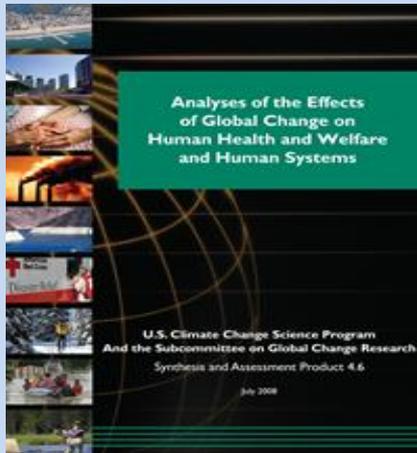
**National
Climate
Assessment**

U.S. Global Change Research Program

Recent Interest Climate Assessments that Focus on Health

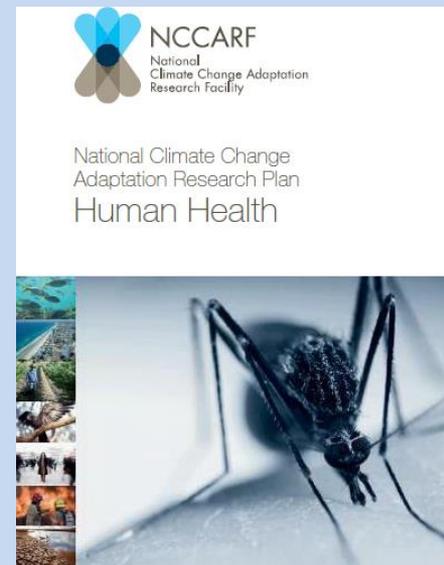
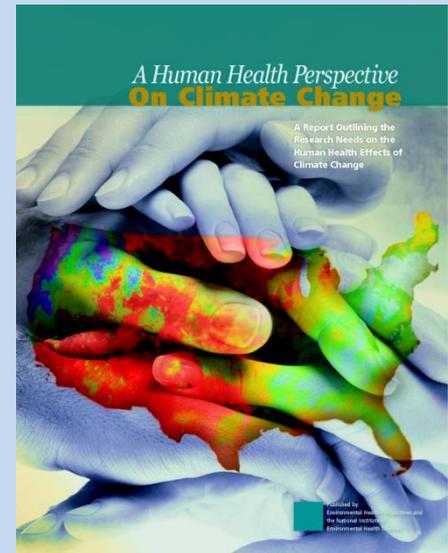
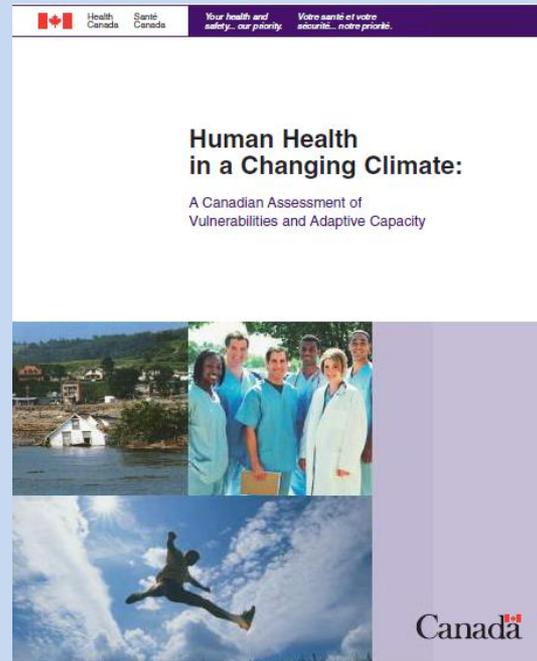
- US GCRP
- United Kingdom
- Canada
- Australia

Synthesis and Assessment Product 4.6 (2008)



National Climate Assessment

U.S. Global Change Research Program



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 - Paul Schramm (CDC) on the Southeast Chapter
 - Jonathan Patz (Wisconsin) on the Midwest Chapter



Key Messages – Human Health

1. Climate change threatens human health – impacts already underway in the U.S.
2. Climate change will amplify existing health threats the nation faces, esp. for vulnerable communities & people.
3. Preparedness & prevention can protect people from some of these impacts; early action is most beneficial, because our ability to adapt to increasing threats may be limited in future.
4. Responding to climate change provides opportunities to improve health and well-being in sectors including energy, agriculture, and transportation; in ways that can protect people, combat climate change, and provide other benefits.



Key Message 1

“Climate change threatens human health and well-being in many ways, including impacts from increased extreme weather events, wildfire, decreased air quality, diseases transmitted by insects, food and water, and threats to mental health. Some of these health impacts are already underway in the U.S.”

Smoke from Wildfires has Widespread Health Effects

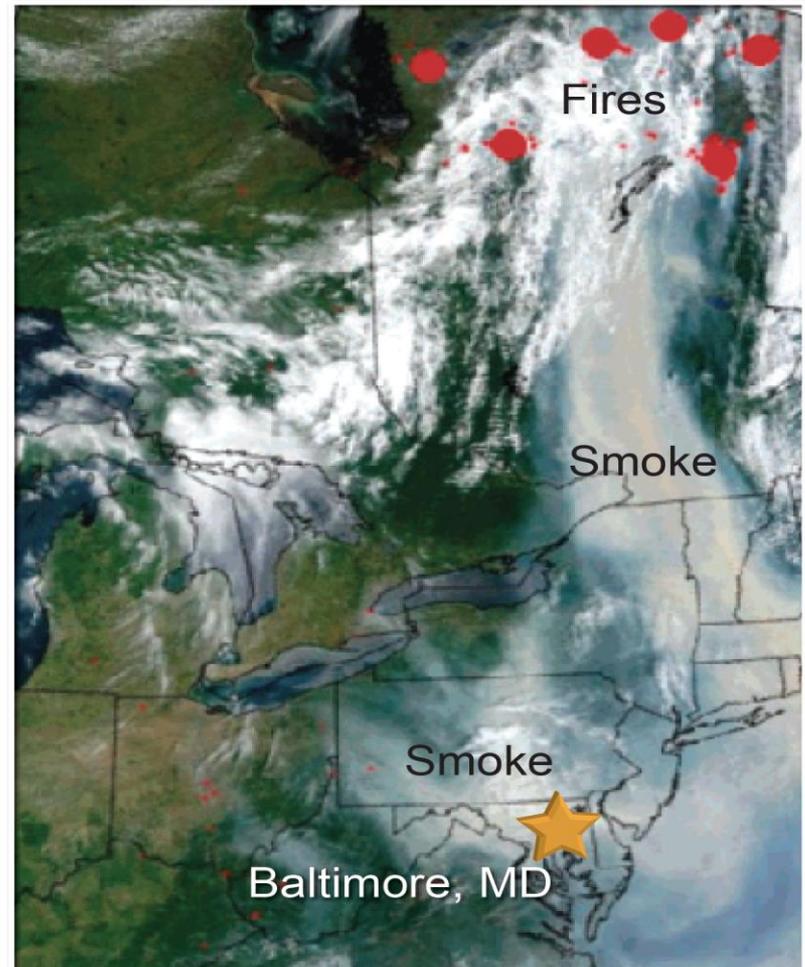
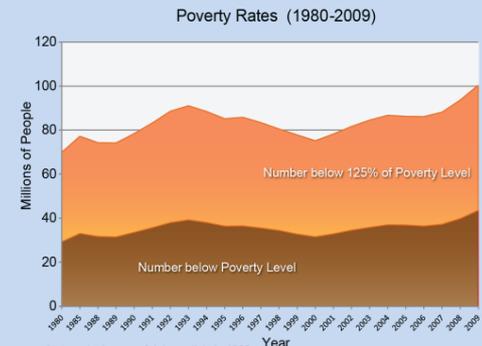
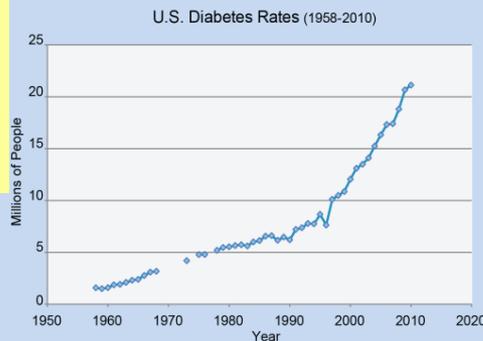
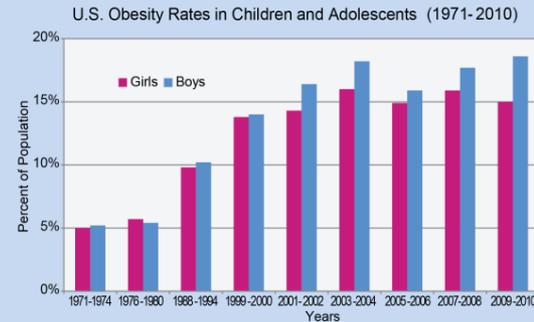
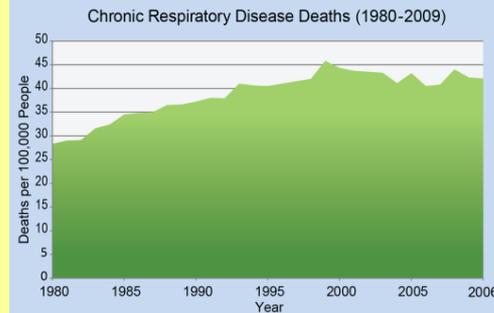
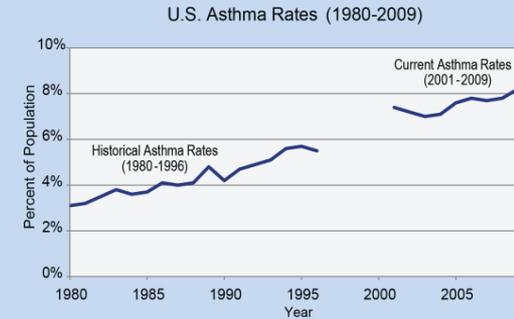
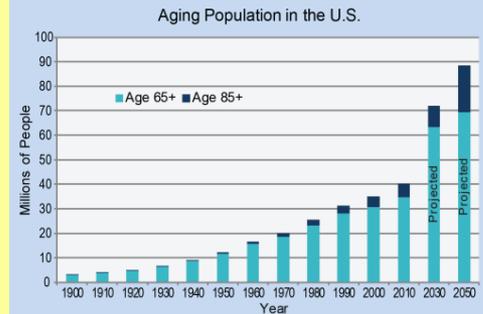


Figure 9.6 (p.341), draft report.

Key Message #2

“Climate change will, absent other changes, amplify some of the existing health threats the nation now faces. Certain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.”

Elements of Vulnerability to Climate Change



Note: only 4 years of data available in 1980s

Figure 9.12 (p.350), draft report.

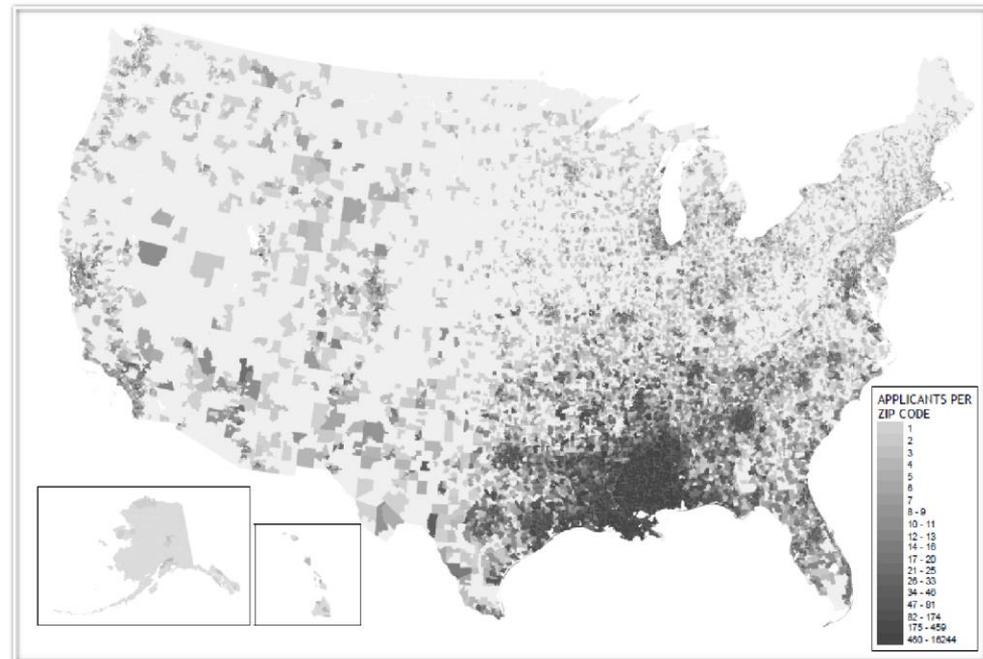


Key Message 3

“Public health actions, especially preparedness and prevention, can do much to protect people from some of the impacts of climate change. Early action provides the largest health benefits. As threats increase, our ability to adapt to future changes may be limited.”

Figure 9.13 (p.352), draft report.

Katrina Refugee Diaspora



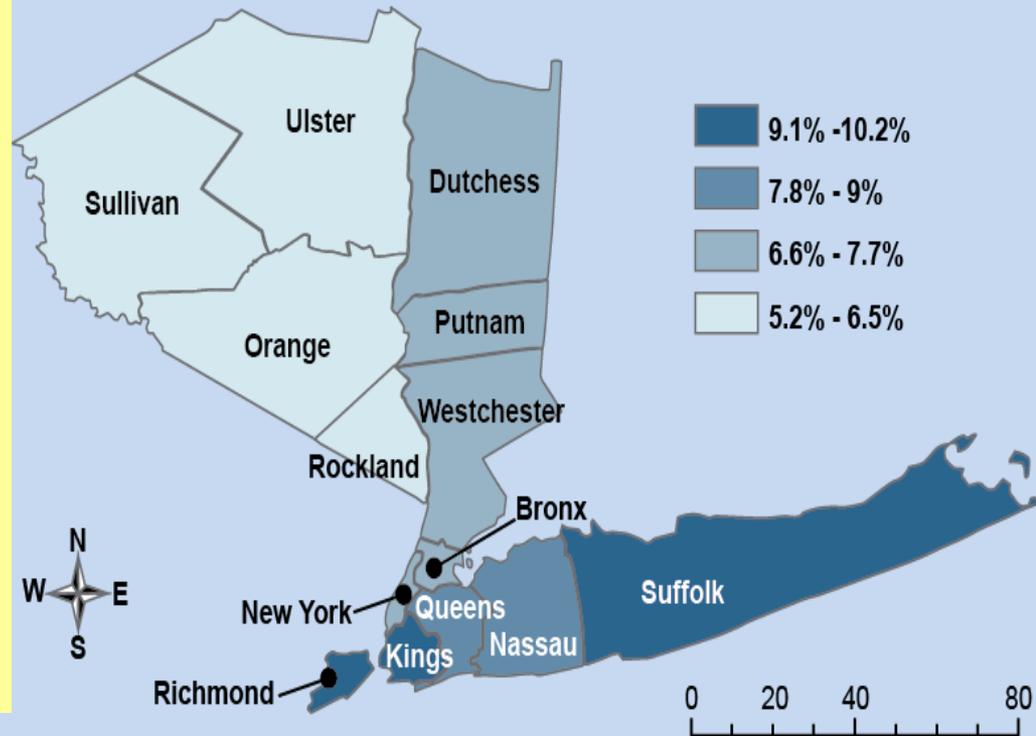
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Key Message 4

“Responding to climate change provides opportunities to improve human health and well-being across many sectors, including energy, agriculture, and transportation. Many of these strategies offer a variety of benefits, protecting people while combating climate change and providing other societal benefits.”

Climate Change Worsens Asthma



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Key Health Threats

- ***Multiple Climate Stressors & Health***
 - Climate change impacts add to the *cumulative* stresses currently faced by vulnerable populations: children, the elderly, the poor, some communities of color, and people with chronic illnesses; in locations (cities, floodplains, and coastlines) are more vulnerable to extreme events & ongoing, persistent climate-related threats: poor air quality, heat, drought, flooding, and mental health stress. Over time, the accumulation of these stresses will be increasingly devastating to these populations.
- ***Societal System Failures During Extreme Events***
 - Multiple system failures can occur during extreme weather events (infrastructure, evacuation, response services in Hurricane Katrina; loss of electrical power during heat waves limits air conditioning access, increasing everyone's vulnerability). Can exceed response capacity & in succession, deplete our reserves from personal to national scale, esp. for vulnerable.
- ***Large-Scale Environmental Change Favors Disease Emergence***
 - Climate change is causing large-scale environmental change, increases likelihood of emergence/re-emergence of unfamiliar disease threats. Factors include shifting pest ranges, lack of immunity & preparedness, inadequate monitoring. Diseases that pose increasing US health threats include Lyme disease, dengue fever, new diseases like Chikungunya.



National Climate Assessment draft report

Northeast Chapter

Summary of Key Messages

- Increased vulnerability to heat waves, coastal flooding due to sea level rise, and river flooding due to more extreme precipitation events
- Growing challenge to the region's environmental, social, and economic systems
- Infrastructure will be compromised
- Agriculture and ecosystems will be increasingly stressed, but a longer growing season may allow exploration of new crop options
- Implementation of adaptation measures is occurring but is still in early stages



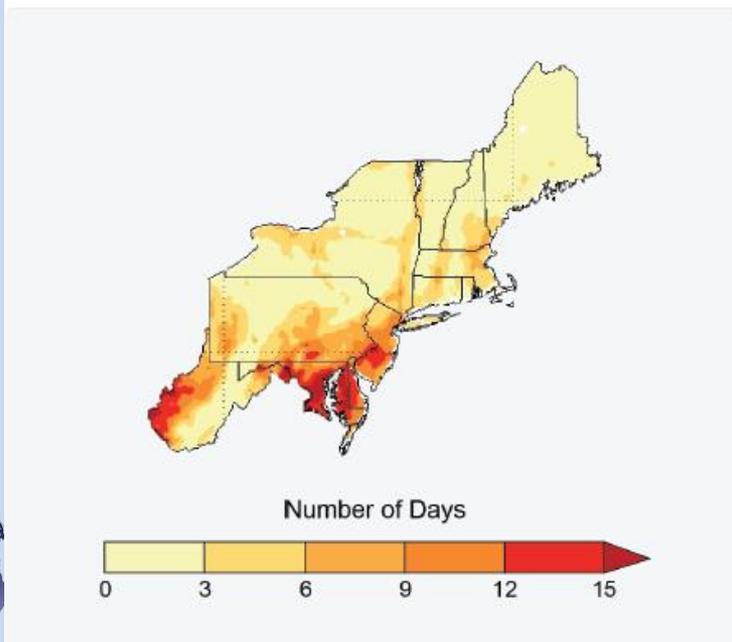
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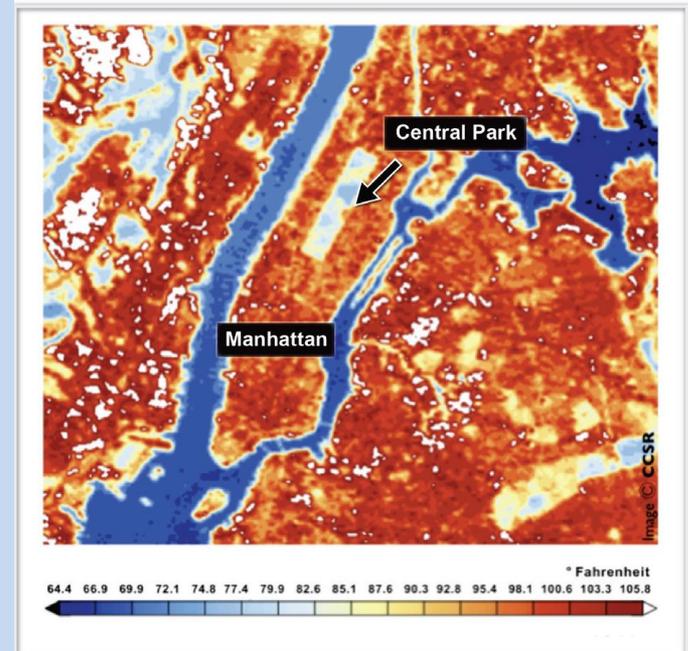
Temperature Impacts

- Warming in the Northeast will be highly dependent on global emissions trajectories.
- Warming of 4.5°F to 10°F is projected by the 2080s (high emissions scenario)
- Frequency, intensity, and duration of heat waves is expected to increase, with larger increases under higher emissions scenarios. Doubling in some areas

Projected Increases in the Number of Days Over 95°F



Urban Heat Island

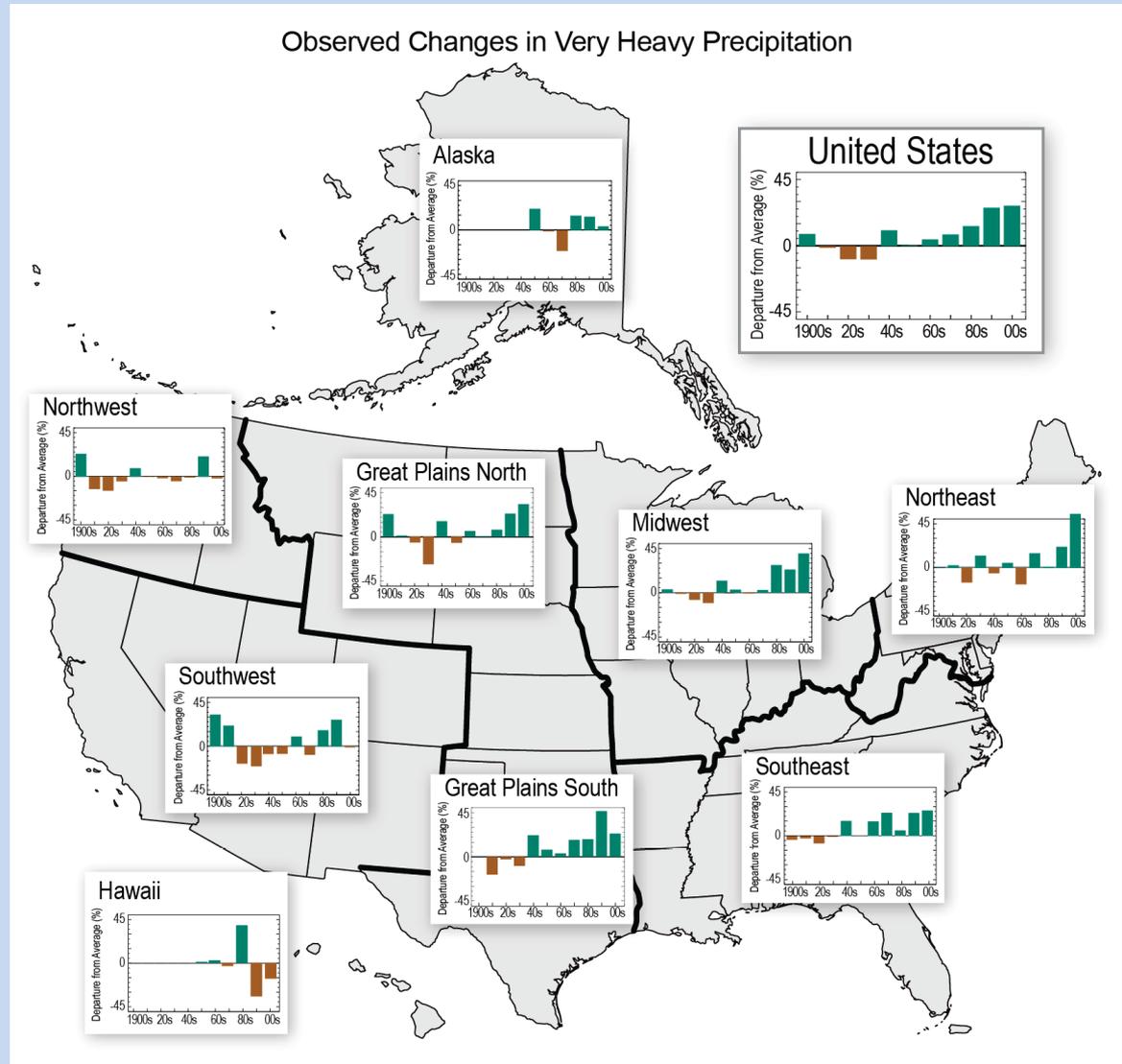


Source, Data are from NASA Landsat 7, Band 6. Source: Center for 6 Climate Systems Research, Columbia University.)



Precipitation Impacts

- Greater uncertainty in projections of precipitation changes
- The frequency of heavy downpours is projected to continue to increase

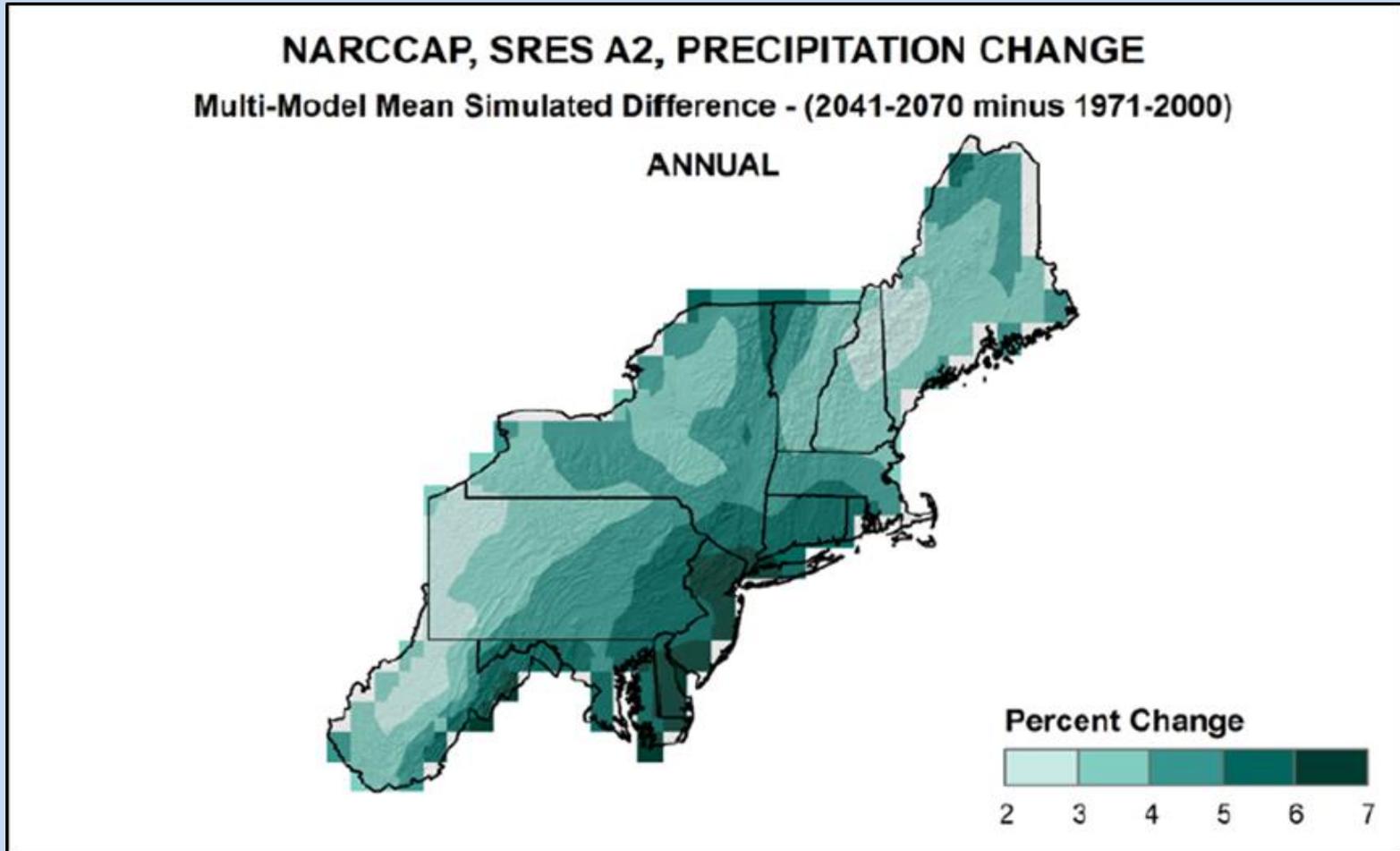


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- Source: Walsh et al. 2013: Draft NCA Report, Chapter 2: Our Changing Climate

Projected Change in Annual Precipitation



Projected percentage increase in annual precipitation in the Northeast



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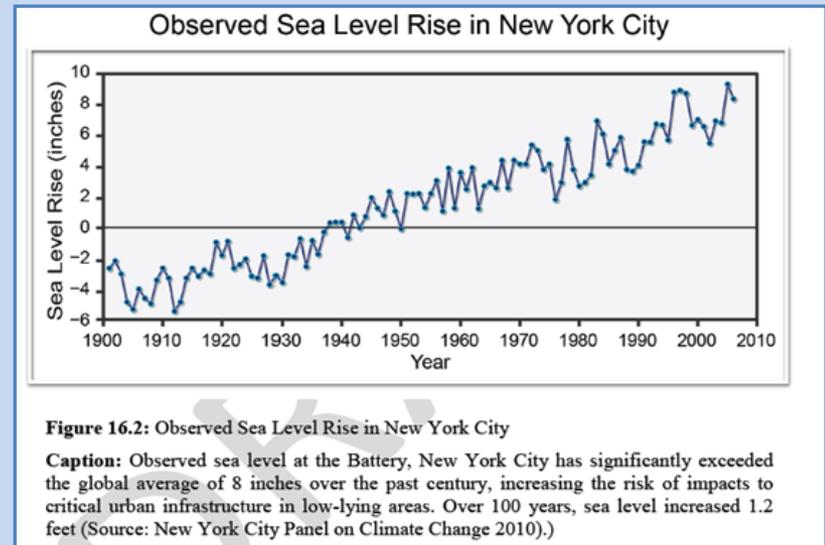
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Sea-level Rise Impacts

- Global sea levels are projected to rise between 1 to 4 feet by 2100
- Sea level rise in the Northeast is expected to exceed the global average by up to 4 inches per century due to local land subsidence



- **Conceptual Design of a Storm Surge Barrier in NYC.** (Source: Aerts et al. 3 2009)

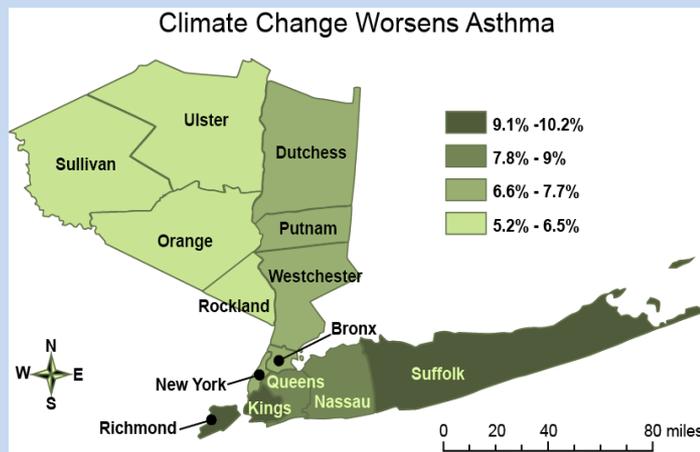


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Health Risks

- Increased premature death and hospitalization due to increases in heat in the Northeast's urban centers.
- In Western New York and western Massachusetts, it is projected that by the 2050s, an additional 5 or more days per year over 95° F may occur by the 2050s – regions where days over 95° F are rare (Kunkel et al. 2012).
- Vulnerability is increased as key infrastructure, including electricity for life-saving cooling, is more likely to fail precisely when it is most needed – when demand exceeds available supply
- Increased ground-level ozone due to warming is projected to increase ozone-related asthma emergency department visits by 7.3% in 2020 in the New York metropolitan area



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Health Risks (continued)

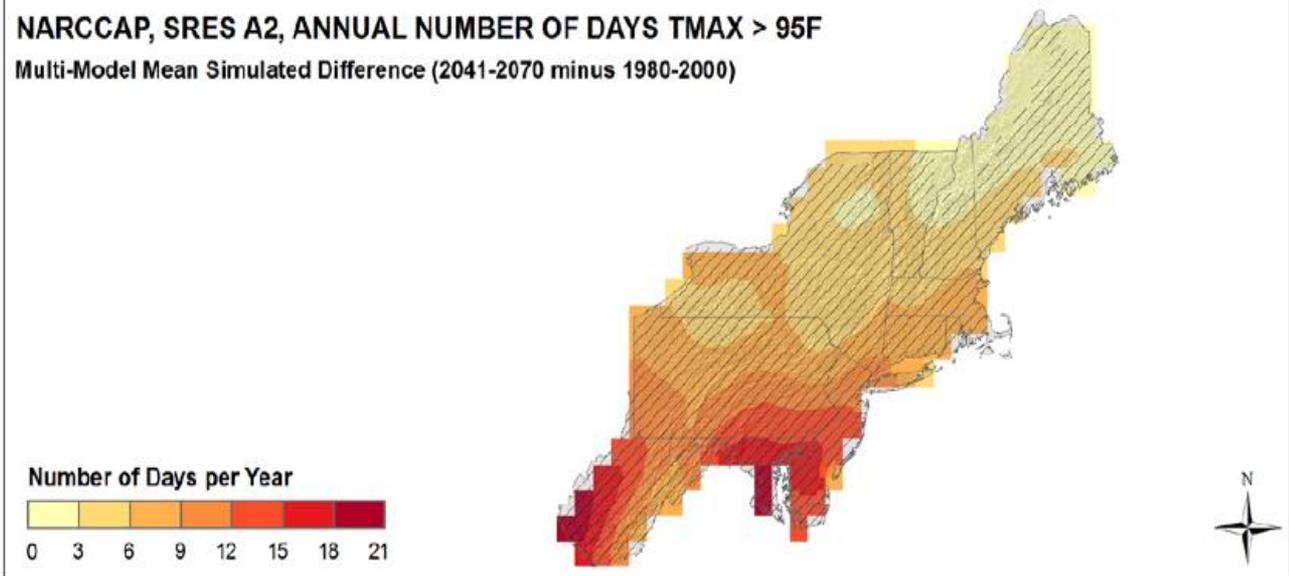
- 1.6 million people in the Northeast live within the FEMA 100-year coastal flood zone
- As sea level rise increases, populations in the current 100-year coastal flood zone will experience more frequent flooding
- Disruptions to services provided by public and private infrastructure in the Northeast threatens public health and safety. A 1.5 foot rise in sea level would expose approximately \$6 trillion worth of property to coastal flooding in the Baltimore, Boston, New York, Philadelphia, and Providence metropolitan areas



Climate Projections and Outlooks

- NOAA technical reports in support of the National Climate Assessment (NCA)
 - Developed by Kenneth Kunkel, North Carolina State University and NOAA's National Climatic Data Center (NCDC)
 - Ten reports: the entire USA, each of the eight NCA regions, and a national sea-level rise scenario
 - Regional climate trends and scenarios using CMIP3; useful for projecting future climate-related disease burden

NARCCAP, SRES A2, ANNUAL NUMBER OF DAYS TMAX > 95F
Multi-Model Mean Simulated Difference (2041-2070 minus 1980-2000)



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Products and Resources: Beyond the Final Report

- A set of climate/health/vulnerability indicators that can be utilized by the health sector for ongoing assessments.
- All technical inputs cited in the 2013 report or other products will be posted publicly (incl. literature review, regional scans, workshop summaries)
- Intention is to post all inputs, but information quality guidelines must first be finalized
- NCANet
 - A network of organizations working with the NCA to engage producers and users of assessment information
 - Builds long-term capacity to conduct and use assessments



**National
Climate
Assessment**

Climate and Health Program

Formally constituted as a Program in March 2009

Leads efforts to:

- identify the health impacts of climate change and the populations most vulnerable to these impacts;
- anticipate future trends;
- assures that systems are in place to detect and respond to emerging health threats;
- and takes steps to assure that these health risks can be managed now and in the future.



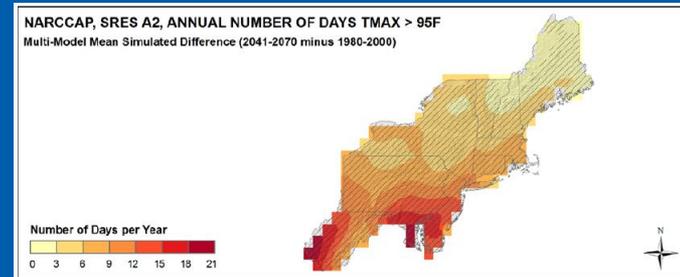
The Climate and Health Program fills three critical roles:

- (1) to **analyze and translate** the latest evidence in climate science to our public health partners;
- (2) to apply these findings to evidence-based **decision support tools**
 - aid in the state and local public health response
- (3) to **provide leadership**
 - inside and outside CDC
 - ensure that public health concerns are represented in climate change adaptation and mitigation strategies
 - create linkages between public health and other sectors



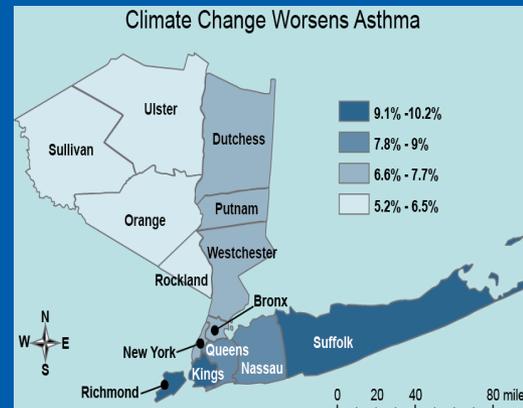
CDC's Priority Actions for Climate Change: Translate Climate Science to our Public Health Partners

Identify regional climate trends that impact health



Identify the health impacts of climate change and the populations most vulnerable to these impacts

Model future health impacts

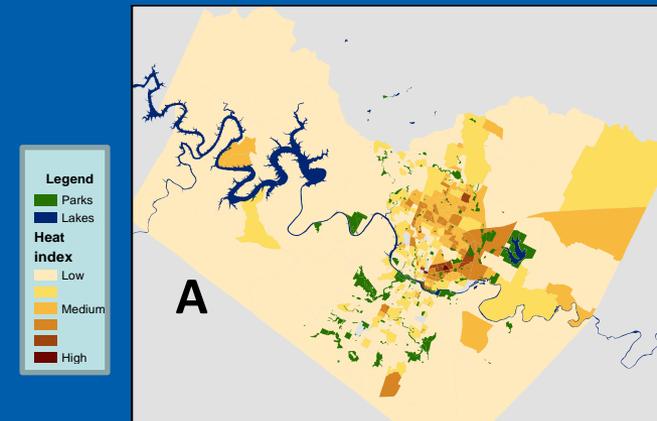
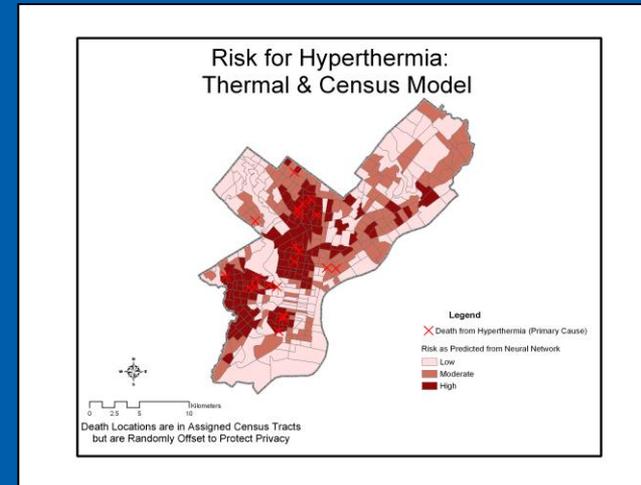


Priority Actions for Climate Change: Develop Support Tools for State and Local Public Health

Technical guidance
and support for
adaptation planning

Create vulnerability
maps

Enhance surveillance
tools

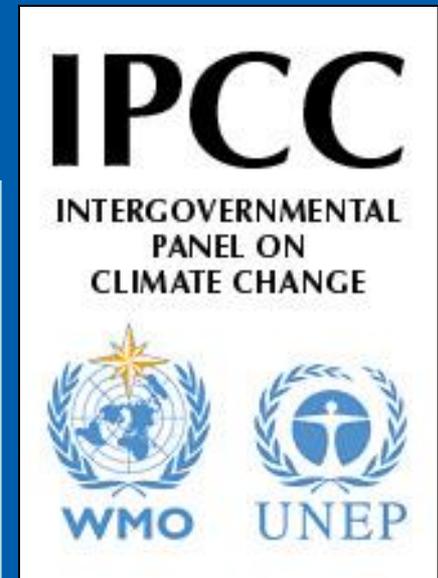


Priority Actions for Climate Change: Leadership and Collaboration

Establish and communicate the key importance of public health in the climate change response



Create linkages between public health and efforts in other sectors



Program Highlight:

Climate-Ready States and Cities Initiative

Objective: To enhance the capability of state and local health agencies to deal with the challenges associated with climate change

Cooperative Agreements with State and Local HDs:

“Developing Public Health Capacity and Adaptations to Reduce Human Health Effects of Climate Change”

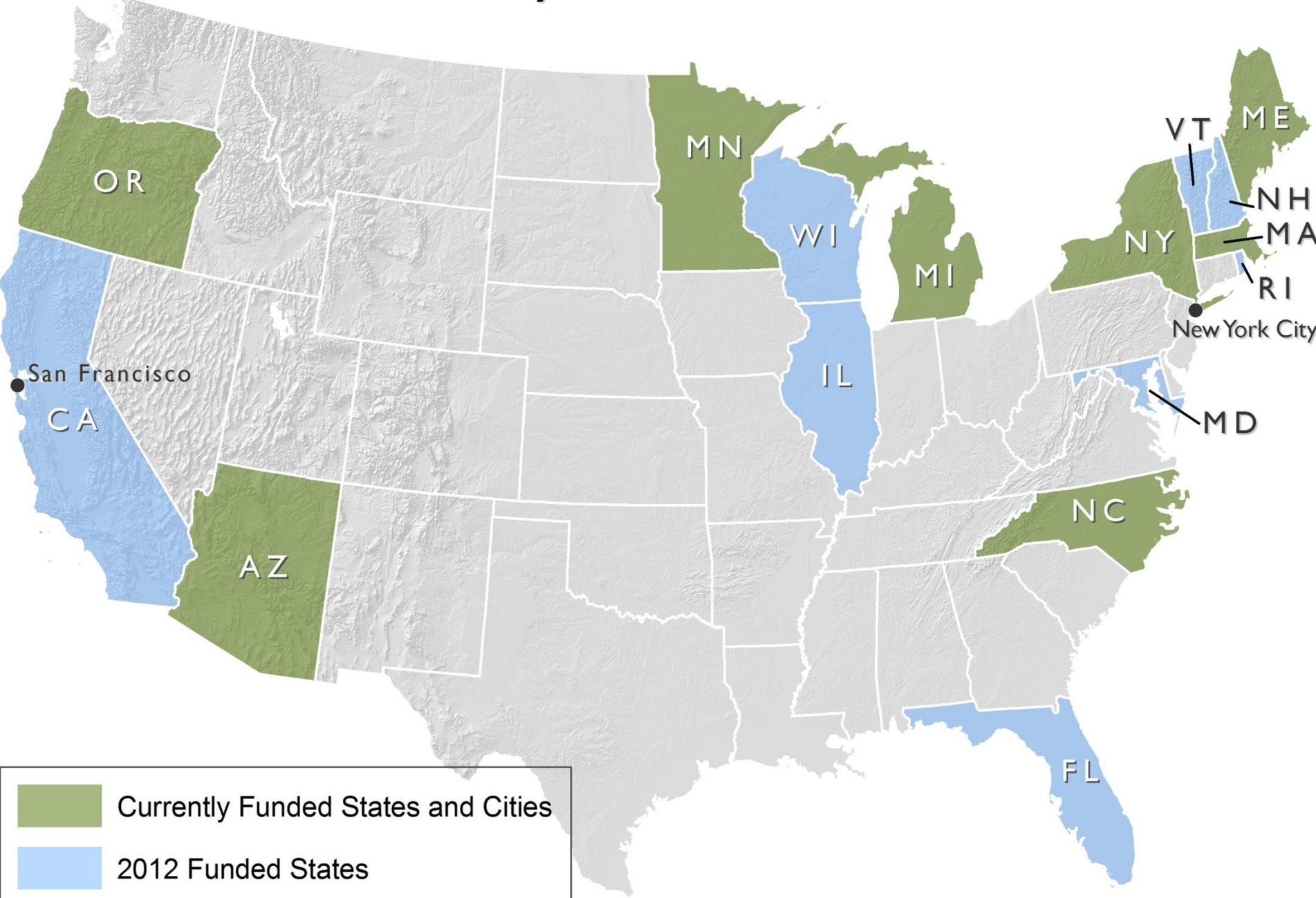
Developing Decision Support Tools:

Communications and Educational Tools

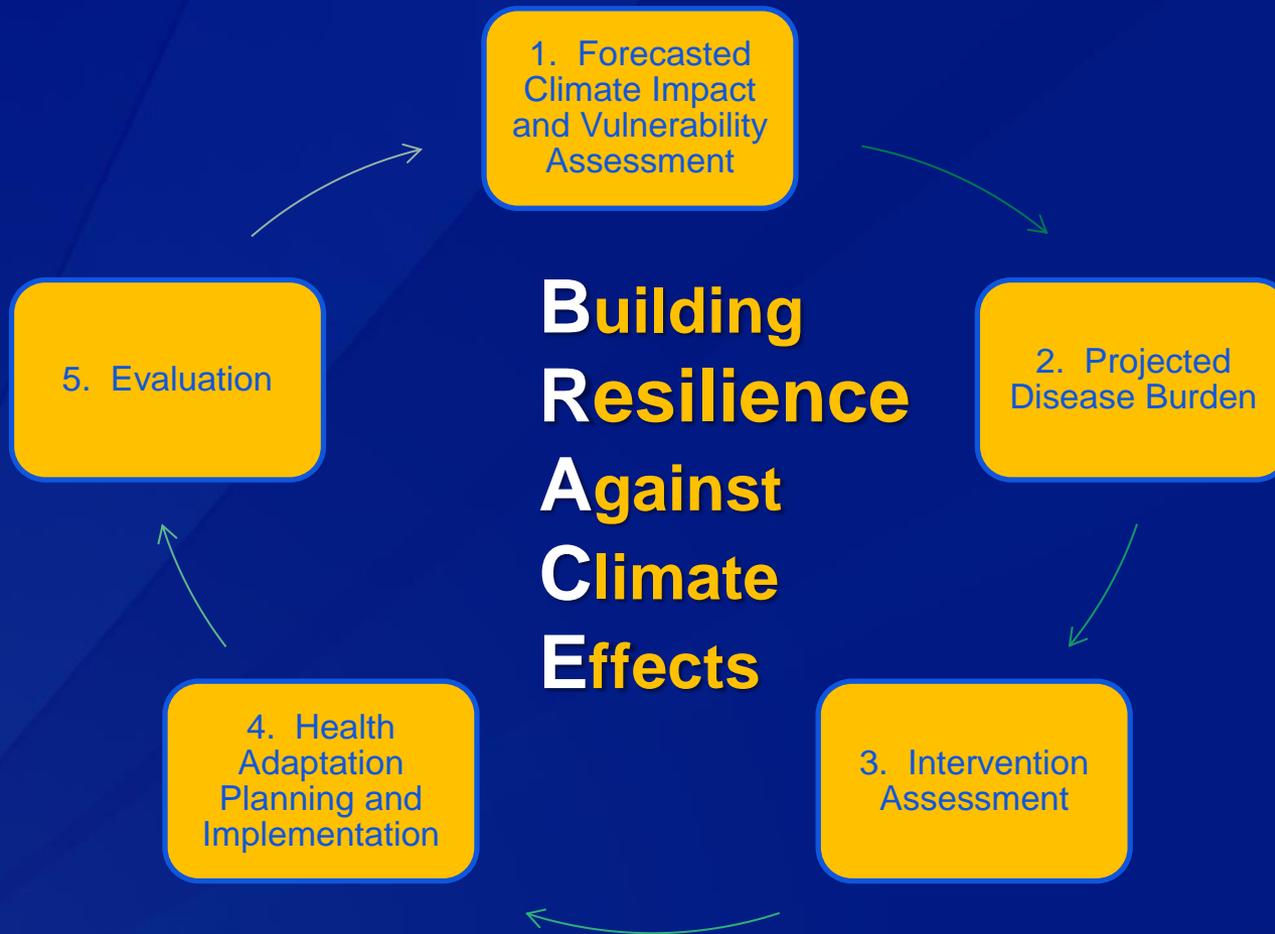
Vulnerability Mapping Tools



CDC Climate Ready States and Cities Initiative



The BRACE Framework



CRSCI activities in the Northeast

- ❑ Maine – Providing important information to the Department of Education
 - Air conditioning
 - Shade covering
- ❑ New York State – Tick borne disease prevention and preparedness
 - Education targeting new areas that are unprepared
- ❑ New York City – Developed a more sensitive and tailored heat warning system for New York City
 - Retrospective analysis of hospitalization, mortality
 - Projections of relevant climatic conditions
 - Understanding of heat island effect in New York

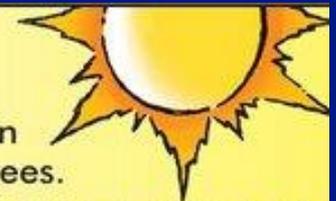
CRSCI activities in the Northeast

- ❑ Massachusetts – Adapting preparedness infrastructure for heat events
 - Schools used as community evacuation facilities
 - Working with Department of Education to ensure that each district has a school equipped with a/c that can act as a cooling shelter



It's a heat wave

A heat wave is defined as three days in a row with temperatures over 90 degrees.



Location	July 3	July 4	July 5	July 6	July 7
Springfield	89	92	98	100	98
Westfield	90	94	98	103	99
Windsor Locks	89	94	97	102	97
Boston	87	95	89	100	83
Providence	85	94	97	102	92

Public Health Adaptation Strategies for Climate Change

- Develop evidence-based approaches that identify spatially-specific vulnerable populations and places
- Enhance surveillance by integrating environmental, meteorological and health data
- Identify co-benefits for health of mitigation and adaptation strategies



Conclusions



- Climate change is now a mainstream issue
- Climate change must also be framed as a human welfare and public health issue.
- Opportunity costs of not taking action are high