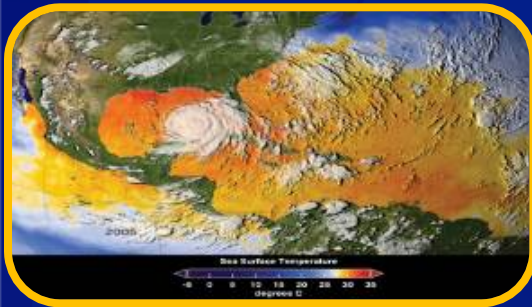
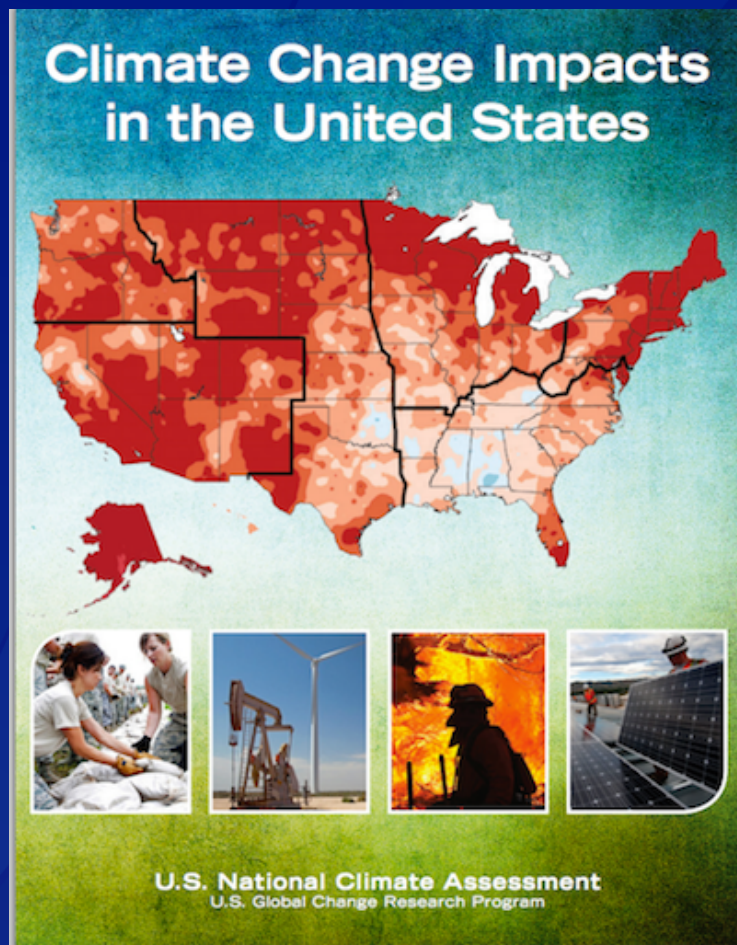


Building Resilience in the Public Health Sector: The Development of an Evidence–Based Framework for Climate change Adaptation Planning



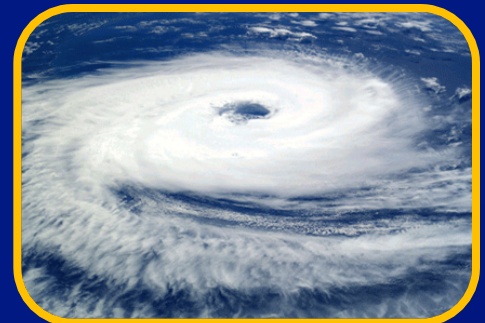
George Luber, PhD
Chief
Climate and Health Program
US Centers for Disease Control and Prevention

2014: Two Major Reports

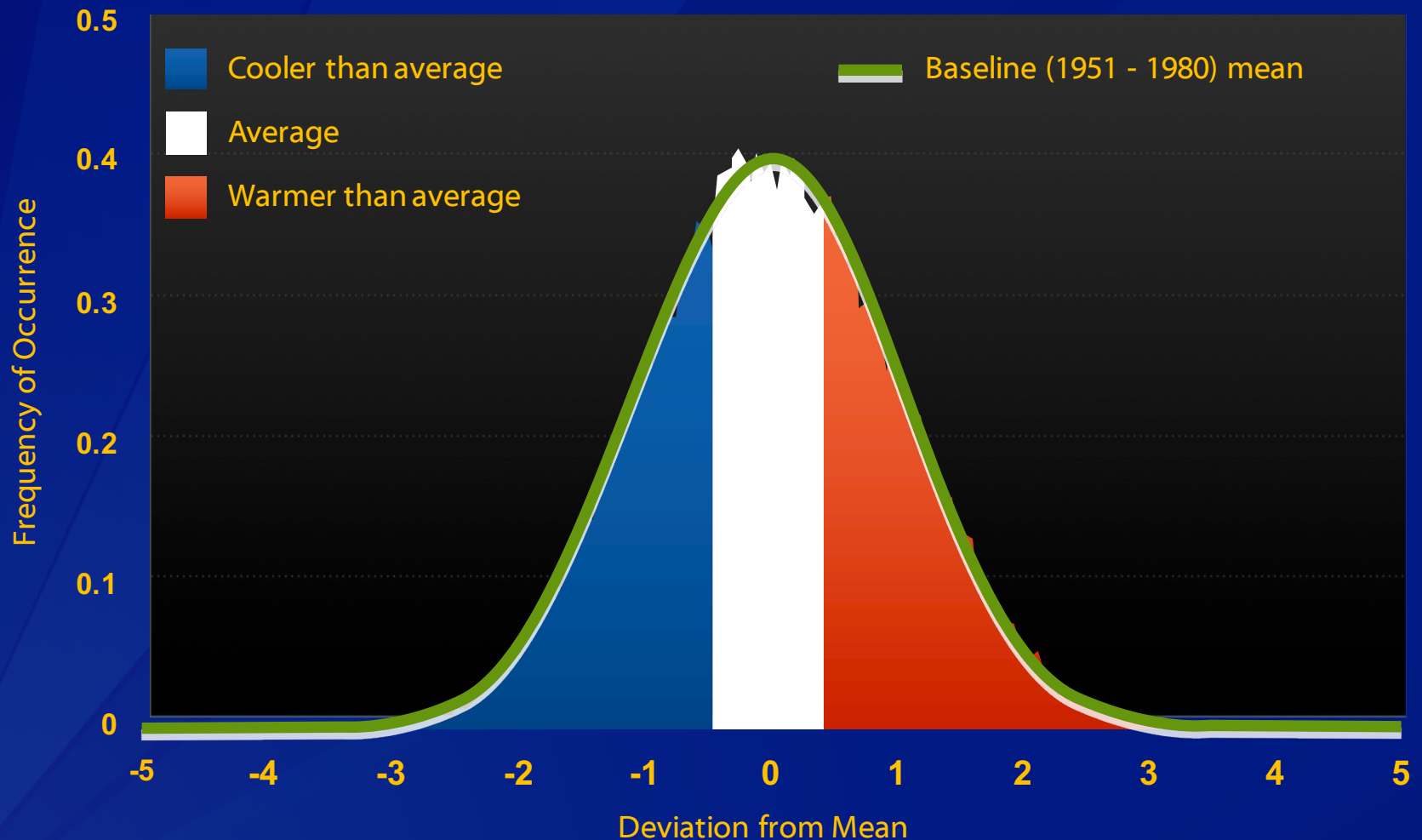


Climate Change Science: Key Findings

- ❑ Climate change is altering both the average (mean) global temperature *and* the global frequency of extremely hot temperatures (variance)
- ❑ The impacts of climate change will vary significantly by region; some places are warming faster than others.

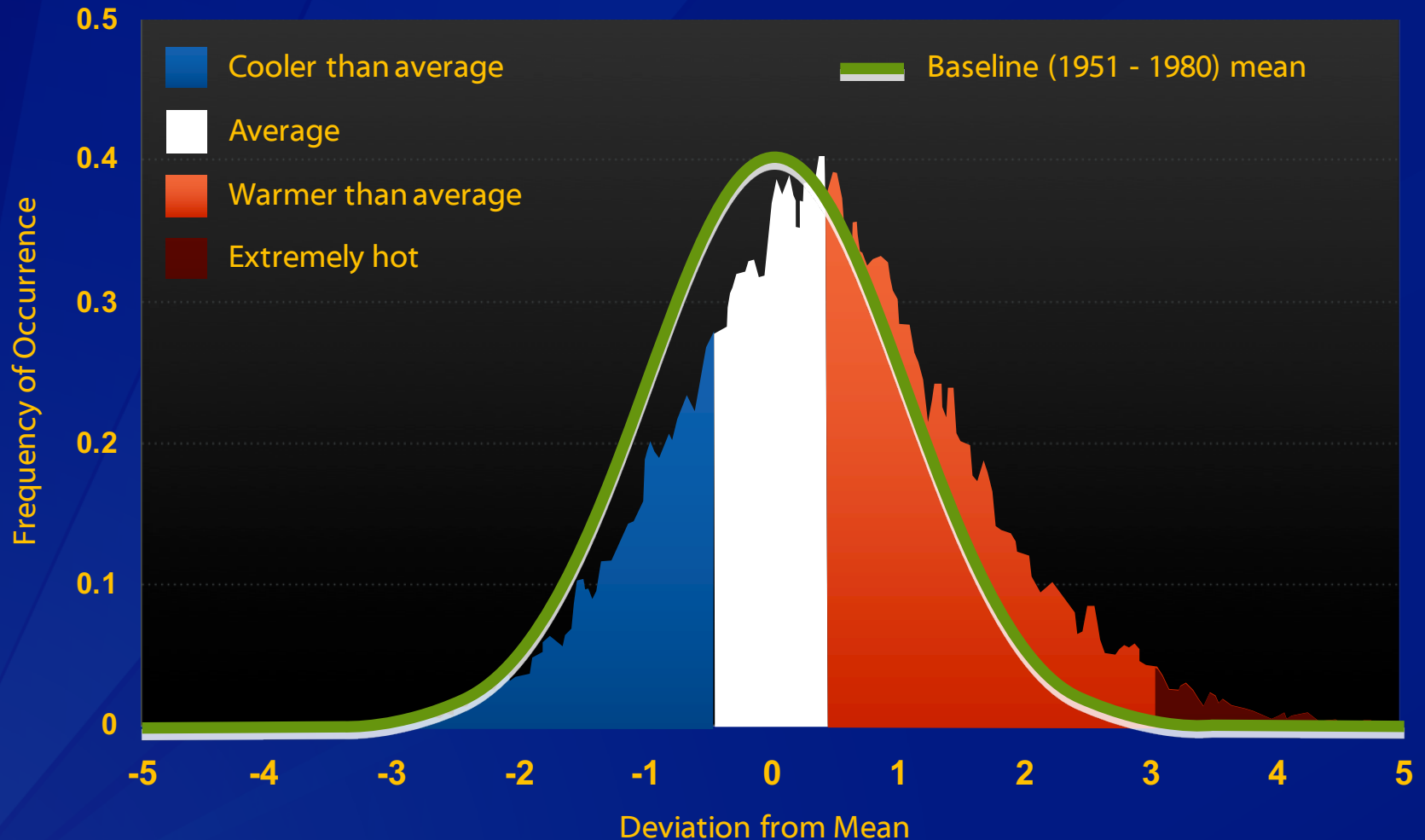


Summer Temperatures 1951–1980



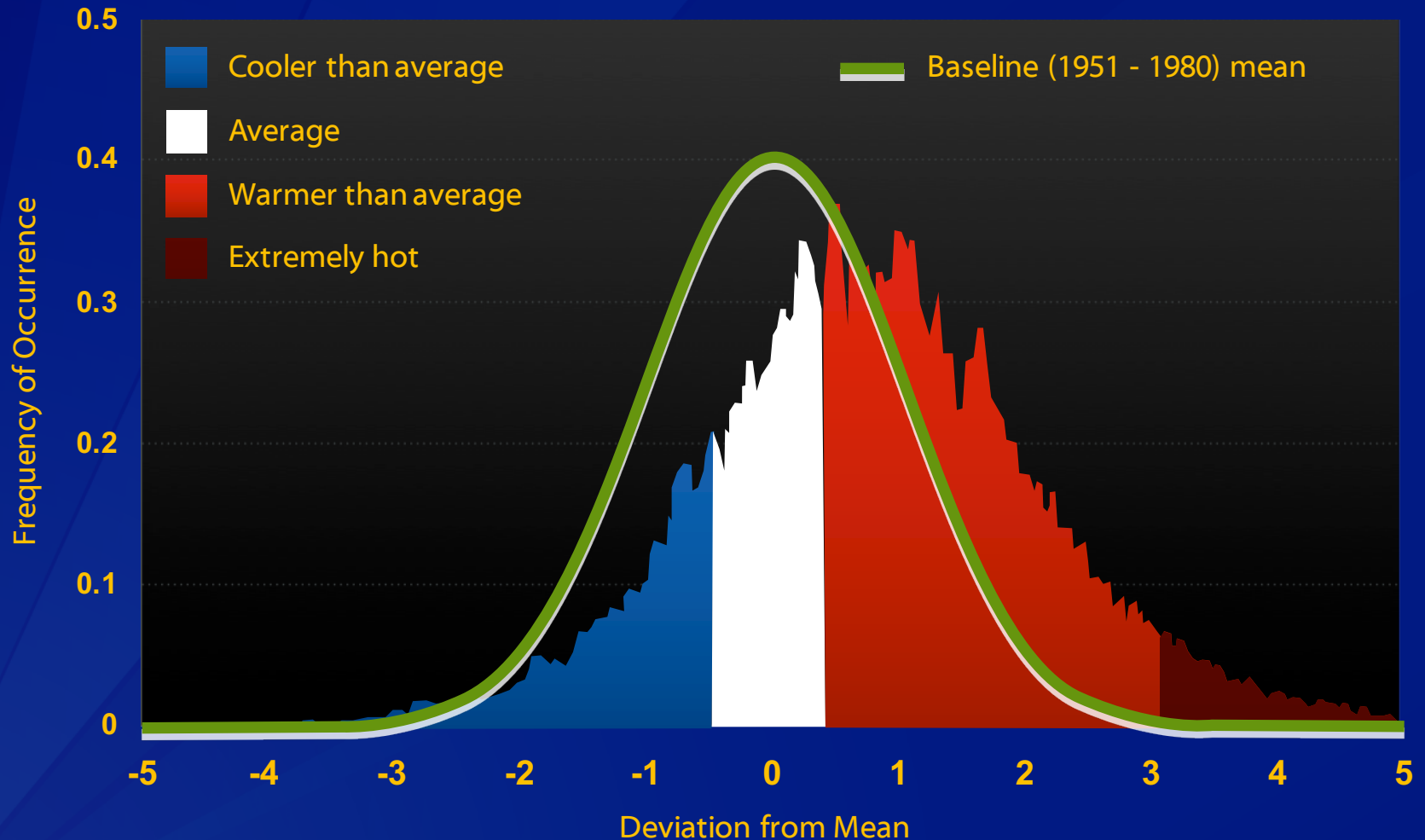
Source: NASA/GISS; Hansen, et al., "Perceptions of Climate Change," Proc. Natl. Acad. Sci. USA 10.1073, August 2012

Summer Temperatures 1981-1991



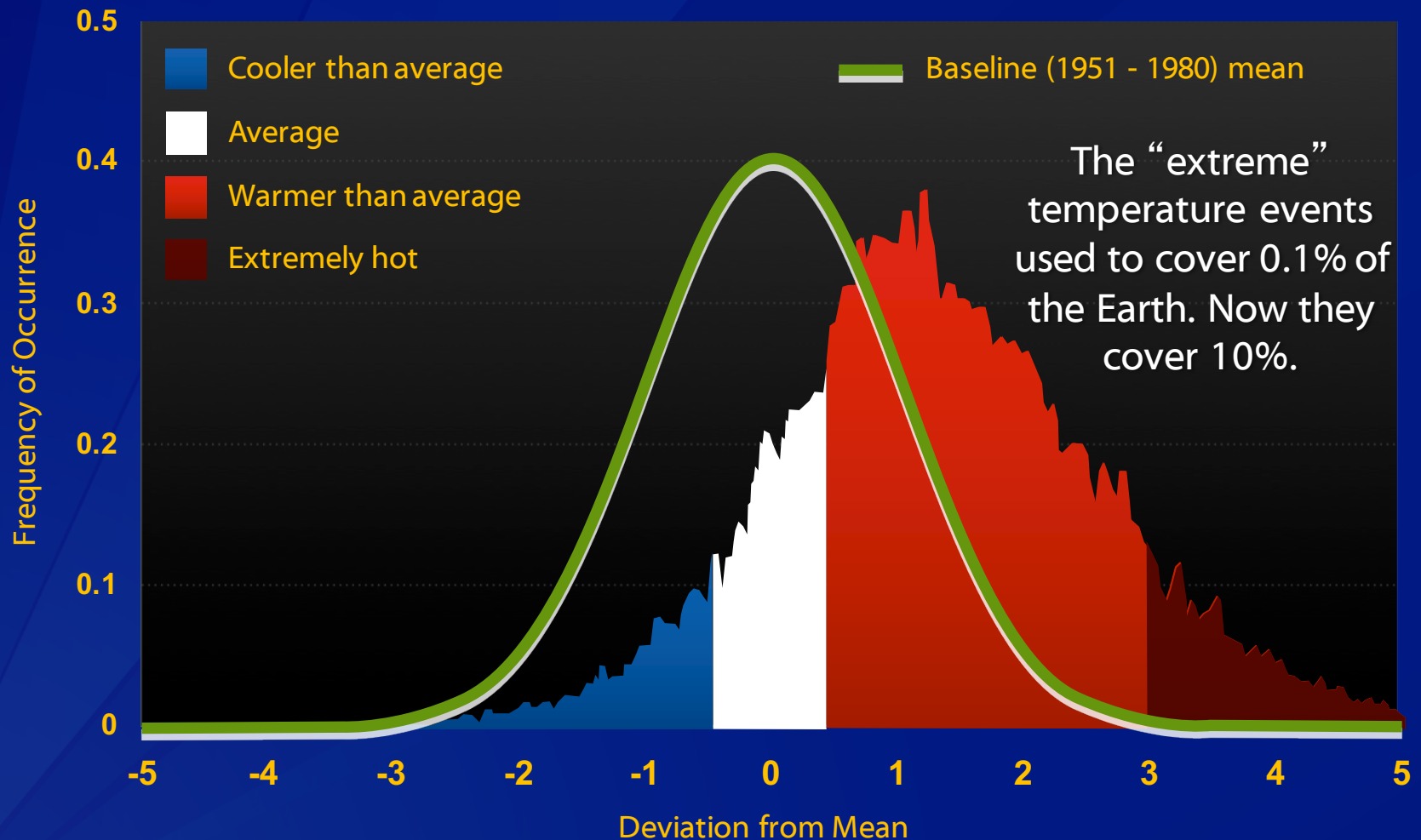
Source: NASA/GISS; Hansen, et al., "Perceptions of Climate Change," Proc. Natl. Acad. Sci. USA 10.1073, August 2012

Summer Temperatures 1991–2001



Source: NASA/GISS; Hansen, et al., "Perceptions of Climate Change," Proc. Natl. Acad. Sci. USA 10.1073, August 2012

Summer Temperatures 2001–2011

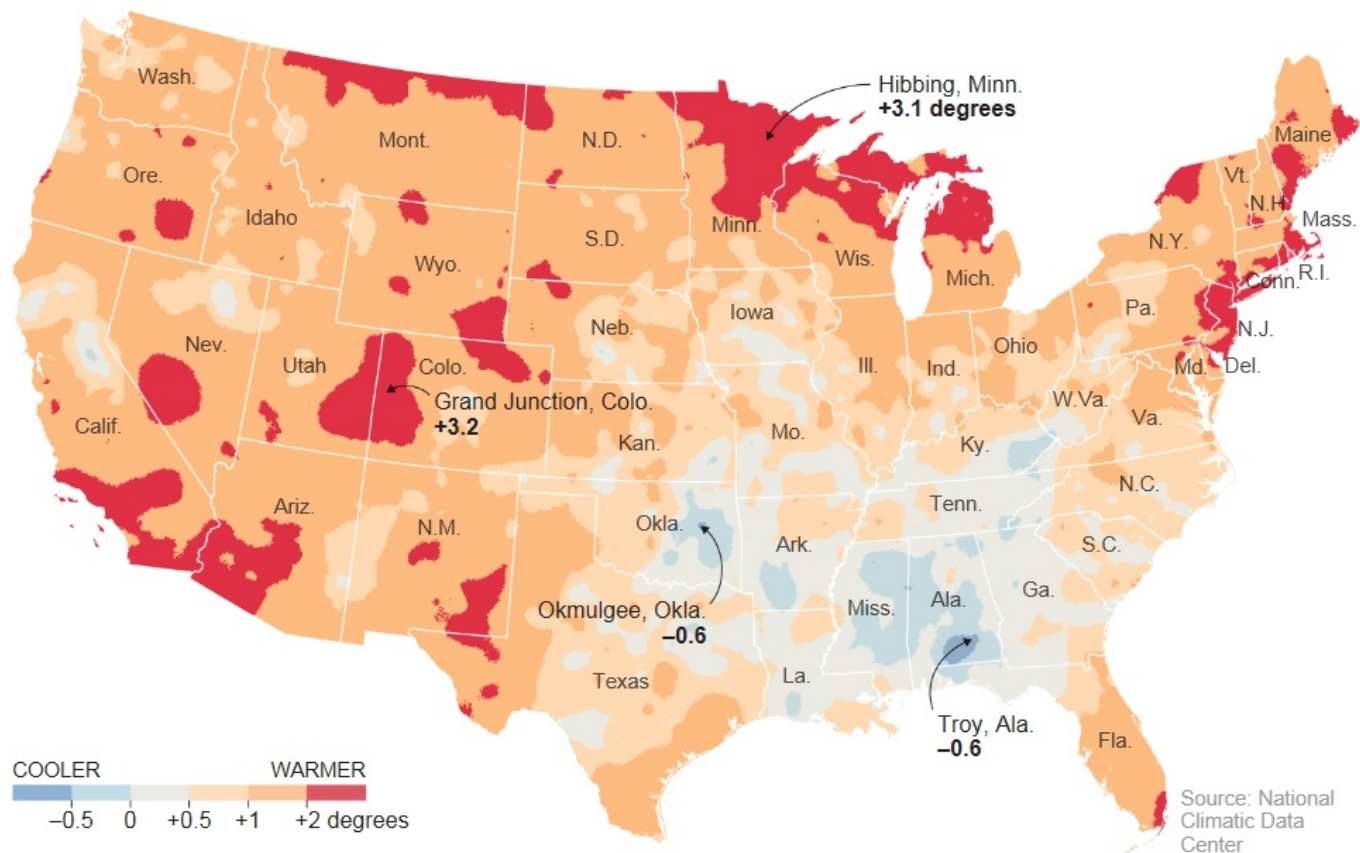


Source: NASA/GISS; Hansen, et al., “Perceptions of Climate Change,” Proc. Natl. Acad. Sci. USA 10.1073, August 2012

Warming has varied significantly by region (observed record)

Rising Temperatures

1991-2012 average temperature compared with 1901-1960 average MAY 6, 2014

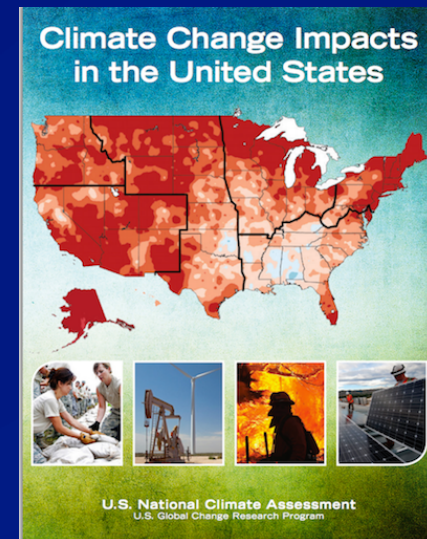


Climate Change and Health: Key Findings

Climate change threatens health in many ways...Some of these impacts are already underway in the US

Climate change will amplify existing health threats. Certain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.

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.



Climate Change Impacts in the United States

CHAPTER 9 HUMAN HEALTH

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What are we preparing for?

Key Health Threats

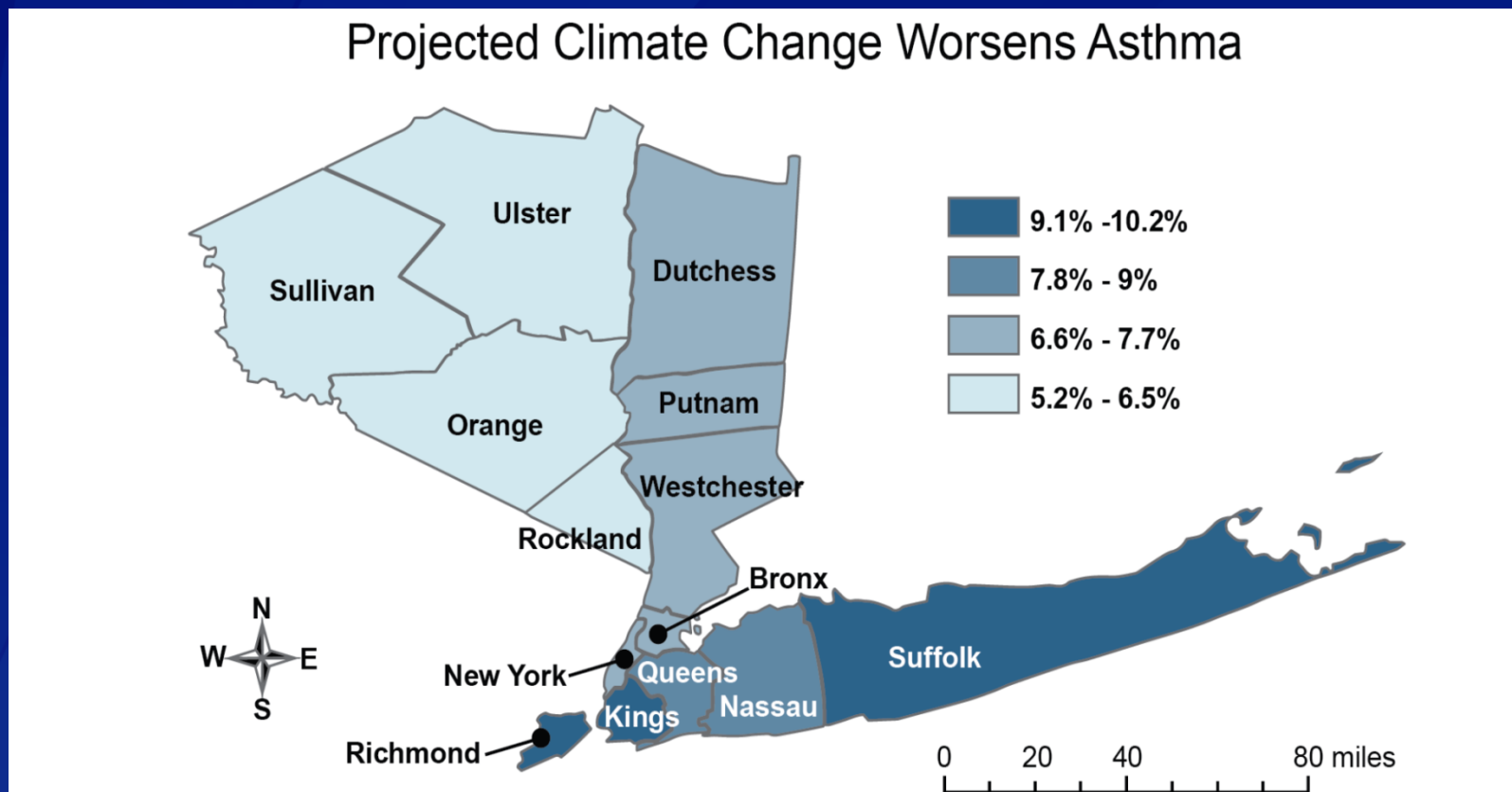
“Morbidity and Mortality by a thousand cuts”

Impacts add to the *cumulative* stresses currently faced by vulnerable populations and in locations most vulnerable to extreme events & ongoing, persistent climate-related threats



National
Climate
Assessment

Impact of Increased Ozone: Projected Increase in ED Visits for Asthma in 2020



Source: Sheffield PE, Knowlton K, Carr JL, Kinney PL. 2011. Modeling of Regional Climate Change Effects on Ground-Level Ozone and Childhood Asthma. *American Journal of Preventive Medicine* 41(3):251-257

Climate Change Impacts Air Quality: Pollen

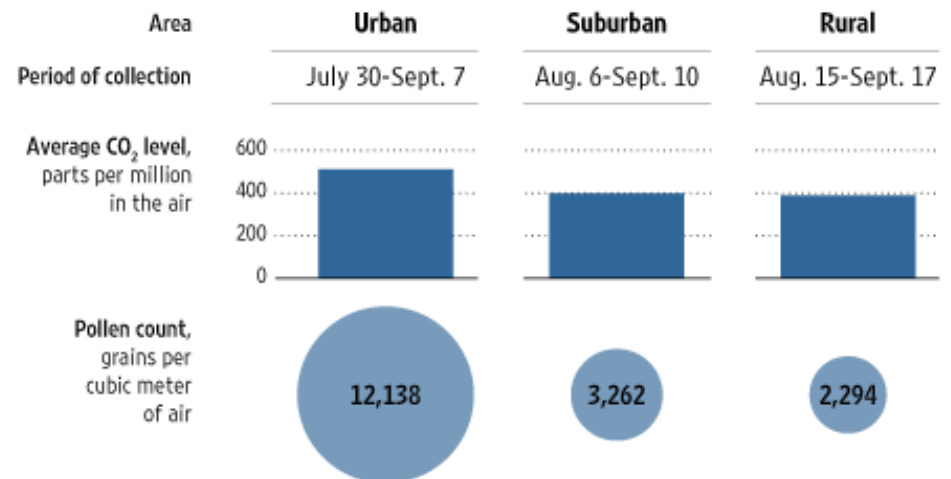


■ Ragweed

- ↑ 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:



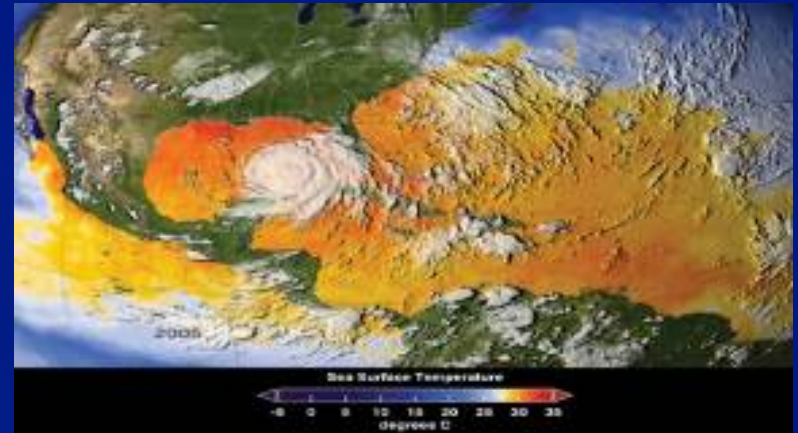
Source: Ziska et al., *J Allerg Clin Immunol* 2003;111:290-95;
Graphic: *Wall Street Journal*, 3 May 2007.

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

Key Health Threats from Climate Change

“Disaster within a disaster”

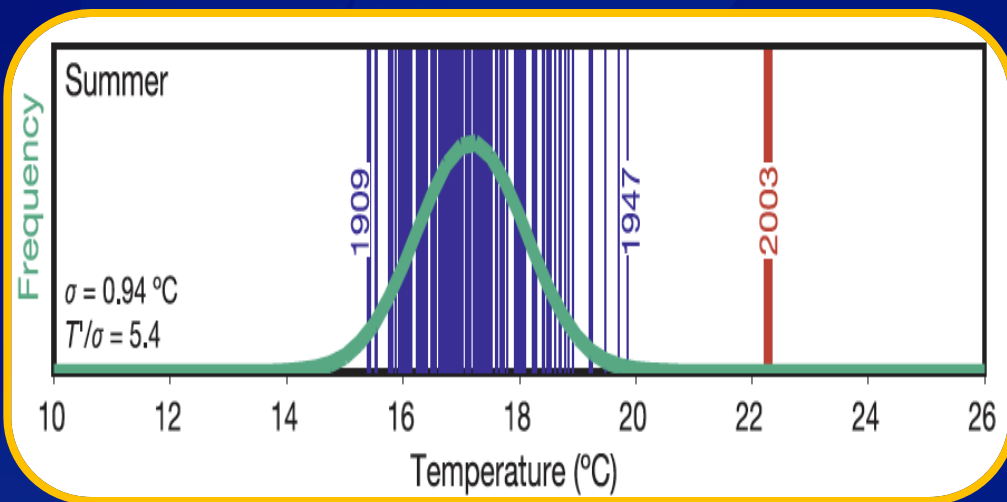
Extreme events increase the probability of “complex emergencies” where multiple system failures can occur which can exceed response capacity.



National
Climate
Assessment

Heat Waves Impact Human Health

European Heat Wave of 2003



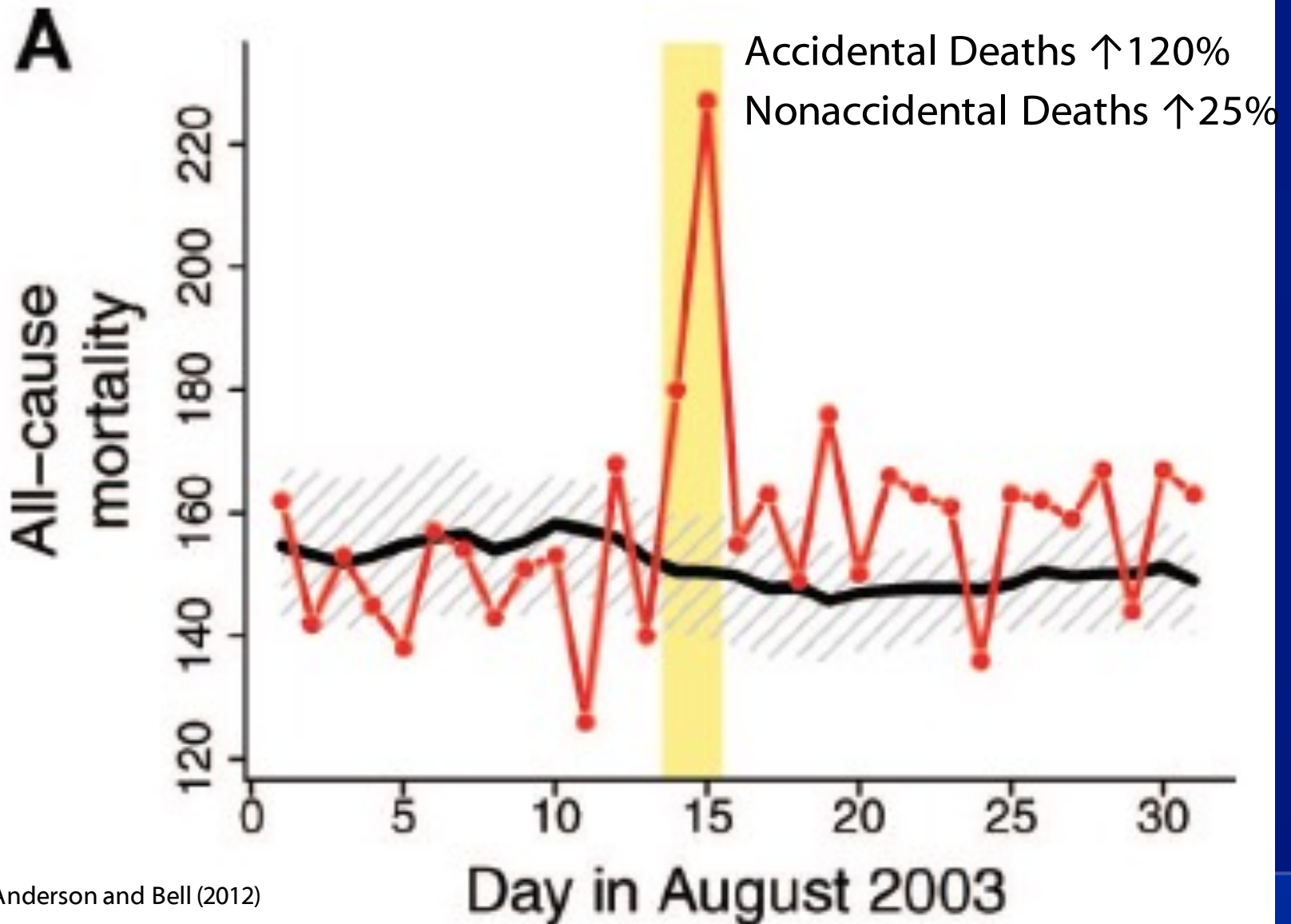
Confirmed Mortality

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

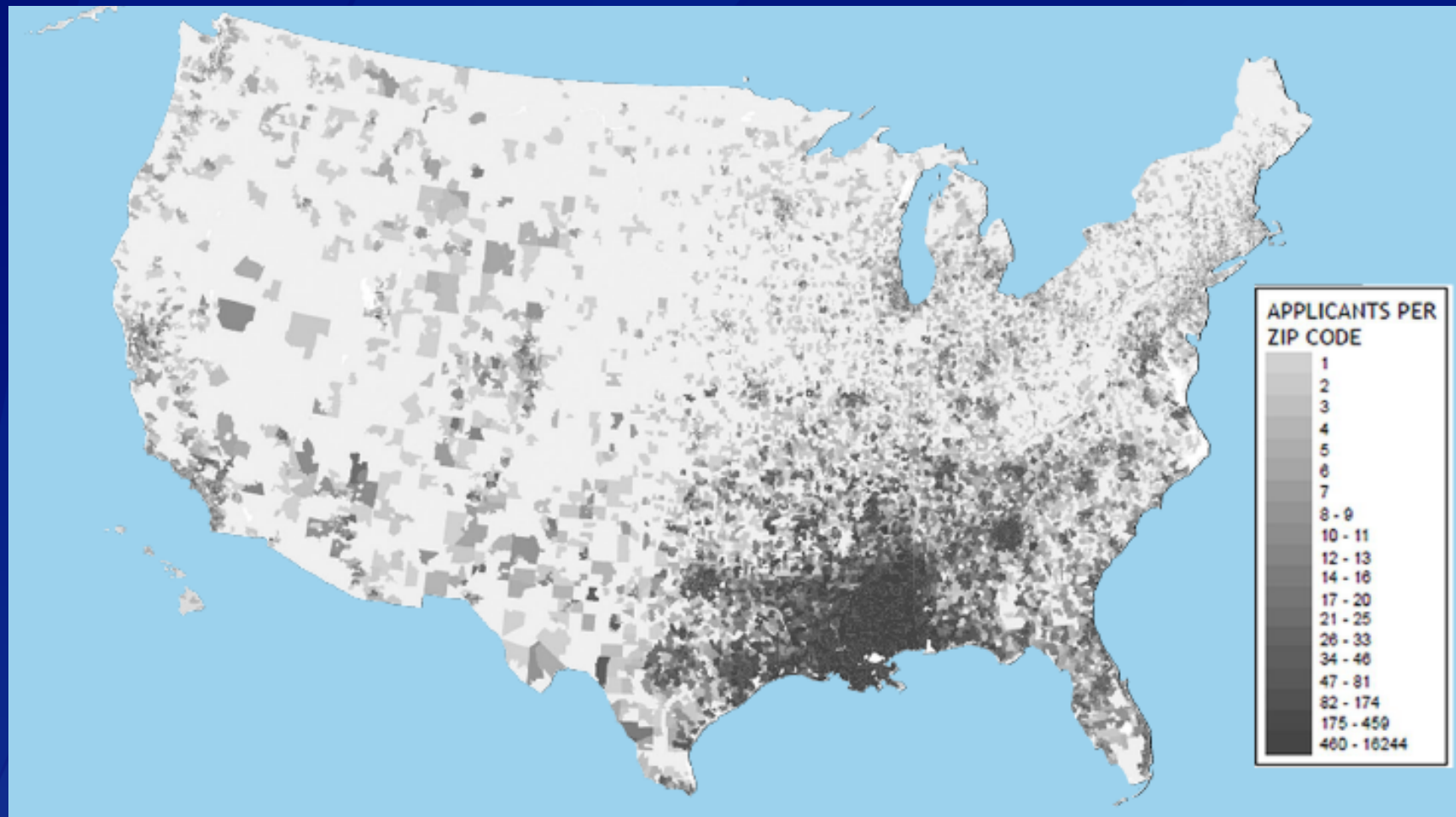
Vandentorren et al. *Am J Public Health* 2004; 94(9):1518-20.

Haines et al. *Public Health* 2006;120:585-96.

NY Power Outage and All-Cause Mortality



Katrina Diaspora



National
Climate
Assessment

What are we modeling?

Key Health Threats

Novel threats

Large scale ecological perturbations facilitate disease emergence and redistribution.



National
Climate
Assessment

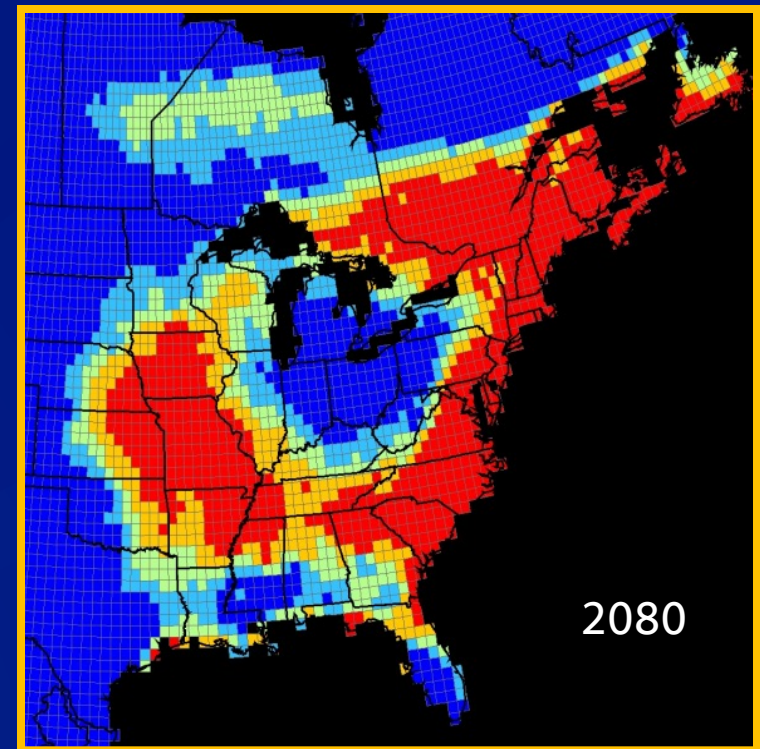
Precipitation, Humidity, and Temperature Changes Impact Human Health.

Example: Lyme Disease

□ Spread of Lyme disease factors

- Climate
- Ecological
- Social

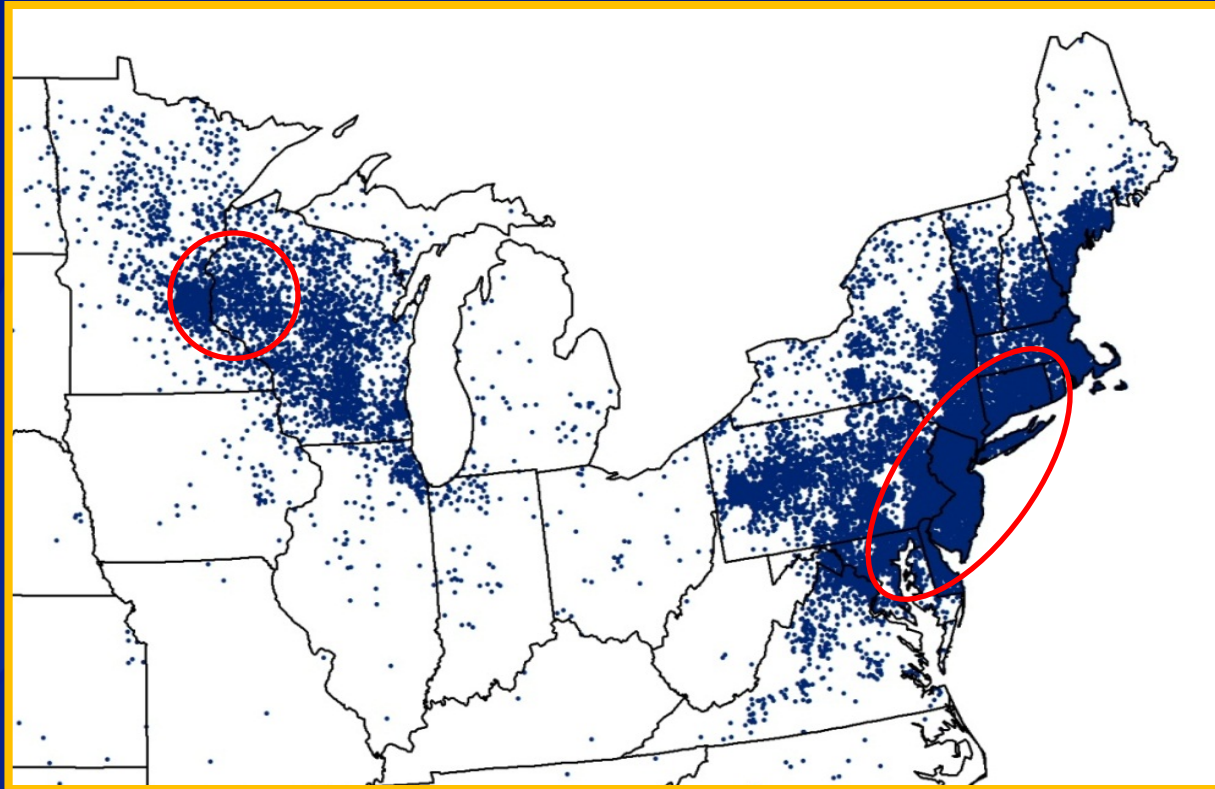
Range of suitable conditions
for *Ixodes scapularis*, the
Lyme disease tick



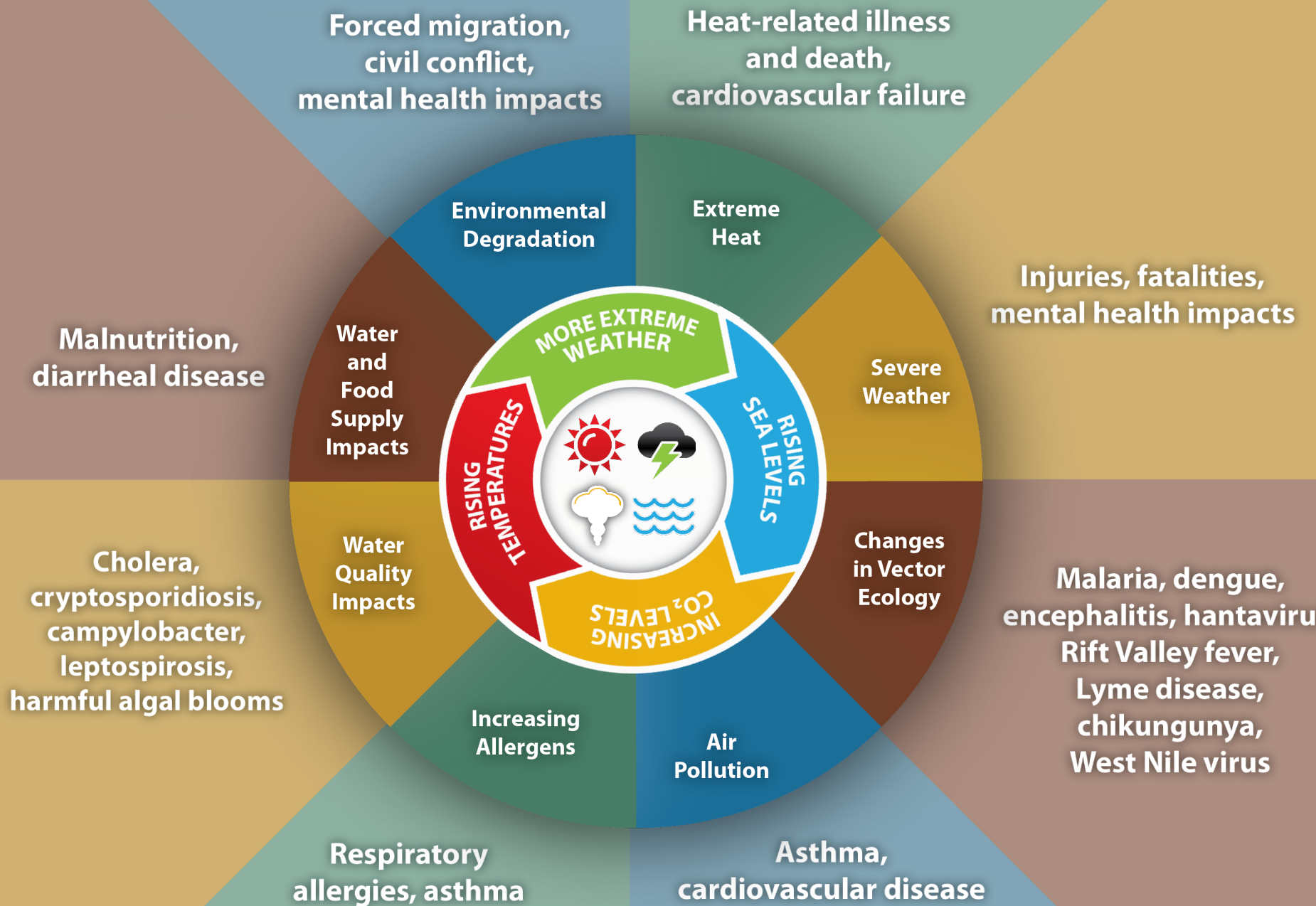
● Constant suitability ● Expanded suitability

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 Case Distribution Change in the United States



1996



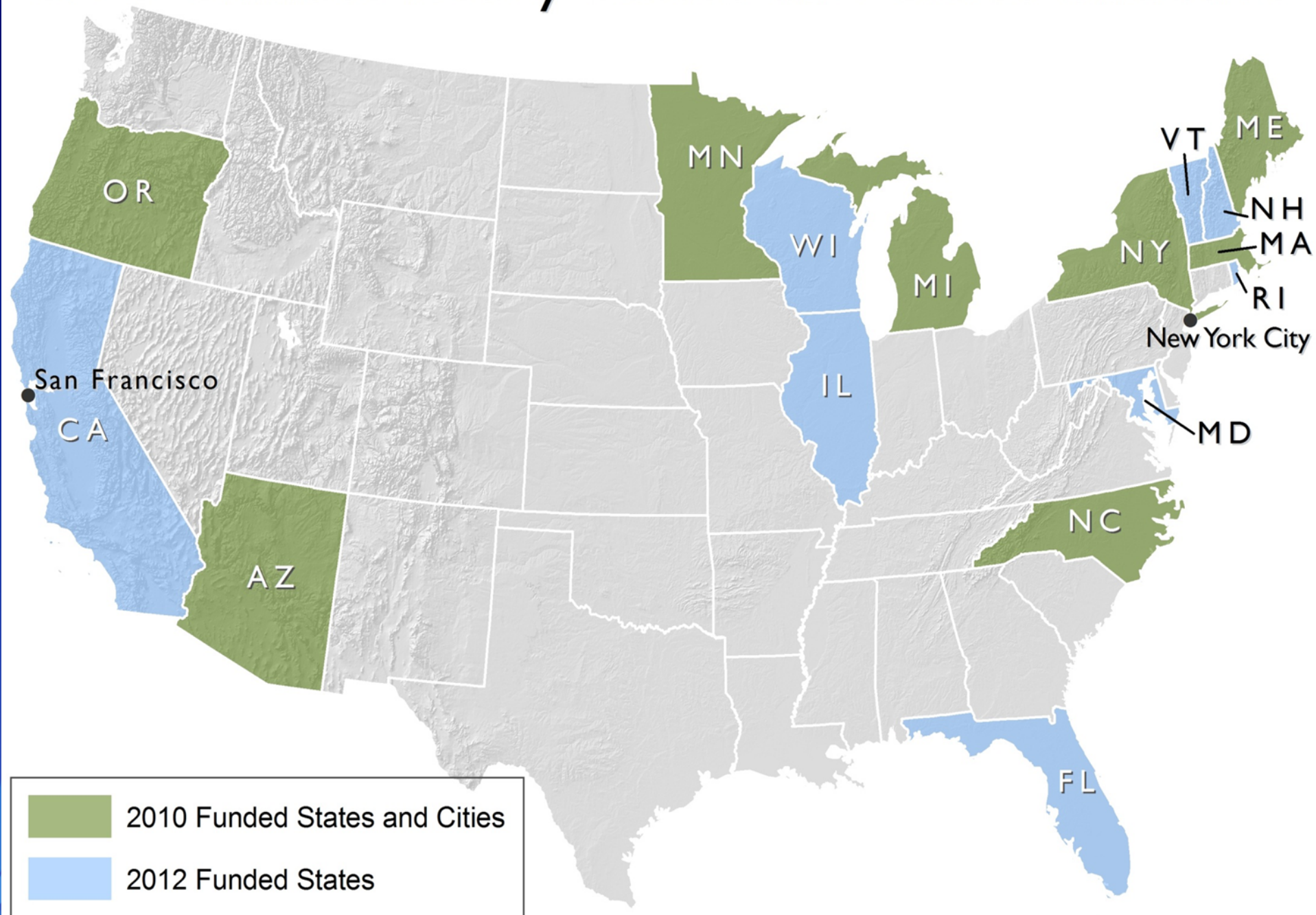
What is CDC doing to prepare for health effects of climate change?

- ❑ **CDC helps states and cities prepare for health challenges of climate change by**
 - Providing scientific guidance
 - Developing decision support tools
 - Ensuring public health concerns are considered in climate change adaptation and mitigation strategies
 - Creating partnerships between public health and other sectors
- ❑ **CDC's Climate and Health Program –only Federal investment in climate change preparedness for public health sector**

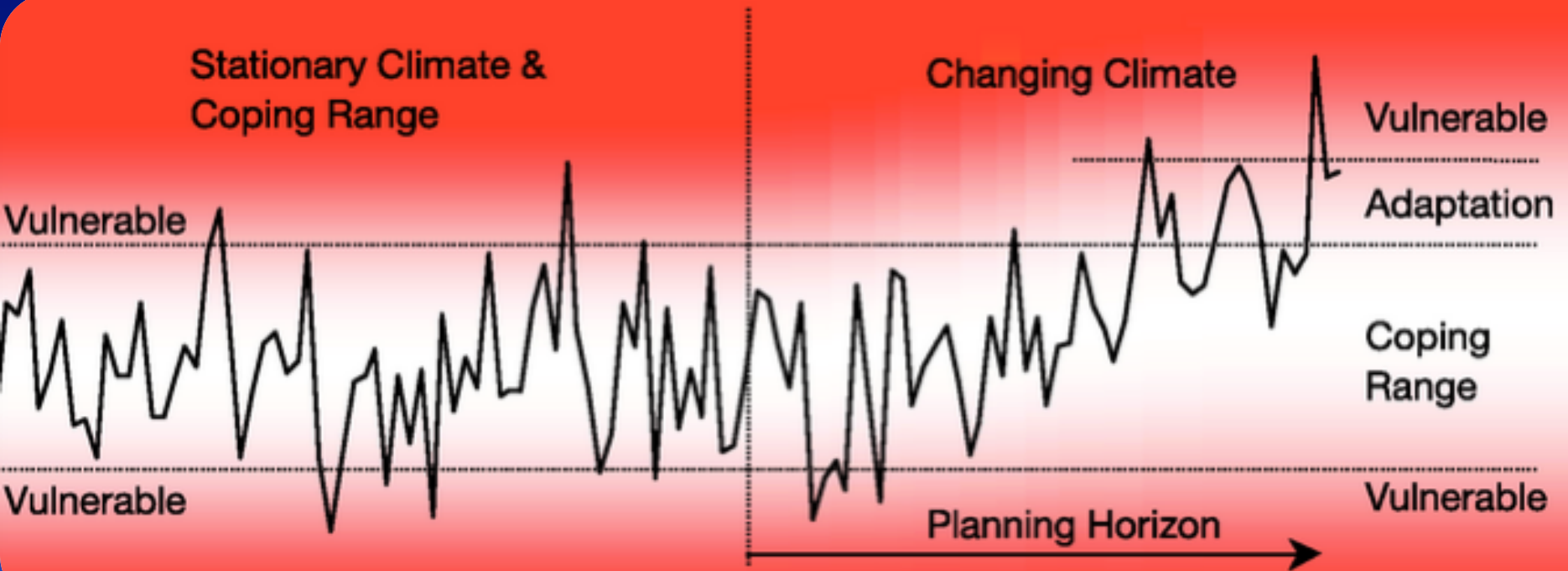
Climate-Ready States and Cities Initiative

- ❑ **CDC effort to enhance capacity of state and local health agencies to deal with health challenges associated with climate change**
- ❑ **CDC accomplishes this by**
 - Funding 18 state and local health departments
 - Providing a framework [BRACE} and tools for planning, implementing, and evaluating climate adaptation strategies
 - Tools to identify populations and places vulnerable to climate impacts
 - Materials to help communicate climate and health issues to public health partners (e.g., extreme heat toolkit)

CDC Climate Ready States and Cities Initiative



The Path Forward: Shifting the Coping Range



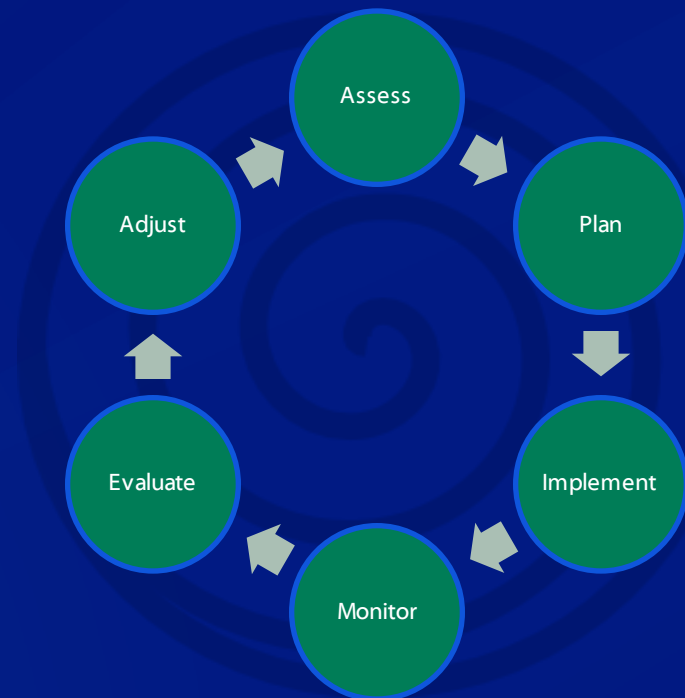
How to Shift a Coping Range?

Integrating Climate Change Adaptation into Public Health Practice: Using Adaptive Management to Increase Adaptive Capacity and Build Resilience

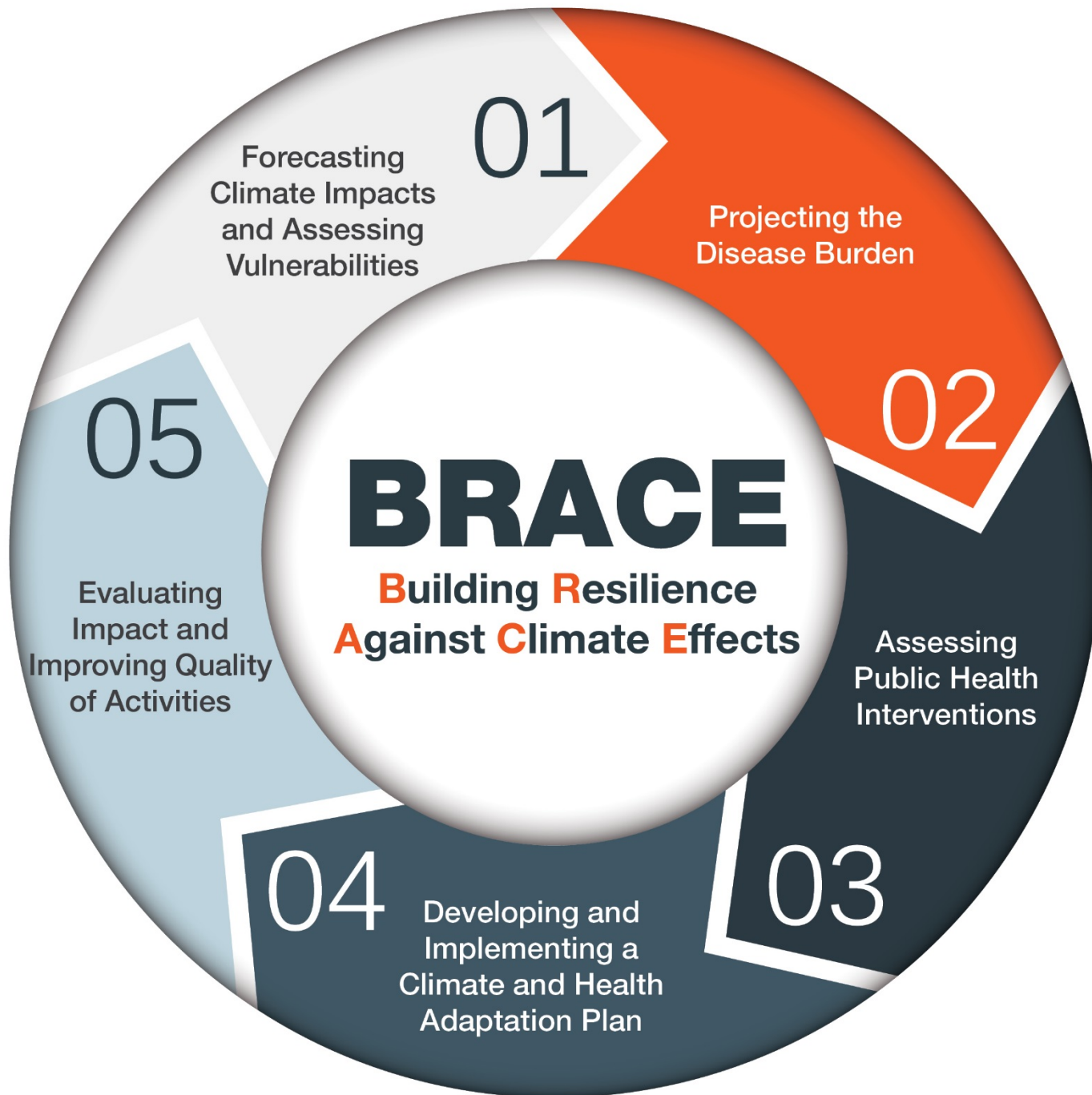
Jeremy J. Hess,^{1,2,3} Julia Z. McDowell,^{1,2} and George Luber¹

¹Climate and Health Program, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia, USA; ²Department of Environmental Health, Rollins School of Public Health, and ³Department of Emergency Medicine, Emory University School of Medicine, Emory University, Atlanta, Georgia, USA

- Return to the risk equation
 - Reduce hazard probability
 - Reduce hazard exposure
 - Reduce vulnerability
- It is an iterative process
- Requires modeling, learning, and adaptive management



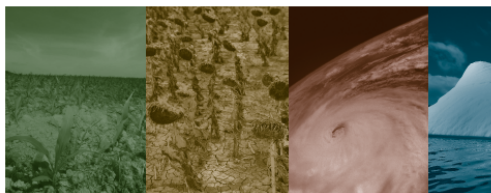
National
Climate
Assessment



BRACE Technical Guidance

Climate Models and the Use of Climate Projections:

A Brief Overview for Health Departments



Climate and Health Technical Report Series

Climate and Health Program, Centers for Disease Control and Prevention

Paul J. Schramm¹, Christopher K. Uejio², Jeremy J. Hess^{3,4*},
Gino D. Marinucci¹, George Luber¹

¹Climate and Health Program, Division of Environmental Hazards and Health Effects (DEHHE), National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA

²Department of Geography, Florida State University, Tallahassee, FL, USA

³Department of Emergency Medicine, School of Medicine, Emory University, Atlanta, GA, USA

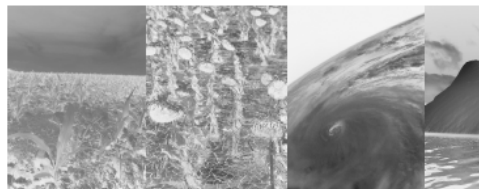
⁴Department of Environmental Health, Rollins School of Public Health, Emory University, Atlanta, GA, USA

National Center for Environmental Health
Division of Environmental Hazards and Health Effects



Assessing Health Vulnerability to Climate Change

A Guide for Health Departments



Climate and Health Technical Report Series

Climate and Health Program, Centers for Disease Control and Prevention

Arie Ponce Manangan¹, Christopher K. Uejio², Shubhaya Saha³, Paul J. Schramm¹,
Gino D. Marinucci¹, Claudia Langford Brown¹, Jeremy J. Hess^{3,4*}, George Luber¹

¹Climate and Health Program, Division of Environmental Hazards and Health Effects (DEHHE), National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA

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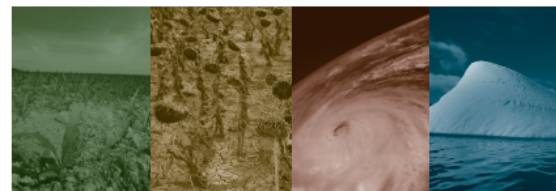
⁴Department of Environmental Health, Rollins School of Public Health, Emory University, Atlanta, GA, USA

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Projecting Climate-Related Disease Burden:

A Guide for Health Departments



Climate and Health Technical Report Series

Climate and Health Program,
Centers for Disease Control and Prevention

Jeremy J. Hess^{3,4*}, Shubhaya Saha³, Paul J. Schramm¹, Kathryn C. Conlon⁵,
Christopher K. Uejio², George Luber¹

¹Climate and Health Program, Division of Environmental Hazards and Health Effects (DEHHE), National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA

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*These authors contributed equally to this work

National Center for Environmental Health
Division of Environmental Hazards and Health Effects



10/1/2019

In Modeling Health Risk, Scale is Critical in Several Key Ways

Spatial

- Global to neighborhood

Temporal

- Multi-decade to hours

Administrative

- International to city

Planning horizons

- Budgets annual
- Infrastructure multi-decade



Adaptation in Action

ADAPTATION IN ACTION:

Grantee Success Stories from CDC's
Climate and Health Program

MARCH 2015



NEW YORK CITY: Creating Resilient Communities

"The events of the past few years show the serious public health threats New York City's 8.2 million residents already face from extreme weather events like heat waves and coastal storms. With climate change, the severity of these risks will increase. It is imperative that citywide climate adaptation and mitigation measures include health-focused strategies."

Andriana Azarias
ACTING DIRECTOR, CLIMATE AND HEALTH PROGRAM,
NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE

THE THREAT TO HEALTH:

- Average summer temperatures in New York City are increasing and more heat waves are predicted for the future, which will increase the risk of heat-related illness among vulnerable populations.
- Hotter temperatures coupled with poor air quality lead to increased hospital admissions for cardiovascular and respiratory problems.
- Flooding from coastal storms is projected to increase in frequency and severity and can result in more outages and home displacements.
- Power outages, from coastal storms or increased demand on the electrical grid during hot weather lead to a variety of health and safety hazards including food and drinking water contamination and heat

ADAPTATION IN ACTION:

- The Climate and Health Program has conducted risk assessments on rising summer temperatures, extreme heat and ground-level ozone, and coastal flooding and power outages to help inform citywide climate adaptation planning and improve public resilience.

(Note to review
still under

ARIZONA: Readying for Extremes

THE THREAT TO HEALTH:

- Extreme heat is the nation's No. 1 weather-related cause of death, and Arizona is home to some of the country's hottest communities. From 1999 to 2009, 1,500 heat-related deaths occurred in Arizona. About 900 heat-related inpatient admission visits and 4,000 emergency department visits happen in Arizona every year.
- The rate of death due to heat exposure in Arizona is three to seven times higher than the overall U.S. rate.
- Arizona is experiencing an increase in the number and extent of extreme heat days. In fact, research conducted in the aftermath of an Arizona heat wave found that every 1-degree increase in temperature was associated with a 6 percent increase in mortality risk.

ADAPTATION IN ACTION:

- The Arizona Extreme Weather and Public Health Program conducted a department-wide assessment to measure the agency's overall capacity to monitor climate and health effects and to pinpoint gaps. Staff also reached out to local public health departments with the same assessment, which covered topics such as assessments, outreach and education, and policy development. The results will eventually be used to shape an extreme weather action plan.

To learn more about the Arizona Extreme

"Arizona is a beautiful place to live, where extreme heat, drought, monsoons and dust storms are the norm. Our program helps residents learn to respect and adapt to these extremes."

Matthew Roach
ENVIRONMENTAL EPIDEMIOLOGIST, EXTREME WEATHER AND PUBLIC HEALTH
PROGRAM, ARIZONA DEPARTMENT OF HEALTH SERVICES

MICHIGAN: Responding to Local Needs

THE THREAT TO HEALTH:

- Extreme heat events are associated with increased health care utilization. Between April and August of 2013, Michigan health officials recorded more than 4,500 heat-related emergency room visits.
- During a 2013 heat wave in Michigan, dehydration complaints increased nearly 80 percent, sun-associated complaints (i.e. sun burn, sun poisoning or sunscreen reactions) rose by nearly 127 percent, and heat-associated complaints (i.e. heat exhaustion, heat stroke or heat reaction) went up 900 percent.
- In Detroit alone, climate models predict the city will experience 30 to 50 days per year of 90 degrees or hotter and 45 to 90 days with temperatures above 91 degrees.

ADAPTATION IN ACTION:

- Thanks to CDC support, the Michigan Climate and Health Adaptation Program is improving state and local capacity to conduct climate change-related health impact assessments (HIA). An HIA is a process that helps evaluate the potential health effects of a plan, project or policy before it is built or implemented.⁴ Such assessments help public health officials more effectively protect people's health. As of 2013, the program had funded two local assessment projects: one in East Lansing and another in Grand Rapids. In East Lansing, local public health officials assessed and offered recommendations to enhance nonmotorized transportation improvements, which can help reduce the emissions that cause climate change while offering safe opportunities for physical activity and reducing pedestrian and bicyclist injuries. In Grand Rapids,

"Climate change is a global and national issue, but its impacts are felt at the local level, affecting the health and well-being of people in every community. Public health needs to engage with community partners, emergency response and citizen groups to advocate for the protection of the vulnerable and to promote tools and adaptations that make our community healthy, resilient and desirable places to live and work."

Lorraine Cameron
MANAGER, EPIDEMIOLOGY AND SURVEILLANCE SECTION, DIVISION OF ENVIRONMENTAL HEALTH,
MICHIGAN DEPARTMENT OF COMMUNITY HEALTH

local health officials assessed a major traffic corridor undergoing redevelopment. The recommendations from the assessment are helping city planners to better consider the health impacts of these activities.

- The program is involved in the Detroit Climate Action Collaborative, which works to ensure that the city's climate action plan protects and benefits all residents. Among its many activities, the collaborative is partnering with the Great Lakes Integrated Sciences and Assessments Center to develop Detroit-specific climate projections. The collaborative is also working with the University of Michigan College of Architecture and Urban Planning to assess the characteristics of climate vulnerable neighborhoods.
- The program works with academic and private sectors to translate research into practice. For example, health officials helped pilot a tool called I-HEAT, which involves the spatial mapping of heat and social vulnerabilities. Health officials also helped pilot a dynamic heat model developed by researchers at Michigan State University. The model considers heat-related social and behavioral factors, such as what prevents or motivates residents from going to cooling centers. **The I-HEAT tool could be used by local health departments to better identify communities vulnerable to heat exposure.**
- To tailor adaptations to community needs, the program funded two local health departments to assess residents' heat readiness. Altogether, more than 3,000 surveys were conducted, and the results are already shaping local response and outreach efforts. For example, in Ingham County, health officials learned that local food banks were an ideal venue to reach vulnerable residents with cooling center information.

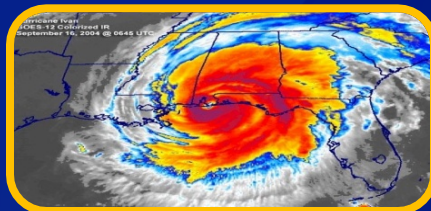
To learn more about the Michigan Climate and Health Adaptation Program, visit www.michigan.gov/mdch/0,4612,7-132-54783_54784_55975--,00.html.

⁴ US Centers for Disease Control and Prevention: <http://www.cdc.gov/healthypieces/hia.htm>

Climate Ready Tribes and Territories Initiative

- ❑ New 2016 funding will be awarded later this year
- ❑ Will support climate and health adaptation activities within tribal groups and territories
- ❑ Will work with partners to identify vulnerable areas and populations
- ❑ Approximately 3 tribes and 2 territories will be funded





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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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