PREPARING FOR THE HEALTH EFFECTS OF CLIMATE CHANGE IN NJ

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11/18/11 IPCC "Special Report on Extremes (SREX)" tells us:

- **Extreme weather increasing (heat, drought, heavy rains, etc.)**
- **Deadly, expensive losses are increasing**
- **In a warming world: extremes occur more frequently**
- **Carbon pollution drives extreme heat, coastal flooding**
- ***Preparedness* is critically important**

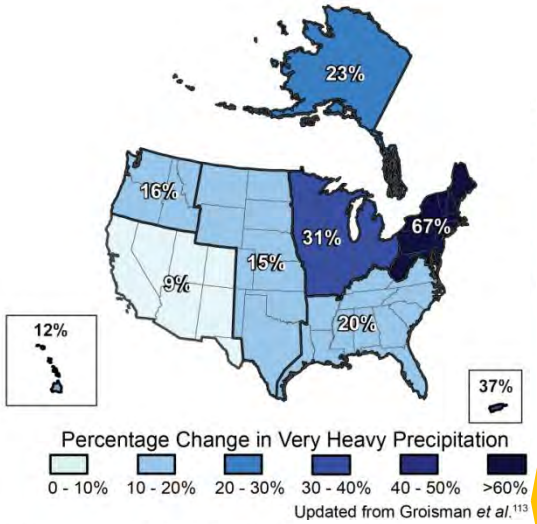
2011: A Year of Extremes

- 14 “billion-dollar” events: heat, drought, floods, snow, tornadoes
- Wettest-ever August & summer in NJ (22.5” of rain)
- Cost estimate of 2011 damages (as of mid-Nov.): ***$53 billion***
- After a record-breaking 2010…
  - tied 2005 for hottest year since 1880
  - 34th consecutive year with global temperature >20th century average
  - Jan 2000-Dec 2010: Warmest Decade on Record

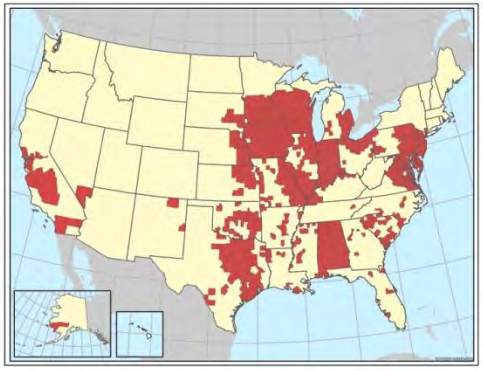
Climate Change is Happening

National impacts observed in recent decades

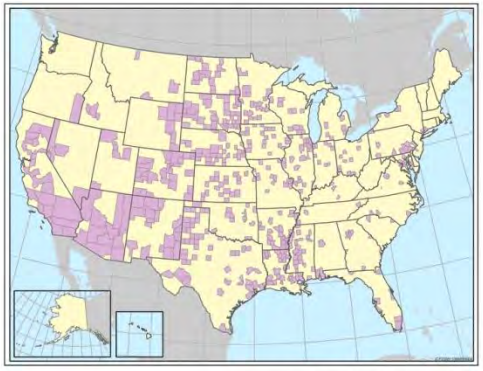
a) Location of Hurricane Landfalls, 1995 to 2000



b) Location of Extreme Heat Events, 1995 to 2000



d) West Nile Virus Cases 2004



US Global Change Research Program (2009)

CCSP SAP 4.6[163]

- 2ºF (1.1º C) rise in US average temperature over the past 50 yrs
- Sea level rise >8" in past 50 yrs in parts of Atlantic & Gulf Coasts
- Oceans 30% more acidic than in pre-industrial times
- Increase in heavy downpours, as much as 67% in Northeast
- Current record warmth: Atlantic sea surface temperatures 4ºF (2ºC) above average
- Destructive potential of Atlantic tropical storms, hurricanes ↑ since 1970

Climate change threatens health

"Climate change is one of the most serious public health threats facing our nation. Yet few Americans are aware of the very real consequences of climate change on the health of our communities, our families and our children."

– Dr. Georges Benjamin, Executive Director of the American Public Health Association

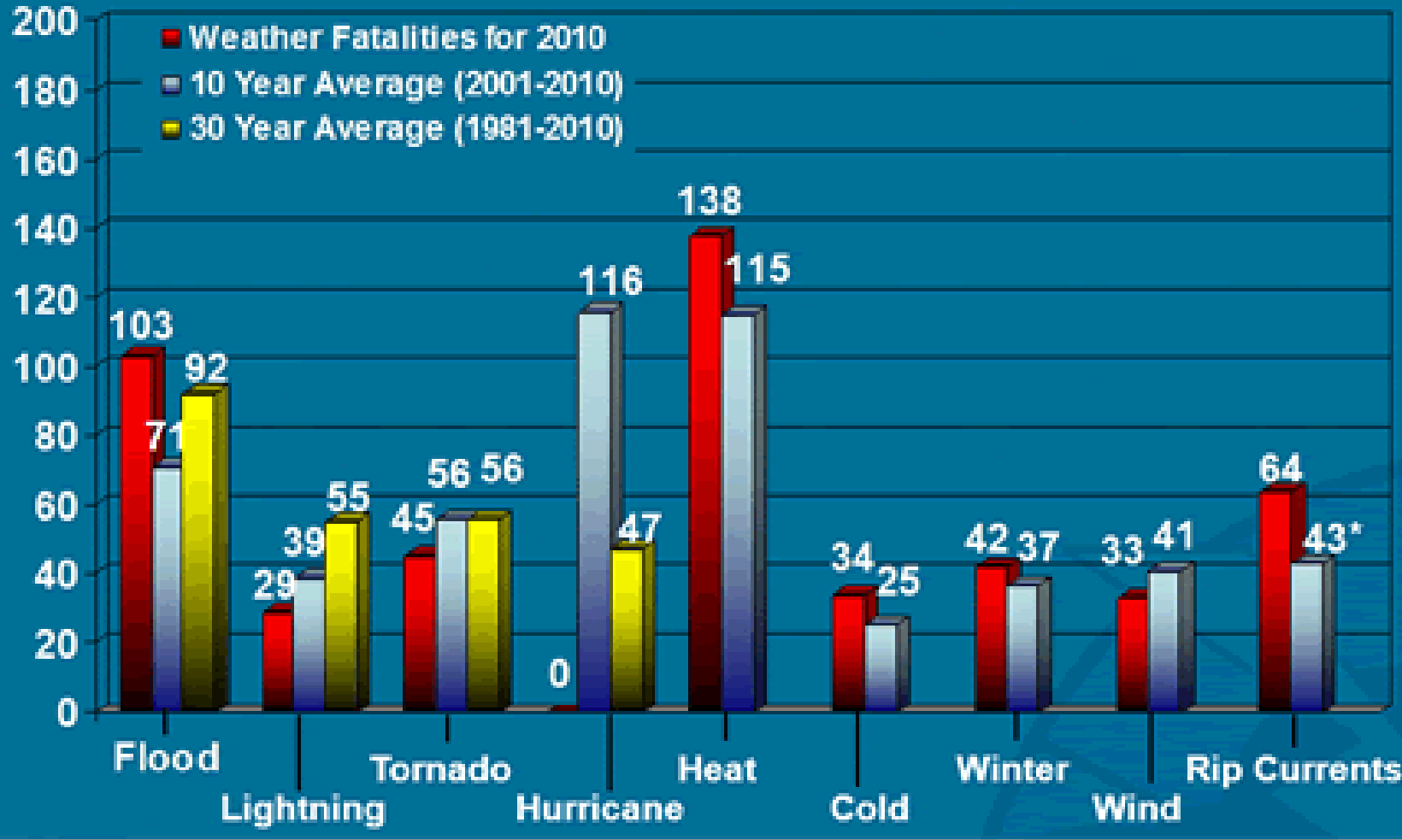
Climate-Health Impacts

- **Extreme Storm Events**
- **Heat Waves**
- **Air Pollution**
- **Pollens and Allergy**
- **Water-borne Diseases**
- **Food-borne Diseases**
- **Vector-Borne Diseases**
- **Ecosystem Impacts**
- **Food & Water Supply Insecurity**
- **Mental Health Impacts**
- **Environmental Refugees**

Vulnerability to climate impacts

- Economically disadvantaged people are among the most climate-vulnerable
- Age vulnerability: children, people 65^{+}
- People with pre-existing illnesses, or limited mobility
- Location affects climate-health vulnerability; for example:
  - Coasts: Sea Level rise, storm surge
  - Cities: heat waves, urban heat island effect, air pollution

Weather Fatalities

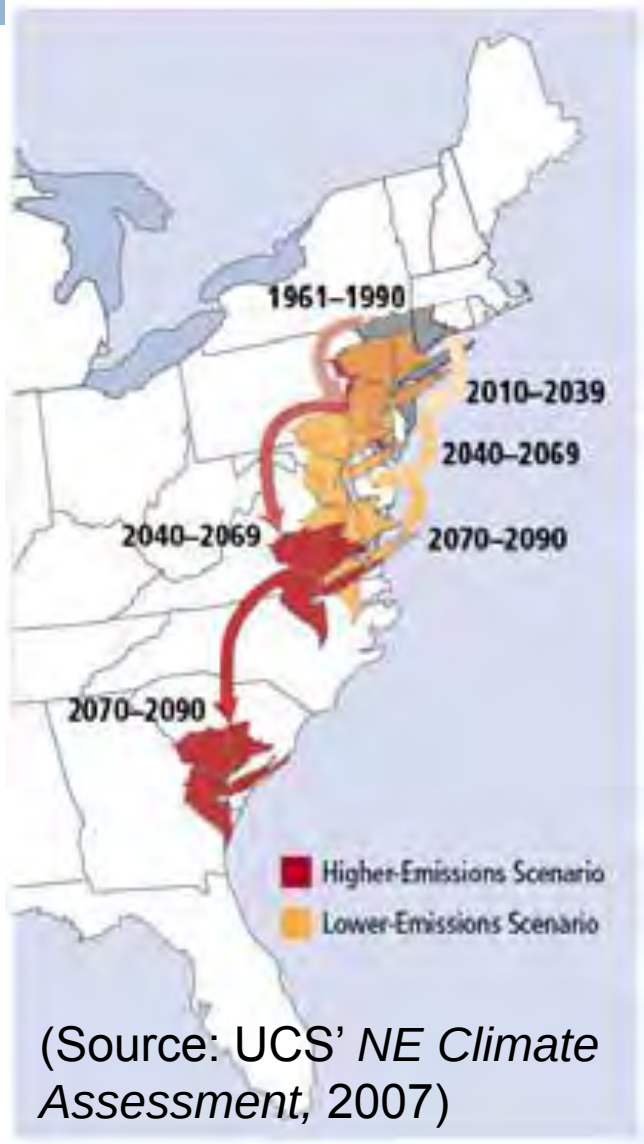


*9 year average

NJ's future under a changing climate

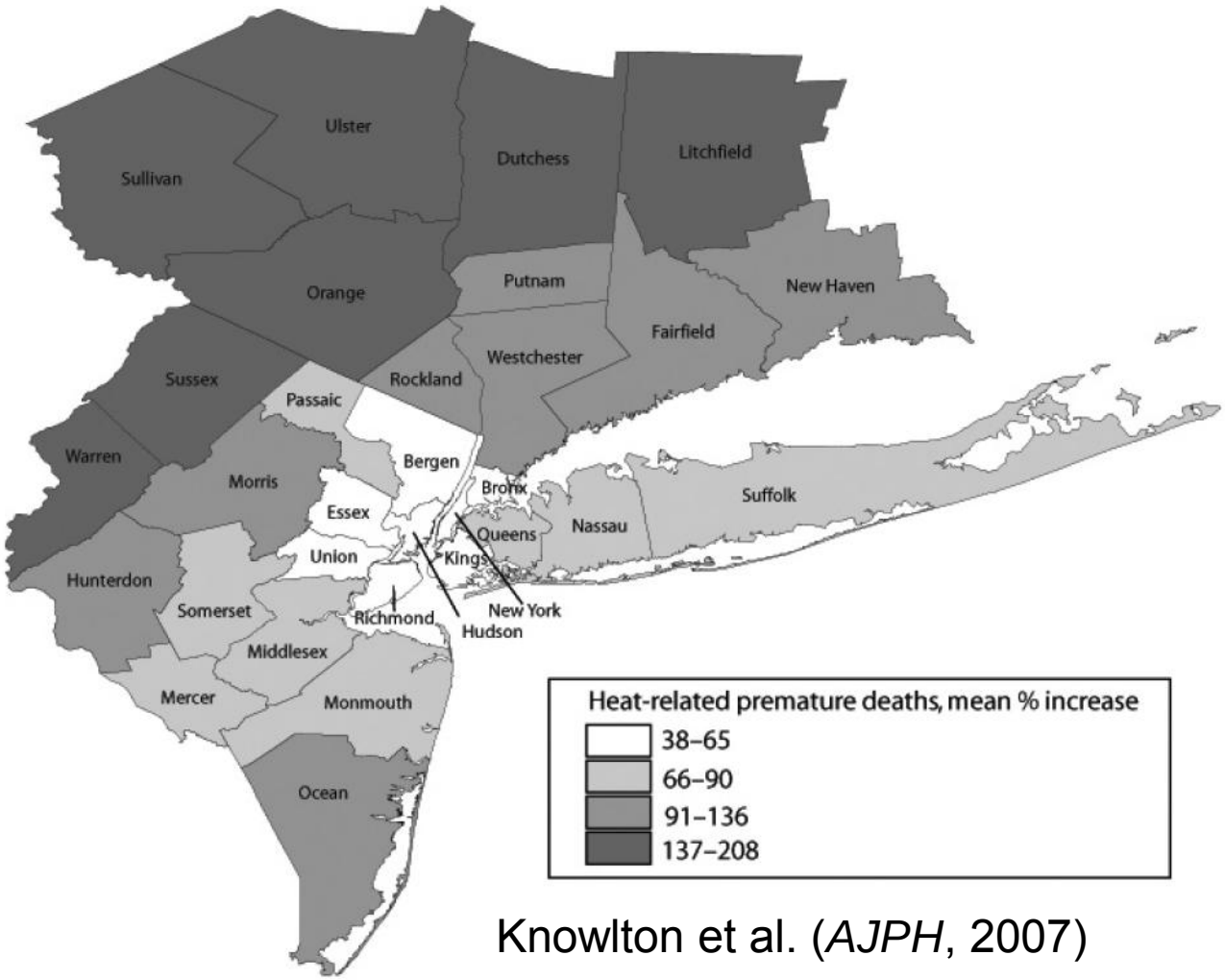
By the 2080s:

- summers 6-14°F hotter
- combined effect of heat + "urban heat islands" mean a month of days above 100°F
- Increased coastal flooding
- Sea level rises another 24-27"
- What is now the "once-in-a-century" Atlantic City flood could happen every 1-2 years



(Source: UCS' *NE Climate Assessment*, 2007)

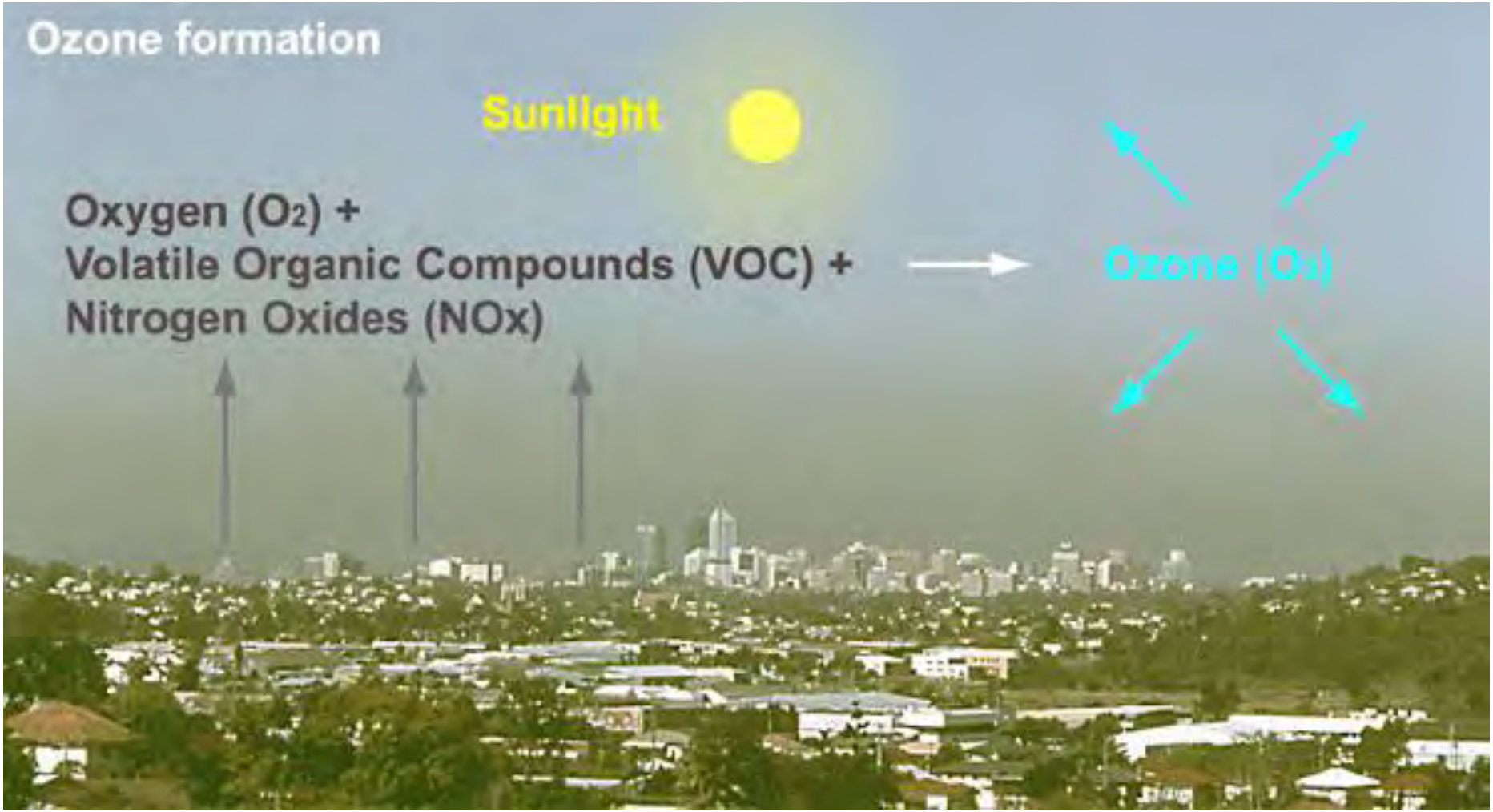
Future climate-health effects : heat stress



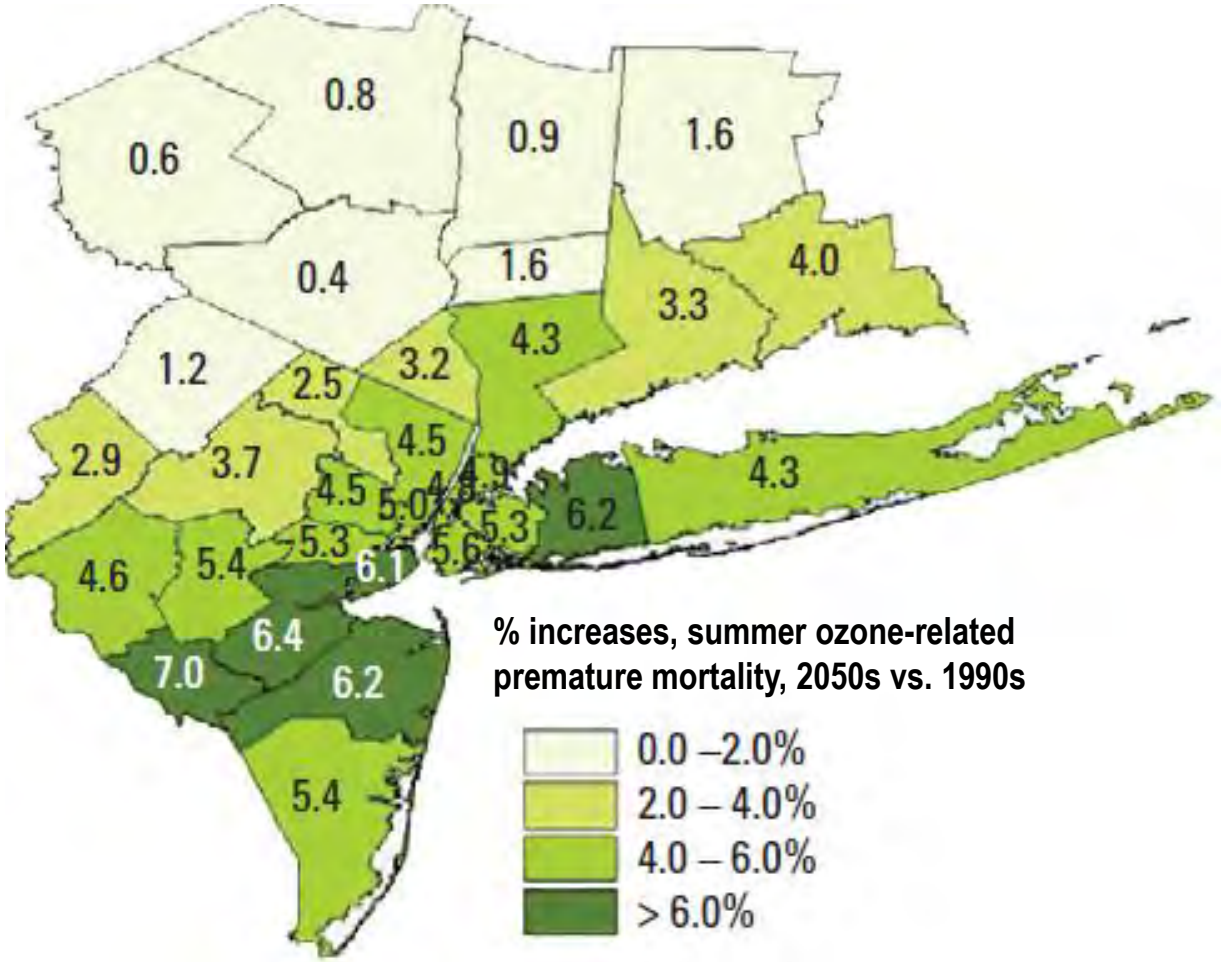
Knowlton et al. (*AJPH*, 2007)

- Summer heat-related mortality could increase 70% by the 2050s, in the tri-state metropolitan region, with climate change
- Adaptation matters: estimated 25% reduction in mortality

Ground-level ozone (smog) formation



Future climate-health effects: air pollution



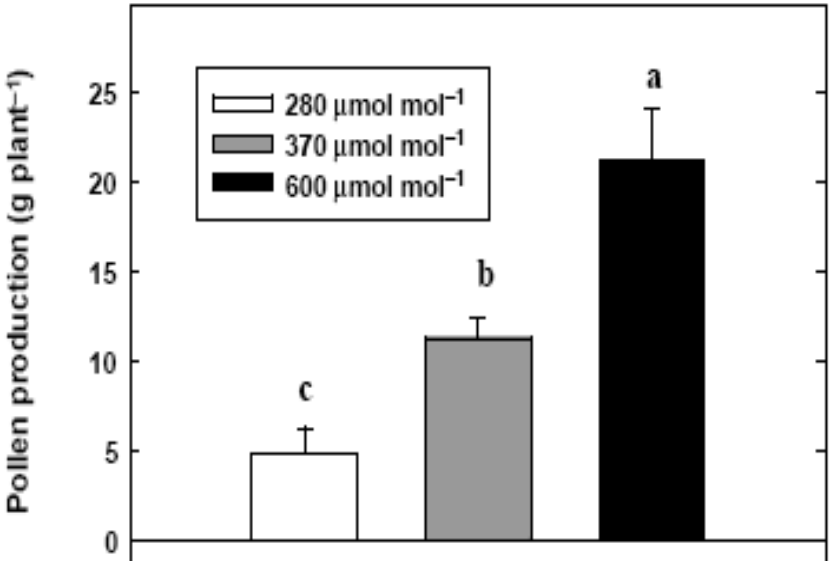
- Summer ozone-related mortality could increase 4.5% region-wide by the 2050s
- Local exposures vary, as do local vulnerabilities

Knowlton et al. (*EHP* 2004)

Ragweed and Climate Change

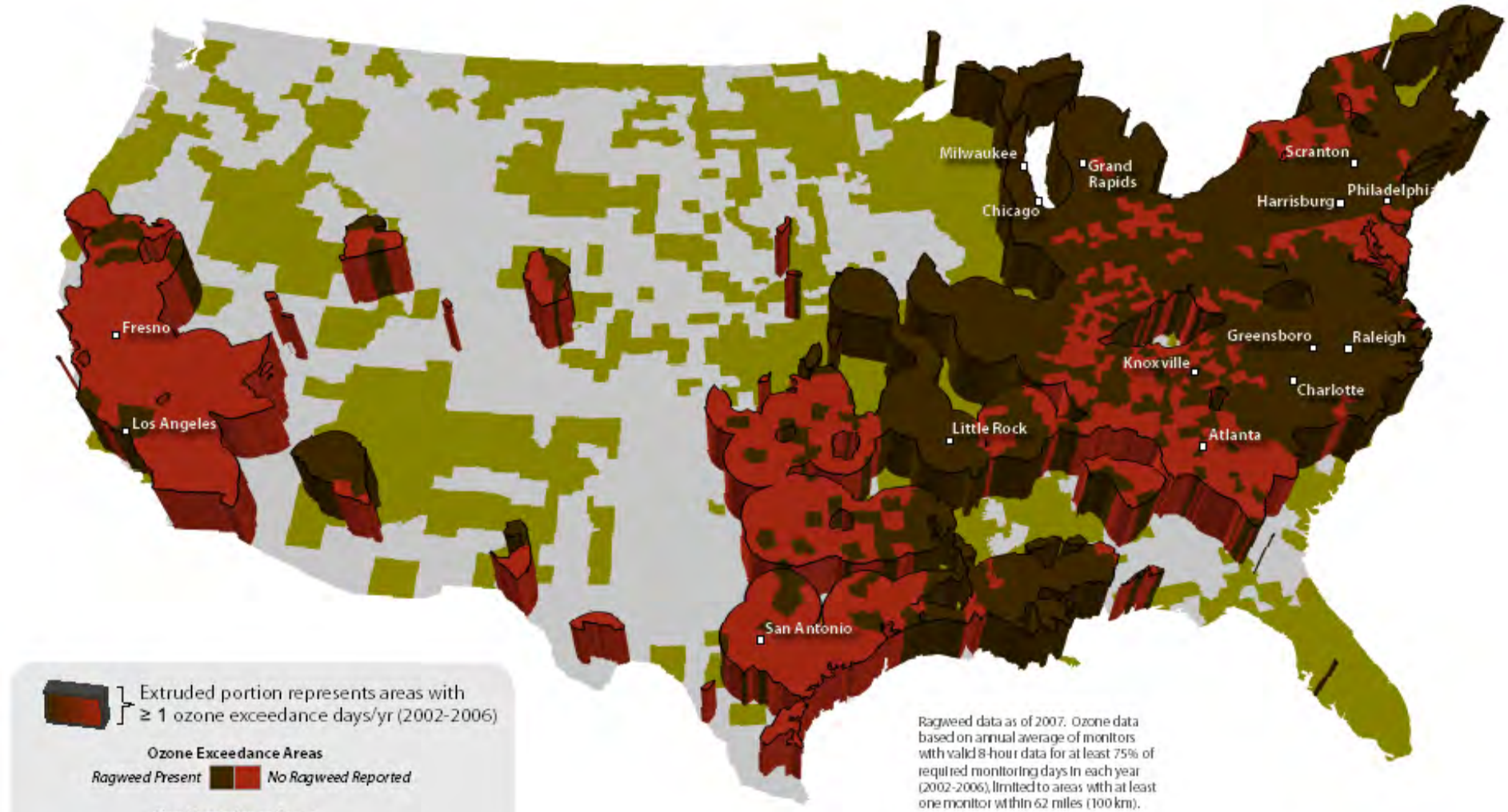
- CO_2 levels today – **131%** more pollen
- CO_2 levels in 2050 – **320%** more pollen

…compared with pre-industrial levels.



Ziska & Caulfield, *Aust J Plant Physiol* 27:893-8, 2000

Ozone and Ragweed Occurrence in the Continental United States



Source: US Environmental Protection Agency, US Department of Agriculture and the Global Biodiversity Information Facility

**Asthma and Allergy Foundation of America, Asthma Capitals 2007*

Climate Change, Allergies & Asthma

- Both ragweed pollen and ozone air pollution are expected to worsen with higher CO2, temperatures.
- Results:
  - Could be more areas with “double-whammy”
  - Longer allergy season
  - Worse symptoms in allergy & asthma sufferers

Source: www.aklung.org/asthma

Infectious Illnesses
Dengue Fever

Dengue Fever Vulnerability in the United States

Suspected Dengue Cases Reported from 1995 - 2005* in the U.S. and Northern Mexico, and U.S. Vector Range

Washington 54 cases
Oregon 90 cases
California 35 cases
Idaho 2 cases
Nevada 1 case
Montana 15 cases
Wyoming 2 cases
Utah 7 cases
Arizona 19 cases
Colorado 43 cases
New Mexico 12 cases
North Dakota 1 case
South Dakota 1 case
Nebraska 4 cases
Kansas 6 cases
Oklahoma 3 cases
Texas 6,836 border region cases 827 in-state cases
Minnesota 23 cases
Iowa 6 cases
Missouri 10 cases
Arkansas 3 cases
Louisiana 5 cases
Wisconsin 50 cases
Illinois 20 cases
Michigan 28 cases
Indiana 3 cases
Ohio 21 cases
Kentucky 2 cases
Tennessee 4 cases
Mississippi 5 cases
Alabama 9 cases
Georgia 84 cases
Florida *190 cases
South Carolina 5 cases
North Carolina 50 cases
Virginia 7 cases
West Virginia 0 cases
Pennsylvania 23 cases
New York 208 cases
Vermont 15 cases
Maine 3 cases
New Hampshire 15 cases
Massachusetts 206 cases
Rhode Island 12 cases
Connecticut 6 cases
New Jersey 6 cases
Delaware 1 case
Maryland 49 cases
Baja California 1 case
Sonora 9,726 cases
Chihuahua 2 cases
Coahuila 3,301 cases
Nuevo Leon 20,809 cases
Tamaulipas 34,138 cases
Hawaii 1,782 cases

*In Aug.-Nov. 2009, 22 confirmed cases of Dengue Fever acquired in Key West, FL were reported. These were the first locally-transmitted infections in Florida in more than 40 years, with more imported cases since then.

Dengue Vulnerability

- Number of suspected cases per state
- Counties reporting positive for one or both dengue mosquito vector species, as of 2005
- Areas vulnerable to dengue fever infection

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Health costs of climate change

- Infrastructure damages are typically the bulk of climate change cost estimates
- Health damage costs have seldom been included
- Valuing *current* climate-sensitive events (via 6 case studies) to predict *future* costs: **$14 Billion**
- Challenge for future: expanding to national scope, projecting economic burden related to health impacts from many more climate-sensitive events

$14 billion in health-related costs *from just six* US climate change-related events, 2002-2009

(Knowlton et al., *Health Affairs* 2011)

Six U.S. Case Studies, 2002-2009, Resulted in More Than $14 Billion in Climate-Related Health Costs.

During the Red River and associated floods, two deaths, 263 emergency room visits, and an estimated 3,000 outpatient visits resulted in nearly $20.4 million in health-related costs. Seasonal river flooding will increasingly affect many areas of the country, resulting in more injuries and deaths. Increased heavy downpours are projected from climate change as temperatures rise, raising levels of both evaporation and precipitation in many areas.

FLOODING, NORTH DAKOTA, 2009

FEMA News Photo

SMOG POLLUTION, NATIONWIDE, 2002

Across the U.S. in 2002, nearly 288 million Americans were exposed to ozone smog levels above the health-based standard, which was then 80 ppb. This exposure hastened death for 795 people, and caused 4,150 hospitalizations and more than 365,000 outpatient visits, at a cost of $6.5 billion. Smog levels are anticipated to rise in the coming years, in the absence of strategies to reduce precursor emissions, because as climate change increases temperatures, ozone-forming chemical reactions also increase.

Over a two-week heat wave, 655 deaths, 1,620 hospitalizations, and more than 16,000 excess emergency room visits, resulted in nearly $5.4 billion dollars in costs. Major heat waves such as this are expected to occur more frequently in the future.

HEAT WAVE, CALIFORNIA, 2006

WILDFIRES, SOUTHERN CALIFORNIA, 2003

These fires burned more than 736,000 acres and resulted in 69 deaths, 778 hospitalizations, and more than 47,600 outpatient visits. Together, this resulted in health-related costs exceeding $578 million. Conditions conducive to wildfires, including drought and extreme heat, are expected to worsen in many parts of the country due to climate change.

© Dave Powell, USDA Forest Service

FEMA News Photo

HURRICANES, FLORIDA, 2004

Four major hurricanes caused 144 premature deaths, nearly 2,200 hospitalizations, 2,600 emergency visits, and $1.4 billion in health-related costs. Climate change is projected to increase the intensity of hurricanes, as sea surface temperature rise in the North Atlantic and provide more energy to drive storm systems. Some climate models project a doubling in the most intense hurricanes (Category 4 and 5) by late in this century.[5]

WEST NILE VIRUS, LOUISIANA, 2002

An outbreak of West Nile Virus in Louisiana in 2002 resulted in an estimated 24 premature deaths, 204 hospitalizations, and nearly 5,800 outpatient visits. Health-related costs totaled $207 million. Mosquito-borne diseases are expected to emerge and spread into more northern climates as temperatures increase and create more habitable environments for mosquitoes.

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Table 1. Health costs in climate change-related case study areas, with costs per health effect, 2002 through 2009.

Climate Change-Related Case Study	Premature Death	Illness	Total Health Cost by Case Study
Ozone smog pollution	$6.3 Billion	$254 Million	$6.5 Billion
Heat wave	$5.2 Billion	$179 Million	$5.3 Billion
Hurricane	$1.1 Billion	$255 Million	$1.4 Billion
Wildfire	$545 Million	$34 Million	$578 Million
Mosquito-borne infectious disease	$190 Million	$18 Million	$207 Million
River flooding	$16 Million	$5 Million	$20 Million
Total costs (in U.S. dollars, 2008)	**$13.3 Billion**	**$744 Million**	**$14.1 Billion**

http://www.nrdc.org/health/accountingforcosts/

Climate Solutions: Strategies

- Two Strategies for Solutions

Mitigation

interventions to reduce emissions (or enhance sinks) of greenhouse gases

Adaptation

initiatives & measures to reduce the vulnerability of natural & human systems against actual or expected climate change effects

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NRDC's *Climate Change Threatens Health* website:
local climate-health threats, and adaptation actions

www.nrdc.org/climatemaps

4 Key Elements of Adaptation: Climate-Health Preparedness Strategies

- Identify Local Vulnerabilities
- Track Environmental Changes & Health Threats
- Build Resilient Communities
- Promote Education & Public Dialogue

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Example: Heat-Health Warning Systems

HEAT WATCH/WARNING SYSTEMS SAVE LIVES

Estimated Costs and Benefits for Philadelphia 1995–98

BY KRISTIE L. EBI, THOMAS J. TEISBERG, LAURENCE S. KALKSTEIN, LAWRENCE ROBINSON, AND RODNEY F. WEIHER

The cost of running a heat wave warning system for Philadelphia were practically at the "noise" level compared to the economic benefits of saving 117 lives in three years.

Ebi et al. (*BAMS* 2004)

- **Identifying Vulnerabilities -** City worked w/agencies to identify where elders live; Neighbors check on elderly via "buddy system" in heatwaves

- **Tracking -** National Weather Service, Dept of Public Health, Corporation for Aging, News Media are in contact when heat wave is predicted, and public is alerted frequently; free "Heatline" info

- **Climate-Smart Design** Cool Homes Program encourages energy-efficient design; free energy audits

- **Public Education**

Cooling centers opened; no utility service suspensions; more Fire, EMS, Homeless svc staff; Public education about protecting health, getting info during heat wave

Promoting adaptation

- *Only 13 states* have climate-health preparedness plans (NJ isn't among them yet)
- Rep. Capps' (D-CA) "Climate Change Health Protection & Promotion Act" proposed Nov. 2011
- Need more state & regional climate-health adaptation plans that target the most vulnerable communities
- Challenges
  - $$ Resources to support national, state & local preparedness
  - Need consensus: climate adaptation as a planning priorities
  - Continued support for national database on climate-sensitive events and associated health outcomes
  - Building a knowledge base now on adaptation

A Clean Energy Future

- Prepare for unavoidable effects of climate change
- Reduce carbon pollution to avoid unmanageable effects

Conclusions

- Climate change harms people's health
- Action needed to reduce carbon emissions & limit the most severe health effects
- Energy/environmental policies must protect health of our most vulnerable
- We can improve our lives, create healthier communities by preparing for climate change's effects

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“We know enough now to act”

* Thank you *

kknowlton@nrdc.org

www.nrdc.org/climatemaps

Link to health costs of climate change paper in* Health Affairs *at:

http://www.nrdc.org/health/accountingforcosts/