

Climate and Human Health Responders Course for Health Professionals

Extreme Weather Hazards

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Project ECHO
Columbia Mailman School of Public Health
Global Consortium on Climate and Health Education
NOAA
Santé Canada
Health Canada

Extreme Weather Hazards
Learning Objectives

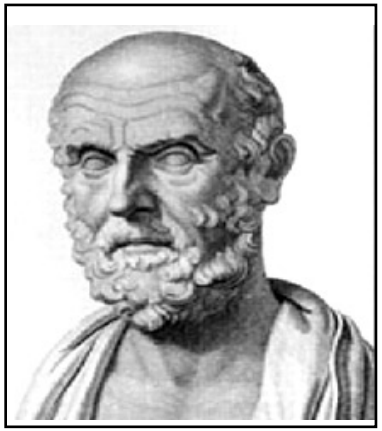
- Describe the ways in which climate change increases the risk of extreme events such as hurricanes, floods and droughts
- Identify short-term and long-term health threats to patients impacted by extreme weather events and steps that health professionals can take to reduce these risks
- Define the roles of disaster risk reduction, public health communication, early warning and regional cooperation in the prevention of the health impacts of extreme weather events
- Explain how the health impacts of climate change will vary within and among different communities by applying concepts of vulnerability, resilience and adaptive capacity

How is climate linked to our health?

Long History Between Climate and Health

- **Hippocrates wrote about epidemics in 400 B.C.E. and noted the change in weather**

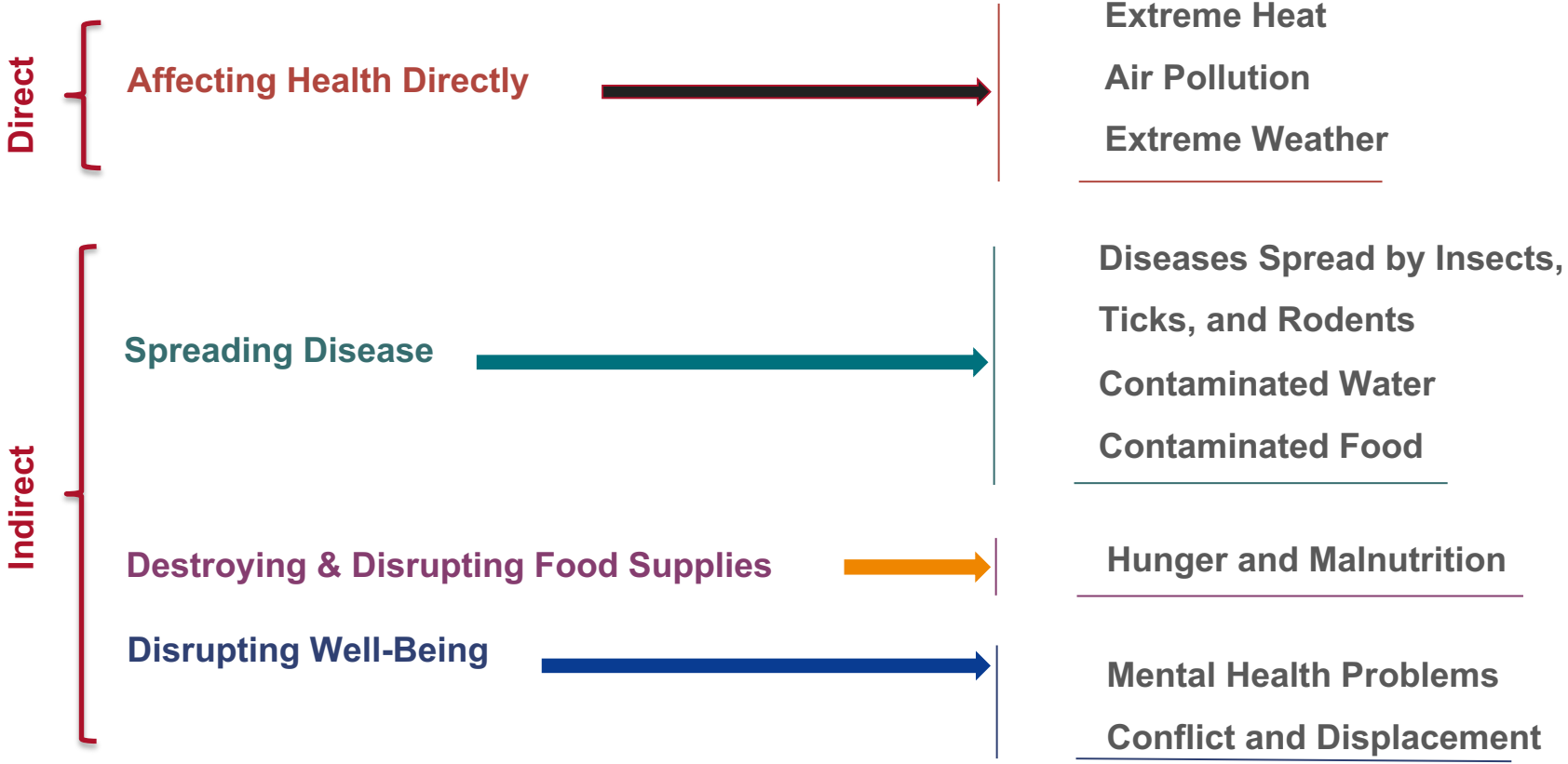
- **1814 Dr. James Tilton, Surgeon General of the Army, directed all hospital surgeons to keep weather records**



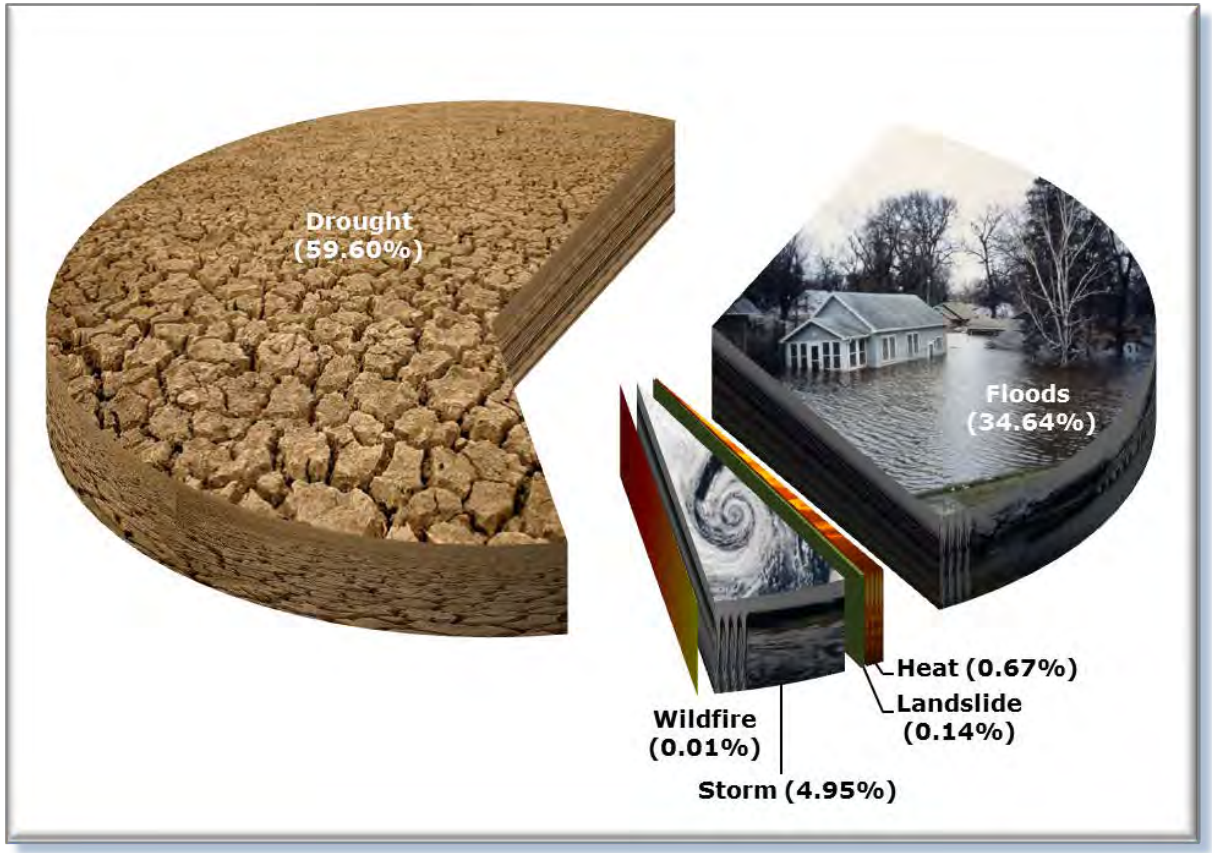

“Floods kill people, but droughts destroy civilizations.”
~U.S. Government Official at a Drought Meeting

Dust Bowl of the 1930s

Climate is Affecting Your Health

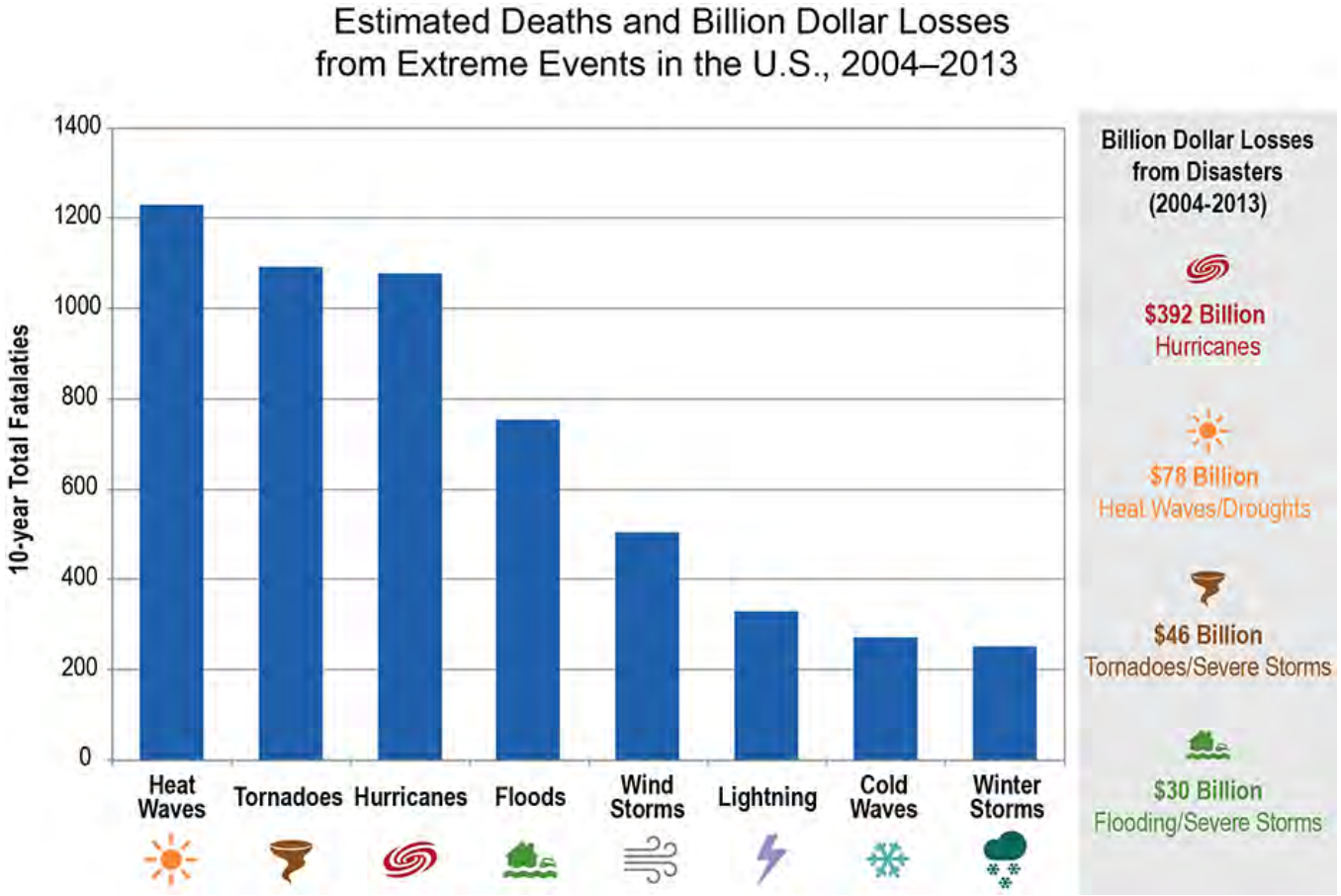


Percentage of disaster-deaths worldwide according to each category of climate-related hazard, (1900-2013)



Source: Adapted from EM-DAT: The OFDA/CRED International Database, Belgium 2012
Keim, ME Extreme Weather Events: the role of public health

Costs of Extreme Events



https://www.cnn.com/2018/08/29/us/puerto-rico-growing-death-toll/index.html

CNN U.S. » Crime + Justice | Energy + Environment | Extreme Weather | Space + Science Live TV U.S. Edition +

How Puerto Rico's death toll climbed from 64 to 2,975 in Hurricane Maria

By Ray Sanchez, CNN

Updated 2:56 PM ET, Wed August 29, 2018

Puerto Rico revises Hurricane Maria death toll 01:39

(CNN) — Puerto Rico's true death toll from Hurricane Maria remains elusive as the storm's one-year anniversary approaches.

The island government raised the **official death toll to 2,975** on Tuesday after maintaining for months that 64 people had died as a result of the storm.

More from CNN

Watch Hurricane Michael's 155 mph winds

Cleveland Parade to Celebrate Tristan Thompson Punching Draymond...

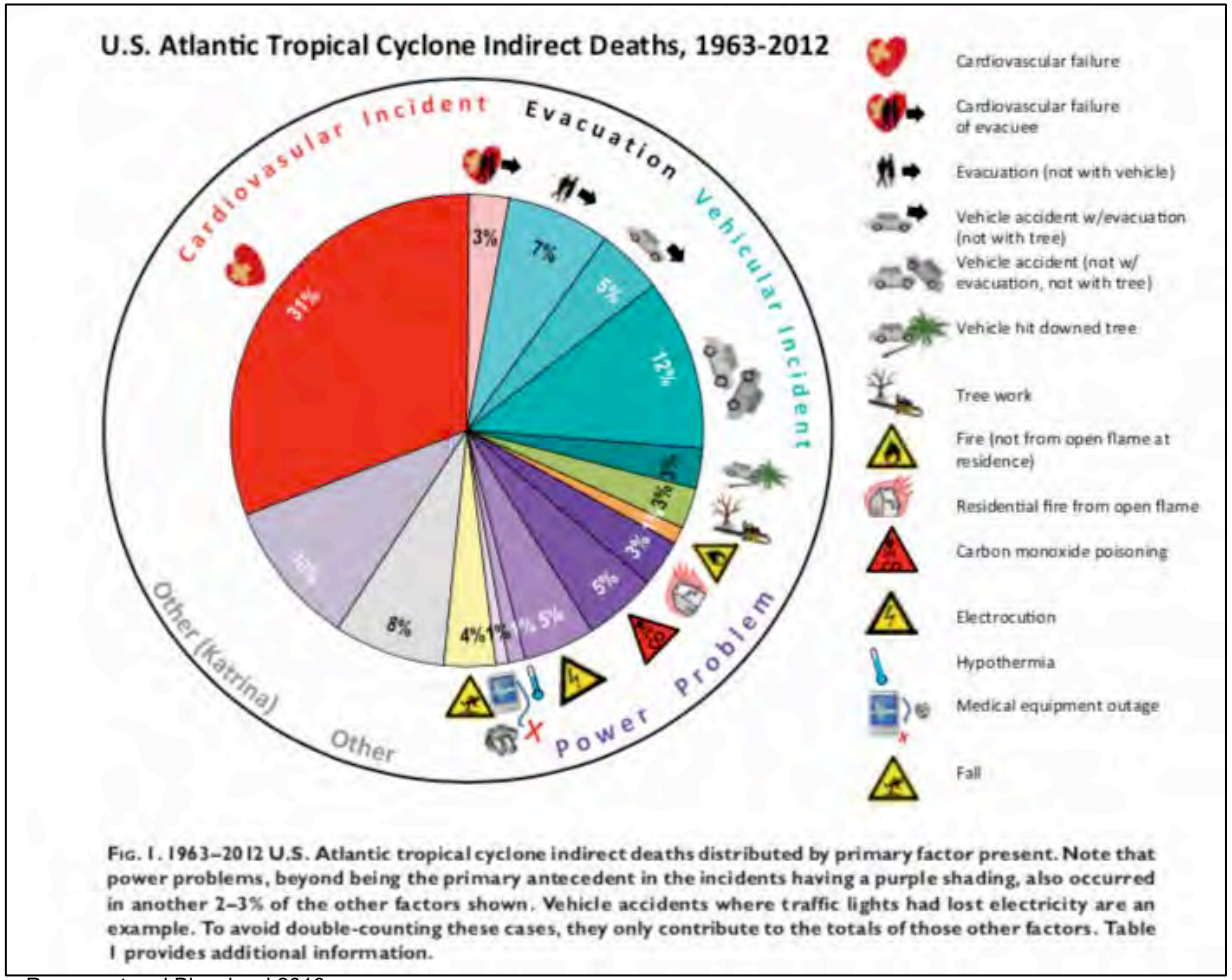
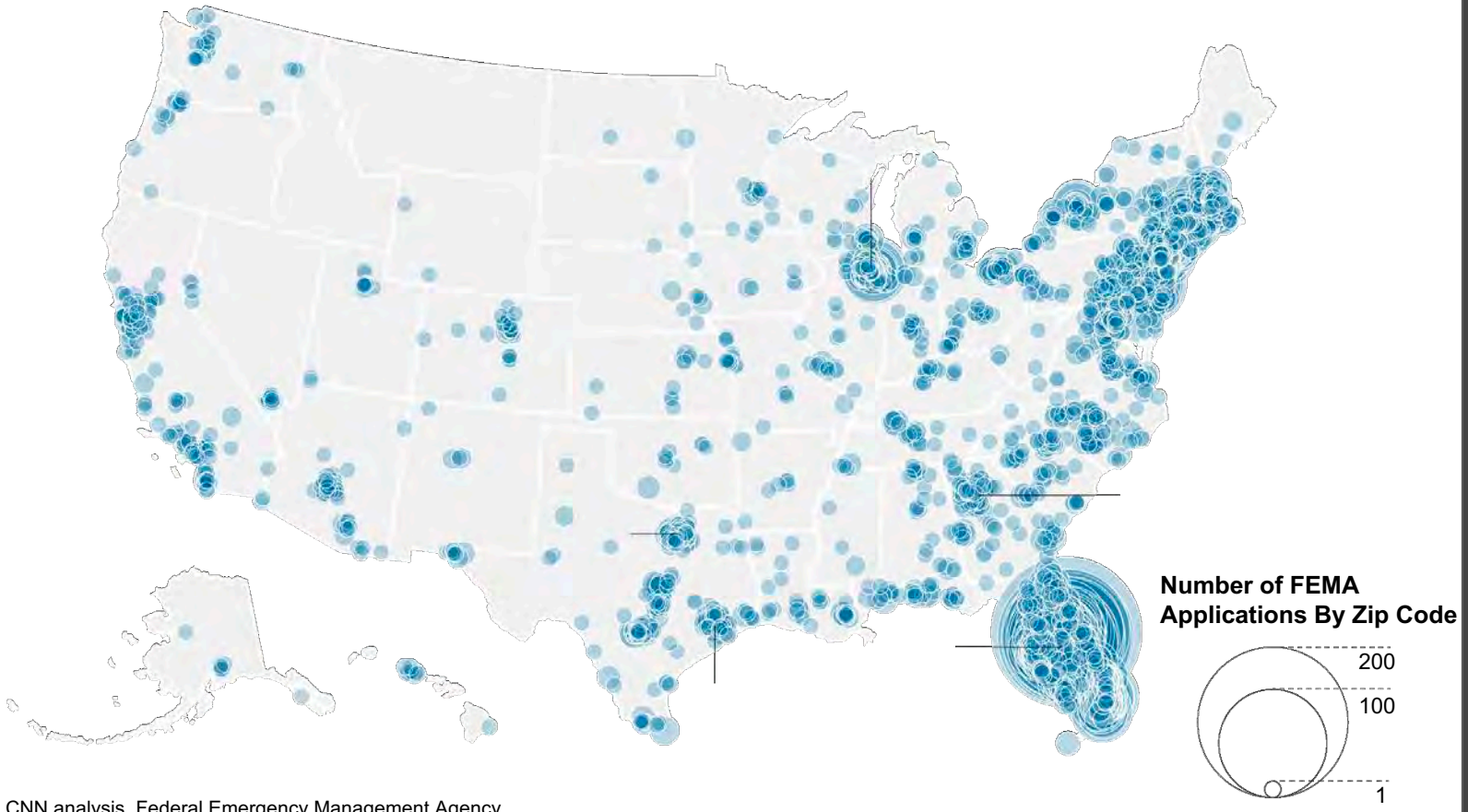


FIG. 1. 1963–2012 U.S. Atlantic tropical cyclone indirect deaths distributed by primary factor present. Note that power problems, beyond being the primary antecedent in the incidents having a purple shading, also occurred in another 2–3% of the other factors shown. Vehicle accidents where traffic lights had lost electricity are an example. To avoid double-counting these cases, they only contribute to the totals of those other factors. Table 1 provides additional information.

Rappaport and Blanchard 2016

Estimate of People Displaced by Hurricane Maria



Source: CNN analysis, Federal Emergency Management Agency

Climate-driven Natural Disasters

Weather vs. Climate

Climate is what you expect, weather is what you get.
~attributed to Mark Twain

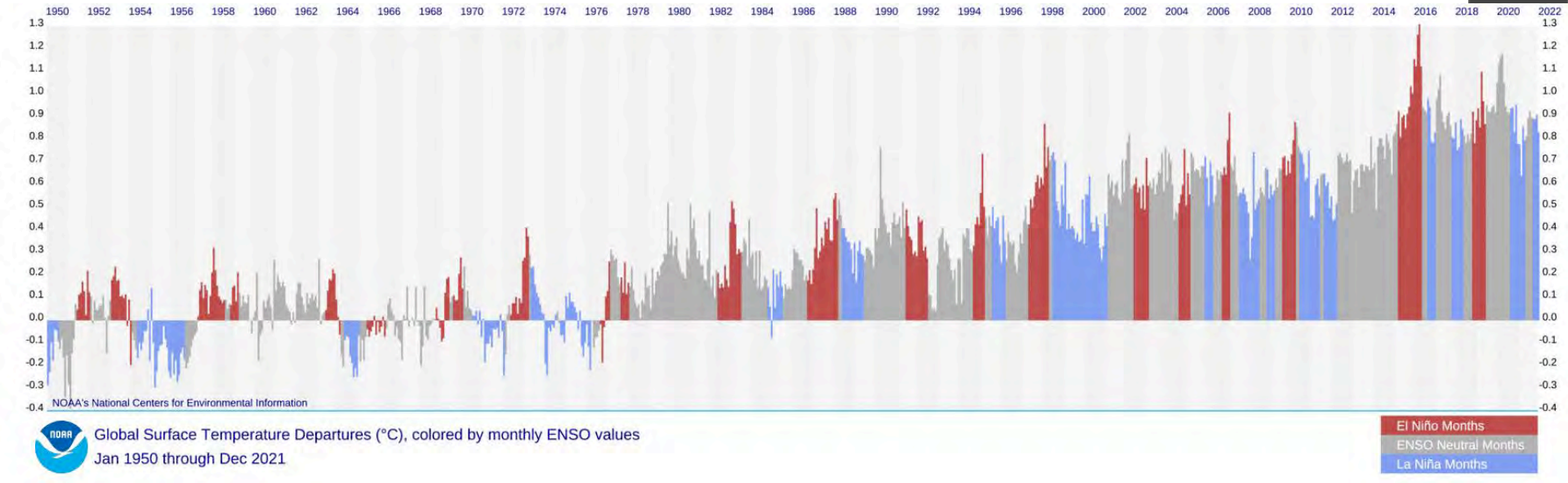
What is climate?

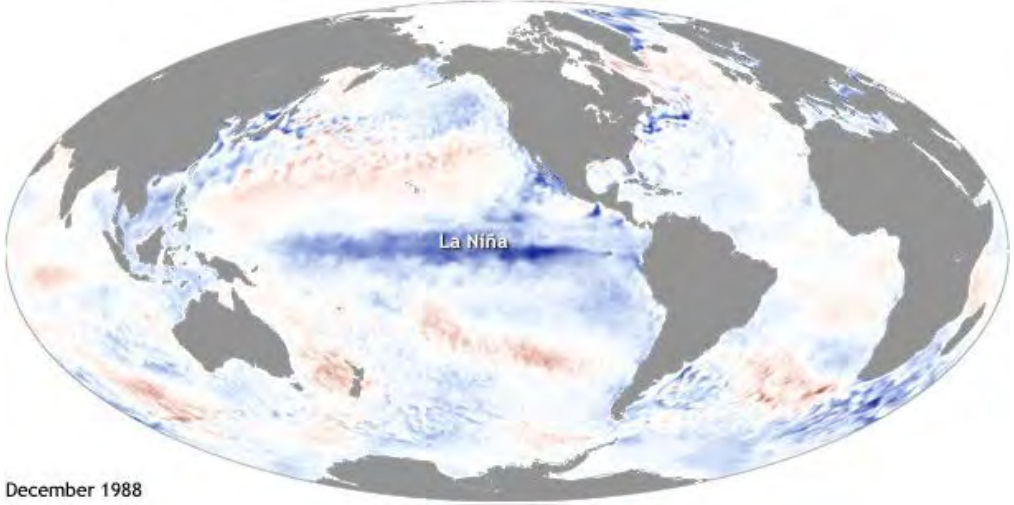
- **Weather** is the current conditions of the atmosphere
  - Extremely variable
  - What is it like outside?

- **Climate** is the behavior of the atmosphere over long time periods
  - Is a Nebraska summer warmer than a Nebraska winter?
  - Florida vs. Nebraska
  - This year vs. a previous year

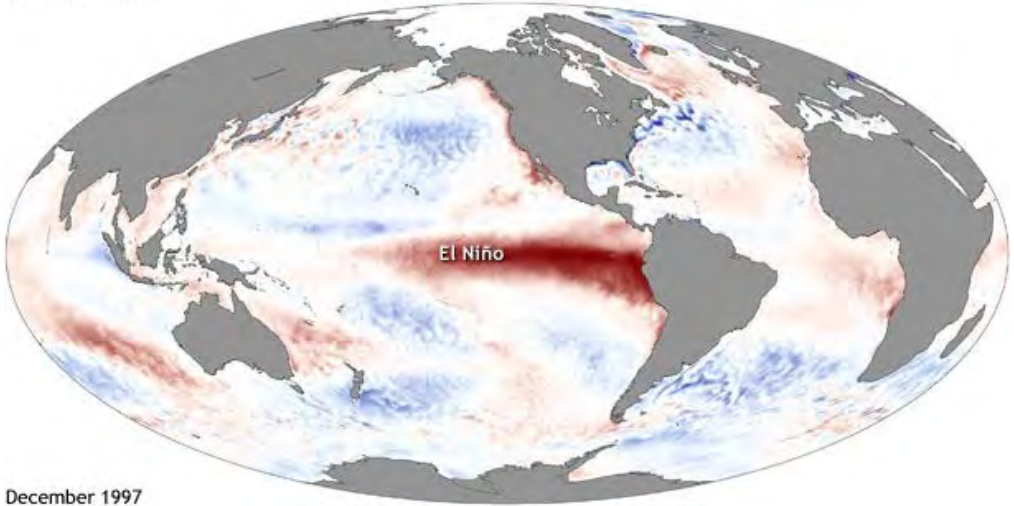
Climate Change vs. Climate Variability

- **Climate change** is a long-term continuous change in the average
  - Average = Climate Normal (e.g. 30 years average)
- **Climate variability** is fluctuation above or below the long-term average
- **Extreme Weather** are weather phenomena that are outside the usual historical distribution (flooding rains, heat waves, droughts, etc.)





December 1988



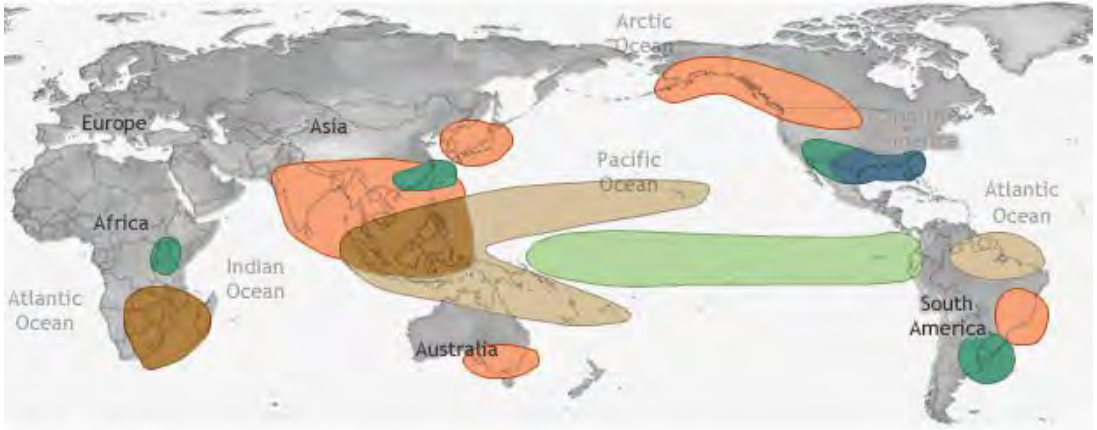
December 1997

Difference from average temperature (°F)

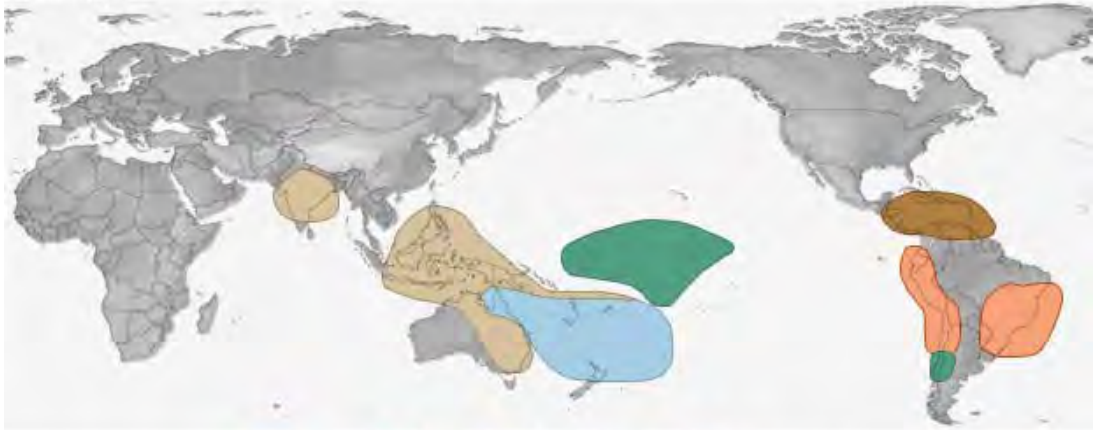
-9 0 9

EL NIÑO CLIMATE IMPACTS

December-February



June-August

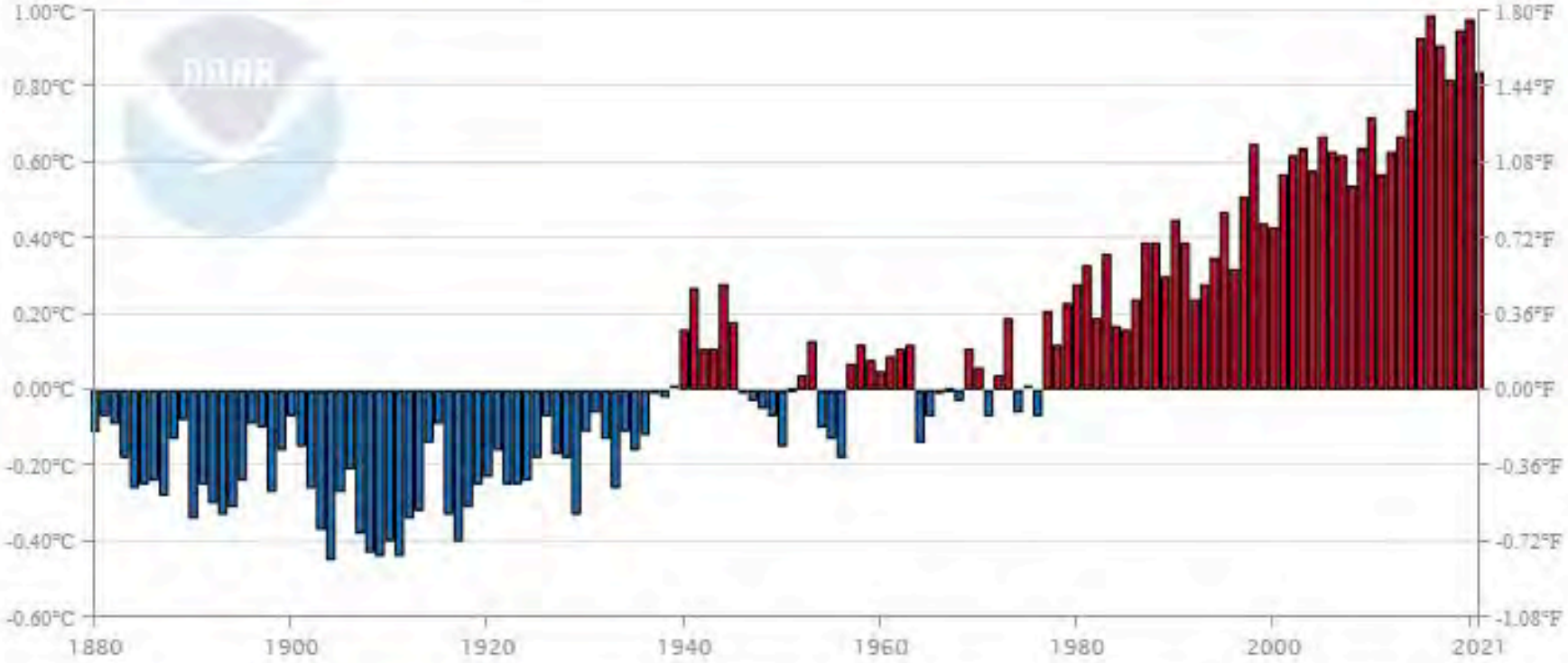


Cool
Warm
Wet
Dry
Cool and dry
Warm and dry
Cool and Wet
Warm and wet

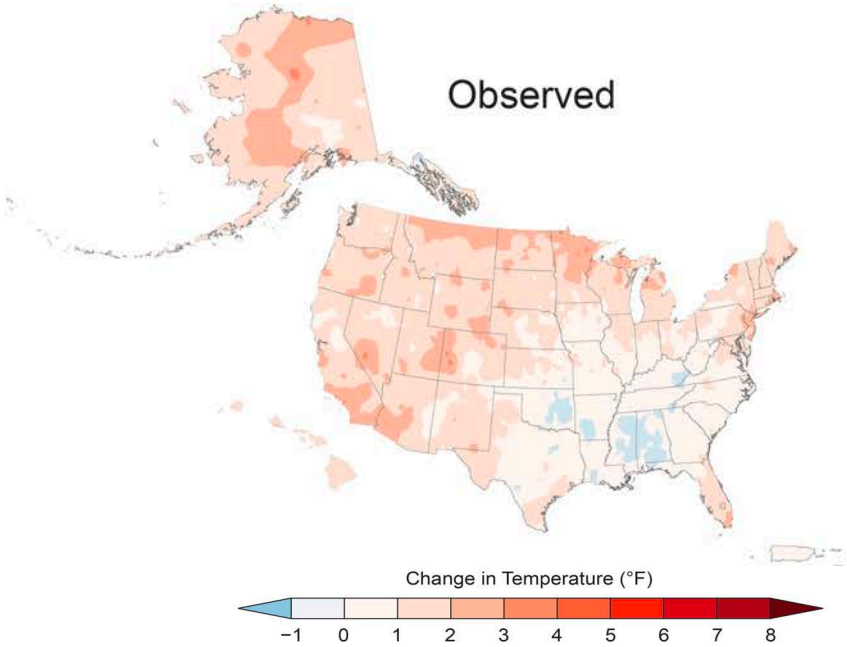
What Do We Know?

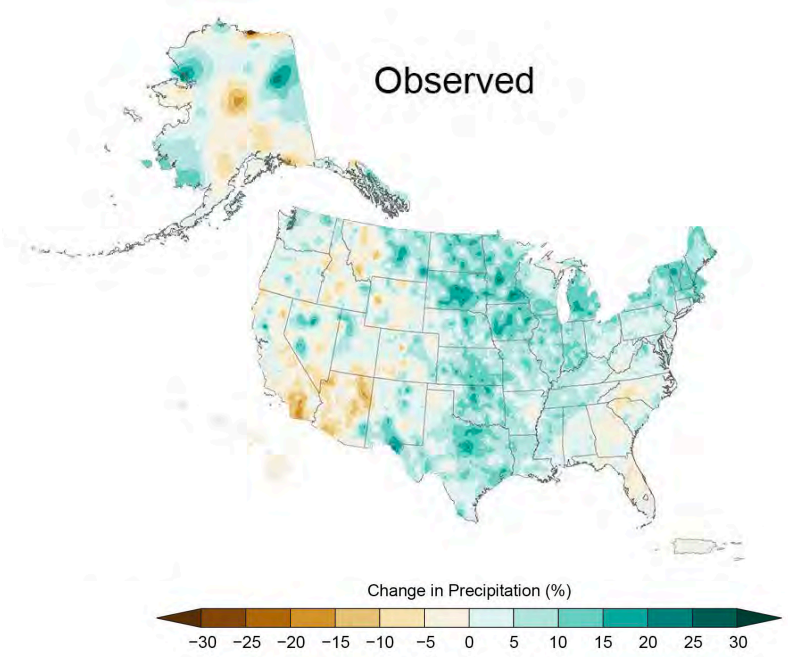
Global Land and Ocean

January–December Temperature Anomalies

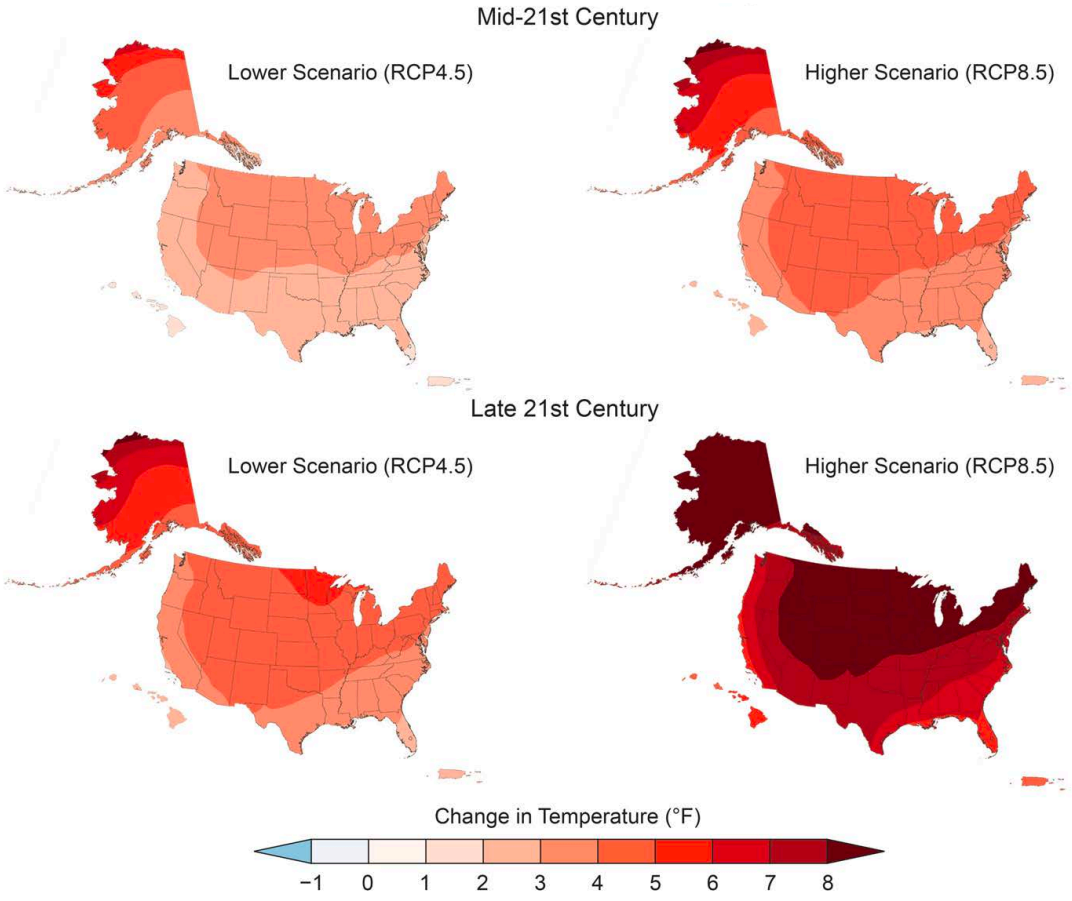


Historical Temperature and Precipitation Changes



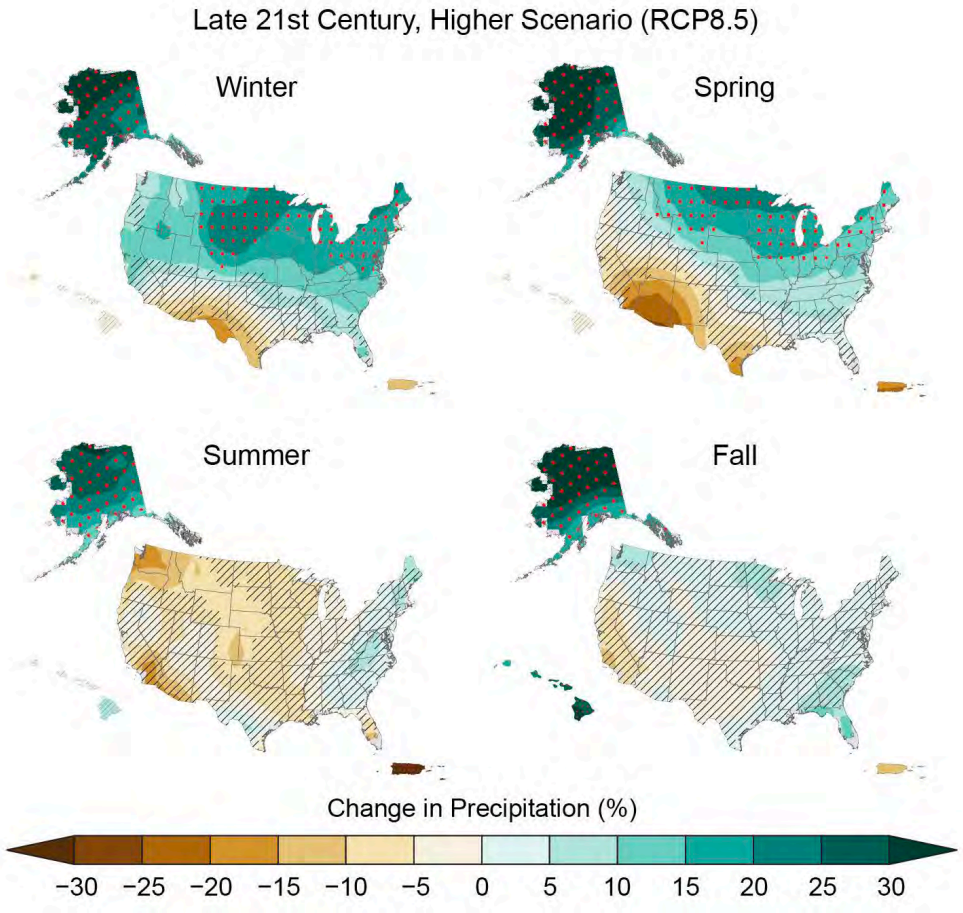


Future Temperature Change

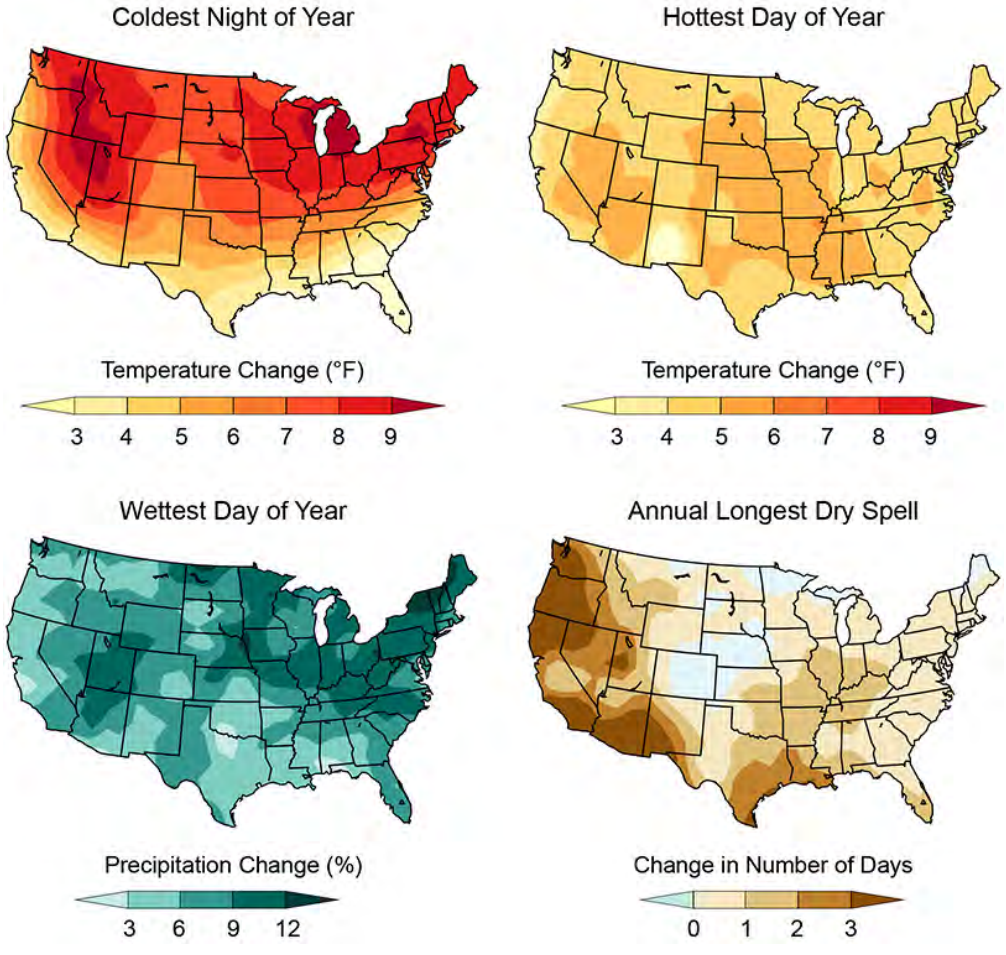


NCA 2018

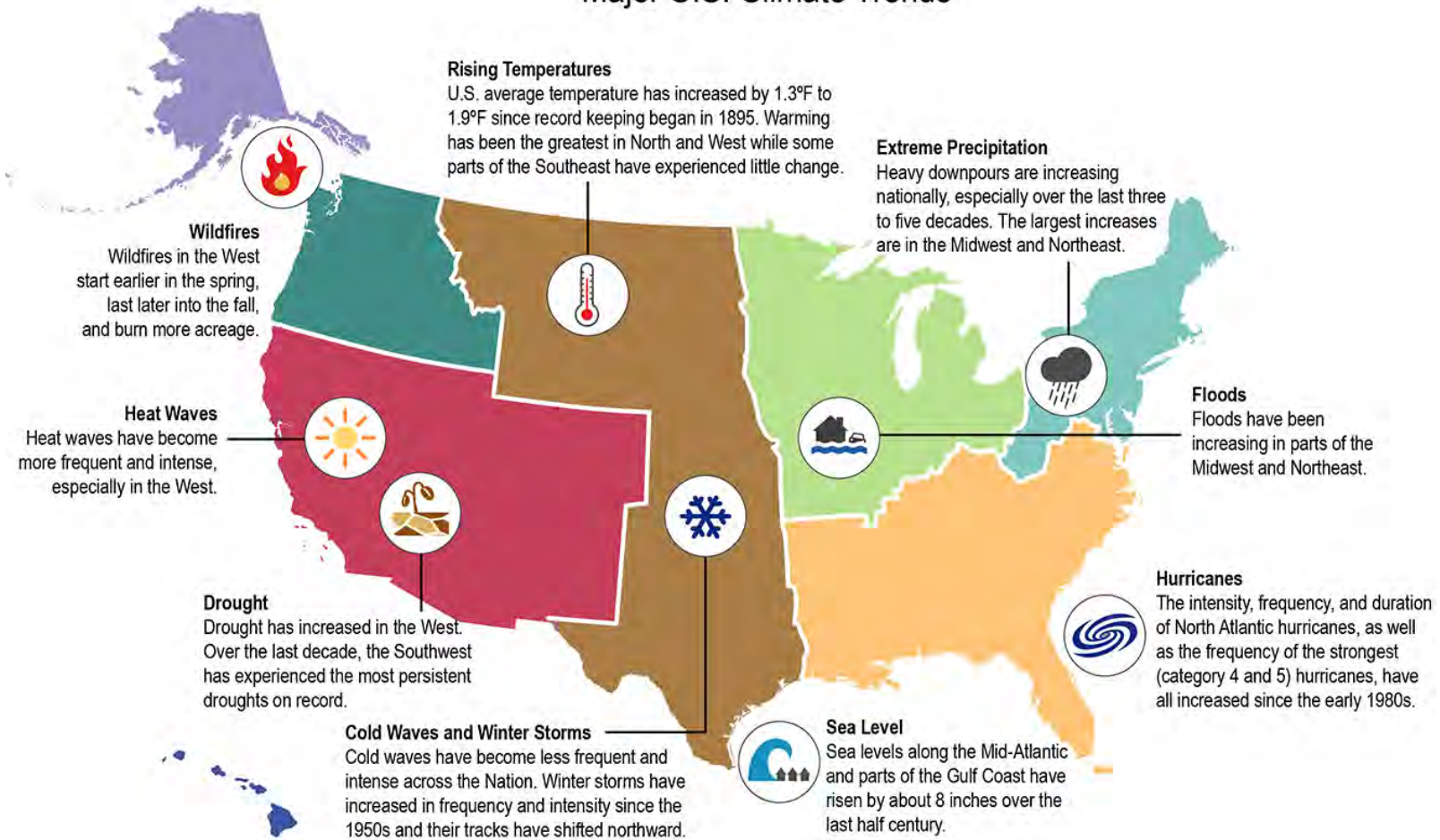
Future Precipitation Change



Projected Changes in the Hottest/Coldest and Wettest/Driest Day of the Year



Major U.S. Climate Trends

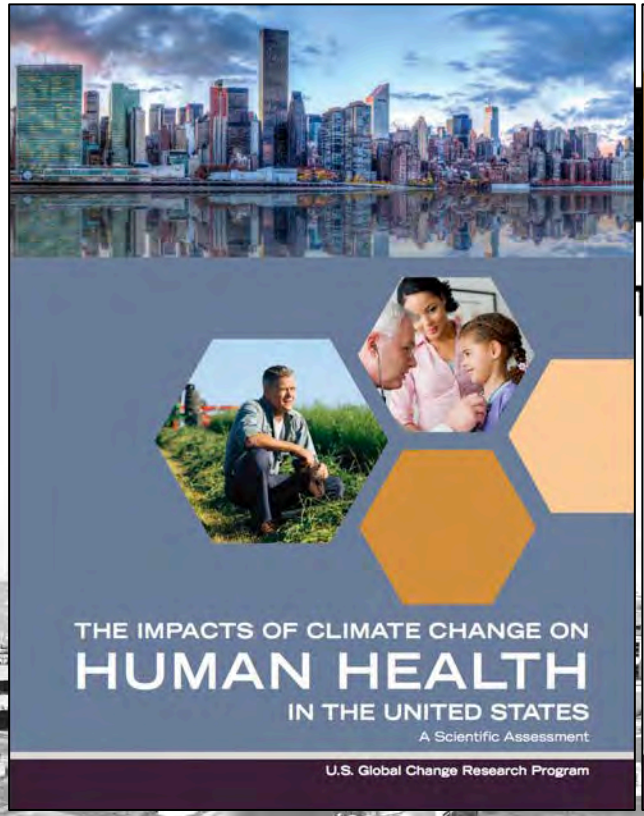


Some Extremes are Changing in a Warmer World

Strongest scientific evidence shows human-caused climate change is increasing heat waves and coastal flooding

Will changes in our climate impact our health?

health2016.globalchange.gov

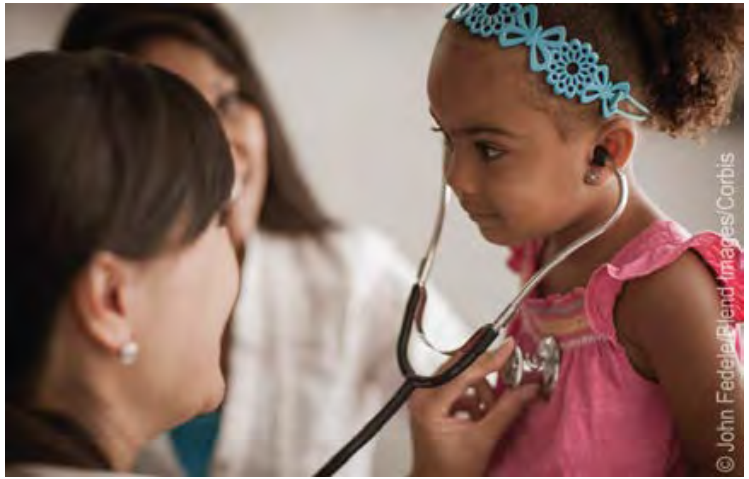


University of Nebraska Medical Center

Executive Summary

Climate change is a significant threat to the health of the American people.

Every American is vulnerable to the health impacts associated with climate change



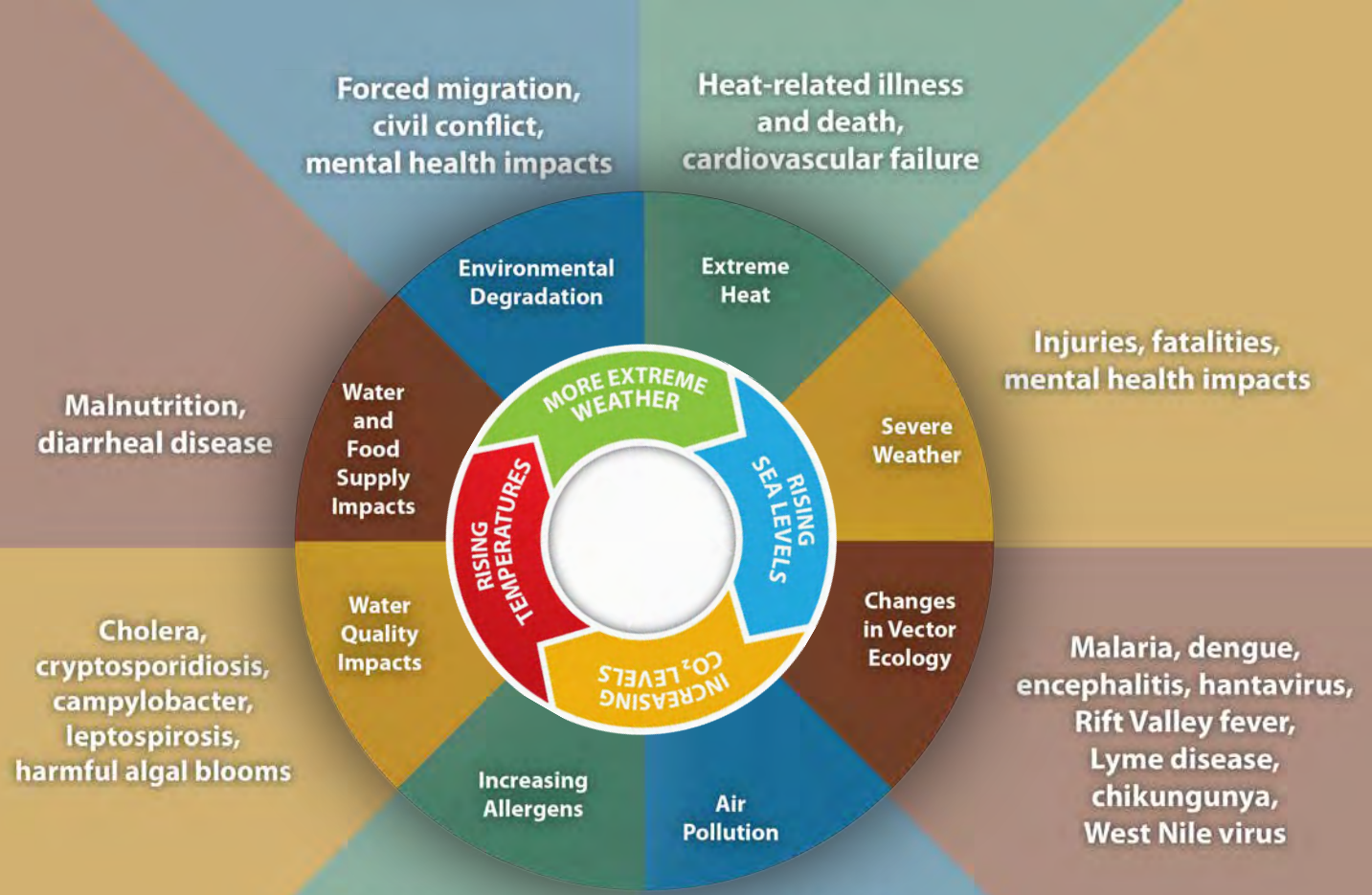
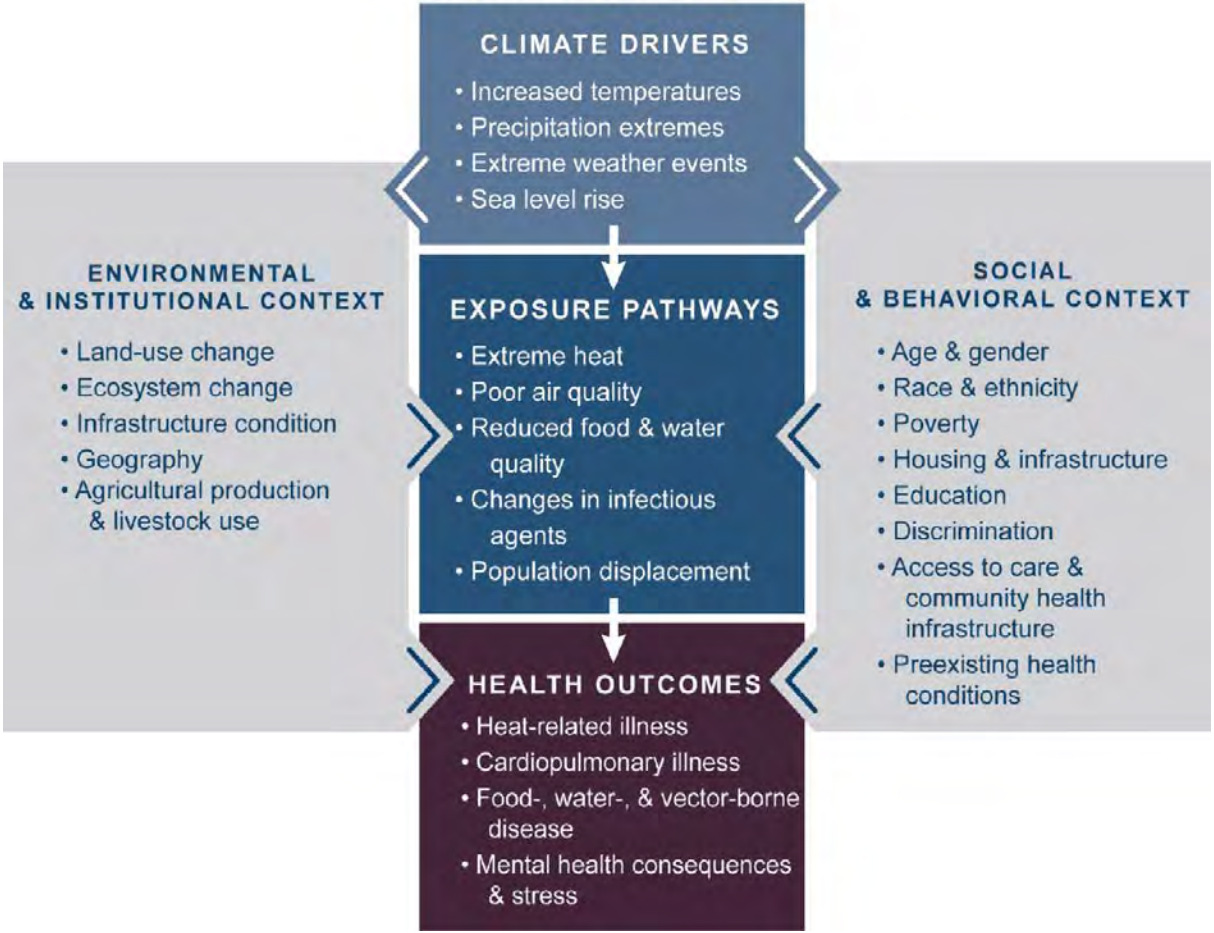
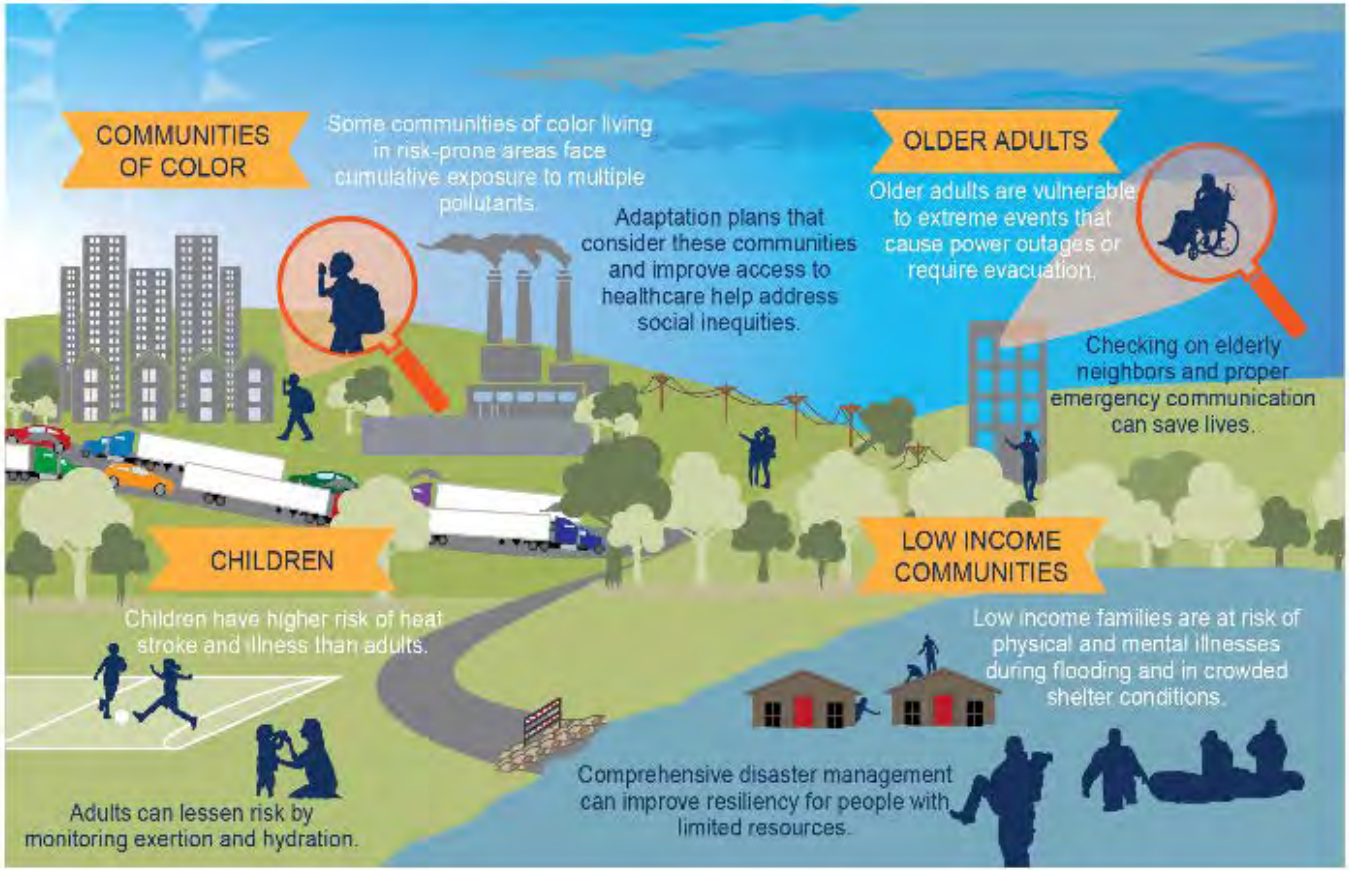


Figure from CDC's Climate and Health Progra

Climate Change and Health

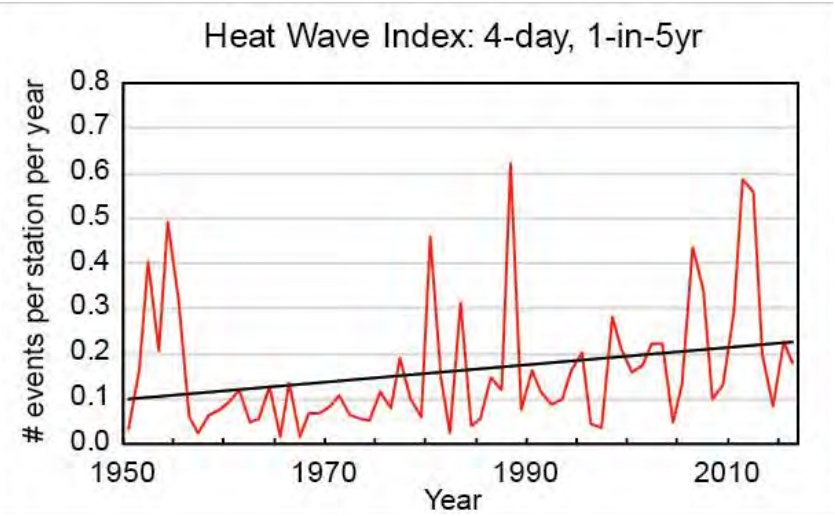


Populations of Concern



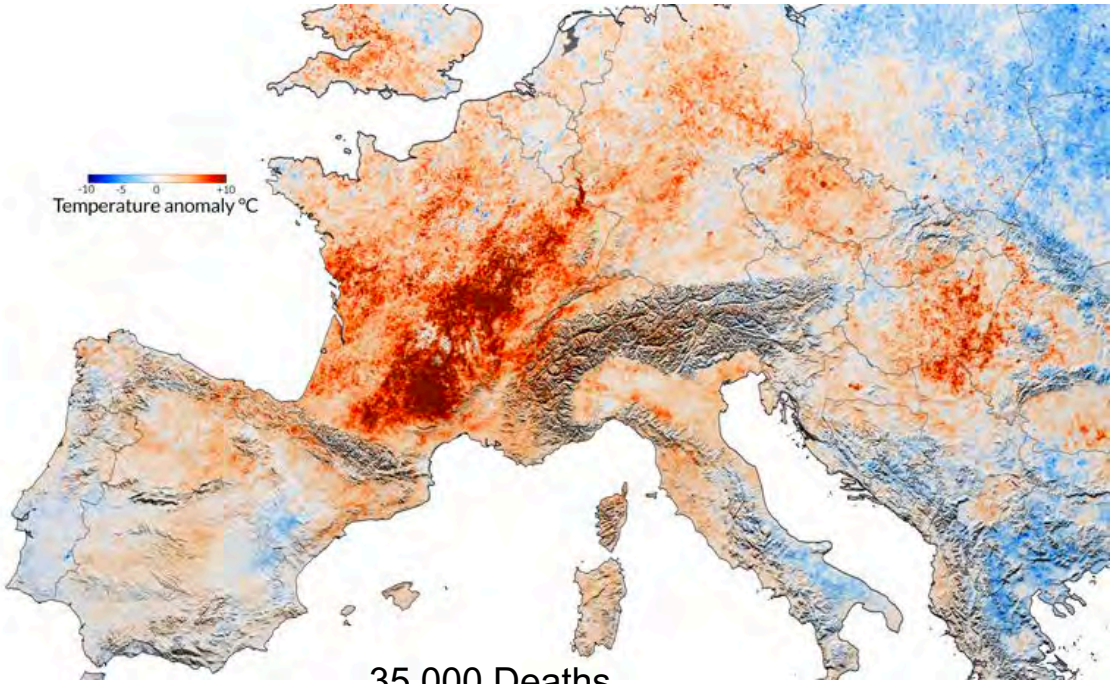
The Impacts of Climate Change are Now

Extreme Heat



- Increased temperatures, higher humidity, longer and more frequent heat waves
- Heat stroke, dehydration, and heat-related illness
- Vulnerable populations: Outdoor workers, student athletes, people in cities, people without air conditioning, people with chronic diseases, pregnant women, older adults, and young children

2003 European Heatwave



35,000 Deaths

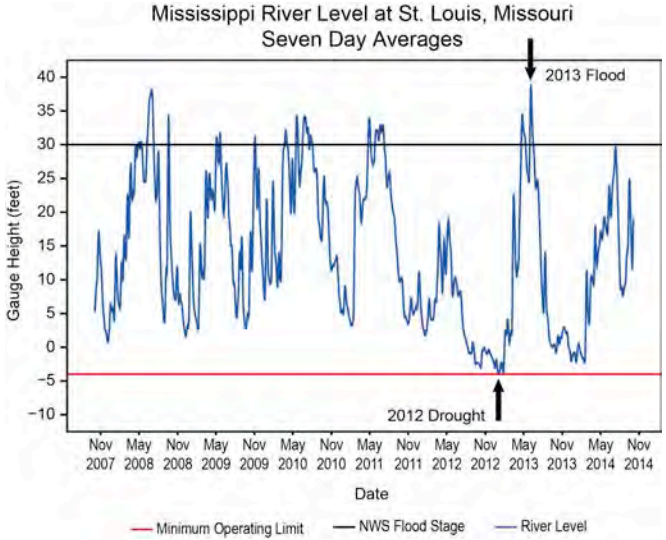
NASA.gov

70% Deaths in Paris and 20% Deaths in London

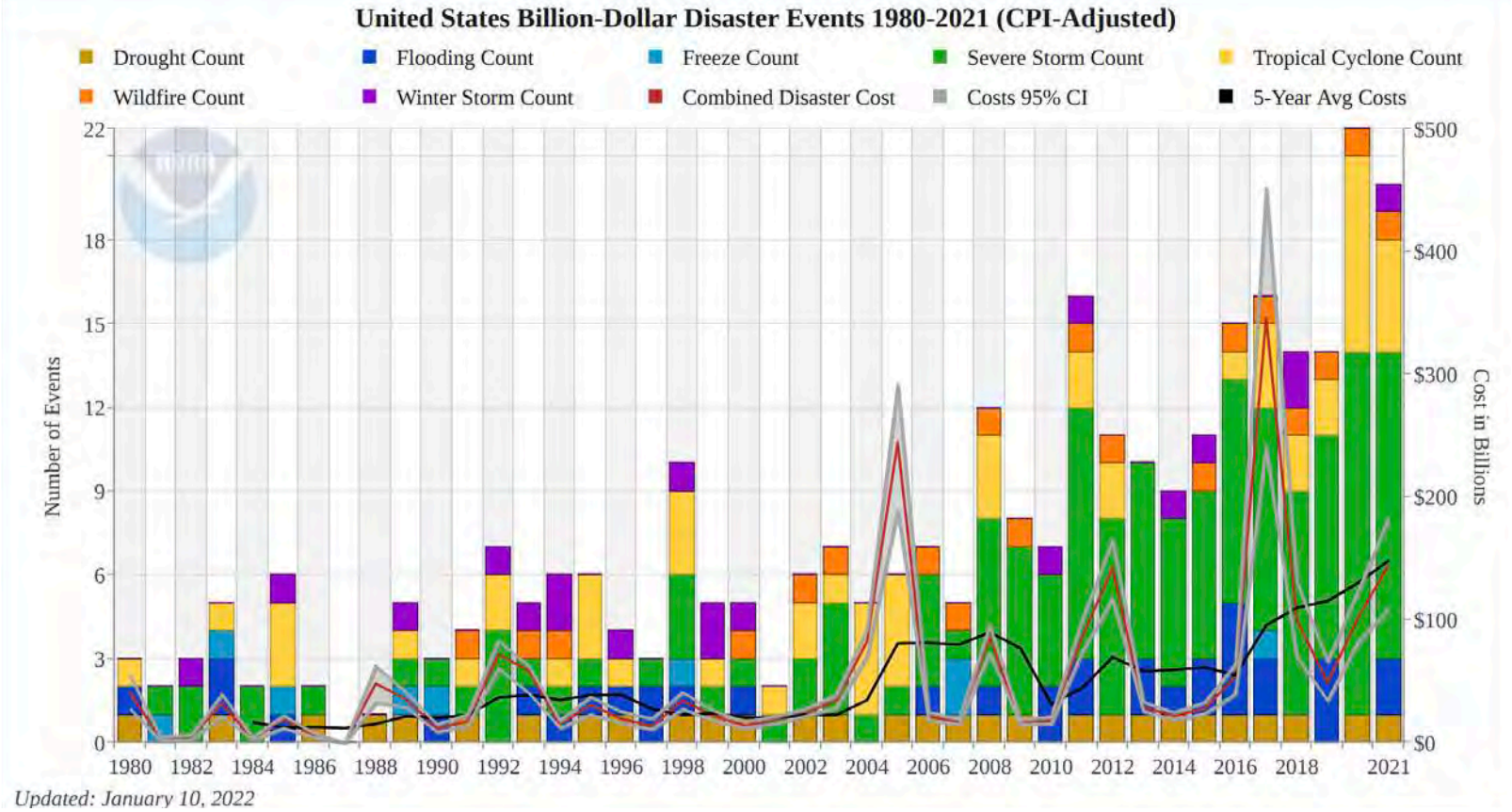
Mitchell, Daniel, et al. "Attributing human mortality during extreme heat waves to anthropogenic climate change." *Environmental Research Letters* 11.7 (2016): 074006.

Extreme Weather

- Increased frequency and severity of heavy downpours, floods, droughts, and major storms
- Injury, illness, displacement, and death
- Vulnerable populations: People who lack access to evacuation routes and people who can't use stairs when elevators are out of service, people in wheelchairs, older adults, the poor, and people with disabilities, particularly if they are unable to access elevators and evacuation routes



Billion-Dollar Disasters are Increasing



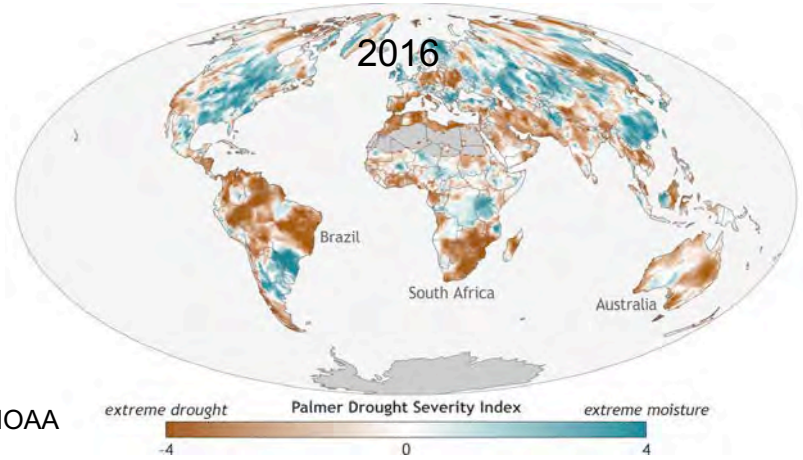
2019 March Flooding

- At least 2 hospitals sustained damage
- At least a dozen long term care facilities were evacuated
- Lack of access to care
  - Flooded roads
  - Damaged infrastructure

Spreading Disease:
INSECTS, TICKS, AND RODENTS

- Higher temperatures, changes in rain patterns, and disrupted ecosystems
- Lyme disease, West Nile disease, etc.
- Vulnerable populations: People who spend more time outdoors in places where these insects and other disease-carriers live

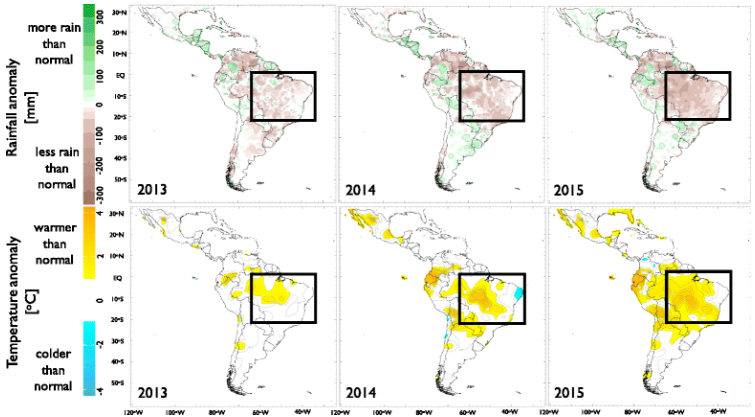
Zika Virus



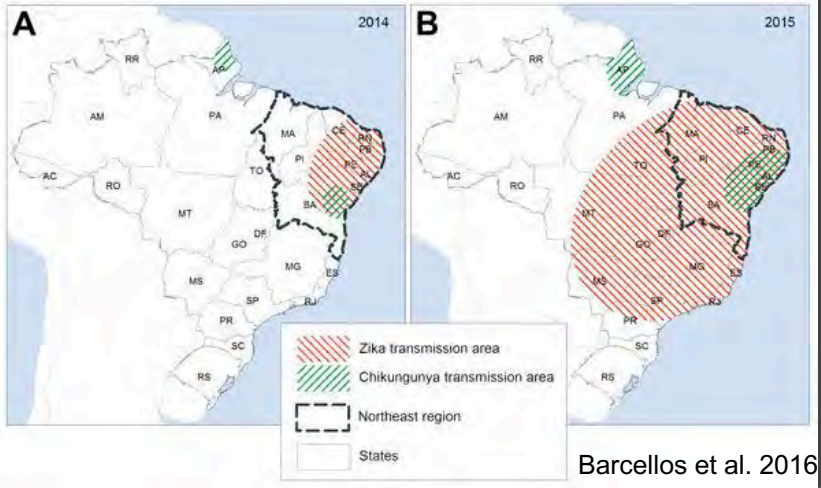
NOAA

Sinclair Stammers/Science Photo Library

WHO



Munoz et al. 2016



Barcellos et al. 2016

Spreading Disease:
Contaminated Food and Water

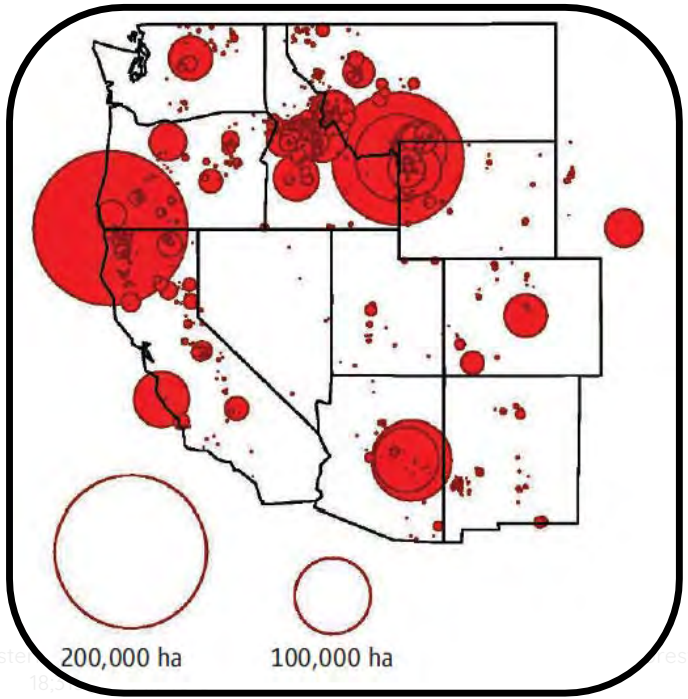
- Higher water temperatures, heavier downpours, rising sea levels, more flooding, increasing temperatures, humidity, and extreme weather events
- Gastrointestinal illness, diseases from toxins in swimming areas and drinking
- Vulnerable populations: Children, the elderly, people with weakened immune systems, people in remote or low-income communities with inadequate water systems, and people in communities that are dependent on fish and shellfish

Air Quality

- Increased wildfires, smog, pollen, and mold
- Asthma, respiratory, and allergy issues
- Vulnerable populations: People with heart and respiratory conditions such as heart disease, asthma, or chronic lung disease

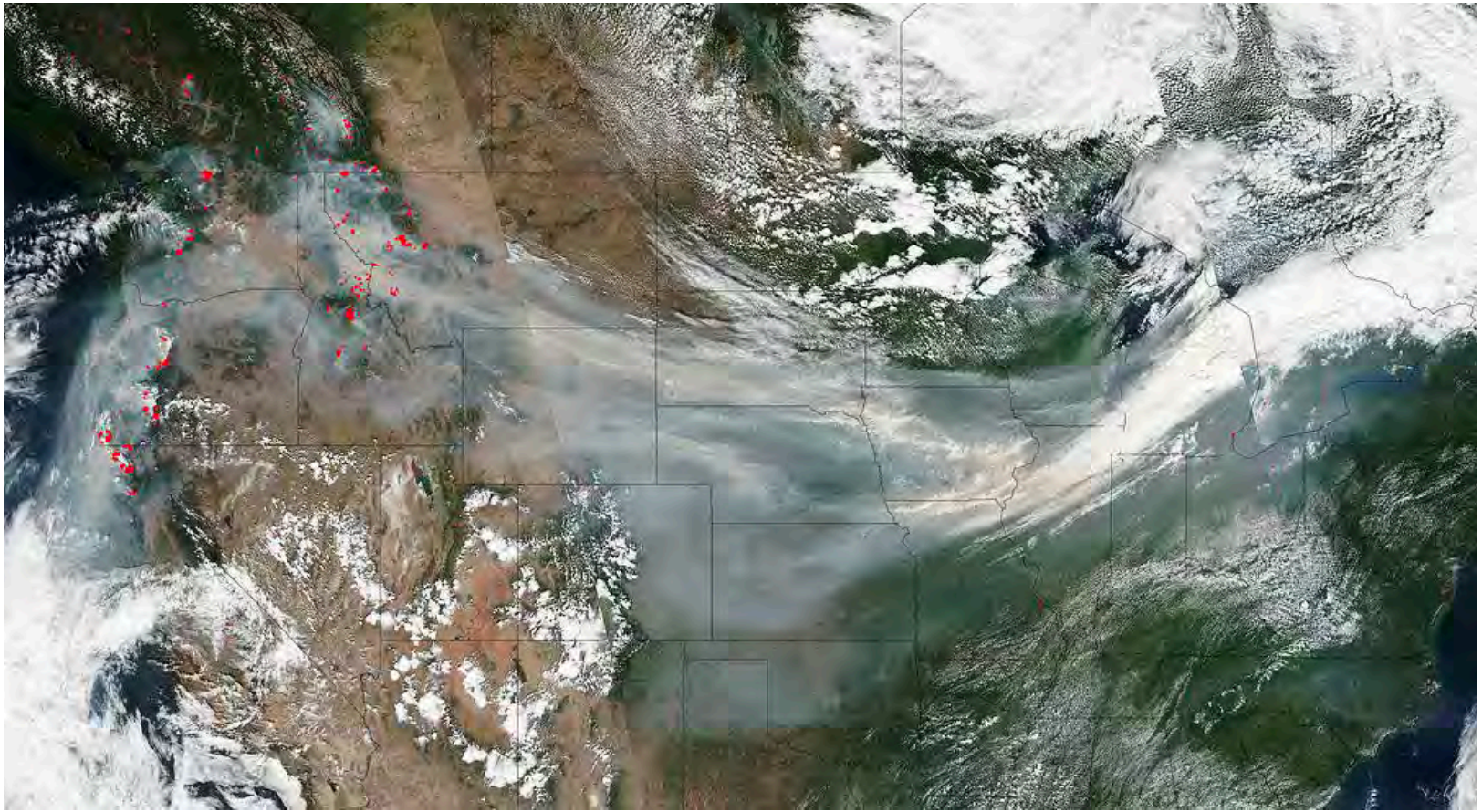
Climate Change Impacts Air Quality: Wildfire Smoke

Wildfire Activity Since 1970



- **Since 1970**
  - Western US wildfire season increased by 78 days
  - Average duration of fires increased five-fold

Westerling AL, Hidalgo HG, Cayan DR, Swetnam TW. Warming and earlier spring increase western U.S. forest wildfire activity *Science*. 2006 Aug 18;



NASA image courtesy Jeff Schmaltz LANCE/EOSDIS MODIS Rapid Response Team, GSFC

Mental and Behavioral Health

- Increased frequency and severity of extreme weather events
- Stress, depression, anxiety, PTSD, and suicidal thoughts
- Vulnerable populations: Children, older adults, pregnant and postpartum women, people with mental illnesses, the poor, homeless people, first responders, and people who rely on the environment for their livelihood

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Local

Kansas farmer on alarming suicide rate: 'Nothing gets farmers more down than a drought'

By: Emily Younger

Posted: May 21, 2018 09:34 PM CDT
Updated: May 21, 2018 11:34 PM CDT

news.com.au

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nsw act

Farmer's recovery from depression which led to two suicide attempts shows cost of drought at family level

STEVE Germon left a suicide note on the porch and set about putting down calves he couldn't feed before turning the gun on himself. Then a ute screamed towards him, his 17-year-old daughter at the wheel.

JACK MORPHET

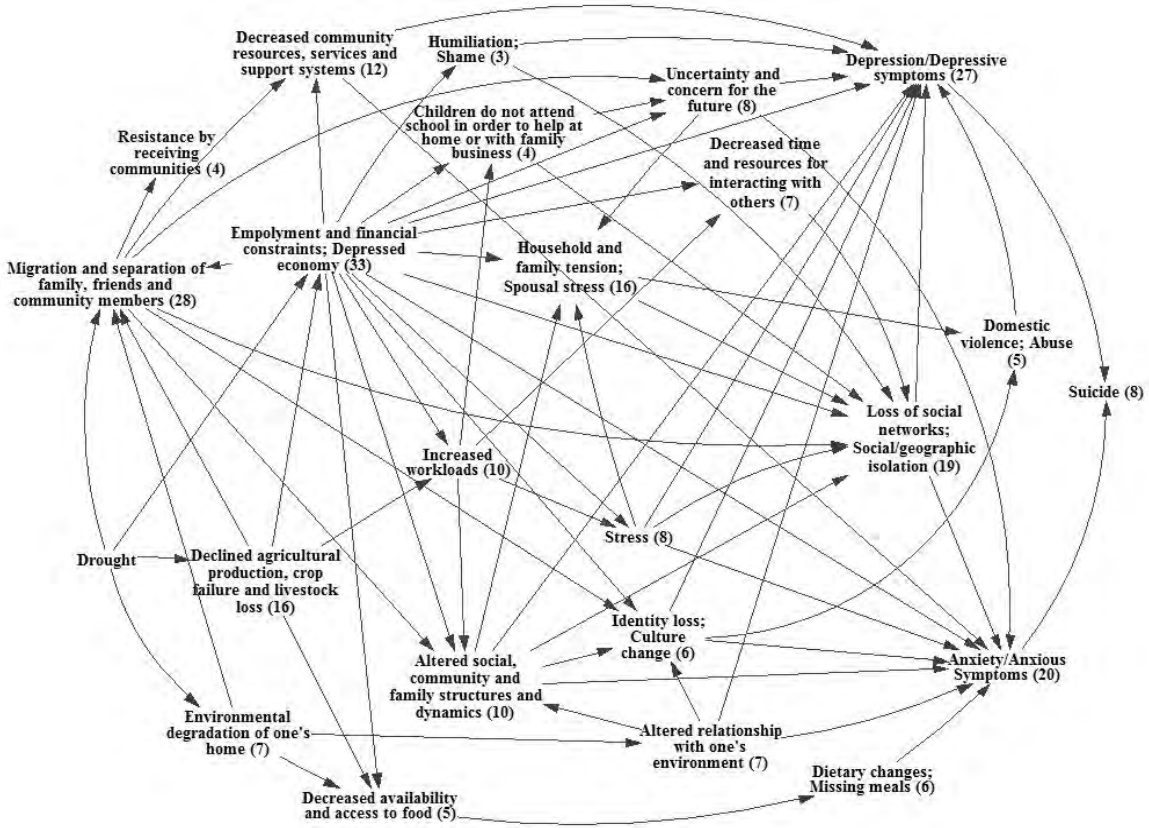
The Sunday Telegraph JULY 1, 2018 1:00AM

NSW stricken by severe drought

DAIRY farmer Steve Germon knows what it's like to be on the brink of suicide. He has been there twice in the past three years.

…at saved him in 2015, but those lonely moments last year

Causal Process Diagram



Vins, H., Bell, J., Saha, S., & Hess, J. J. (2015). The mental health outcomes of drought: a systematic review and causal process diagram. *International journal of environmental research and public health*, *12*(10), 13251-13275.

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journal homepage: www.elsevier.com/locate/scitotenv

The association between drought conditions and increased occupational psychosocial stress among U.S. farmers: An occupational cohort study

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[b] Environmental, Agricultural, and Occupational Health, College of Public Health at the University of Nebraska Medical Center, 984388 Nebraska Medical Center, Omaha, NE 68198, USA
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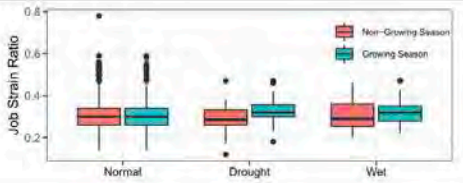
HIGHLIGHTS

- Drought risk for farmer occupational psychosocial stress is unknown.
- Farmers are a vulnerable population to extreme weather events.
- A linear mixed effects longitudinal model evaluated farmer job strain.
- Growing season drought increased farmers occupational psychosocial stress.
- Drought planning should consider occupational psychosocial stress effects.

GRAPHICAL ABSTRACT



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Climate

ABSTRACT

Background: Drought represents a globally relevant natural disaster linked to adverse health. Evidence has shown agricultural communities to be particularly susceptible to drought, but there is a limited understanding of how drought may impact occupational stress in farmers.
Methods: We used repeated measures data collected in the *Musculoskeletal Symptoms among Agricultural Workers* Cohort study, including 498 Midwestern U.S. farmers surveyed with a Job Content Questionnaire (JCQ) at six-month intervals in 312 counties from 2012 through 2015. A longitudinal linear mixed effects model was used to estimate the change in job strain ratio, a continuous metric of occupational psychosocial stress, during drought conditions measured with a 12-month standardized precipitation index. We further evaluated associations between drought and psychological job demand and job decision latitude, the job strain components, and applied a stratified analysis to evaluate differences by participant sex, age, and geography.
Results: During the growing season, the job strain ratio increased by 0.031 (95% CI: 0.012, 0.05) during drought conditions, an amount equivalent to a one-half standard deviation change (Cohen's D = 0.5), compared to non-drought conditions. The association between drought and the job strain ratio was driven mostly by increases in the psychological job demand (2.09; 95% CI: 0.94, 3.24). No risk differences were observed by sex, age group, or geographic region.
Conclusions: Our results suggest a previously unidentified association between drought and increased occupational psychosocial stress among farmers. With North American climate anticipated to become hotter and drier, these findings could provide important health effects data for federal drought early warning systems and mitigation plans.

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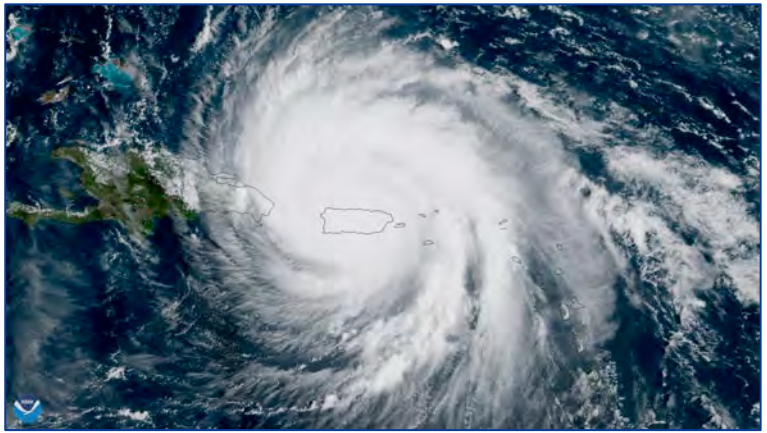
E-mail address: berma186@umn.edu (J.D. Berman).

https://doi.org/10.1016/j.scitotenv.2021.149245
0048-9697/

Drought Causes Stress in Farmers

The effect estimate for drought was 4x greater magnitude than people reporting pain in multiple body parts.

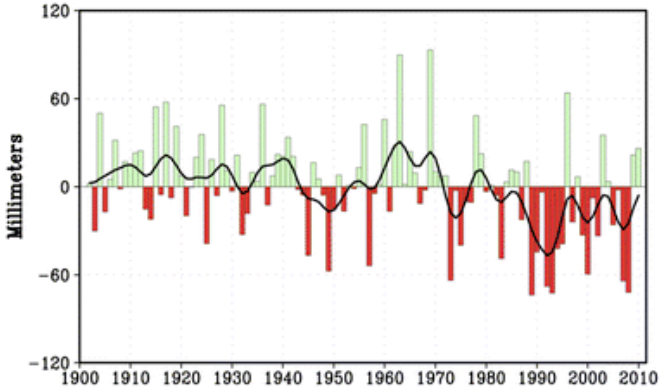
Displacement and Conflict

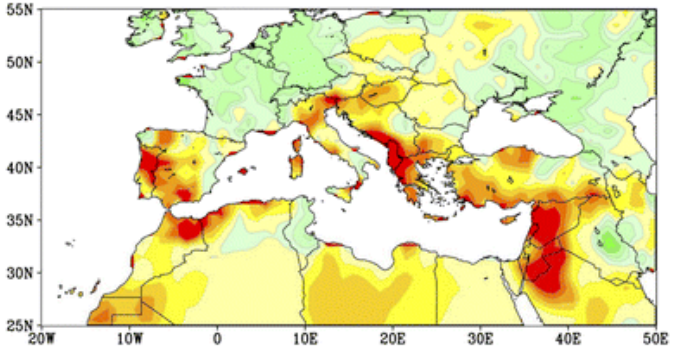


- Increased frequency and severity of extreme weather events
- Stress, depression, anxiety, PTSD, and suicidal thoughts
- Vulnerable populations: Children, older adults, pregnant and postpartum women, people with mental illnesses, the poor, homeless people, first responders, and people who rely on the environment for their livelihood

Syrian Conflict

- **Estimated that over 400,000 people killed (UN)**
- **Over 5.5 million refugees (UNHCR)**





Gleick 2014

Climate Change is Local

Why Should Healthcare and Public Health Care?

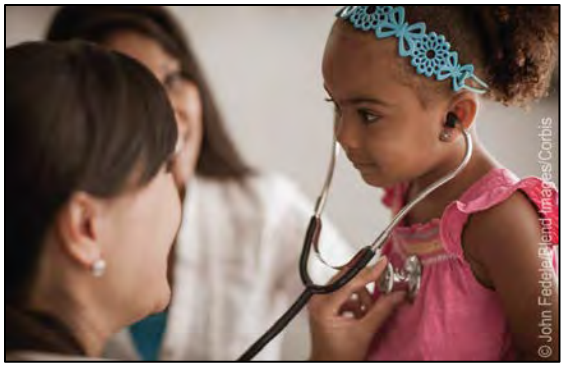
“Do no harm”

- Hospitals can lead America’s effort to transform the energy system
  - Transitioning to renewable energy can improve the health of our communities
- Health and health-related sectors should invest in preparedness for climate change
  - Protect vulnerable communities
- Educating and training the next generation of health professionals
  - Invest in continuing education

Prepare Public Health Agencies

Closing thoughts

- Climate Change is a Significant Health Threat
- All people are vulnerable… some more at risk than others
- Costs are Increasing
- Multiple relationships between climate and health
- Lots to be gained by combining expertise
- Multiple opportunities to address this issue



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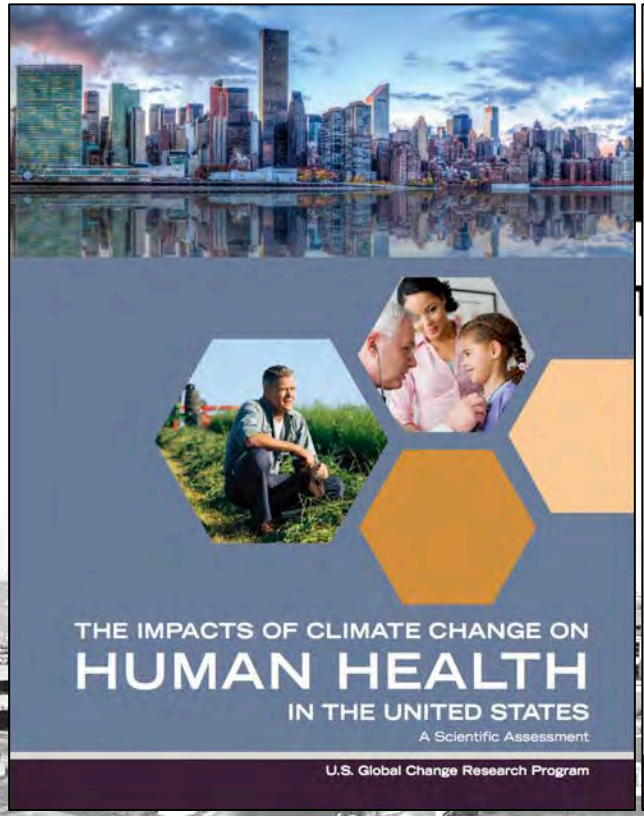

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Disclosure Information

No disclosure