

Intersection Between Drought and Human Health

Jesse E. Bell, PhD

**Claire M. Hubbard Professor of Health and Environment
Faculty Fellow, Daugherty Water for Food Global Institute
Department of Environmental, Agricultural, and Occupational Health
College of Public Health
University of Nebraska Medical Center**

**What words come
to mind when you
think of drought?**



**How many of those
words can connect
to health?**





“Floods kill people, but droughts destroy civilizations.”

~U.S. Government Official at a Drought Meeting

Drought has shaped our society



Dust Bowl of the 1930s



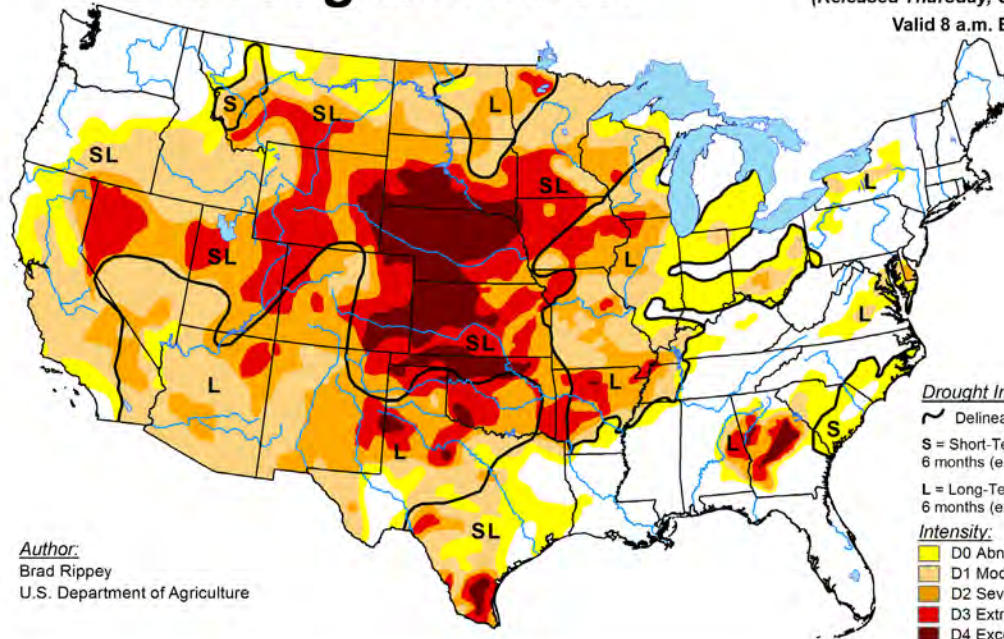
2012 Drought

U.S. Drought Monitor

October 23, 2012

(Released Thursday, Oct. 25, 2012)

Valid 8 a.m. EDT



Author:
Brad Rippey
U.S. Department of Agriculture

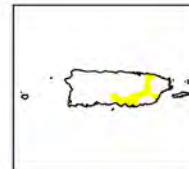
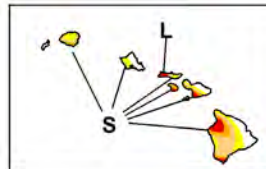
Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- Yellow: D0 Abnormally Dry
- Light Orange: D1 Moderate Drought
- Orange: D2 Severe Drought
- Red: D3 Extreme Drought
- Dark Red: D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



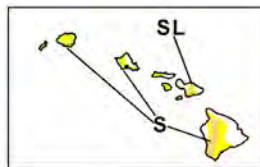
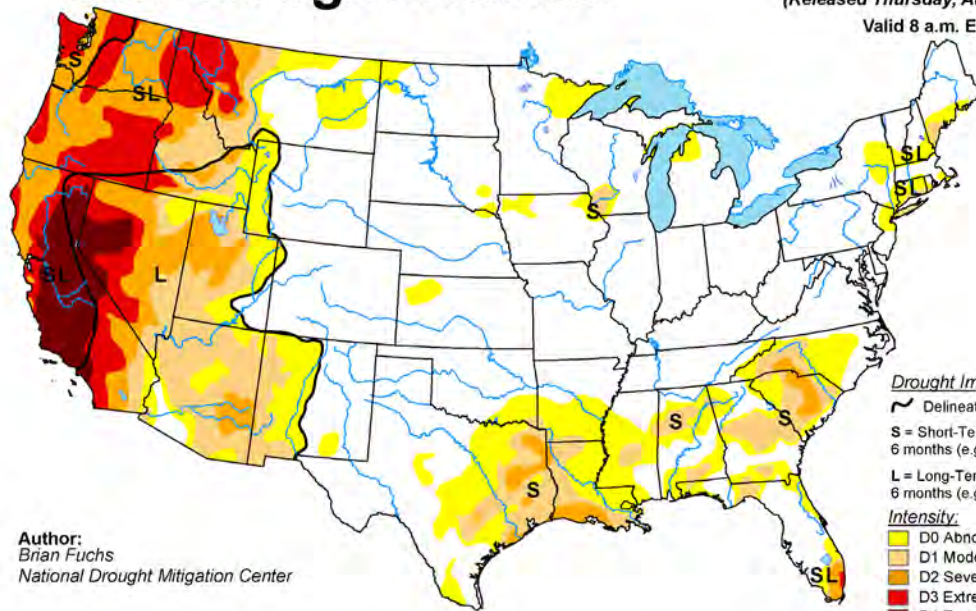
<http://droughtmonitor.unl.edu/>



2011-2017 California Drought

U.S. Drought Monitor

August 11, 2015
(Released Thursday, Aug. 13, 2015)
Valid 8 a.m. EDT



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

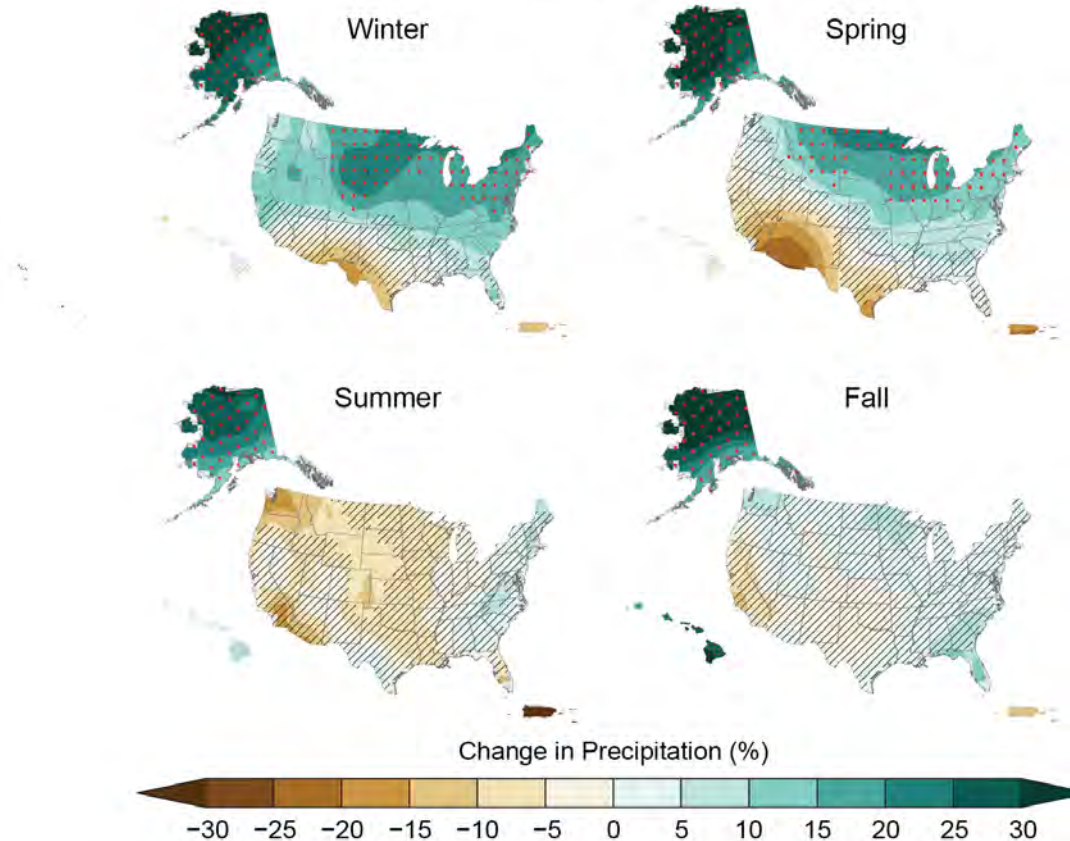


<http://droughtmonitor.unl.edu/>



Droughts are changing

Late 21st Century, Higher Scenario (RCP8.5)



Connecting Drought to Health



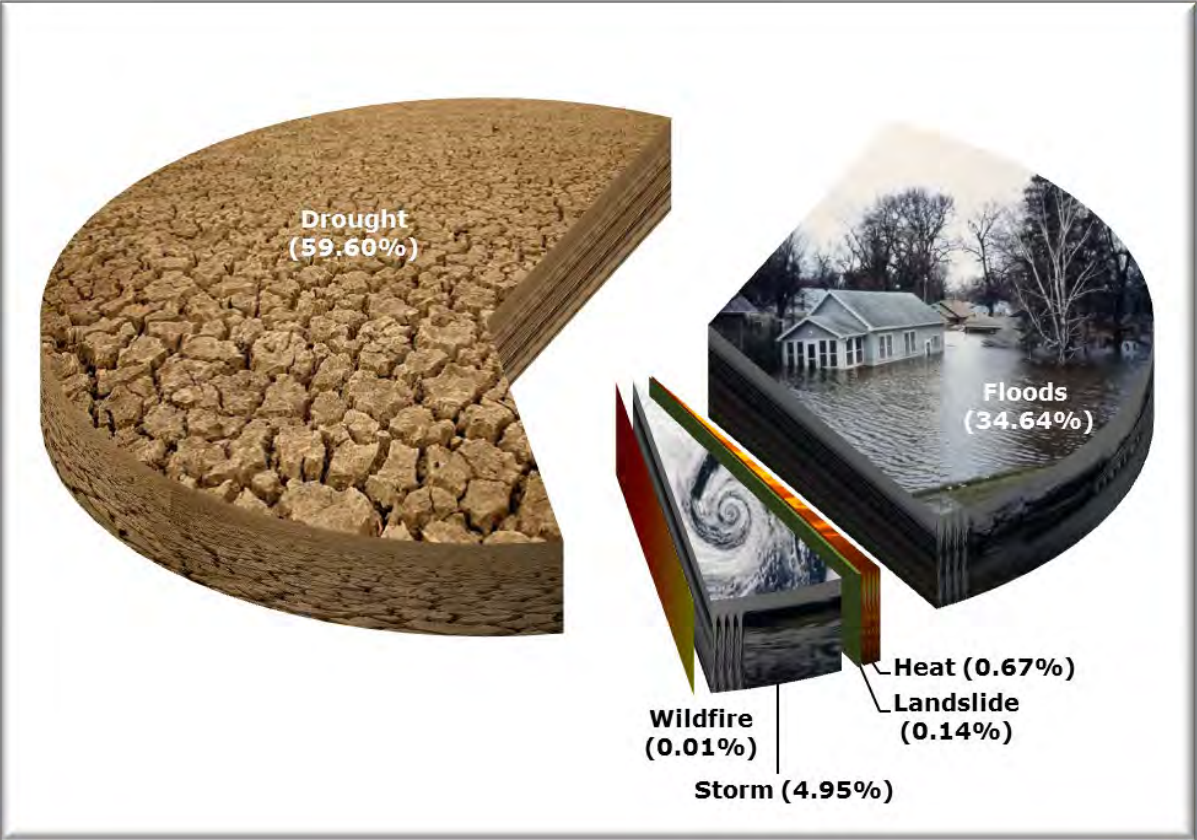
The difference between the fields on either side of dairy farmer Tom Barcellos is water. (Tomas Ovalle / For The Times)



© John Fedele/Blend Images/Corbis



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

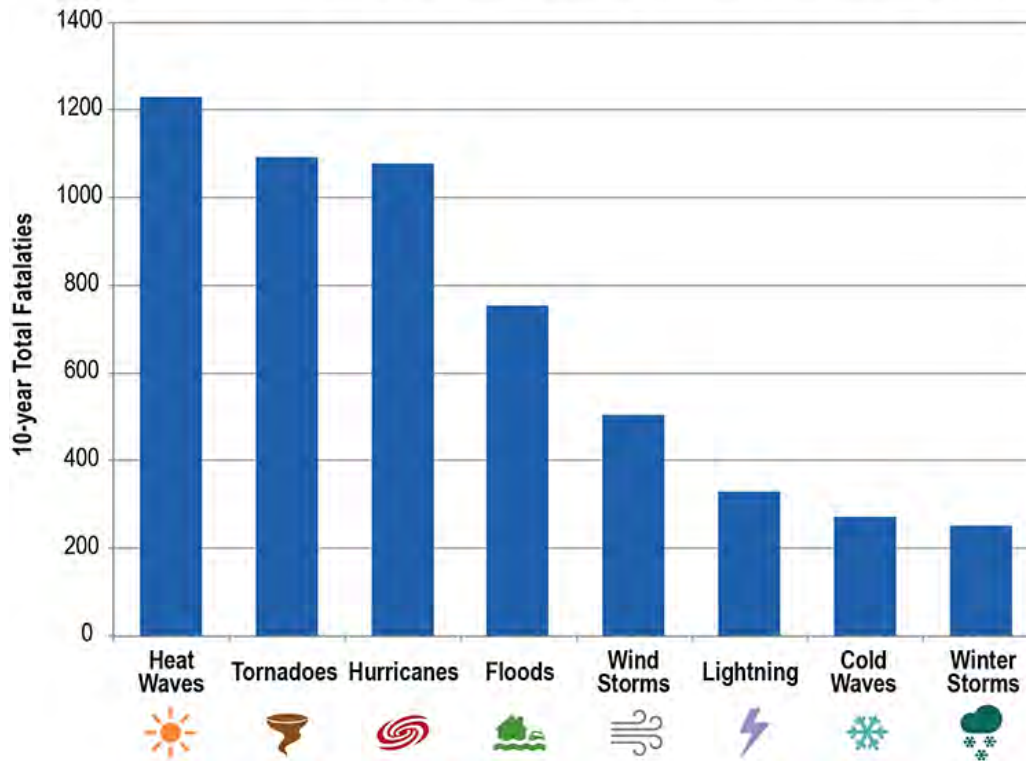


Source: Adapted from EM-DAT: The OFDA/CRED International Database, Belgium 2012
Keim, ME Extreme Weather Events: the role of public health



Drought Impacts

Estimated Deaths and Billion Dollar Losses
from Extreme Events in the U.S., 2004–2013



Billion Dollar Losses
from Disasters
(2004-2013)



\$392 Billion
Hurricanes



\$78 Billion
Heat Waves/Droughts



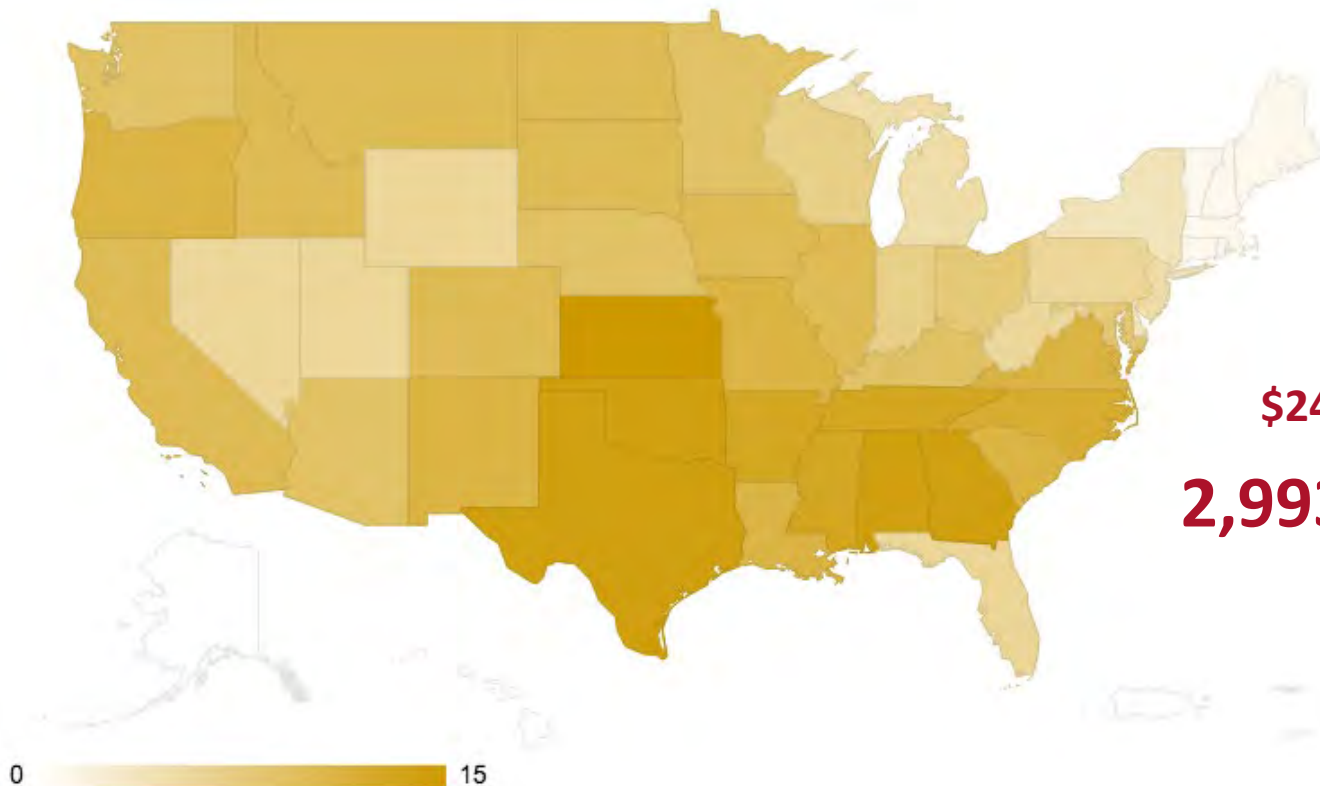
\$46 Billion
Tornadoes/Severe Storms



\$30 Billion
Flooding/Severe Storms



1980-2018* NOAA Billion-Dollar Drought Disasters (CPI-Adjusted)

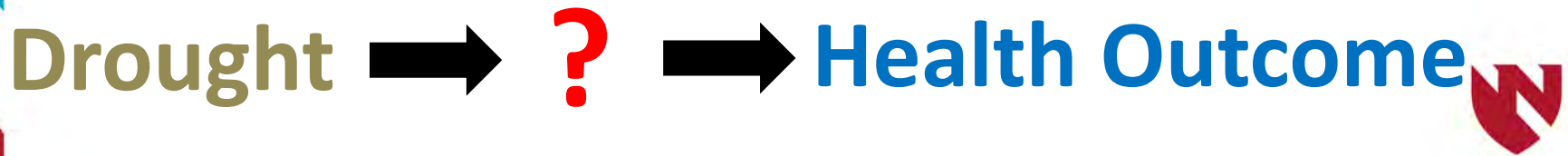


25 Events
\$241 Billion Lost
2,993 Deaths

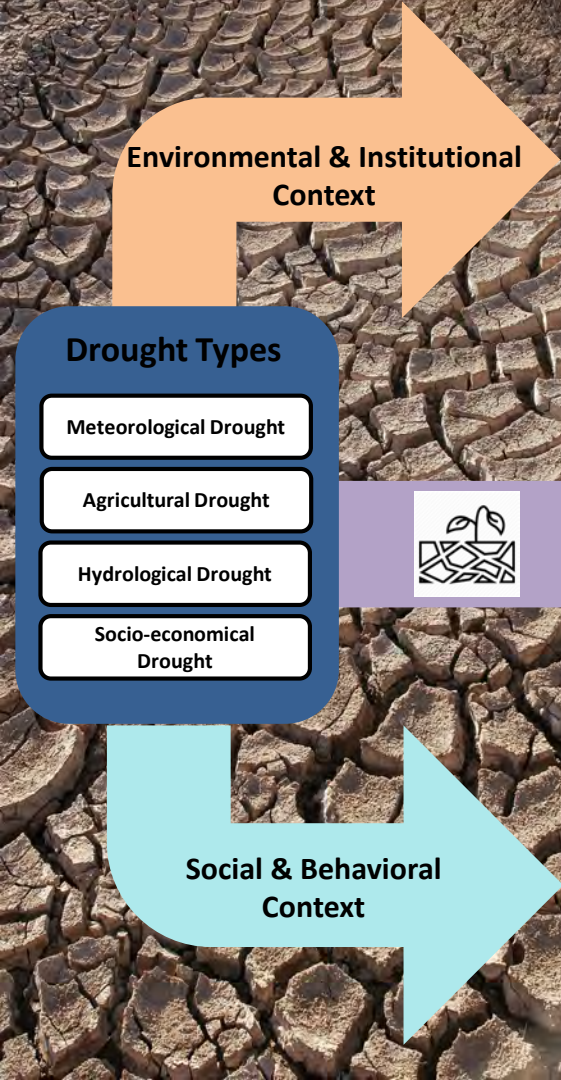


Health Surveillance Data

- ✓ Drought can be a slow evolving
- ✓ The impacts are not immediate
- ✓ Can require intermediate steps for health outcomes
- ✓ Surveillance is not designed to connect drought and health







Environmental & Institutional Context

Drought Types

Meteorological Drought

Agricultural Drought

Hydrological Drought

Socio-economical Drought



Social & Behavioral Context

Water Supply

Local Environmental Conditions

Preparedness of Health Departments

Agricultural Management Practices

Power, Transportation, Communication and Healthcare Infrastructure

Exposure Pathways

Increase in Dust and dust Storms

More Frequent Wildfires

Decrease in Water Quality and Quantity

More Frequent and More Intense Heat Waves

Change in Vector Habitat and Range

Loss of Agriculture and Food Security

Health Outcomes

Respiratory Issues

Allergy-related Illnesses

Injuries

Infectious Disease

Hunger/Famine

Heat Illnesses

Gastrointestinal Illnesses

Mental Health Consequences

Social Determinants of Health

Occupation

Rural/Urban

Race/Literacy/Age

Dependence on Caregivers and Medication

Determinants of Vulnerability

EXPOSURE

Exposure is contact between a person and one or more biological, psychosocial, chemical, or physical stressor, including stressors affected by drought and climate variability.

SENSITIVITY

Sensitivity is the degree to which people or communities are affected, either adversely or beneficially, by drought and climate variability.

ADAPTIVE CAPACITY

Adaptive capacity is the ability of communities, institutions, or people to adjust to potential hazards, to take advantage of opportunities, or to respond to consequences.

VULNERABILITY of Human Health to Drought

HEALTH IMPACTS

Injury, acute and chronic illness (including mental health and stress-related illness), and death



Threat Multiplier



Compromised Quantity and Quality of Water

Surface Water



Courtesy of USGS

Groundwater



Courtesy of USDA



Secondary/Related Events

- Extreme heat
- Wildfires
- Dust storms/haboobs
- Rain/storm effects



Courtesy of USGS



Courtesy of FCC

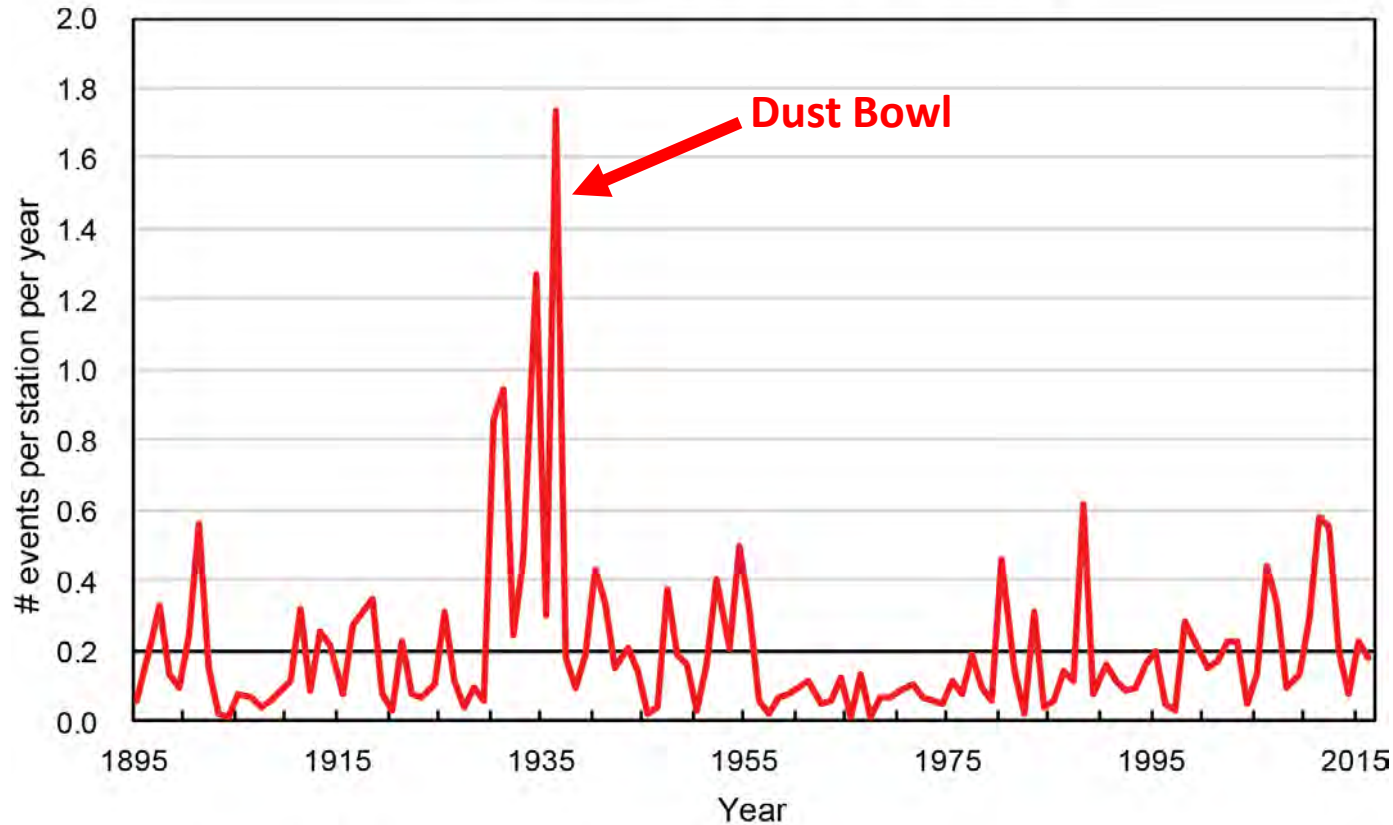


Courtesy of NOAA



Extreme Heat and Drought

Heat Wave Index: 4-day, 1-in-5yr



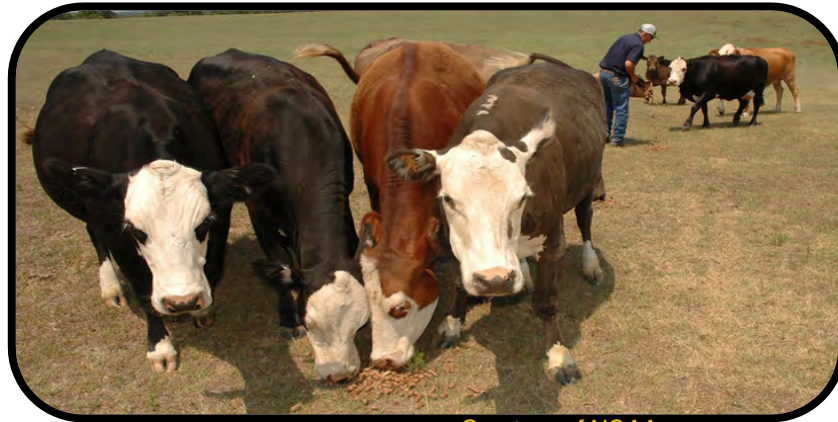
Compromised Food and Nutrition



Courtesy of USDA



Courtesy of USGS



Courtesy of NOAA



Increased Disease Incidence

- **Infectious disease**
- **Chronic disease**
- **Vectorborne and zoonotic disease**



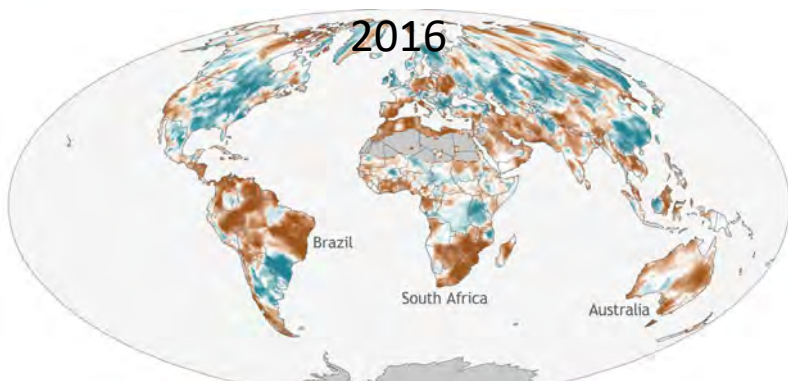
Courtesy of USGS



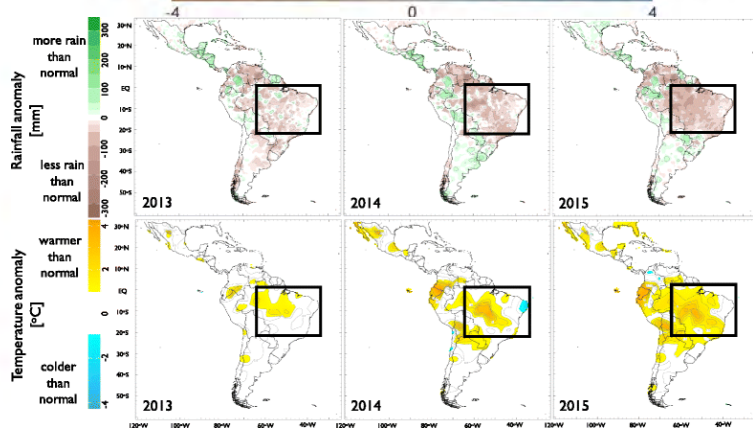
Courtesy of NSF



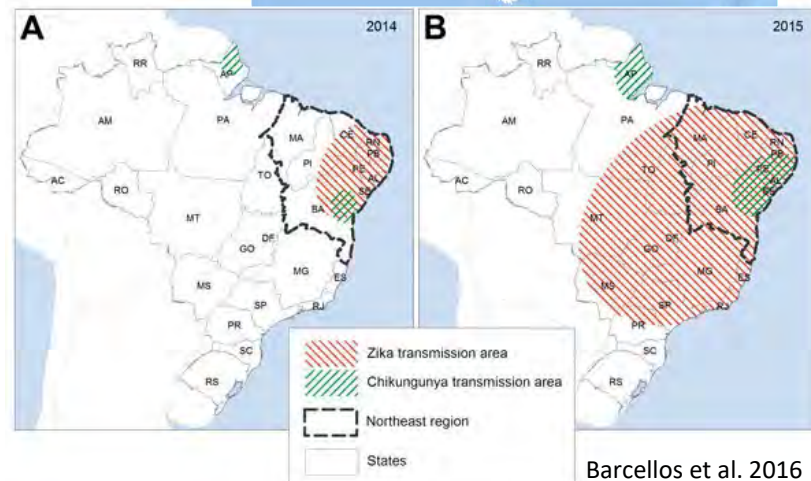
Zika Virus



NOAA
extreme drought Palmer Drought Severity Index extreme moisture



Munoz et al. 2016



Barcellos et al. 2016

Vector-borne Diseases

The Washington Times

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Deer ticks disappearing amid ongoing drought in Northeast



FILE - This March 2002 file photo shows a deer tick under a microscope in the entomology lab at the University of Rhode Island in South Kingstown, R.I. Some scientists are suggesting the 2016 drought that is gripping the Northeast ... [more >](#)

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

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Additional Health Risks

- Sanitation and hygiene
- Recreational risks
- Mental and behavioral health



Courtesy of CDC



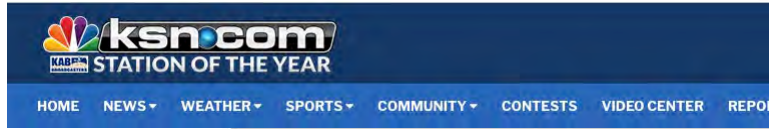
Courtesy of USACE



Courtesy of House Committee on Agriculture



Complex Pathways: Mental Health

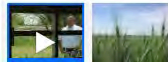


Local

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



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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

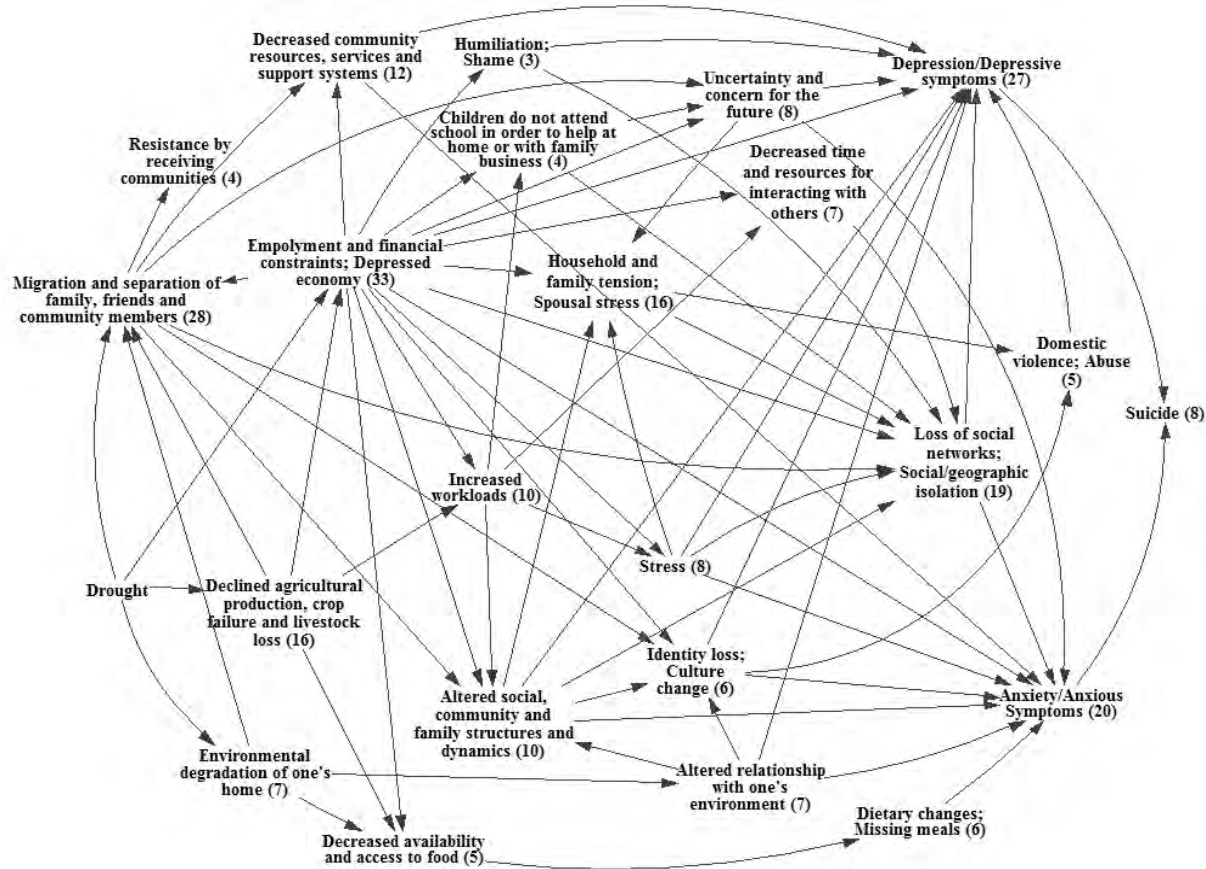


NSW stricken by severe drought

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.

... that saved him in 2015, but those lonely moments last year

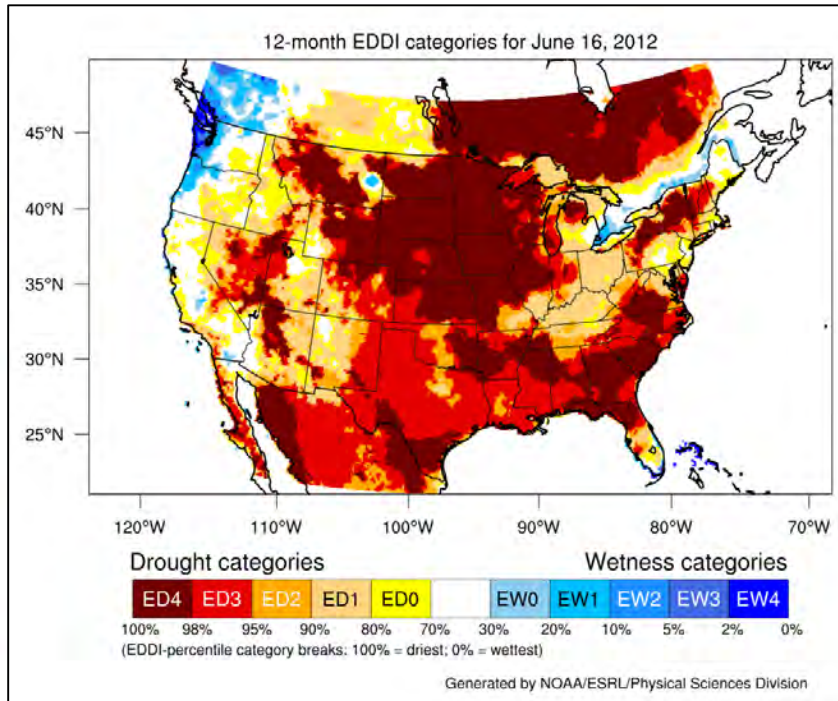
Causal Process Diagram



Drought and Mortality

County-level Mortality

1980-2014



Nebraska Study on Drought and Mortality: *Significant Positive Relationships*

Age	Race	Gender	Mean	Mean IRR	95% HPD Interval	
45-54	white	Male	0.00678	1.0068	0.00243	0.0106
45-54	White	Female	0.0109	1.0109	0.00604	0.0153
55-64	White	Male	0.00582	1.0058	0.00317	0.00872

Incidence Rate Ratio (IRR):

IRR less than 1 suggests decreasing mortality rates with increasing drought severity and larger than 1 suggests increasing mortality rates with increasing drought severity



What Connections Do You See?



Engagement



DROUGHT AND PUBLIC HEALTH IN THE U.S.

Why drought matters

When drought affects a community, its devastating consequences can include decreased quality and quality, and increased risk to complex, and costly.



CDC A-Z INDEX ▾

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WHEN EVERY DROP COUNTS

Protecting Public Health During Drought Conditions
A GUIDE FOR PUBLIC HEALTH PROFESSIONALS

Protect health

plants, animals, and the environment that drought can do:

- Intensify wildfires and dust storms, thus increasing the number of particulates in the air. This can worsen asthma and other heart and lung diseases.

PREPARING FOR THE HEALTH EFFECTS OF DROUGHT

A RESOURCE GUIDE FOR PUBLIC HEALTH PROFESSIONALS

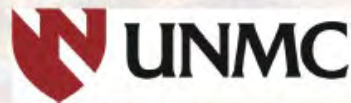
- the at-risk populations living within the affected area, and

NATIONAL DROUGHT & PUBLIC HEALTH SUMMIT

June 17-19, 2019 | Atlanta, GA

Thank you to our Summit Planning Partners:

Centers for Disease Control and Prevention (CDC)
National Integrated Heat Health Information System (NIHHIS)
Environmental Protection Agency (EPA)
Natural Resources Defense Council (NRDC)
UNL National Drought Mitigation Center (NDMC)



COLLEGE
OF PUBLIC HEALTH

Summit

- Over 50 attendees

Topics Discussed

- Environmental Exposure
- Water Quality/Quantity
- Heat
- Air Quality
- Disease
 - Valley fever and West Nile
- Vulnerable Populations
- State, Local, and Tribal Health Departments
- Non-Government Organizations
- International
- Next Steps



Participants

- American Geophysical Union
- Arizona Department of Health Services
- Atlanta Regional Commission
- Carolinas Integrated Sciences and Assessments
- CDC/Division of Environmental Health Science and Practice
- CDC/Mycotic Diseases Branch
- CDC/National Center for Environmental Health
- Centers for Disease Control and Prevention
- Council of State and Territorial Epidemiologists
- Emory University
- Environmental Protection Agency
- Florida State University
- Georgia Department of Public Health/Environmental Health
- Metropolitan North Georgia Water Plant
- National Aeronautics and Space Administration
- National Drought Mitigation Center
- National Integrated Heat Health Information System
- National Resources Defense Council
- NOAA/National Integrated Drought Information System
- Oak Ridge Institute for Science and Education
- Pala Band of Mission Indians
- Pan-American Health Organization
- U.S. Geological Survey
- University Corporation for Atmospheric Research
- University of Arizona
- University of Colorado at Boulder
- University of Houston
- University of Minnesota
- University of Nebraska Medical Center



Outcomes



- **Building Collaboration**
 - Establish local meetings and/or a yearly summit, which will focus on issues of drought, heat, health, and other related issues.
- **Communication and Education**
 - Engage with climate and health communicators, including policymakers, who can assist in disseminating messages about drought to the wider public.
- **Data and Indicators**
 - Assess drought indicators for scale and location, so that they can be adapted for health usage.
- **Coordination and Implementation**
 - Identify interdisciplinary teams, and develop a community of practice that can act as a workgroup to achieve the goals of the implementation strategy.
- **International Synergies**
 - Assess ongoing international activities and connect with international groups/efforts for drought and health. Integrate knowledge from existing efforts into future NIDIS workshops.
- **Research**
 - Explore interdisciplinary mechanisms for collaboration on research questions.
- **Resources and Support**
 - Create funding strategy, with designations for time, personnel, funds, and resources to address next steps.



Engagement Strategies

Public Health Preparedness



Emergency Preparedness



Healthcare Preparedness



Drought and Health Workshop Goals

- Share the current state of knowledge on drought and health
- Identify gaps and needs for evidence-based research, capacity building, and communication
- Engage and develop a drought and health community of practice
- Jointly develop a collaborative, multi-partner NIDIS Drought & Public Health Strategy that builds upon Summit outcomes.



Email: jesse.bell@unmc.edu

Twitter: [@JesseEugeneBell](https://twitter.com/JesseEugeneBell)



Future Needs:



- Still much to be learned about drought and public health
 - What do public health departments need?
 - Who else should be at the table?
- Research is needed in many different areas:
 - Analysis of surveillance data
 - Improved environmental monitoring
 - Role of public health departments
 - Economic impact of drought on public health
 - Lessons learned and best practices



Drought Data on CDC's National Environmental Public Health Tracking Network

