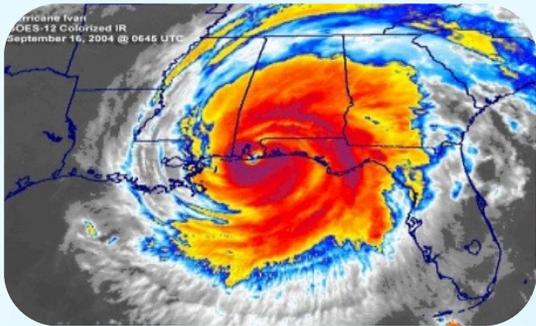


Exploring the morbidity impacts associated with drought conditions in the US



Shubhayu Saha

National Center for Environmental Health
Centers for Disease Control and Prevention

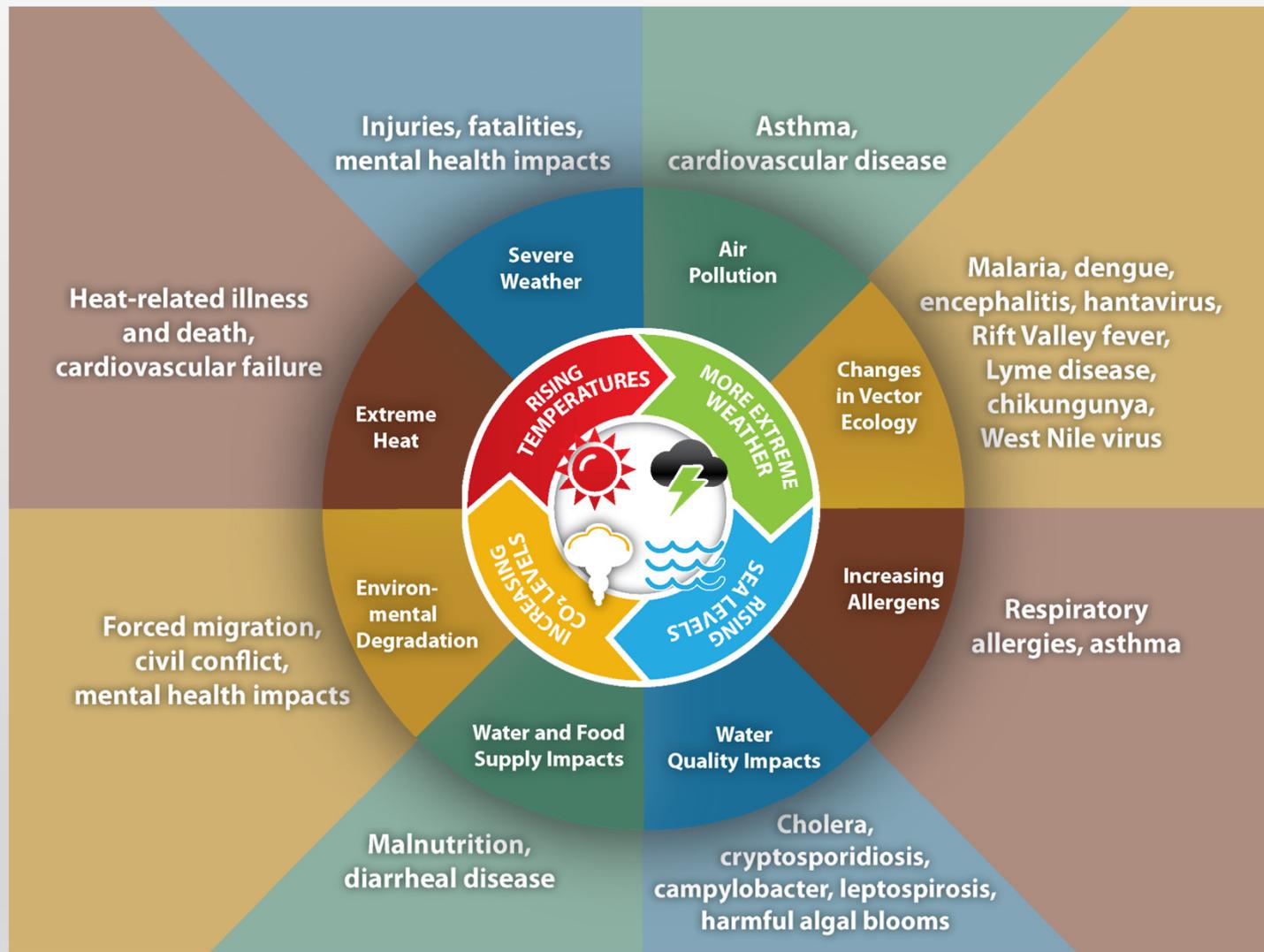
National Center for Environmental Health
Division of Environmental Health Science and Practice



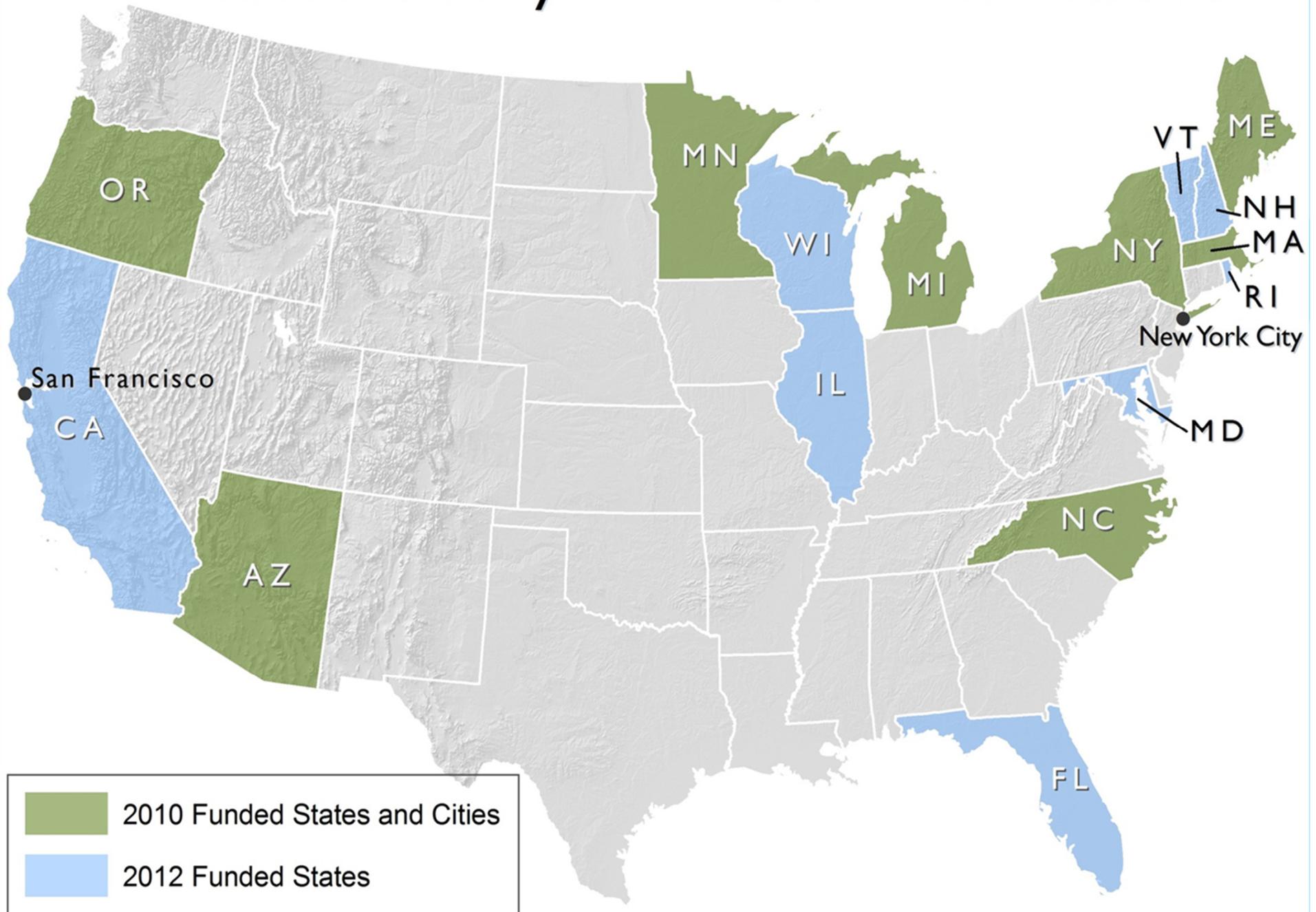
Presentation outline...

- Climate and health program
- Exploring impact of drought on a range of health outcomes

Impact of Climate Change on Human Health



CDC Climate Ready States and Cities Initiative



Building Resilience Against Climate Effects (BRACE)



The screenshot shows the top navigation bar of the GlobalChange.gov website. The header is dark blue with the GlobalChange.gov logo and text on the left, and search and navigation links on the right. Below the header is a dark blue navigation menu with five items: 'Understand Climate Change', 'Assess National Climate Assessment' (highlighted with a green underline), 'Explore USGCRP Highlights', 'Browse Reports & Resources', and 'Engage Connect & Participate'. Below the navigation menu is a white banner with the text 'Fourth National Climate Assessment' and social media sharing icons on the right.

<https://www.globalchange.gov/nca4>



Climate Change Affects the Health of All Americans

Exposure and Resilience Vary Across Populations and Communities

Adaptation Reduces Risks and Improves Health

Reducing Greenhouse Gas Emissions Results in Health and Economic Benefits

Drought – Health chapter, Fourth National Climate Assessment, 2018

FOURTH NATIONAL CLIMATE ASSESSMENT

CHAPTER 14: HUMAN HEALTH

4 ABOUT ▾ CHAPTERS ▾ DOWNLOADS ▾

CH 14: HEALTH 

Box 14.1: Health Impacts of Drought and Periods of Unusually Dry Months

In late 2015, California was in the fourth year of its most severe drought since becoming a state in 1850, with 63 emergency proclamations declared in cities, counties, tribal governments, and special districts.^{10,11} Households in two drought-stricken counties (Tulare and Mariposa) reported a range of drought-related health impacts, including increased dust leading to allergies, asthma, and other respiratory issues and acute stress and diminished peace of mind.¹⁰ These health effects were not evenly distributed, with more negative physical and mental health impacts reported when drought negatively affected household property and finances.

Drier conditions can increase reproduction of a fungus found in soils, potentially leading to the disease coccidioidomycosis, or Valley fever.^{3,12} Coccidioidomycosis can cause persistent flu-like symptoms, with over 40% of cases hospitalized and 75% of patients unable to perform their normal daily activities for weeks, months, or longer. Higher numbers of cases in Arizona and California are associated with periods of drier conditions as measured by lower soil moisture in the previous winter and spring.¹³

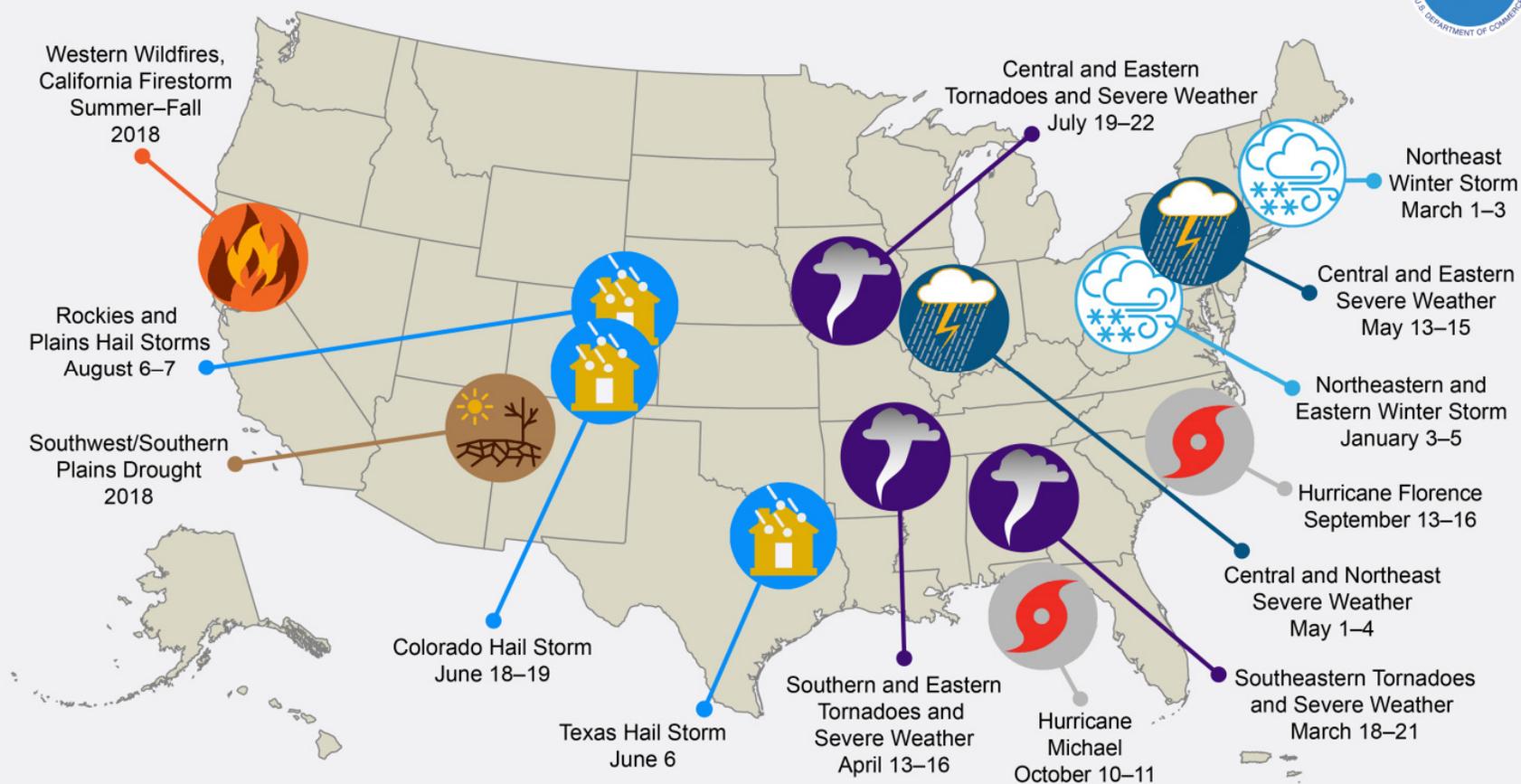
Overall, the impacts of drought on hospital admissions and deaths depend on drought severity and the history of droughts in a region.¹⁴ Complex relationships between drought and its associated economic consequences, particularly the interactions among factors that affect vulnerability, protective factors, and coping mechanisms, can increase mood disorders, domestic violence, and suicide.^{15,16,17}

Temperature Extremes

High temperatures in the summer are conclusively linked to an increased risk of a range of illnesses and death, particularly among older adults, pregnant women, and children.¹⁸ People living in urban areas may experience higher ambient temperatures because of the additional heat associated with urban heat islands, exacerbating heat-related risks.¹⁹ With continued warming, increases in heat-related deaths are projected to outweigh reductions in cold-related deaths in most regions.¹⁸

SECTIONS
Executive Summary
Introduction
KM 1: Health Impacts
KM 2: Vulnerable Populations
KM 3: Adaptation Benefits
KM 4: Mitigation Benefits
Traceable Accounts
References

U.S. 2018 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the 14 separate billion-dollar weather and climate disasters that impacted the United States during 2018.

<https://www.ncdc.noaa.gov/billions/>

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CDC National Environmental Health Tracking portal

  National Environmental Public Health Tracking Network ✕

Select Content Area

- Air Quality
- Asthma
- Biomonitoring: Population Exposures
- Birth Defects
- Cancer
- Carbon Monoxide Poisoning
- Childhood Cancers
- Childhood Lead Poisoning
- Chronic Obstructive Pulmonary Disease (COPD)
- Climate Change
- Community Characteristics
- Community Design
- Developmental Disabilities
- Drinking Water
- Drought
- Heart Disease
- Heat Stress Illness
- Hormone Disorders
- Lifestyle Risk Factors
- Pesticide Exposures
- Populations and Vulnerabilities
- Radon
- Reproductive and Birth Outcomes
- Sunlight and UV
- Toxic Substance Releases

GEOGRAPHY ?

STEP 4: TIME ?

STEP 5: ADVANCED OPTIONS ?

<https://www.cdc.gov/nceh/tracking/default.htm>



CDC National Environmental Health Tracking portal

The screenshot shows the top navigation bar with the Department of Health & Human Services and CDC logos, and the text "National Environmental Public Health Tracking Network". Below this, the interface is divided into four steps: STEP 1: CONTENT, STEP 3: GEOGRAPHY, STEP 4: TIME, and STEP 5: ADVANCED OPTIONS. Each step has a question mark icon. In STEP 1, a dropdown menu is open, showing "Climate Change" selected. A list of indicators is displayed below the dropdown, including "Flood Vulnerability", "Future Projections of Extreme Heat", "Future Projections of Extreme Precipitation", "Heat stress emergency department visits", "Heat stress hospitalizations", "Heat Vulnerability - Adaptive Capacity", "Heat Vulnerability - Exposure", "Heat Vulnerability - Sensitivity", "Heat-Related Mortality", "Historical Extreme Heat Days and Events", "Historical Extreme Precipitation", and "Temperature Distribution".

STEP 1: CONTENT ?

Climate Change ▾

Select Indicator

- Flood Vulnerability
- Future Projections of Extreme Heat
- Future Projections of Extreme Precipitation
- Heat stress emergency department visits
- Heat stress hospitalizations
- Heat Vulnerability - Adaptive Capacity
- Heat Vulnerability - Exposure
- Heat Vulnerability - Sensitivity
- Heat-Related Mortality
- Historical Extreme Heat Days and Events
- Historical Extreme Precipitation
- Temperature Distribution

STEP 3: GEOGRAPHY ?

STEP 4: TIME ?

STEP 5: ADVANCED OPTIONS ?

<https://www.cdc.gov/nceh/tracking/default.htm>

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CDC National Environmental Health Tracking portal

 National Environmental Public Health Tracking Network

STEP 1: CONTENT

Climate Change

Historical Extreme Heat Days and Events

Dates of extreme heat days

STEP 3: GEOGRAPHY

Alabama

- Autauga
- Baldwin
- Barbour
- Bibb
- Blount
- Bullock
- Butler
- Calhoun
- Chambers
- Cherokee
- Chilton

STEP 4: TIME

All Years

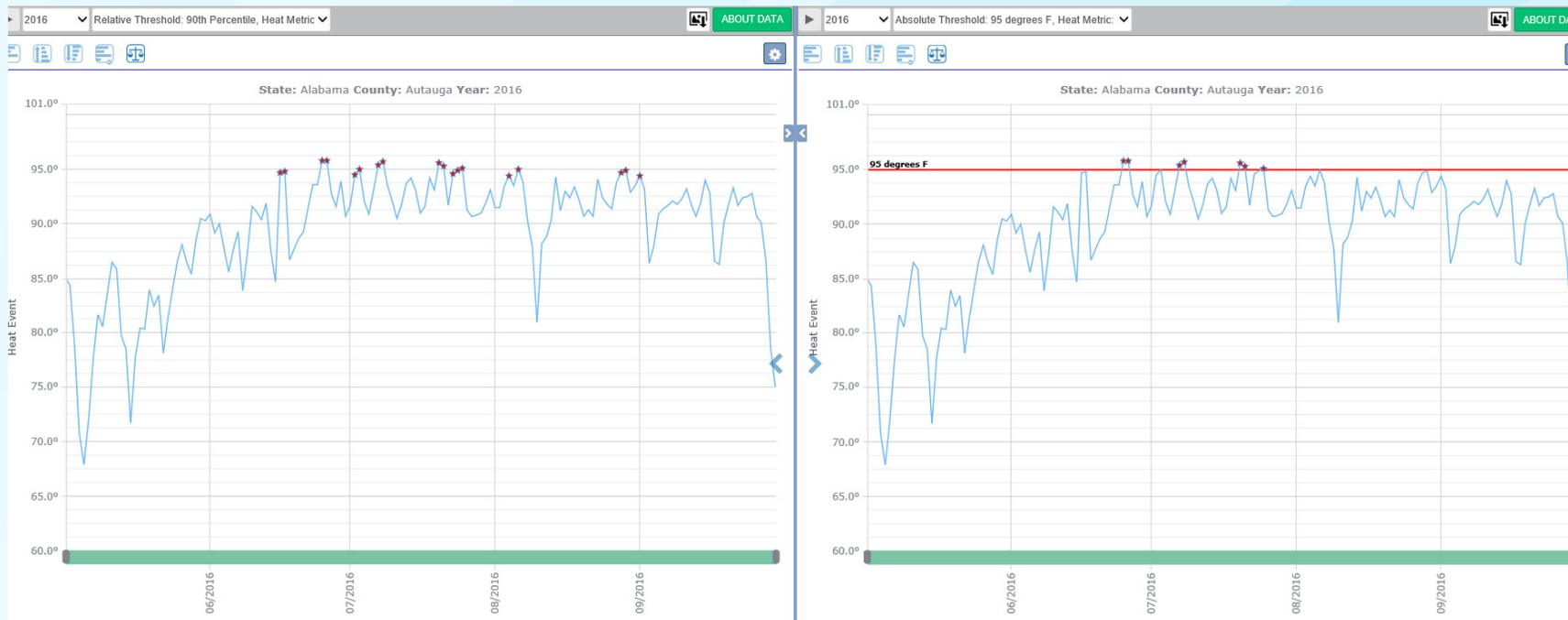
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011
- 2010
- 2009
- 2008
- 2007
- 2006

STEP 5: ADVANCED OPTIONS

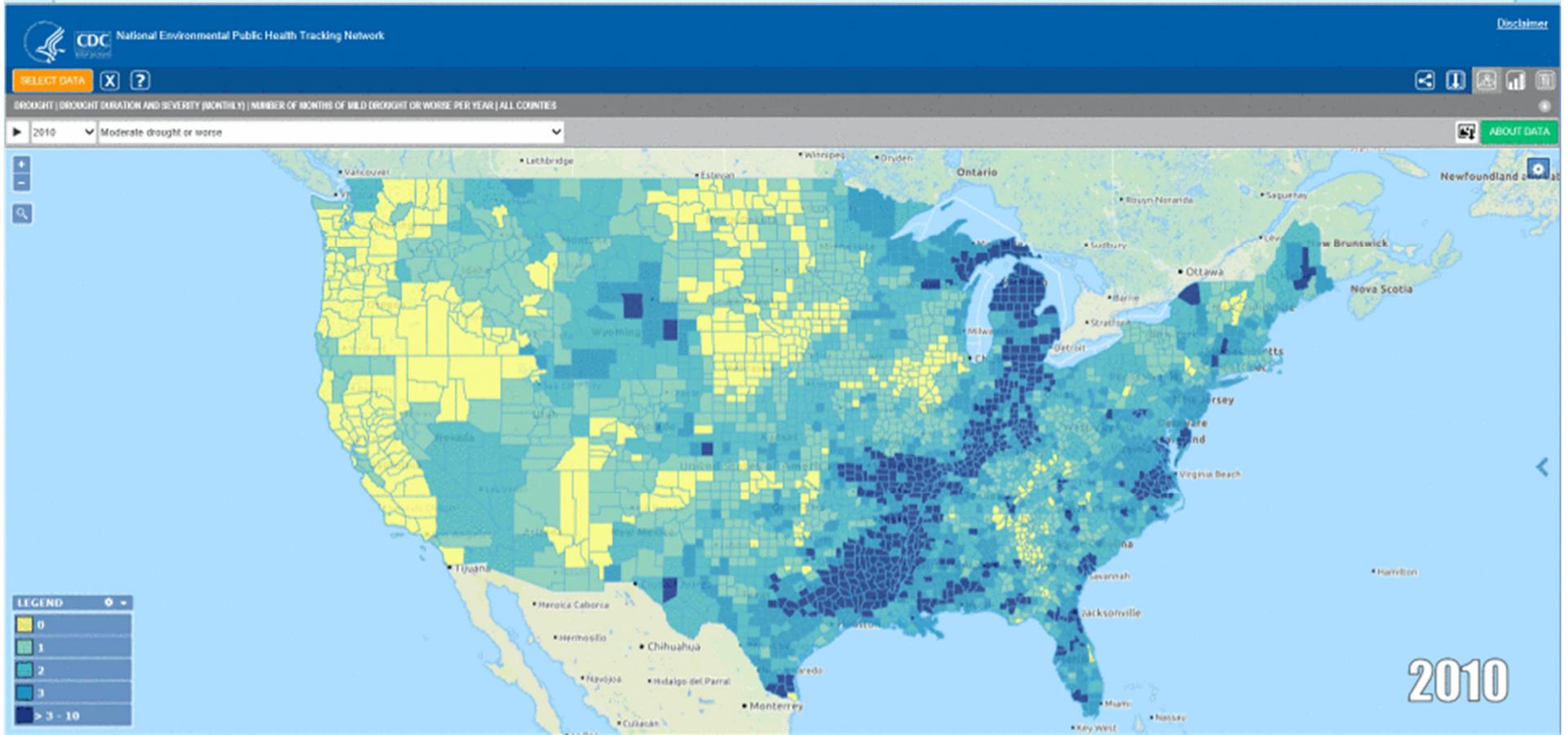
Required

- Heat Metric
 - Heat Metric: Daily Maximum Temperature
 - Heat Metric: Daily Maximum Heat Index
- One Strat Type Only
 - Absolute Threshold
 - Relative Threshold
 - Relative Threshold: 90th Percentile
 - Relative Threshold: 95th Percentile
 - Relative Threshold: 98th Percentile
 - Relative Threshold: 99th Percentile





Spatial and temporal variation of drought in the United States

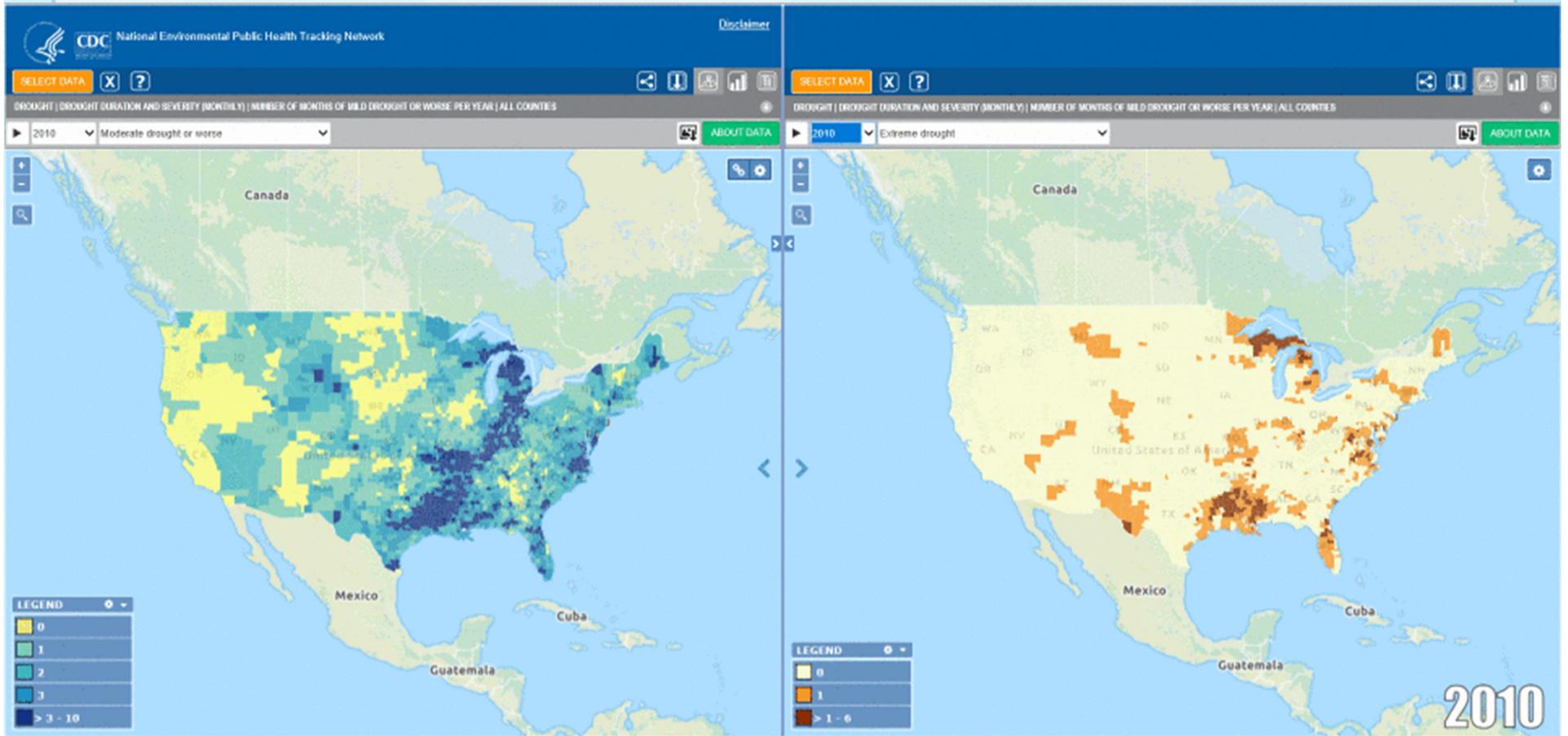


<https://ephtracking.cdc.gov/>

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Which level of drought severity to use?



<https://ephtracking.cdc.gov/>

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Health data source – Healthcare Cost and Utilization Project (HCUP)

State	State Inpatient Databases	State Ambulatory Surgery and Services Databases	State Emergency Department Databases
	Central Distributor*	Central Distributor*	Central Distributor*
Alaska			
Arizona	1990-2018		2005-2018
Arkansas	2004-2017		2013-2017
California	2003-2011	2005-2011	2005-2011
Colorado	1990-2017	1997-2017	
Connecticut			
District of Columbia	2013-2017		
Florida	1990-2017	1997-2017	2005-2017
Georgia	2010-2017†	2010-2017†	2010-2017†
Hawaii	1996-2016		2003-2016
Illinois			
Indiana			
Iowa	1990-2018	2004-2018	2004-2018
Kansas	2010-2017	2010-2017	2010-2017
Kentucky	2000-2017	2000-2017	2008-2017
Louisiana			
Maine	1999-2003, 2006-2017	1999-2003, 2006-2017	1999-2003, 2006-2017
Maryland	1990-2017	1997-2017	1999-2017
Massachusetts	1990-2016		2002-2016
Michigan	1999-2017	2004-2017	
Minnesota	2010-2018	2010-2018	2010-2018
Mississippi	2010-2011 2013-2017		
Missouri			
Montana			

State	State Inpatient Databases	State Ambulatory Surgery and Services Databases	State Emergency Department Databases
	Central Distributor*	Central Distributor*	Central Distributor*
Nebraska	2001-2017	2001-2017	2001-2017
Nevada	2002-2017	2011-2017	2010-2017
New Hampshire			
New Jersey	1990-2017	1997-2017	2004-2017
New Mexico	2007-2017		
New York	1990-2016	1997-2016	2006-2016
North Carolina	2000-2017	2000-2017	2007-2017
North Dakota			
Ohio			
Oklahoma			
Oregon	1993-2018	2010-2018	2015-2018
Pennsylvania			
Rhode Island	2002-2017		2007-2017
South Carolina	1995-2017	2000-2017	2000-2017
South Dakota	2007-2017		
Tennessee			
Texas			
Utah	1997-2017	1997-2017	2000-2017
Vermont	2001-2016	2001-2016	2002-2016
Virginia			
Washington	1990-2017		
West Virginia	2000-2017		
Wisconsin	1990-2017	1998-2017	2004-2017
Wyoming			

Health data source – Healthcare Cost and Utilization Project (HCUP)

U.S. Department of Health & Human Services

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Search Term



HCUPnet
Healthcare Cost and Utilization Project

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- Minnesota
- Missouri
- Nebraska
- Nevada

Select All Select None

Setting of Care

SELECT DIAGNOSIS/PROCEDURE

Diagnosis/Procedure

TOOLS

Submit Request

reactions to stress, 308.4 Mixed disorders as reaction to stress, 308.9 Unspecified acute reaction to stress, 309.0 Adjustment disorder with depressed mood, 309.1 Prolonged depressive reaction, 309.21 Separation anxiety disorder, 309.24 Adjustment disorder with anxiety, 309.28 Adjustment disorder with mixed anxiety and depressed mood, 309.81 Posttraumatic stress disorder, 311 Depressive disorder, not elsewhere classified, 313.0 Overanxious disorder specific to childhood and adolescence, 292.84 Drug Depressive Syndrome (after Oct 1, 2004), 293.84 Organic Anxiety Syndrome (after Oct 1, 2004), 296.50 Bipolar Aff, Depr-Unspec (after Oct 1, 2004), 296.51 Bipolar Affec, Depr-Mild (after Oct 1, 2004), 296.52 Bipolar Affec, Depr-Mod (after Oct 1, 2004), 296.53 Bipol Aff, Depr-Severe (after Oct 1, 2004), 296.54 Bipol Depr-Sev W Psych (after Oct 1, 2004), 296.55 Bipol Aff Depr-Part Rem (after Oct 1, 2004), 296.56 Bipol Aff Depr-Full Rem (after Oct 1, 2004), 296.80 Manic-Depressive Nos (after Oct 1, 2004), 300.01 Panic Disorder (after Oct 1, 2004), 300.4 Neurotic Depression (after Oct 1, 2004), 309.0 Brief Depressive React (after Oct 1, 2004), 309.24 Adj React-Anxious Mood (after Oct 1, 2004), 296.5 Bipolar Affect, Depress, 296.8 Manic-Depressive Nec/Nos, 300.0 Anxiety States, 305.8 Antidepressant Abuse, 308 Acute Reaction To Stress - Total number of discharges: N

	Year																	
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Arizona	3,934	4,022	4,960	6,101	7,076	6,707	6,706	7,229	7,116	6,691	5,761	6,202	6,128	6,414	6,096	5,341	4,820	4,814
California	39,663	39,636	40,744	43,253	46,166	49,711	46,915	45,783	46,372	43,929	46,281	48,272	48,540	47,907	45,774	45,527	43,993	43,572
Minnesota					13,431	14,466	14,593	15,528	15,964	16,107	16,200	17,311	18,177	19,436	18,790	19,047	19,008	19,314
Nebraska					3,985	4,027	4,395	3,778	3,810	4,335	4,257	4,800	5,150	6,027	6,204	6,041	6,548	6,611
Nevada						1,188	907	795	1,018	999	893	840	1,023	985	1,145	1,443	1,561	1,880

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HCUP variables

Age

Gender

Clinical codes for healthcare visits

Health insurance status

Race

County or zipcode of patient residence

Month of healthcare visit

Urban-rural designation of residence county

Cost associated with healthcare visit

Causal pathway linking drought to mental health

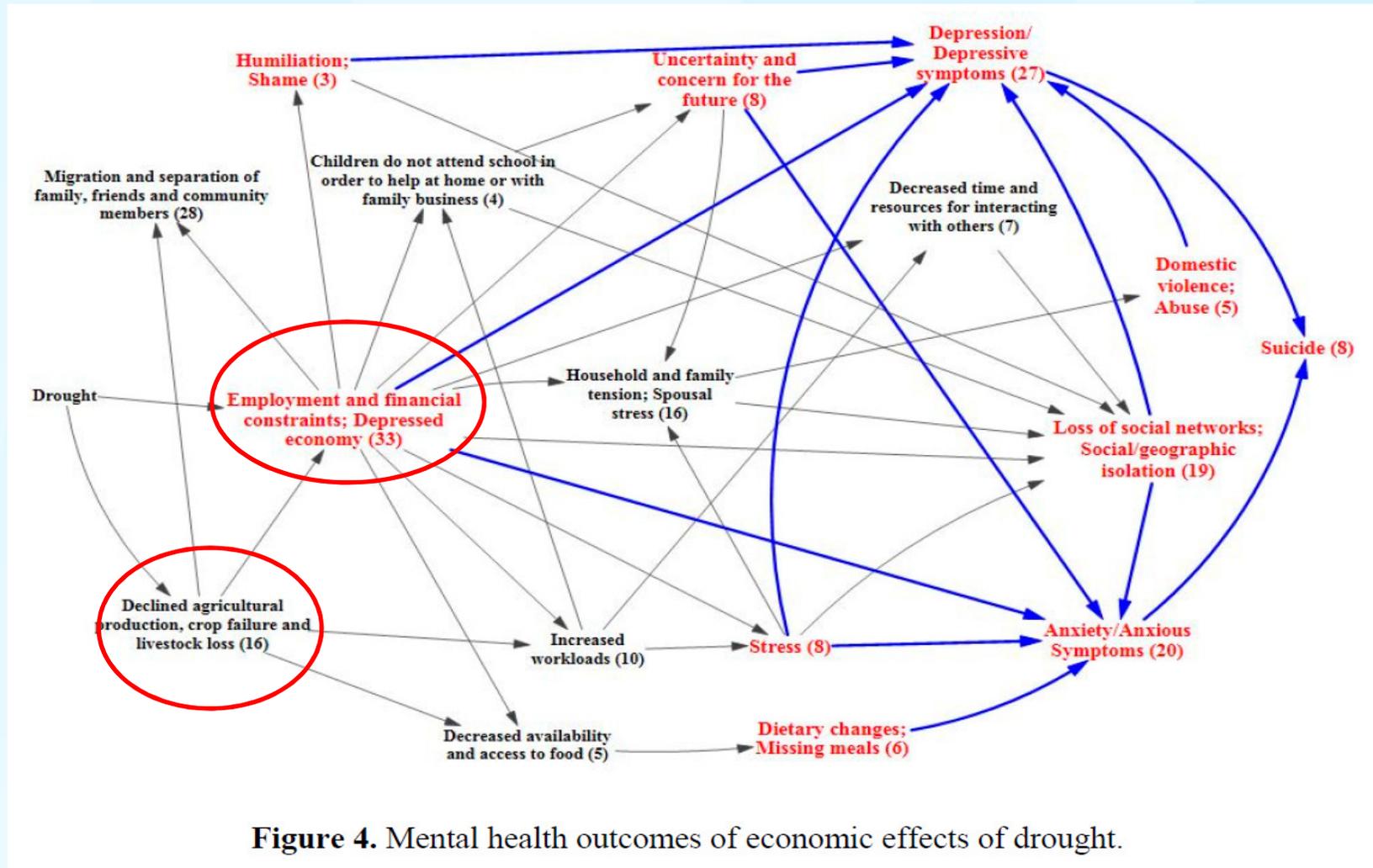
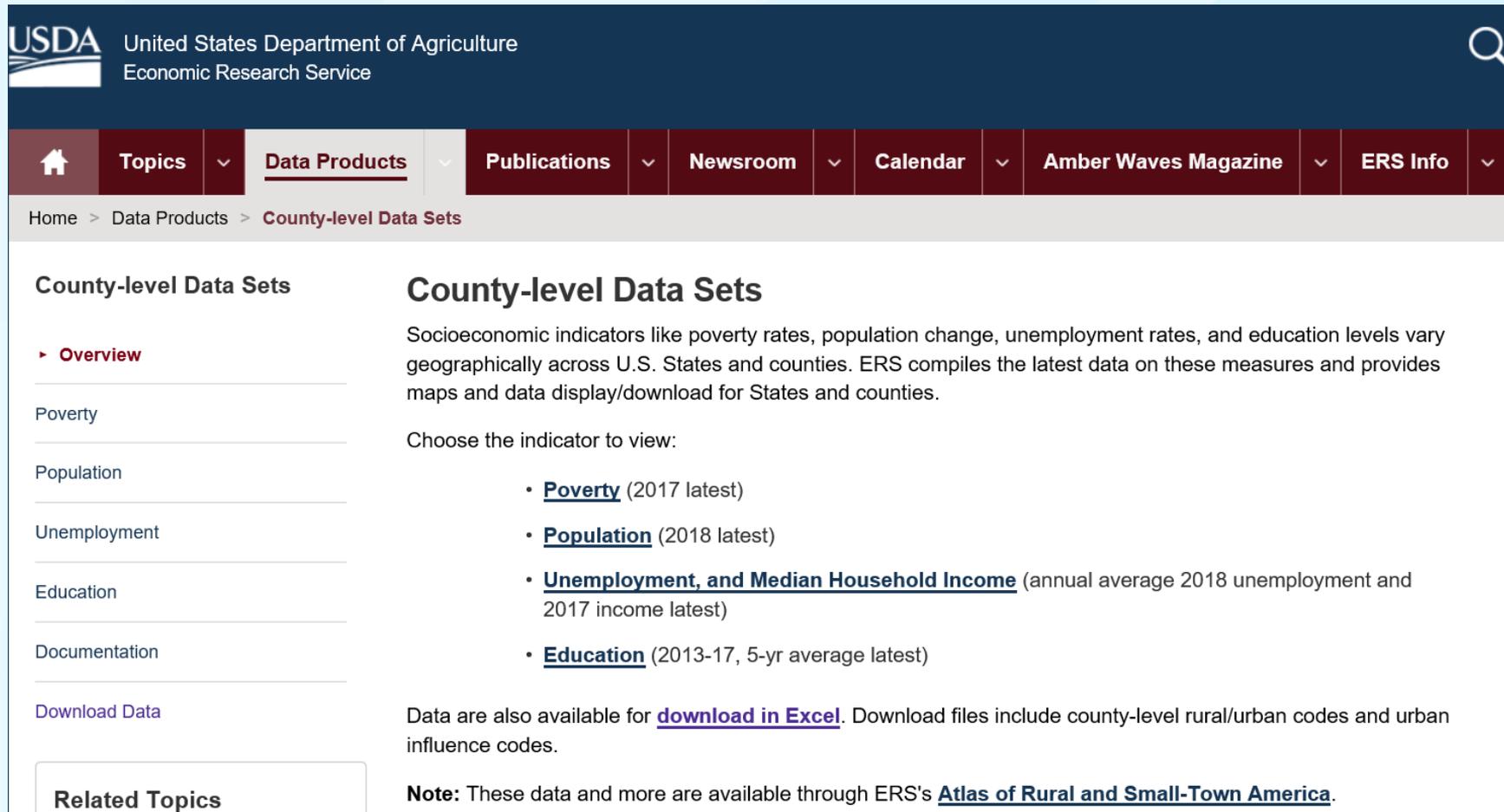


Figure 4. Mental health outcomes of economic effects of drought.

Vins et al., 2015

Potential economic indicators for drought and mental health analysis



The screenshot shows the USDA Economic Research Service website. The header includes the USDA logo and the text 'United States Department of Agriculture Economic Research Service'. A navigation menu contains links for Home, Topics, Data Products, Publications, Newsroom, Calendar, Amber Waves Magazine, and ERS Info. The breadcrumb trail is 'Home > Data Products > County-level Data Sets'. The main content area is titled 'County-level Data Sets' and includes an 'Overview' section with links for Poverty, Population, Unemployment, Education, and Documentation. A 'Download Data' link is also present. A list of indicators to view is provided: Poverty (2017 latest), Population (2018 latest), Unemployment, and Median Household Income (annual average 2018 unemployment and 2017 income latest), and Education (2013-17, 5-yr average latest). A note states that data are also available for download in Excel and that these data are available through ERS's Atlas of Rural and Small-Town America.

USDA United States Department of Agriculture
Economic Research Service

Home > Data Products > **County-level Data Sets**

County-level Data Sets

Overview

- Poverty
- Population
- Unemployment
- Education
- Documentation

[Download Data](#)

County-level Data Sets

Socioeconomic indicators like poverty rates, population change, unemployment rates, and education levels vary geographically across U.S. States and counties. ERS compiles the latest data on these measures and provides maps and data display/download for States and counties.

Choose the indicator to view:

- [Poverty](#) (2017 latest)
- [Population](#) (2018 latest)
- [Unemployment, and Median Household Income](#) (annual average 2018 unemployment and 2017 income latest)
- [Education](#) (2013-17, 5-yr average latest)

Data are also available for [download in Excel](#). Download files include county-level rural/urban codes and urban influence codes.

Note: These data and more are available through ERS's [Atlas of Rural and Small-Town America](#).

Potential economic indicators for drought and mental health analysis



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GDP by County

Prototype Gross Domestic Product by County, 2012-2015

The Bureau of Economic Analysis released prototype statistics for gross domestic product (GDP) by county for 2012-2015. Combined with BEA's county estimates of personal income, GDP by county offers a more complete picture of local area economic conditions.

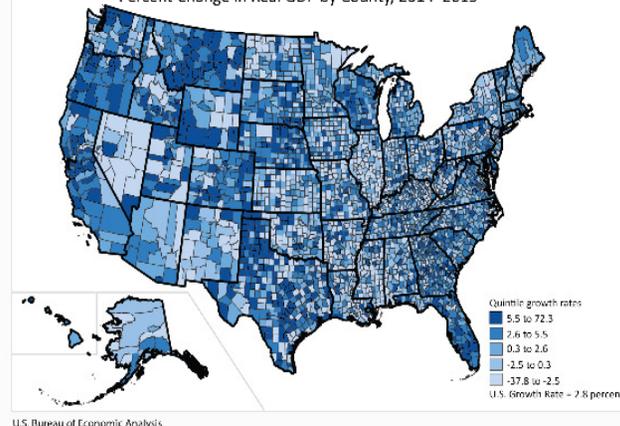
 Current Release

Current Release: December 12, 2018

Next Release: December 12, 2019

[Share Feedback on These Statistics](#)

Percent Change in Real GDP by County, 2014-2015



Potential economic indicators for drought and mental health analysis

The screenshot shows a web browser window displaying the USDA website. The address bar shows the URL: <https://usda.library.cornell.edu/concern/publications/x920fw89s?locale=en>. The page header includes the USDA logo and the text "United States Department of Agriculture Economics, Statistics and Market Information System". There are "Log in" and "Sign Up" links in the top right. A large banner image of cotton plants is overlaid with a search bar that says "Search Publications" and "Enter a keyword to search over 2100 publications". Below the banner, a breadcrumb trail shows "Home / Farm Labor". The main heading is "Farm Labor" with a "NASS" tag. A "Log in or Sign Up to subscribe" button is on the right. The main text describes the annual release of regional and national data for self-employed, unpaid, and hired workers and wage rates. A "LATEST RELEASE" box shows the date "May 30, 2019" with links for "PDF", "TXT", and "ZIP". The Windows taskbar at the bottom shows the date and time as "6:21 AM 11/21/2019".



Thank you

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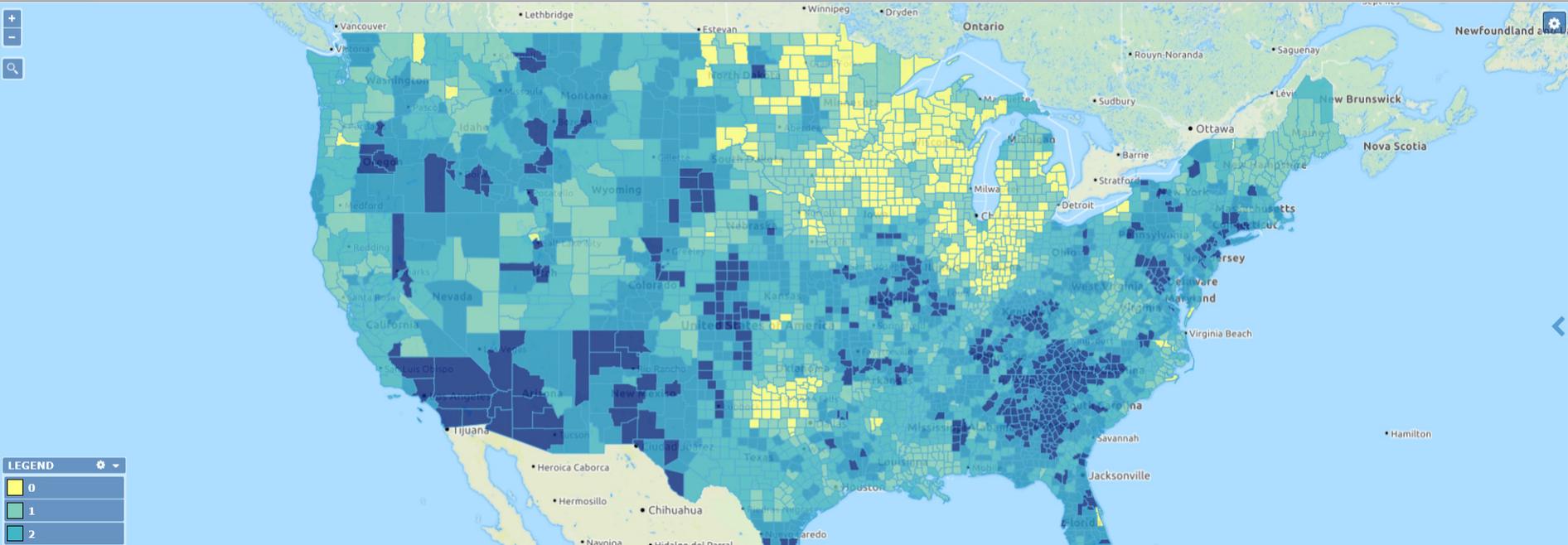
SELECT DATA [X] [?]



DROUGHT | DROUGHT DURATION AND SEVERITY (MONTHLY) | NUMBER OF MONTHS OF MILD DROUGHT OR WORSE PER YEAR | ALL COUNTIES

2016 Moderate drought or worse

ABOUT DATA



LEGEND

- 0
- 1
- 2



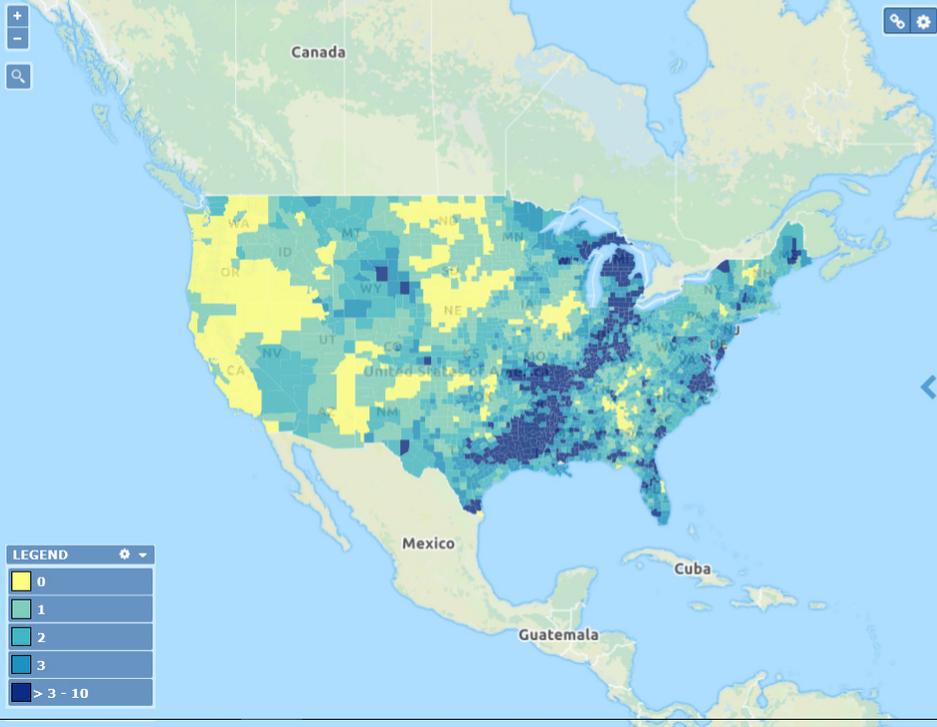
SELECT DATA X ?



DROUGHT | DROUGHT DURATION AND SEVERITY (MONTHLY) | NUMBER OF MONTHS OF MILD DROUGHT OR WORSE PER YEAR | ALL COUNTIES

2010 Moderate drought or worse

ABOUT DATA



SELECT DATA X ?



DROUGHT | DROUGHT DURATION AND SEVERITY (MONTHLY) | NUMBER OF MONTHS OF MILD DROUGHT OR WORSE PER YEAR | ALL COUNTIES

2010 Extreme drought

ABOUT DATA

