

# The United States Drought Monitor Process: What is it and how is the map made?

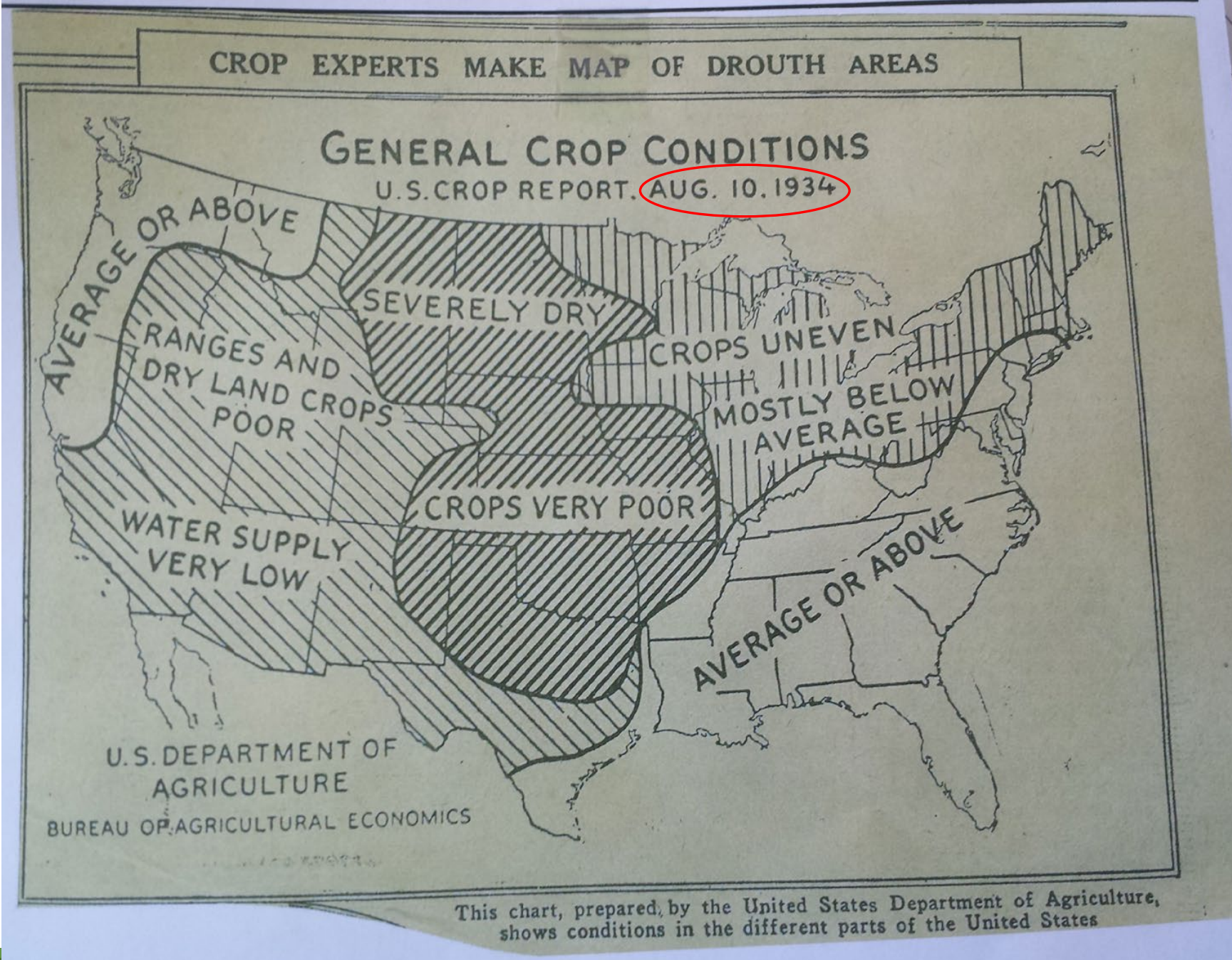
**Brian Fuchs**  
**National Drought Mitigation Center**  
**University of Nebraska-Lincoln**  
**School of Natural Resources**



UT Drought Meeting  
December 4, 2020



Scientists have been trying to monitor and map drought conditions for a long time

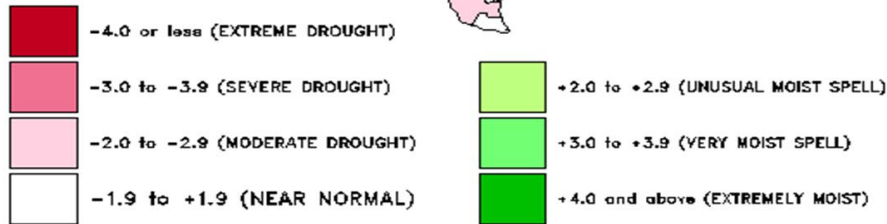
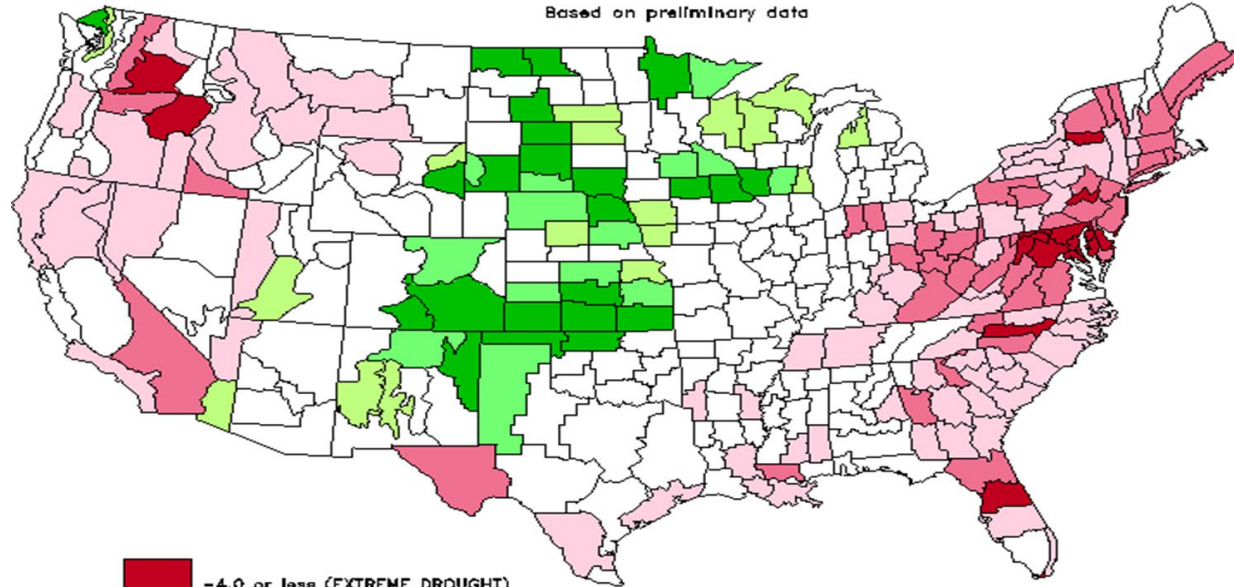


# efforts to monitor drought to early efforts of the USDM

Single Index/Indicator such as the PDSI

DROUGHT SEVERITY INDEX BY DIVISION  
(LONG TERM PALMER)

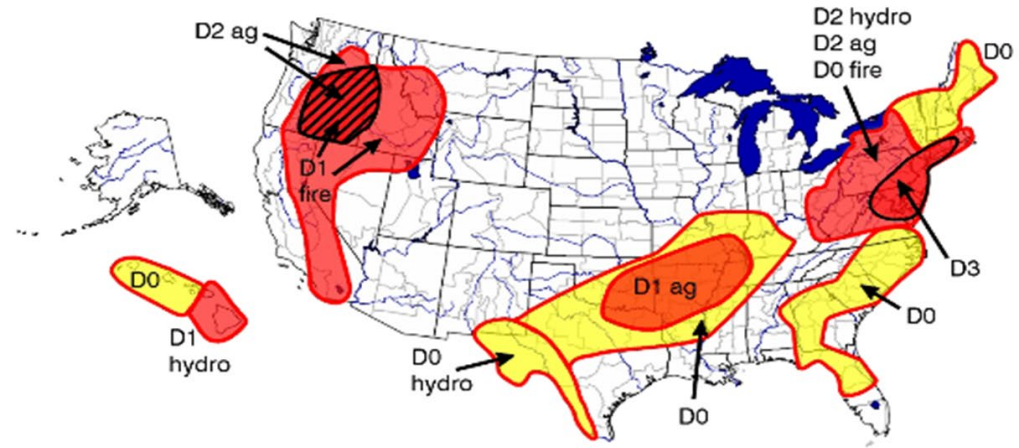
AUG 7, 1999  
Based on preliminary data



CLIMATE PREDICTION CENTER, NOAA

Hybrid Approach (made in Corel Draw)

## August 3, 1999 Experimental U.S. Drought Monitor



"Drought" means moisture shortages leading to damaged crops or pastures, high wildfire risk, or water shortages. The map is based on information from many sources, including both satellite and surface data, and it focuses on widespread drought. Local conditions may vary.

**Yellow (D0)** = Drought Watch Area (abnormally dry but not full drought status)

**Red (D1-D4)** = Current drought ranging in severity from standard (D1) to severe (D2-D3) to extreme (D4)

Crosshatching (▨) = Overlapping drought type areas

Drought type: Used when impacts differ  
 Ag = agricultural (crops, grasslands)  
 Fire = forestry (wildfire potential)  
 Hydro = hydrological (rivers, wells, reservoirs)

Plus (+) = Forecast to intensify  
 Minus (-) = Forecast to diminish



# Hybrid Approach is used: U.S. Drought Monitor (USDM)

**Objective**  
indicators &  
indices

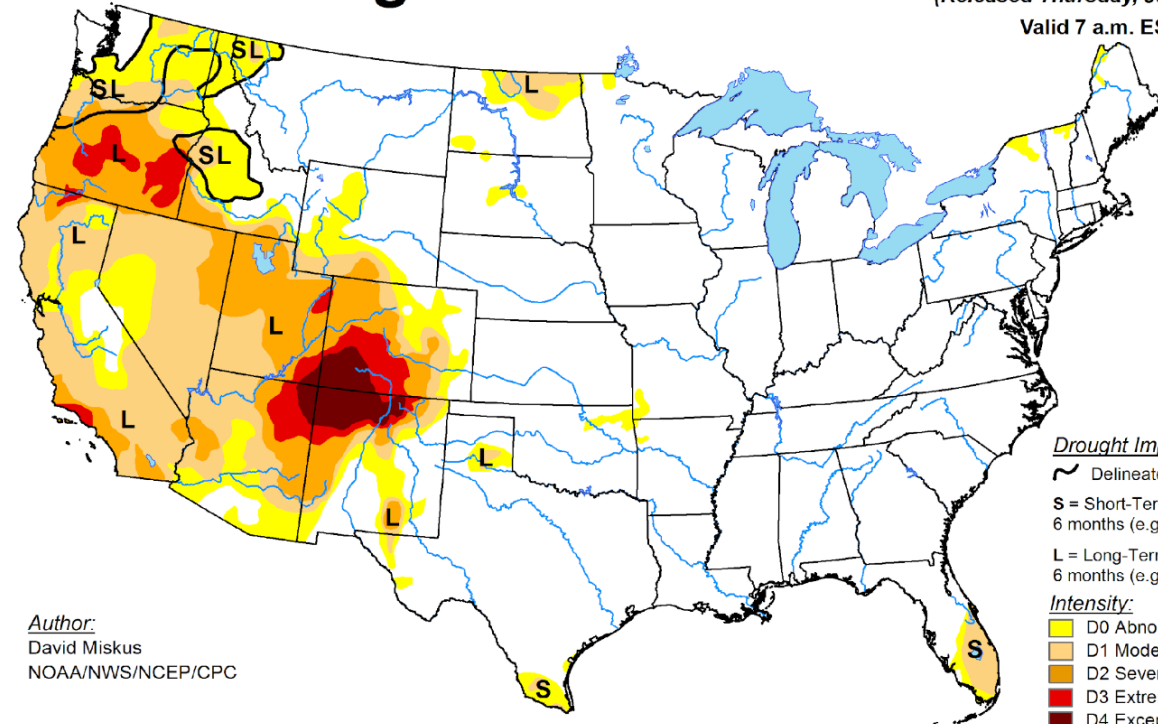


**Subjective**  
expertise  
and impacts



## U.S. Drought Monitor

January 1, 2019  
(Released Thursday, Jan. 3, 2019)  
Valid 7 a.m. EST



*Author:*  
David Miskus  
NOAA/NWS/NCEP/CPC

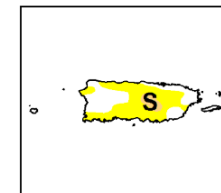
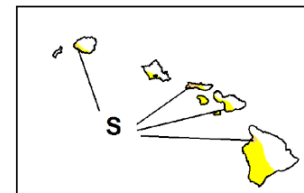
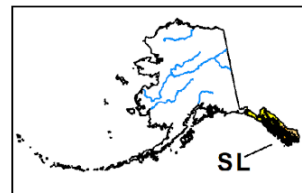
### Drought Impact Types:

- 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:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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



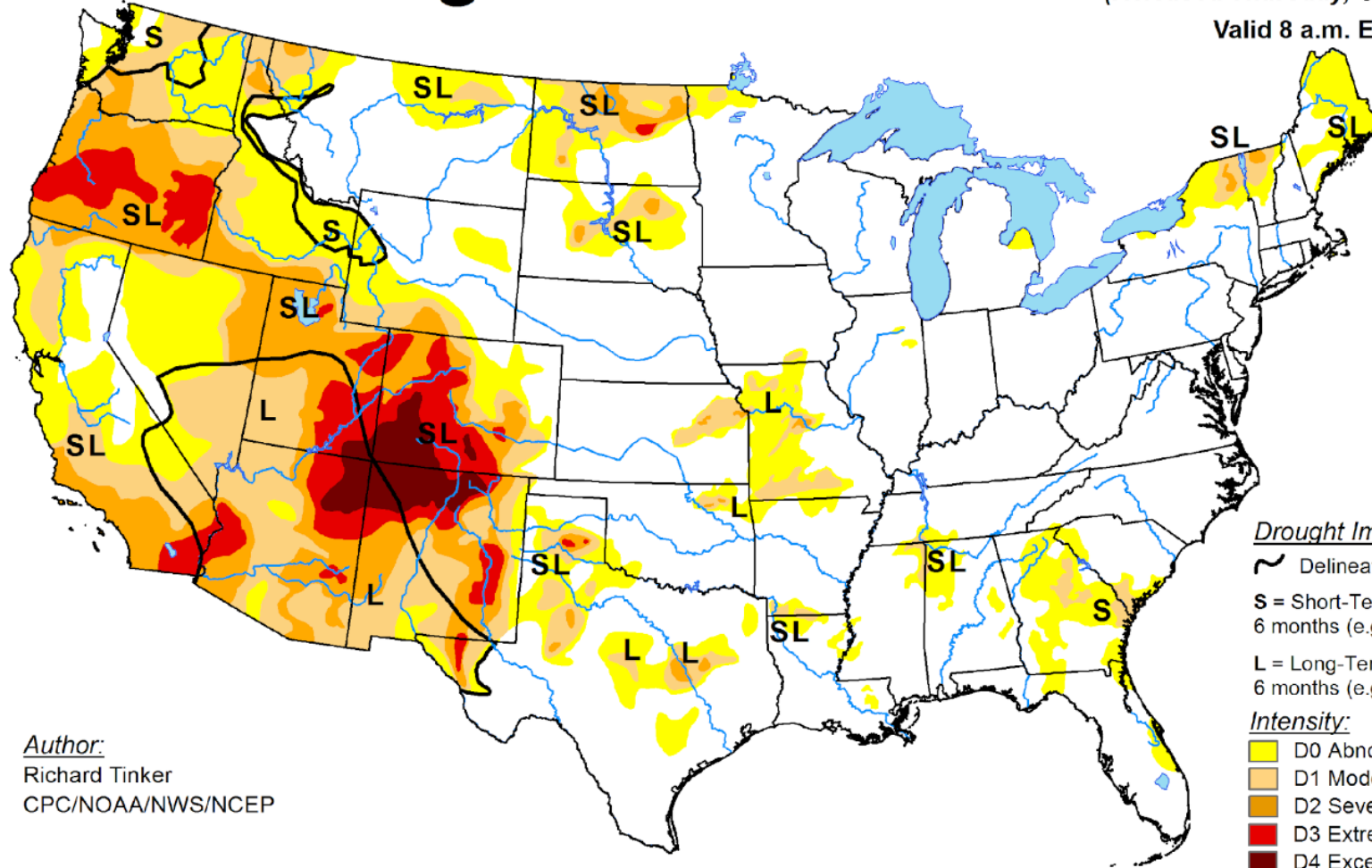
<http://droughtmonitor.unl.edu/>

# U.S. Drought Monitor

October 9, 2018

(Released Thursday, Oct. 11, 2018)

Valid 8 a.m. EDT



Timescales of potential impacts delineated

### Drought Impact Types:

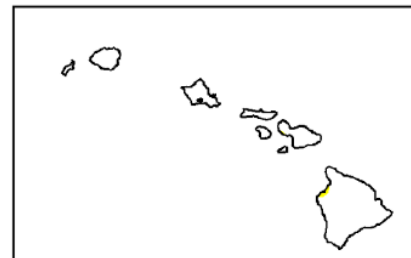
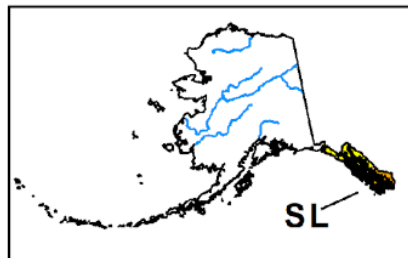
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

### Intensity:

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

Author:  
Richard Tinker  
CPC/NOAA/NWS/NCEP

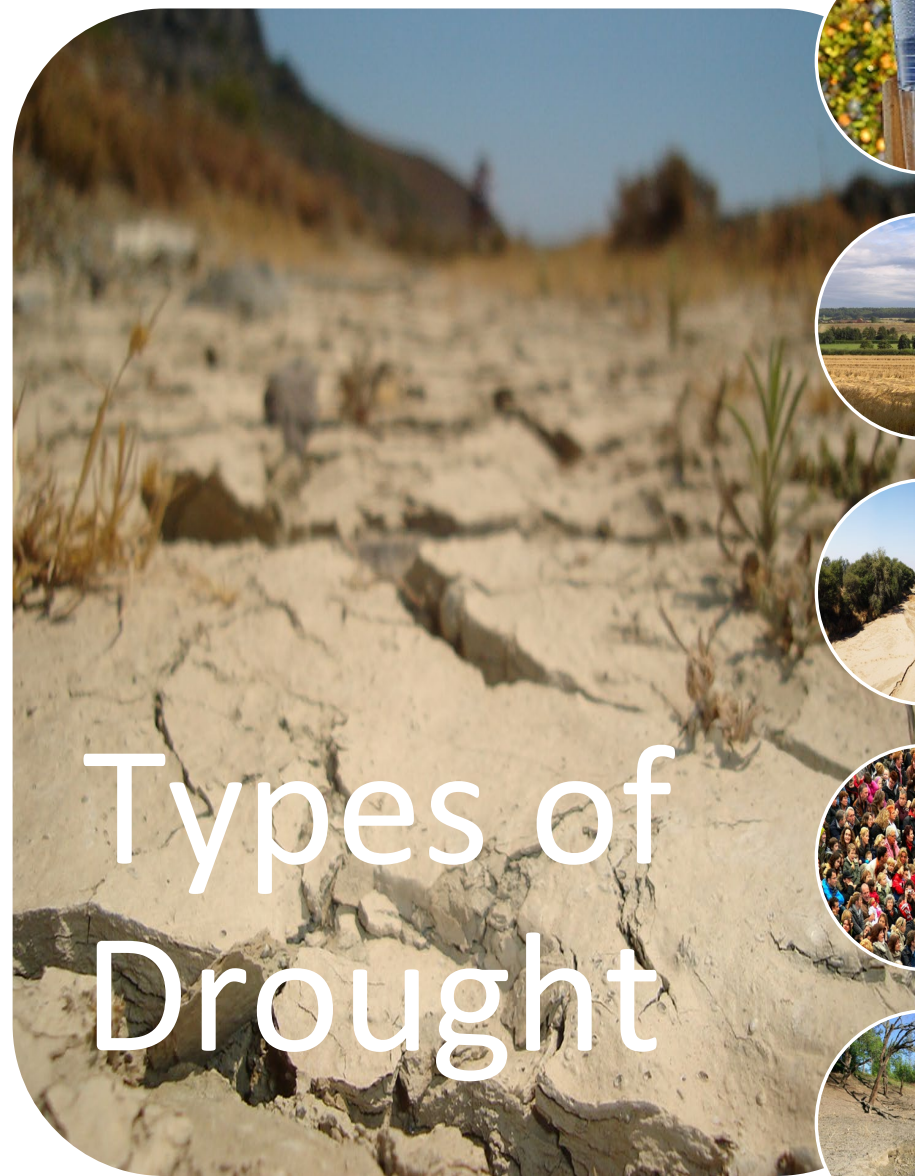
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<http://droughtmonitor.unl.edu/>

The map is...

An attempt to  
represent all the  
different types of  
drought on one  
map



Meteorological



Agricultural



Hydrological



Socio-  
economic

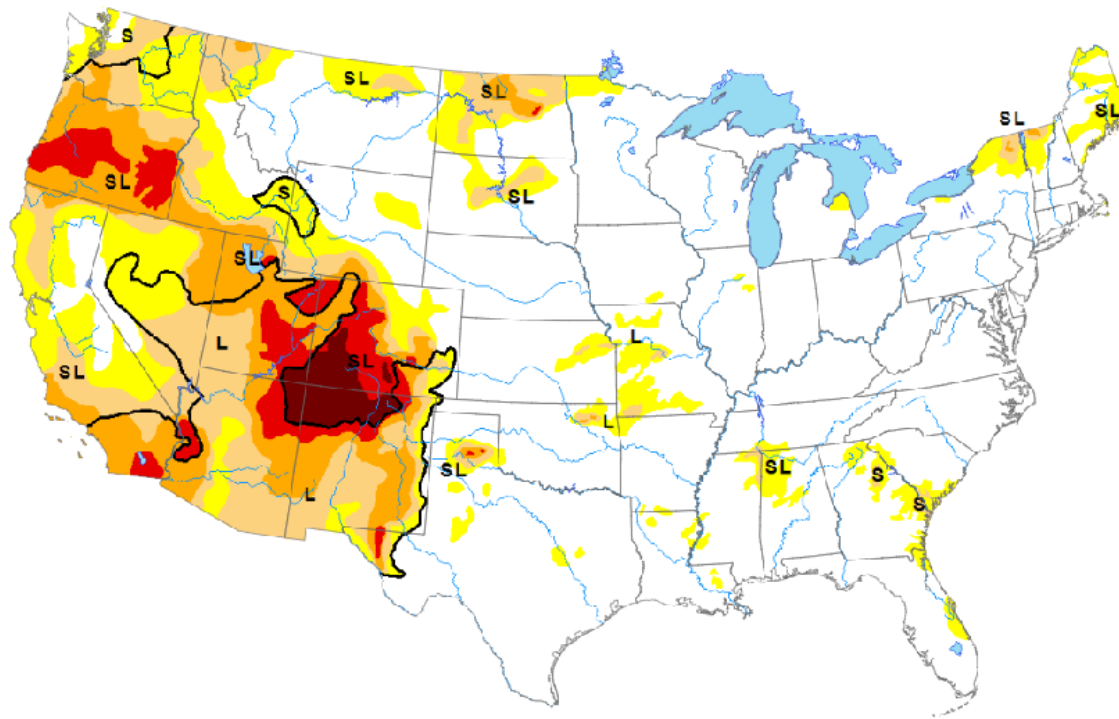


Ecological

# The United States Drought Monitor

Map released: October 18, 2018

Data valid: October 16, 2018 | Author: [Eric Luebehusen](#), U.S. Department of Agriculture








The data cutoff for Drought Monitor maps is each Tuesday at 8 a.m. EDT. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.



- Hosted by the NDMC as part of a 3-way partnership with NOAA and USDA
- Over 12.5 million hits a year (more during significant drought events)
- Used in several USDA programs
- Used by the IRS for tax deferrals
- Many others !

5 levels of intensity on the map, 4 are considered drought, 1 is not

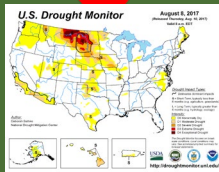
*Intensity:*

-  D0 Abnormally Dry } Not Drought
-  D1 Moderate Drought
-  D2 Severe Drought
-  D3 Extreme Drought
-  D4 Exceptional Drought

4 Drought intensities



# U.S. Drought Monitor Objectives



- Assessment of current conditions and current impacts
- The U.S. Drought Monitor is NOT a model
  - The map is made manually each week based off the previous week's map
- The U.S. Drought Monitor is NOT interpreting only precipitation
- The U.S. Drought Monitor is NOT a forecast or drought declaration
  - Can be used by decision makers in this way though
- The U.S. Drought Monitor does NOT take into account any relief programs when the map is produced.
- Identifying **impacts** on the map using impact labels
  - “**S**” short-term impacts, “**L**” long-term impacts or “**SL**” for a combination of both
  - “**S**”-6 month time scales or less, “**L**”-greater than 6 month time scales
- Incorporate **local expert** input
  - Accomplished via email and impact reports (USDMM listserver)
  - Validation of Objective Indicators
- Authors try to be as **objective** as possible (using the percentiles methodology) and the “Convergence of evidence” approach
  - The physical data, drought indices/ indicators must support the depiction on the map
  - **Impact data validates physical data but impacts alone will not drive changes on the map.**






# Percentiles and the U.S. Drought Monitor



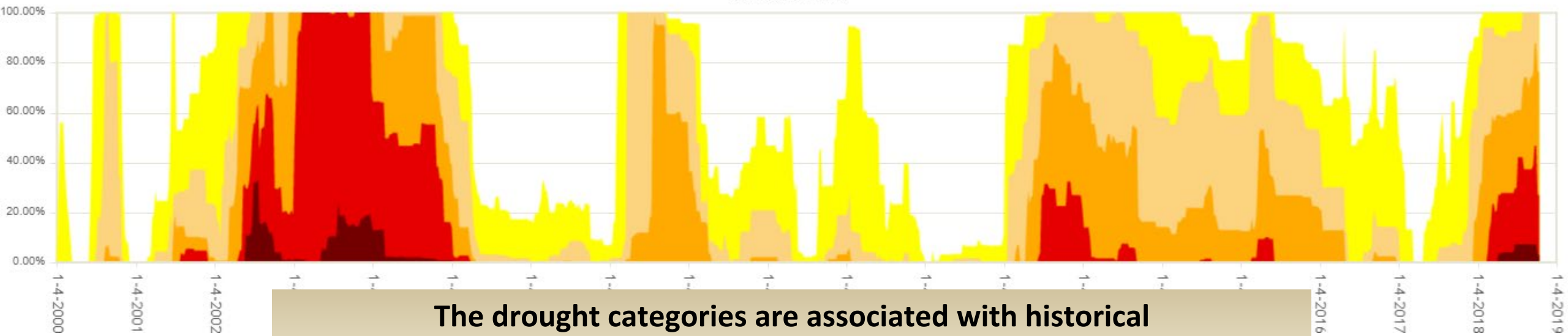
## Advantages of percentiles:

- Can be applied to any parameter used in the drought analysis
- Can be used for indicators of any length of data record
- Puts drought in historical perspective:

How many occurrences in a given period of time

D4: Exceptional Drought (percentile)		( <i>1<sup>st</sup>-2<sup>nd</sup></i> )
D3: Extreme Drought (percentile)		( <i>3<sup>rd</sup>-5<sup>th</sup></i> )
D2: Severe Drought (percentile)		( <i>6<sup>th</sup>-10<sup>th</sup></i> )
D1: Moderate Drought (percentile)		( <i>11<sup>th</sup>-20<sup>th</sup></i> )
D0: Abnormally Dry (percentile)		( <i>21<sup>st</sup>-30<sup>th</sup></i> )

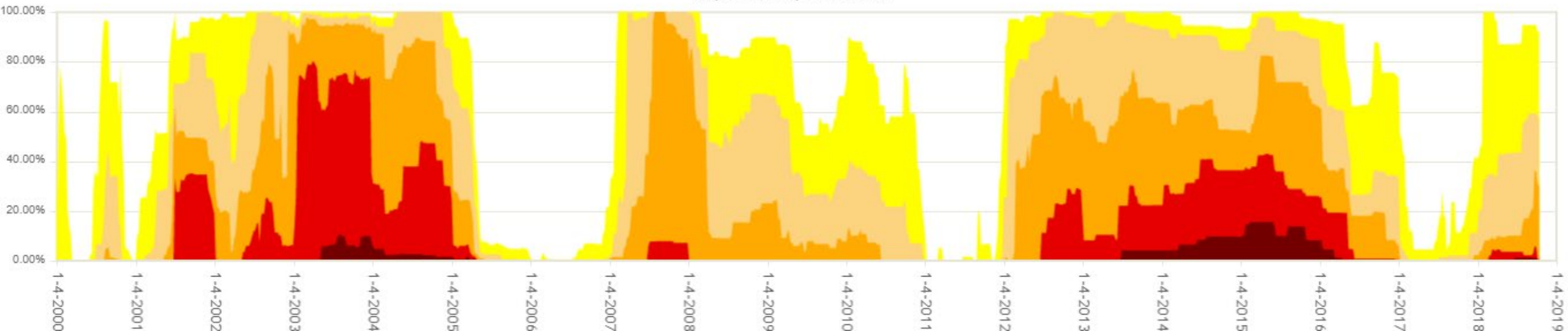
Utah Percent Area



**The drought categories are associated with historical occurrence/likelihood (percentile ranking)**

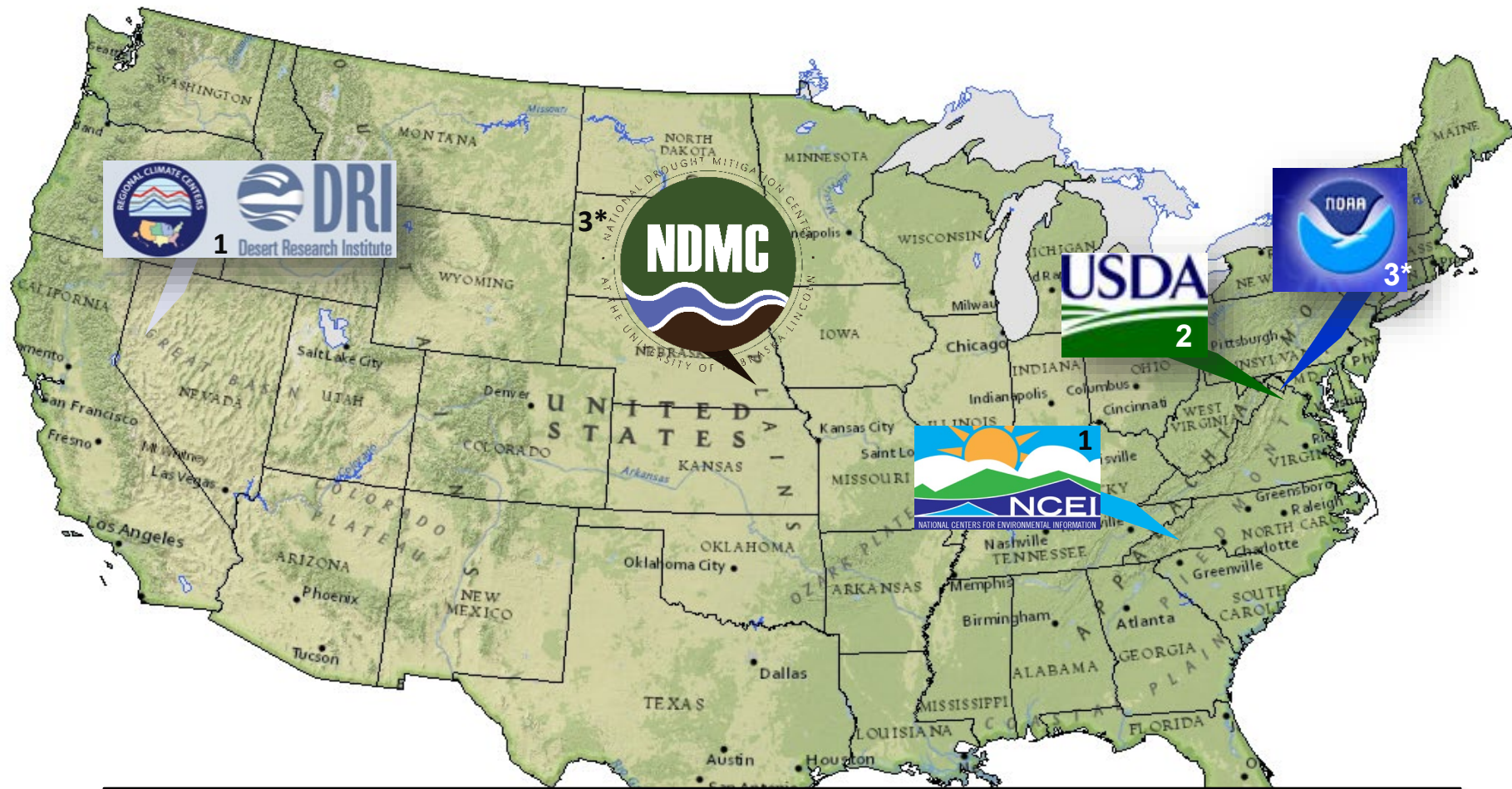
**It is not anecdotal or subjective, like “It’s really, really dry!!” ....or, “I don’t remember it ever being this dry, we have to be D3!!”**

16 (Great Basin) Percent Area



How is all of this done?

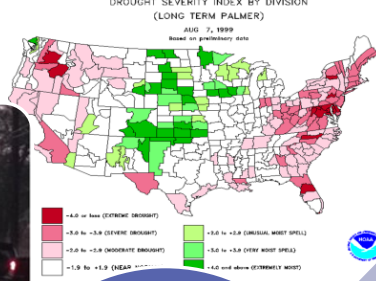




**Requirement: Authors must work at a regional or national “center”, government or academia/research**

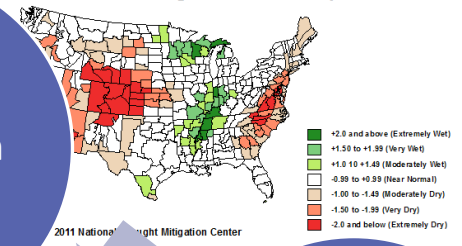
**There are currently 10\* authors, and all are volunteers**



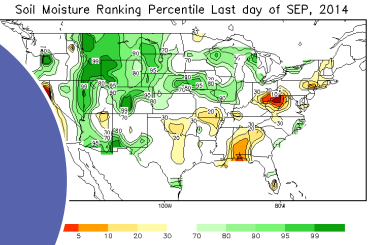


Drought Indices such as SPI/PDSI

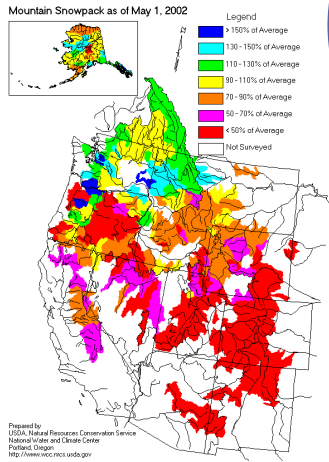
12-month SPI through the end of September 2002



Soil Moisture: both modeled and measured

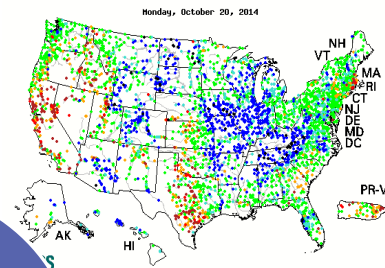


Precipitation and Snow

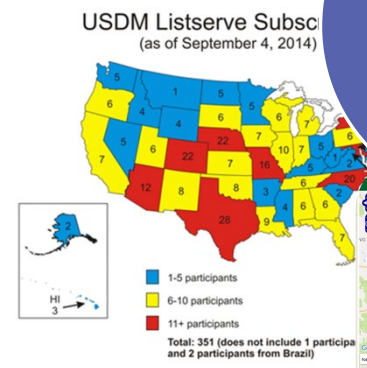


Most of the information analyzed each week falls into one of these categories. Authors now use roughly **40-50 unique indicators** while creating the U.S. Drought Monitor map, but not all areas are represented equally by all pieces of data.

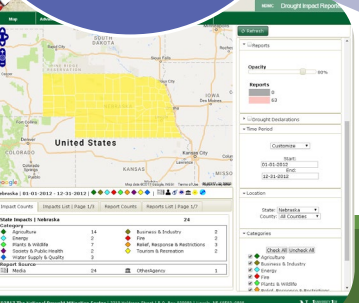
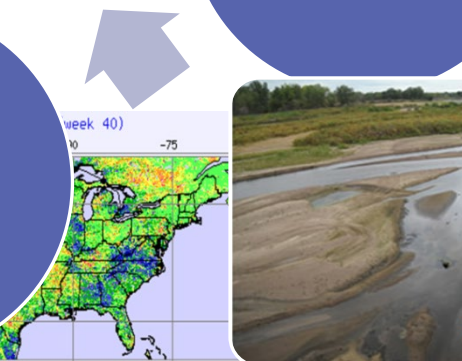
Streamflow, Reservoirs, and Wells



Expert Local Input and Impacts



Remote Sensing

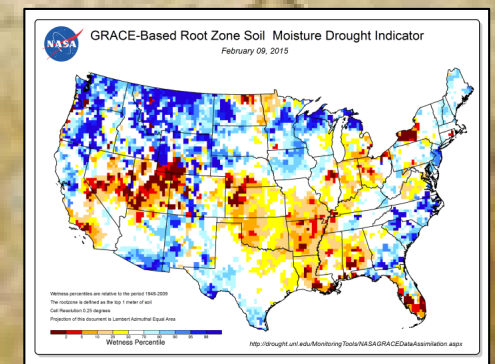
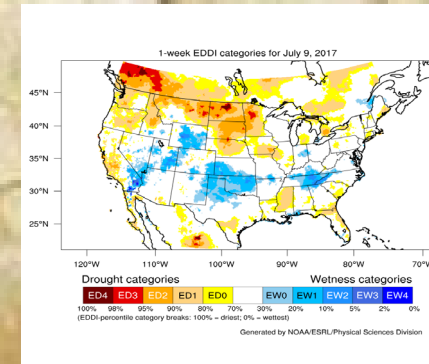
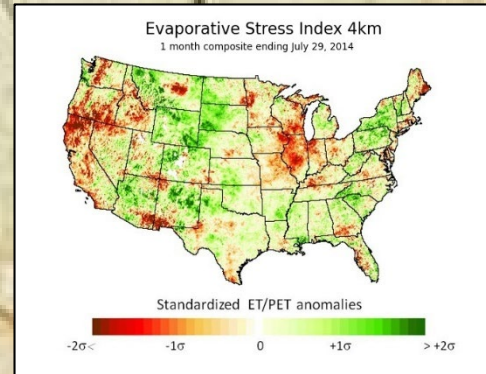
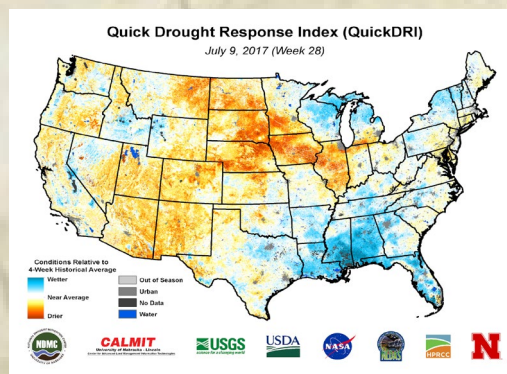
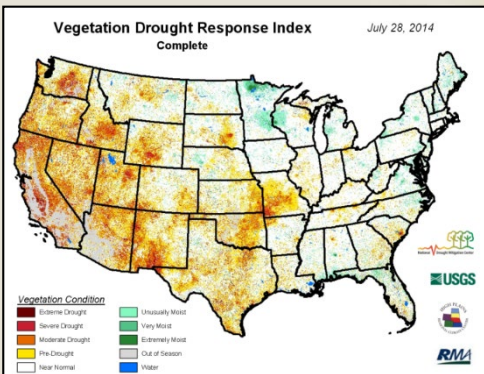
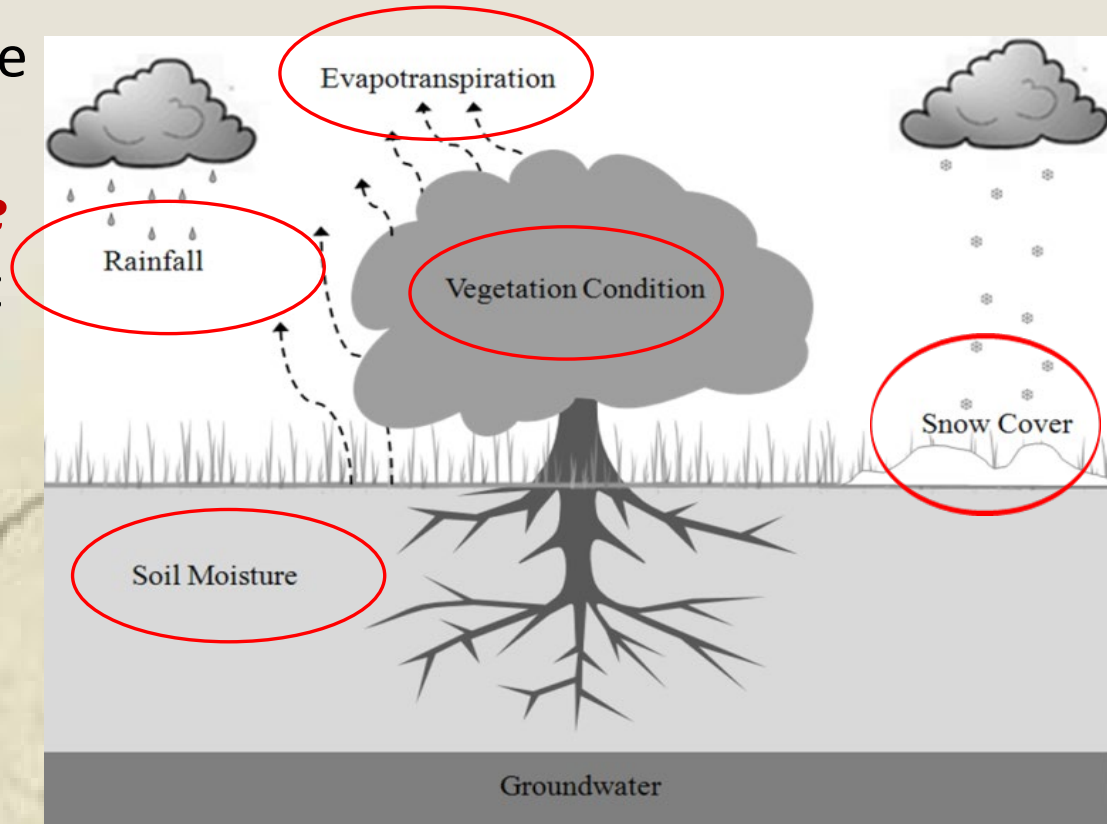


# Emerging Satellite-based Observations and Products

Over the past 10+ years, a number of satellite remote sensing-based tools and **products characterizing different parts of the hydrologic cycle that influence drought conditions** allowing new composite drought indicators to be developed.

## Examples

- Evaporative Stress Index (ESI)
- Quick Drought Response Index (QuickDRI)
- Evaporative Demand Drought Index (EDDI)
- GRACE soil moisture and groundwater anomalies
- Vegetation Drought Response Index (VegDRI)



Once the map is completed and published for the week, the map is final and **no changes will be made retroactively!**

## U.S. Drought Monitor

October 9, 2018  
Wednesday, Oct. 11, 2018  
10:00 a.m. EDT



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



# Regional and Local Feedback/ Input Process

## *How are other states contributing?*

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- Annual User **Feedback Forums** (USDAM/NADM) since 2000
- Various webinars/telecons/reports/data/products
- **Regional Climate Centers** and **NOAA Regional Climate Service Directors and Coordinators** along w/ **Weather Forecast Offices (WFOs)**
- **State Climatologists**
- **USDA FSA/NRCS**
- **Native American Tribal input**
- **CoCoRaHS (impacts)**
- National Integrated Drought Information System (**NIDIS**) **RDEWS** basin webinars:
- **State Drought Task Forces** : North Carolina, Hawaii, Oklahoma, Texas, New Mexico, Alabama, Florida, South Dakota, Kentucky, Arizona, Montana, and California and many others!

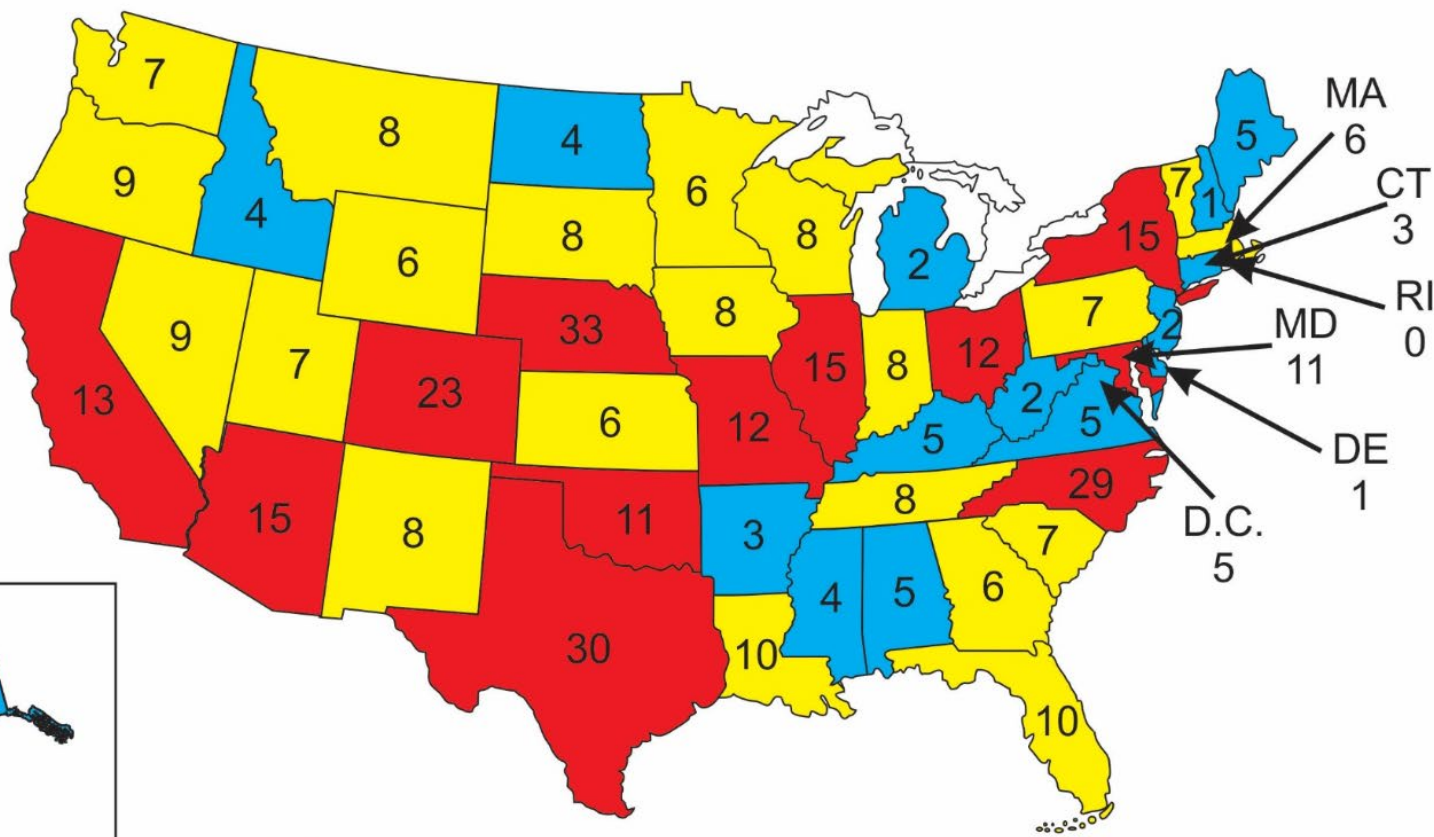
# How can contributions to the USDM Author work:

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- ❖ Have multiple “points of contact” responsible for pushing the consensus up to the author
- ❖ Rotate the responsibilities so multiple people are well versed in gathering and consolidating the information for the state/region
- ❖ Utilize all or some of the following: virtual meetings, phone calls, email listservers, drop box, and other tools to collect and discuss weekly input
- ❖ Have a threshold of when this group will meet based upon the current conditions, season, and what will the group do when there is not drought
- ❖ How will impact information be collected (utilizing NDMC’s tools or another option) ?
- ❖ Ideally, positions or departments would be identified in a planning document so as people come and go, the responsibilities will continue

# USDM Listserv Subscribers

(as of September 13, 2019)



- 1-5 participants
- 6-10 participants
- 11+ participants

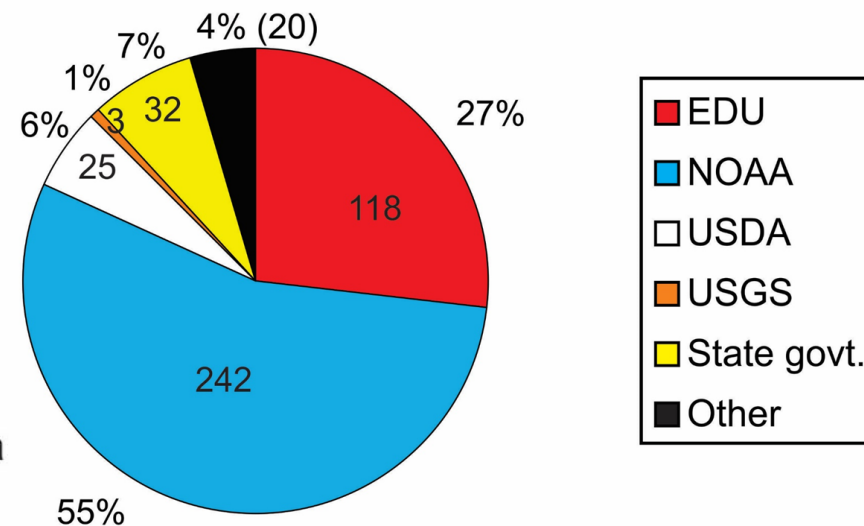
**Total: 440 (does not include 2 participants from Canada and 2 participants from Brazil)**

## We want YOU



## USDM Listserv Subscribers

(as of September 13, 2019)

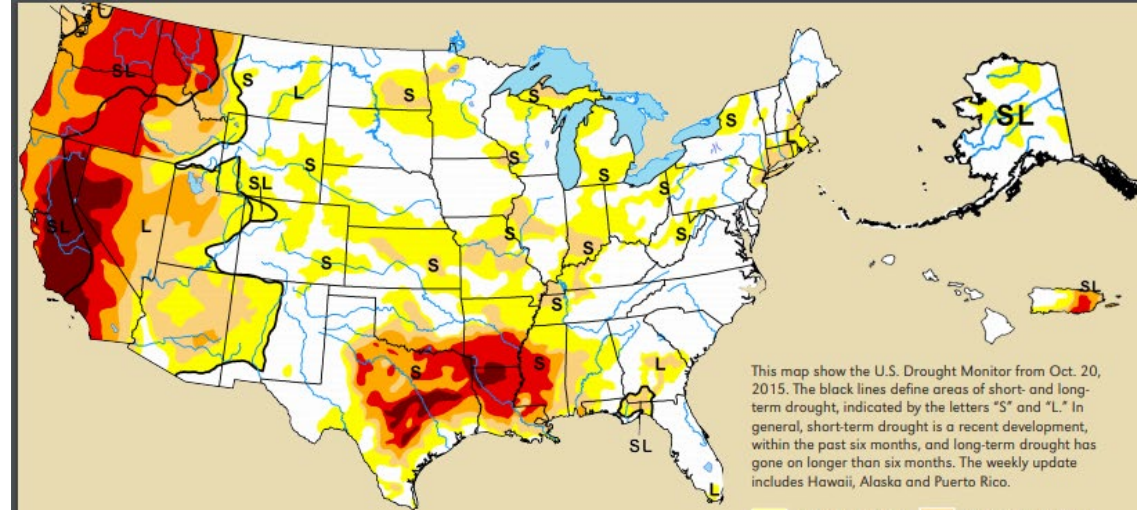


# US Drought Monitor Brochure

[https://droughtmonitor.unl.edu/data/docs/what\\_is\\_usdm.pdf](https://droughtmonitor.unl.edu/data/docs/what_is_usdm.pdf)

Also available in Spanish

NATIONAL DROUGHT MITIGATION CENT



**D0:** Abnormally dry    **D1:** Moderate drought  
**D2:** Severe drought    **D3:** Extreme drought  
**D4:** Exceptional drought

## What is the U.S. Drought Monitor?

Maybe you've seen it in the media: that map of the U.S. painted with blobs of yellow, orange and red. It shows drought — but how do we know which colors go where? Who decides? What does it mean for you?

### A USDM Q&A

The U.S. Drought Monitor is a map released every Thursday, showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4).

#### What agencies or organizations are responsible for the USDM?

The Drought Monitor has been a team effort since its implementation in 1999, produced jointly by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture. The NDMC hosts the web site of the drought monitor and the associated data, and provides the map and data to NOAA, USDA and other agencies. It is freely available at [droughtmonitor.unl.edu](http://droughtmonitor.unl.edu).

#### Who uses it, and what do they do with it?

The USDA uses the drought monitor to trigger disaster declarations and eligibility for low-interest loans. The Farm Service Agency uses it to help determine eligibility for their Livestock Forage Program, and the Internal Revenue Service uses it for tax deferral on forced livestock sales due to drought. State, local, tribal and basin-level decision makers use it to trigger drought responses, ideally along with other more local indicators of drought.

#### How does drought affect the country?

Drought is a normal part of the climate cycle. It is a slow-moving hazard, which causes people to underestimate the damage it can do, but losses from drought are as substantial as those from hurricanes, tornados and other faster-moving disasters. Drought causes losses to agriculture; affects domestic water supply, energy production, public health, and wildlife; and contributes to wildfire, to name a few of its effects.

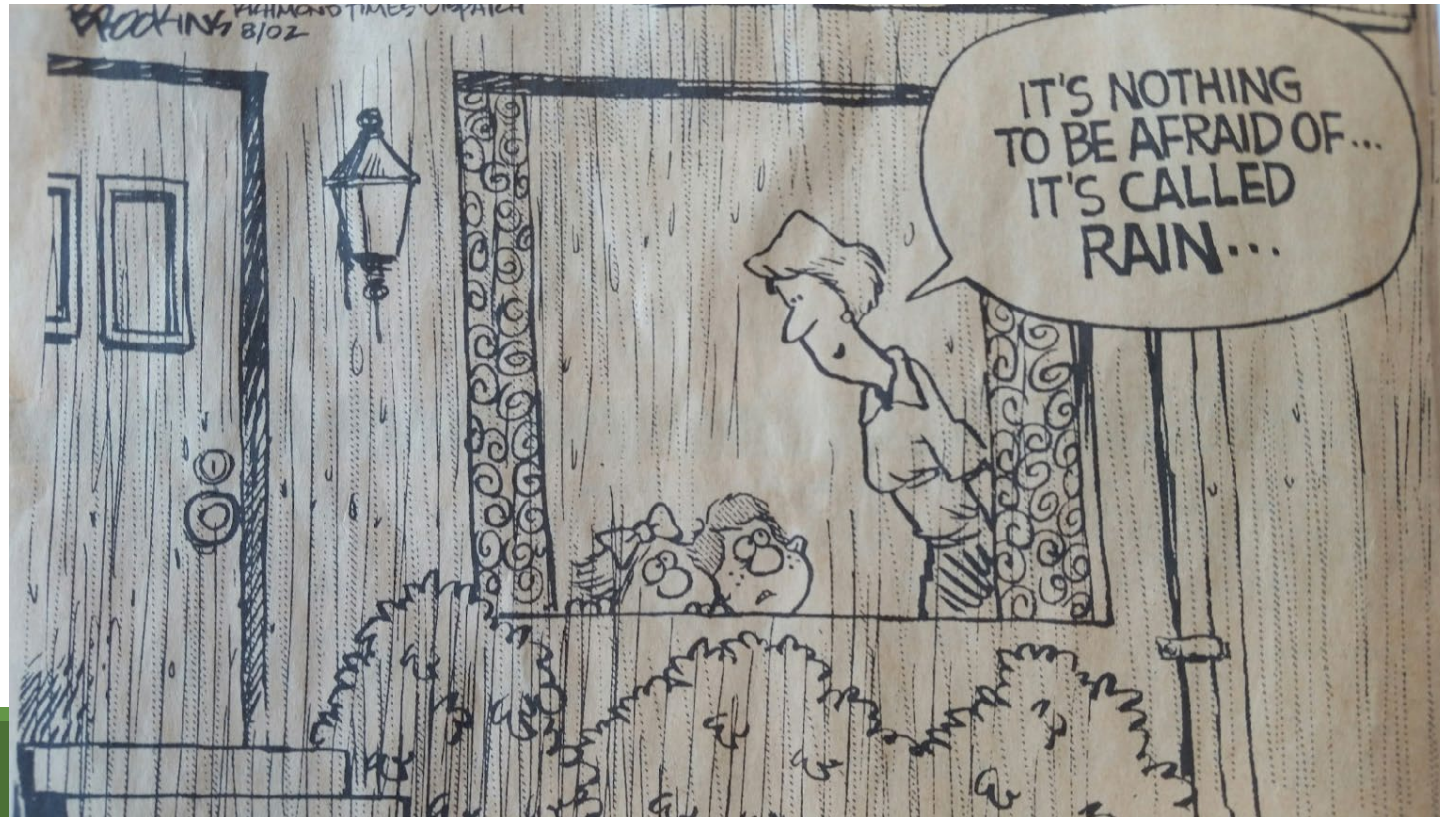
No single federal agency is in charge of water or drought policy; response and mitigation fall to an assortment of federal authorities. The USDA leads response efforts; NOAA, through the National Integrated Drought Information System ([drought.gov](http://drought.gov)), leads monitoring; agencies such as the U.S. Geological Survey and NASA contribute data; and the Environmental Protection Agency regulates water quality. The National Drought Resilience Partnership, launched in the aftermath of widespread drought in 2012, is an effort to unify federal drought response and policy. Drought response efforts, planning, and water law vary from state to state.

#### How do we know when we're in a drought?

Recognizing drought before it intensifies can reduce impacts and save money. How you recognize it depends on how it affects you. Traditional ways to measure drought are by comparing observed precipitation with what's normal (climatologic), by comparing soil moisture and crop conditions with what's normal (agricultural), or by looking at how much water is contained in snow, the level

[droughtmonitor.unl.edu](http://droughtmonitor.unl.edu)

# OUR PARTNERS



# Any Questions ?



DROUGHT.UNL.EDU

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 /NationalDroughtMitigationCenter

 @droughtcenter

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