

# Exploring the Enigma That is Drought

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NATIONAL DROUGHT  
MITIGATION CENTER  
*UNIVERSITY OF NEBRASKA*

*CoCoRaHS WxTalk Webinar Series*

April 1, 2026

# National Drought Mitigation Center (NDMC)

Monitoring  
+ Early  
Warning

Policy +  
Planning

Vulnerability  
and Risk  
Assessment



Educators  
and  
Students

Media

Policy +  
Decision  
Makers

General  
Public

Other  
Scientists

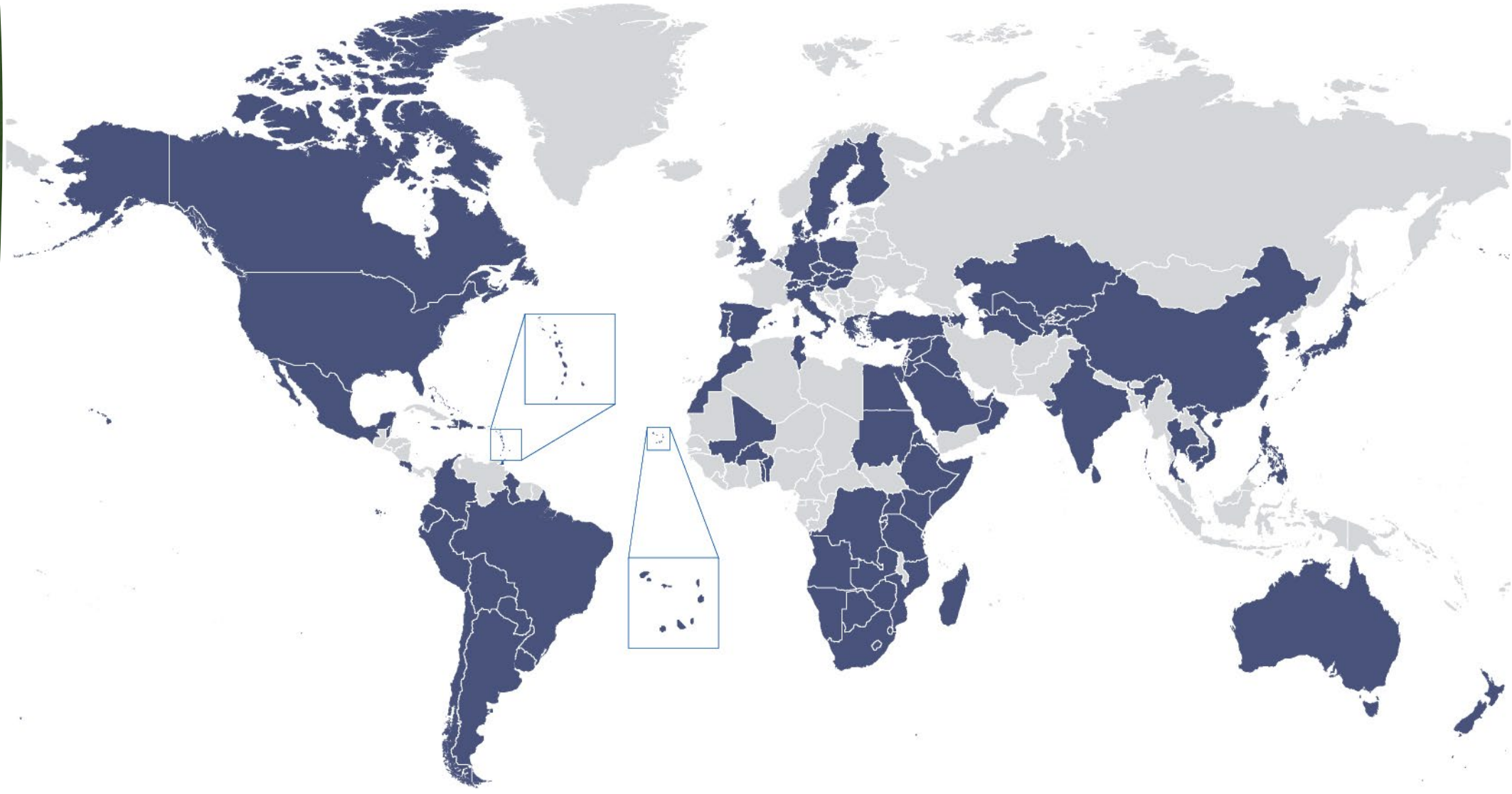
**Services, Education,  
Outreach, &  
Engagement**

**Usable, Actionable, & Policy  
Informing Information**

**Drought Science**  
*(21 Staff/6 students)*

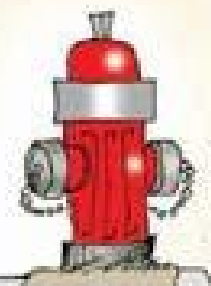
# Global Footprint:

Informed by where we've worked the past 30 years



Past/Prior efforts w/: World Bank, WMO, FAO, UNCCD, USDA-FAS, IDMP, IWMI + USAID

# HOW DRY IS IT?



# Standard Raininguage

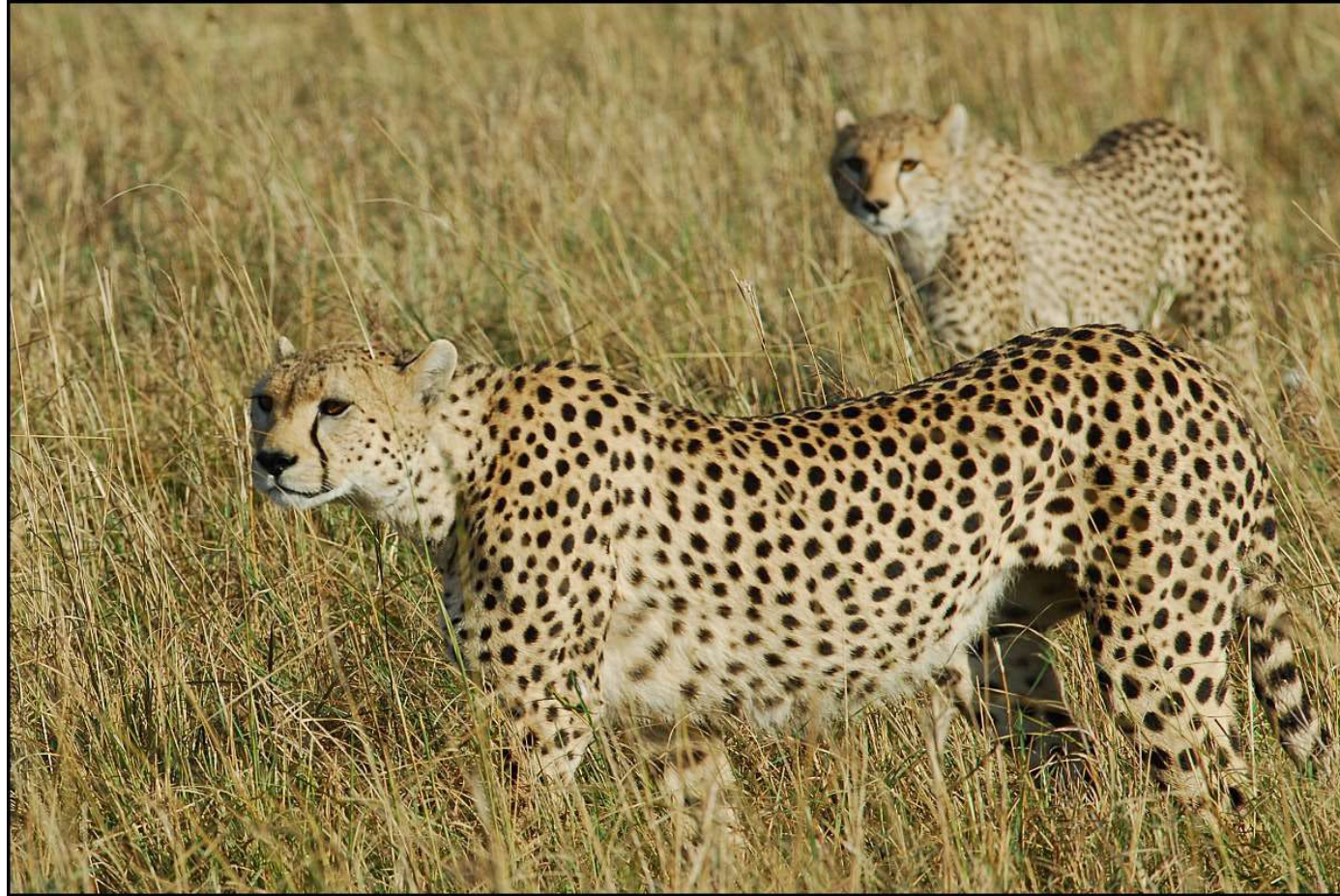
-New Nebraska Raininguage



# What is Drought?



# Flood....



–Photo Credit: <http://www.wildherps.com/>



# Flooding.....



Photo Credit: The Nature Conservancy



Andrea Booher/FEMA Photo



Photo Credit: Missouri Independent



# Tornadoes.....



# Drought....



# Flash Drought?



Photo Credit: A-Z Animals



# 1930s



GROVE AND BUILDINGS COVERED BY DRIFTING SOIL - S. DAK - 1935

© 1935  
ROLAND PHOTO  
CO.  
GREGORY, I. D.  
D-15

**NOT the  
1930s!**



Photo: Cimarron County, Oklahoma  
Gary McManus, Oklahoma Climatological Survey, late June, 2008



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Photo: Jeff Bonner, TPWD. Gray County, Texas, March 2006

2026



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### U.S. Drought Monitor

March 24, 2026  
(Released Thursday, Mar. 26, 2026)  
Valid 8 a.m. EDT

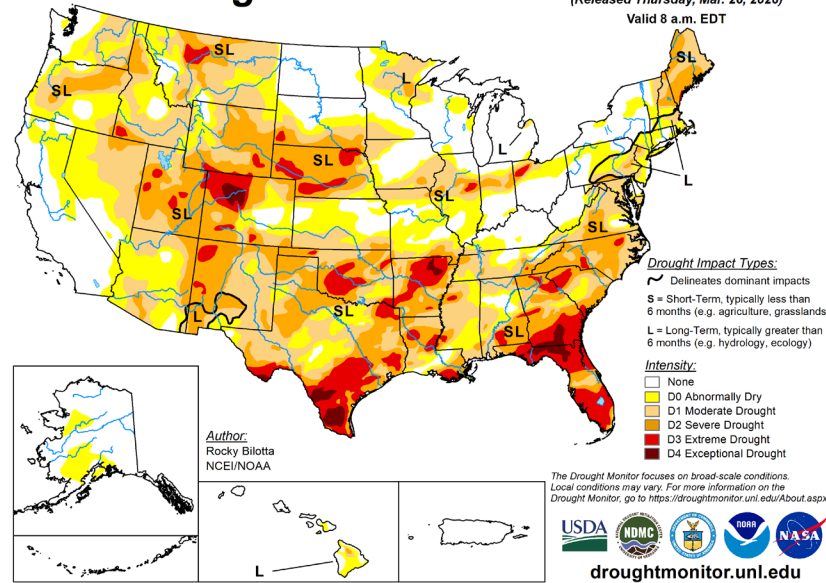
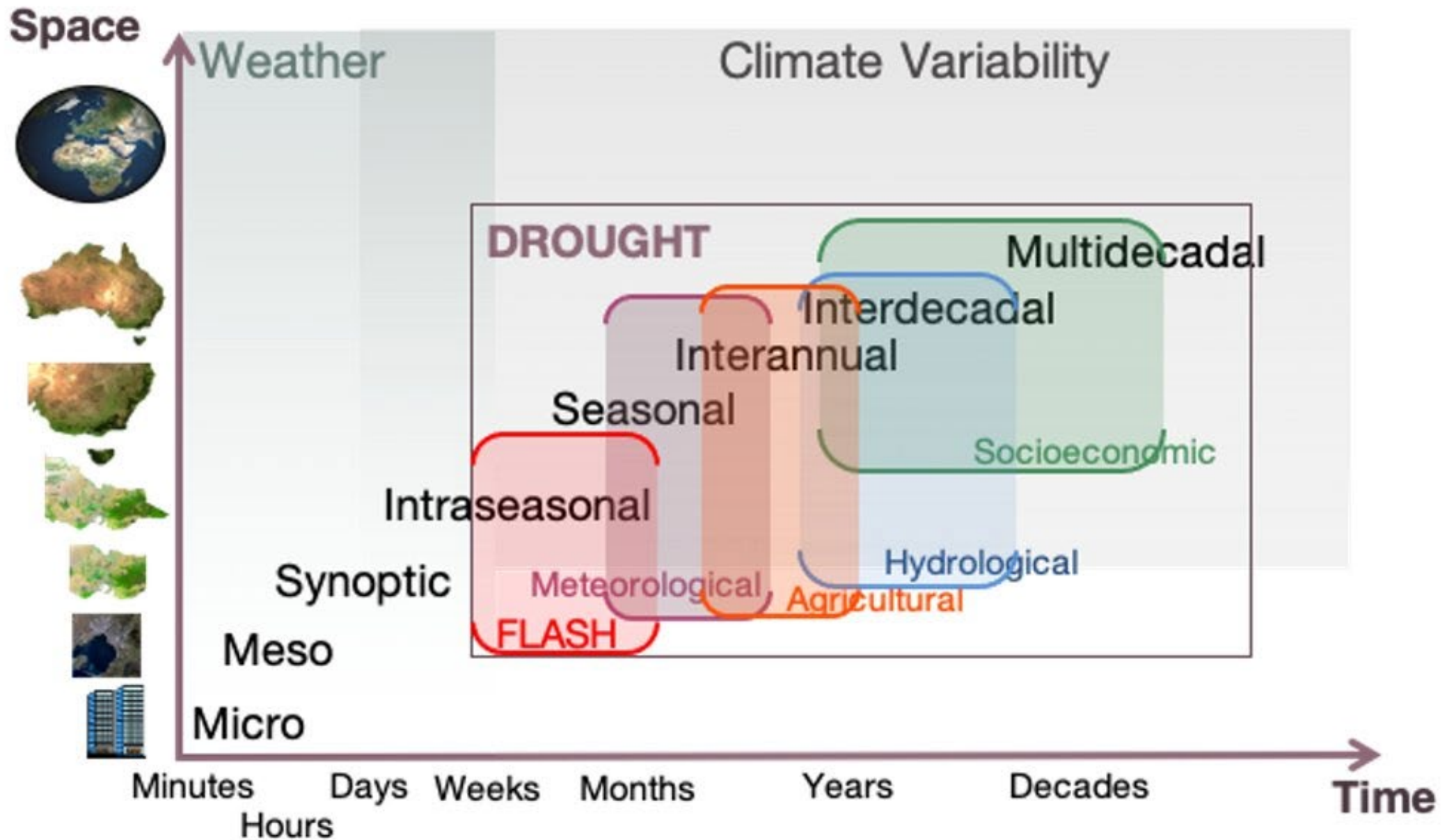


Photo: FencePost.com and Dave Weaver/AP. Nebraska Panhandle wildfires (March 2026)



# Context: Terms Related to Conditions of Low Water Availability

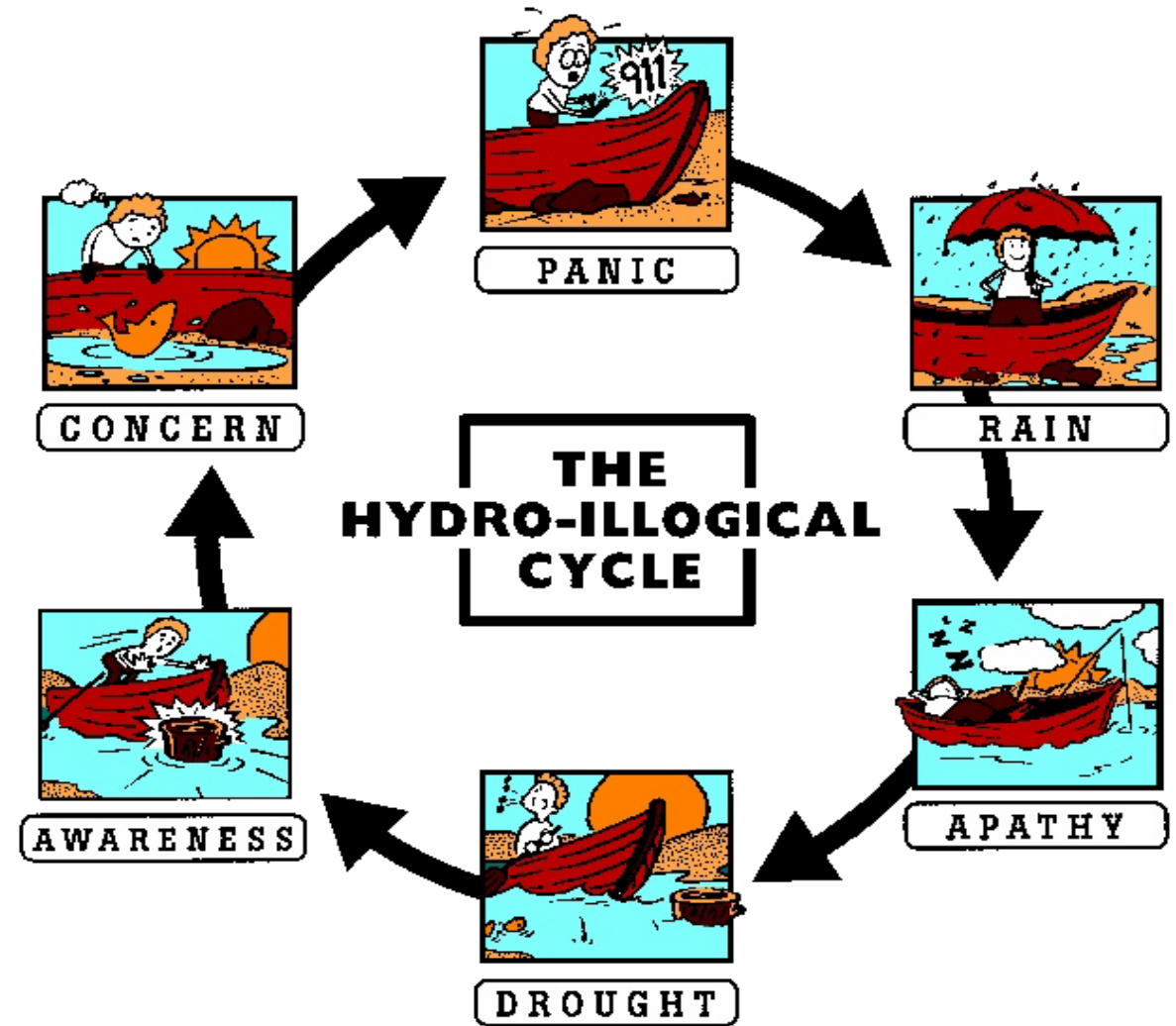
	Short/Mid Time Scale or Temporary	Long Time Scale or Quasi-Permanent
Natural	Drought	Aridity
Man-made	Water Scarcity	Desertification

Pereira et al. 2002, Van Loon and Van Lanen 2013



# Characteristics of Crisis Management

- reactive, post-impact
- poorly coordinated
- untimely
- poorly targeted
- ineffective
- decreases self-reliance  
→ greater vulnerability



# Drought Differs from other Natural Hazards

- “Usually” a slow-onset, creeping phenomena *(or is it?)*
- Absence of a universal definition
  - Severity is best described through multiple indicators and indices (and impacts?)
- Impacts are typically non-structural and spread over large areas
- Mitigation interventions are less obvious
- **RESULT**, progress on reducing our risk to drought has been slow



# Types of Drought

- There are *indices and indicators* used to identify *all* of these types of drought at various thresholds
- There is *no single definition* of drought
- Thus, in most cases, there *is no “one-size-fits-all”* drought indicator or index

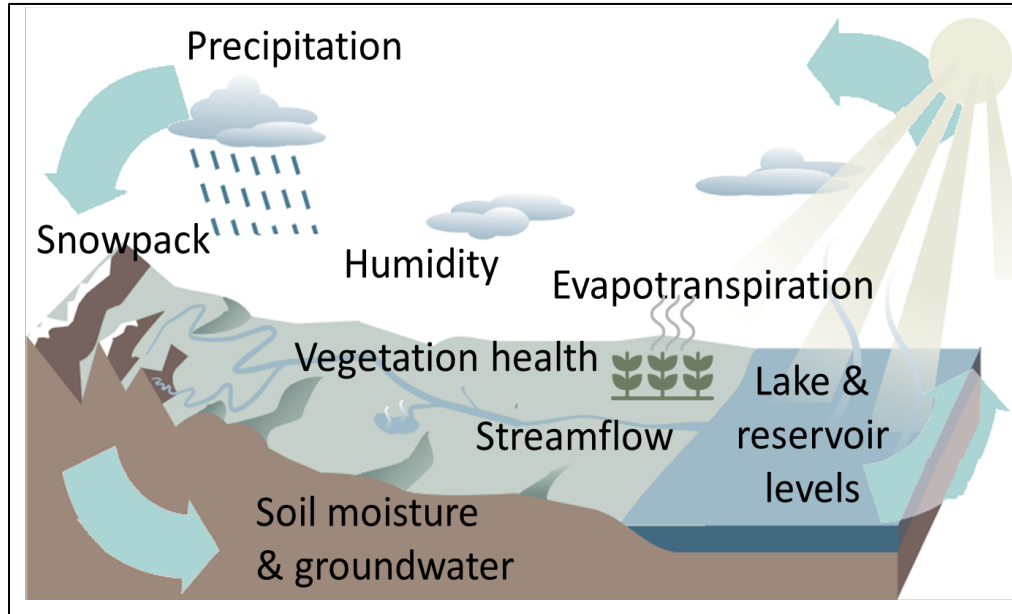
- Meteorological
- Flash
- Ecological/Environmental
- Agricultural
- Hydrological
- Socioeconomic



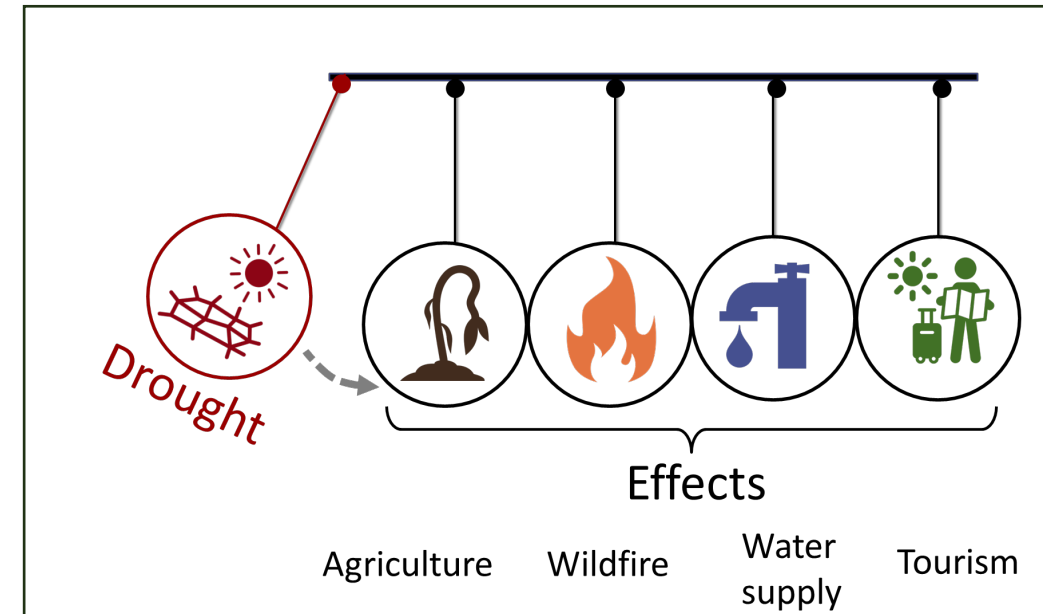
# Monitoring System

- Tracks, assesses and reports climate and water supply trends and current conditions – ***including drought impacts!***

## Climate and water supply indicators



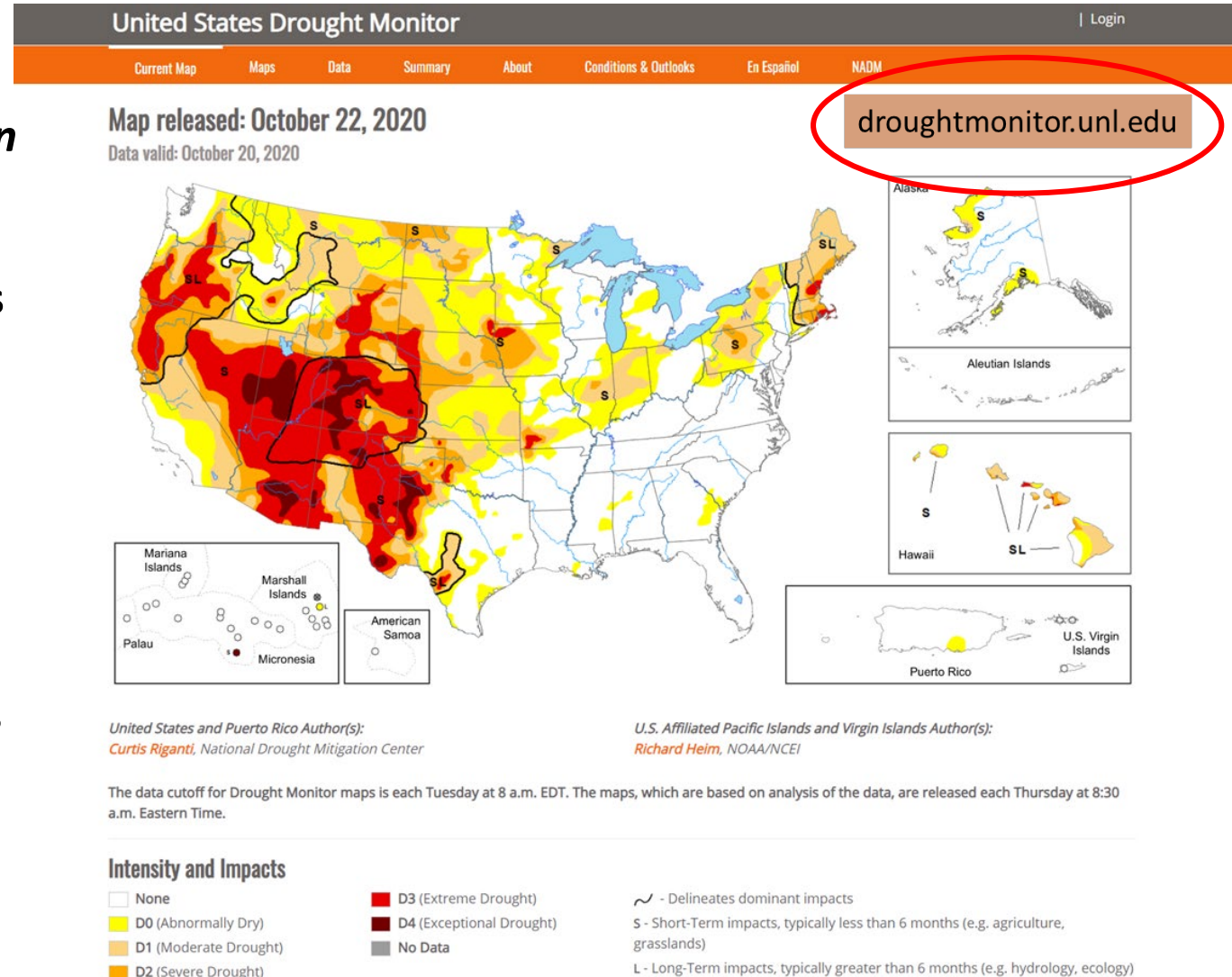
## Drought Impacts



# Science before policy

## U.S. Drought Monitor (USDM):

- **State-of-the-science** drought assessment in the U.S. since 1999
  - **Collaborative effort** between NOAA, USDA and NDMC
- Composite indicator blends objective indicators and indices with **field input from over ~400 experts**
- **“Convergence of Evidence”** approach
- **Policy implications** in Farm Bill (USDA), IRS, Federal Reserve Board, CDC, FERC, NOAA-NWS and several state drought plans and task forces
- **“Go to source”** for media and the public
  - ~12+ million page views annually

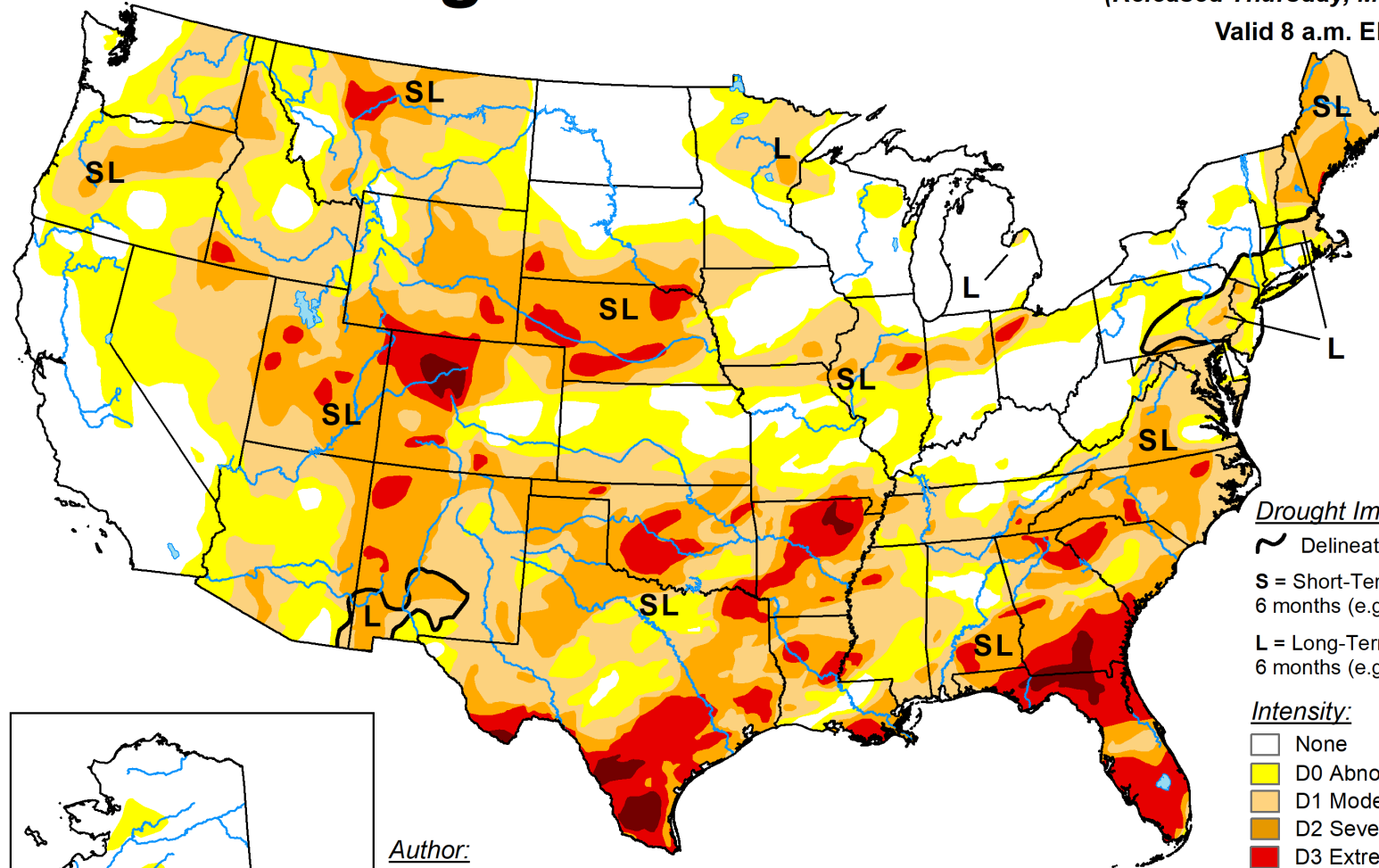


The First Hybrid CDI? (1999)

In production for over 25 years now and haven't missed a single week

# U.S. Drought Monitor

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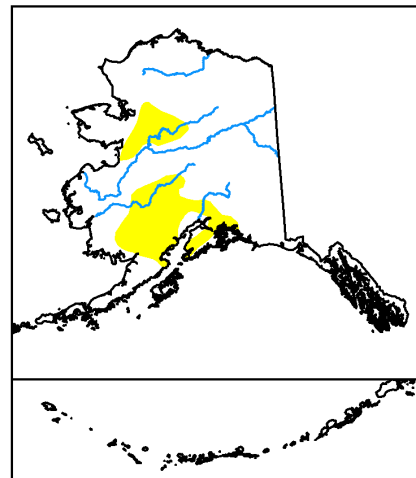


### Drought Impact Types:

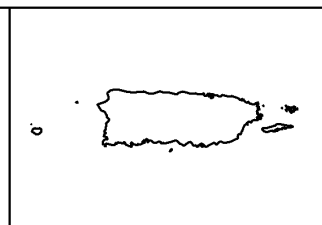
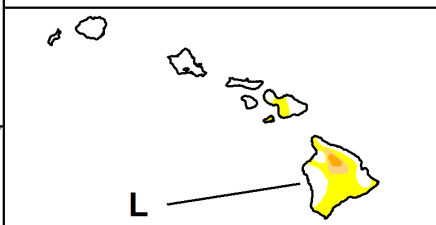
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

### Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought



Author:  
Rocky Bilotta  
NCEI/NOAA



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



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

**Drought categories are based on historical likelihood**

		<b>Percentile</b>	<b>~Frequency</b>
	None	31-100	Once per 1 to 3 years
<b>D0</b>	Abnormally dry	21-30	Once per 3 to 5 years
<b>D1</b>	Moderate drought	11 - 20	Once per 5 to 10 years
<b>D2</b>	Severe drought	6 - 10	Once per 10 to 20 years
<b>D3</b>	Extreme drought	3 - 5	Once per 20 to 50 years
<b>D4</b>	Exceptional drought	1 - 2	Once per 50 to 100 years

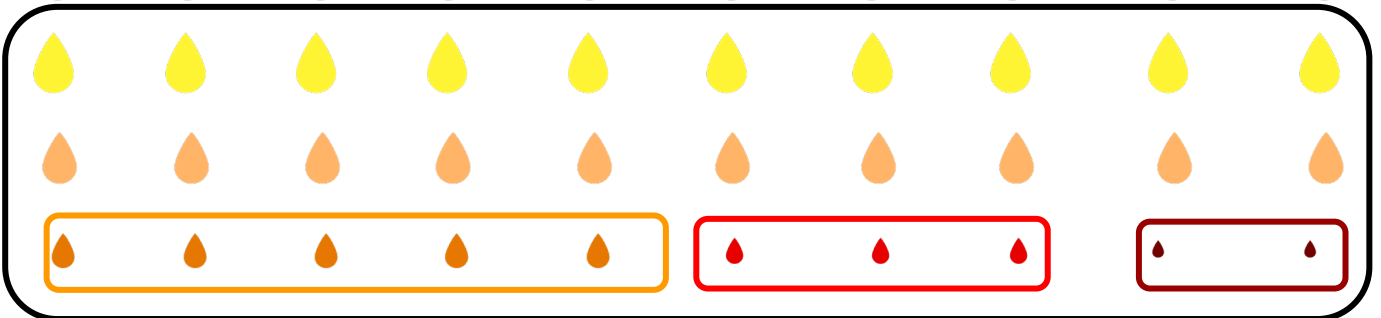
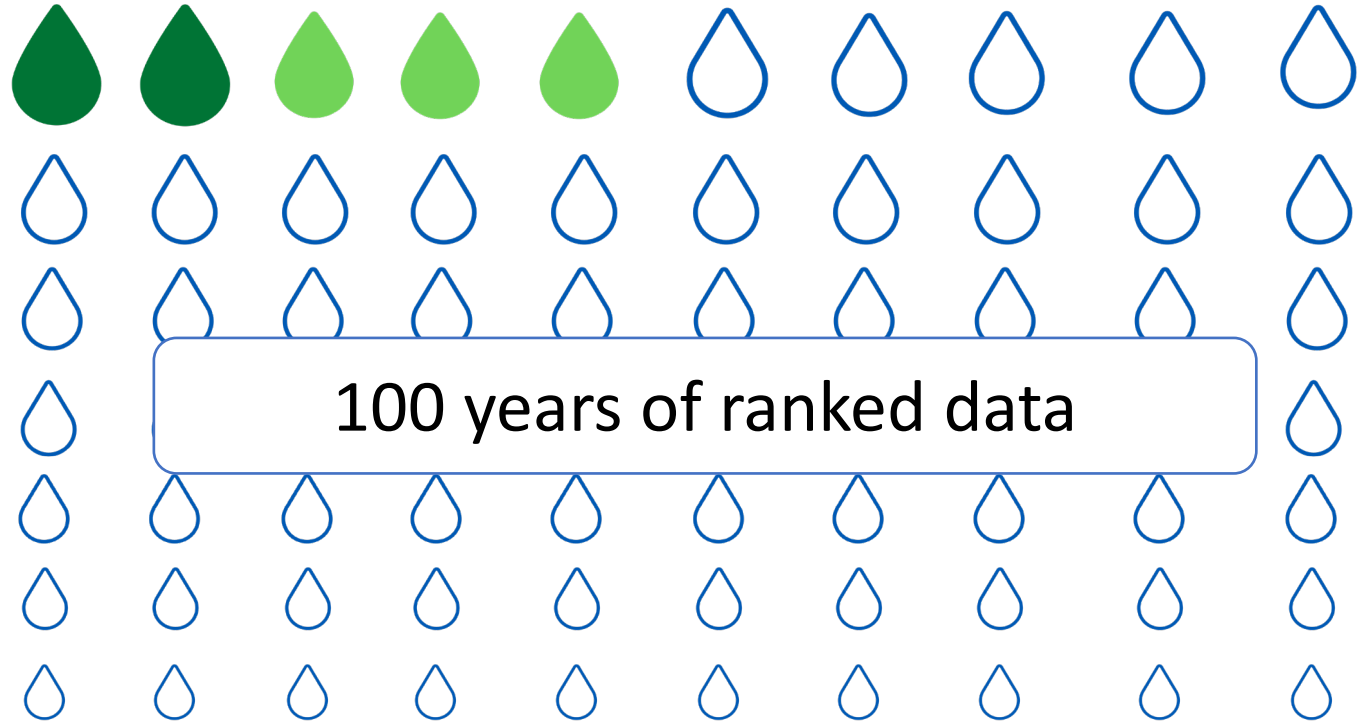


# Percentiles give historical context



34.53 30.81 28.35 26.36 26.25  
 1941 1957 1938 1978 1965

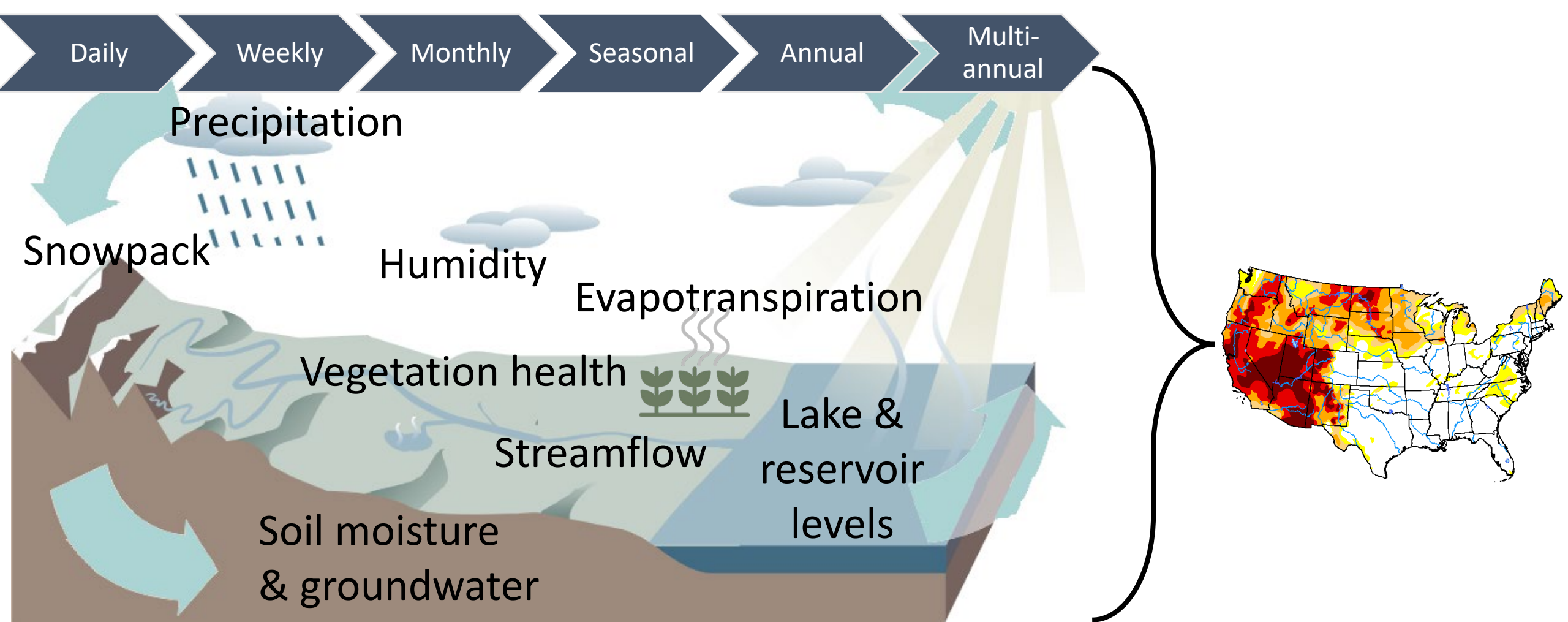
Most



		Percentile
	D0	Abnormally Dry 21-30
	D1	Moderate Drought 11-20
	D2	Severe Drought 6-10
	D3	Extreme Drought 3 - 5
	D4	Exceptional Drought 1 - 2

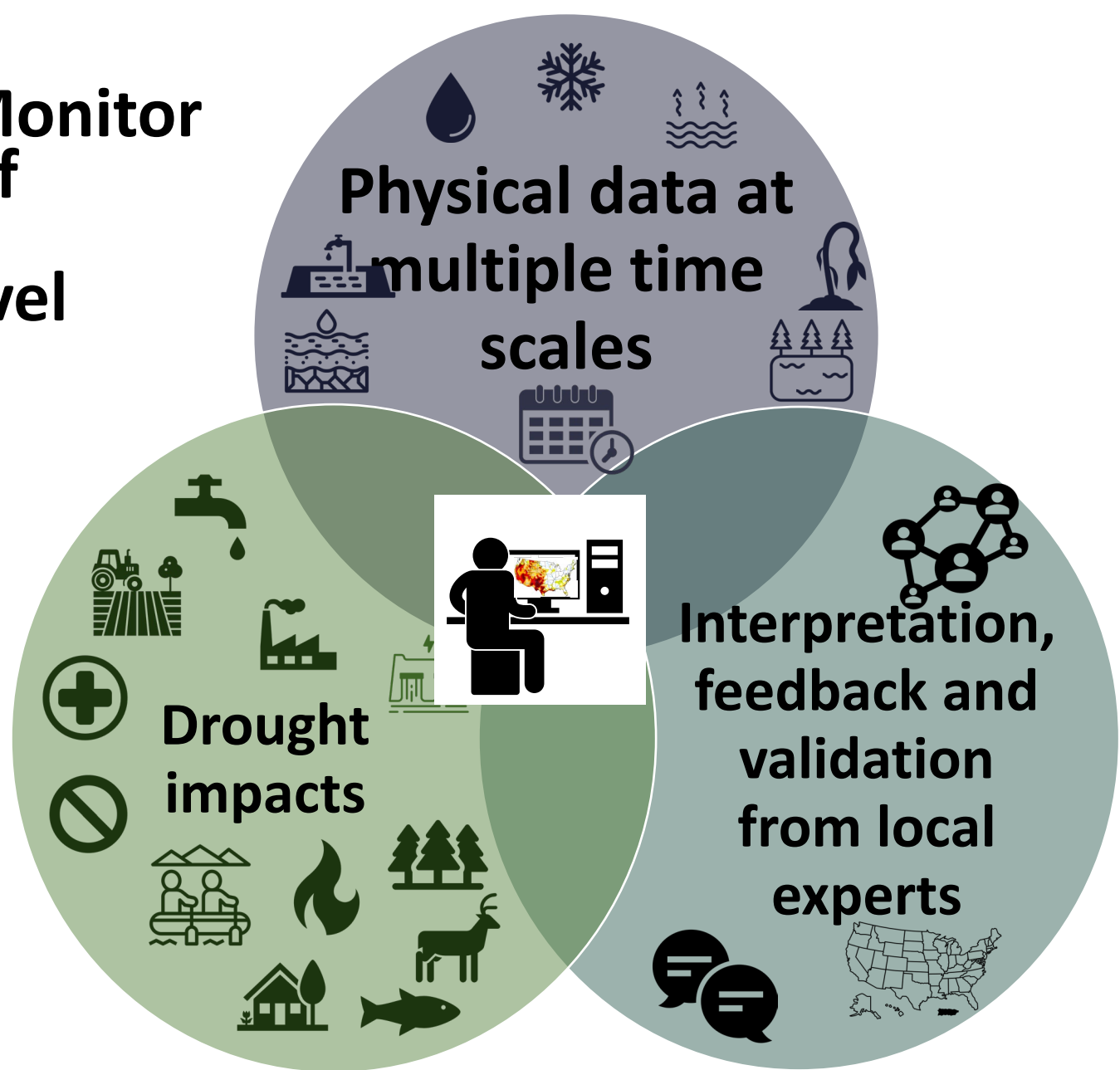
10.19 10.09 9.78 9.46 7.97  
 1934 2012 1956 1950 2020

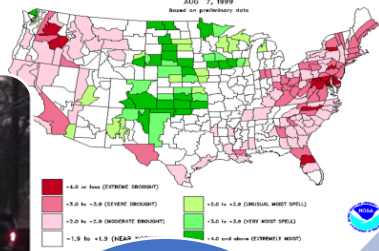
Least



The USDM is based on more than just rain and snow

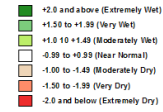
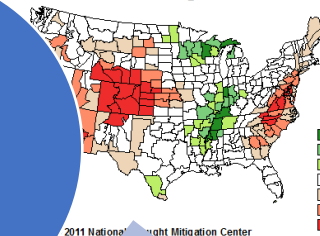
# U.S. Drought Monitor Convergence of Evidence on Another Level





Indices:  
SPI/PDSI

12-month SPI through the end of September 2002

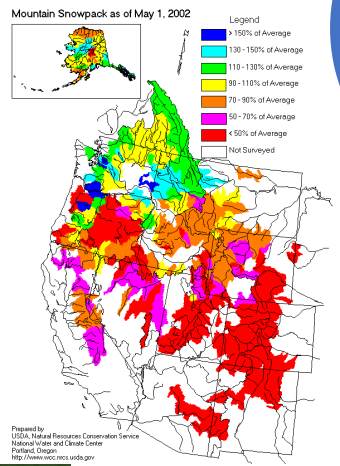
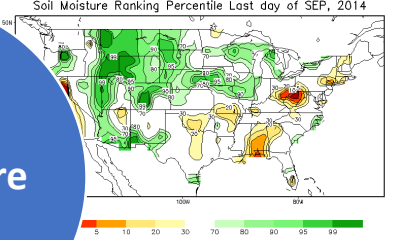


Precipitation  
and Snow

Most of the information analyzed each week falls into one of these categories.

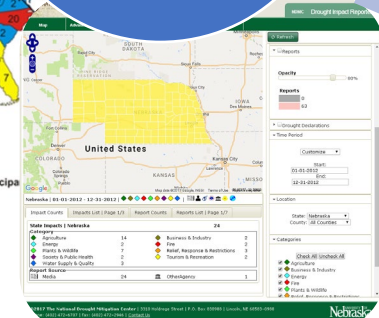
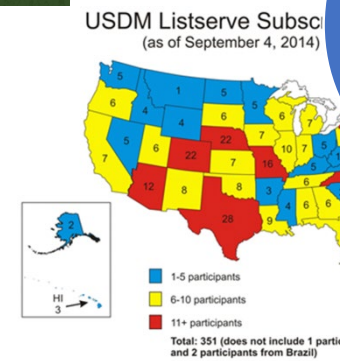
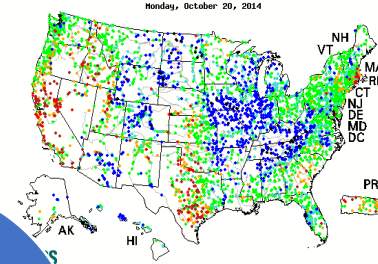
Authors now use roughly **40-50 unique indicators** while creating the U.S. Drought Monitor map, but not all areas are represented equally by all pieces of data.

Soil Moisture



Expert Local  
Input and  
Impacts

Streamflow  
and  
Reservoirs



Remote  
Sensing

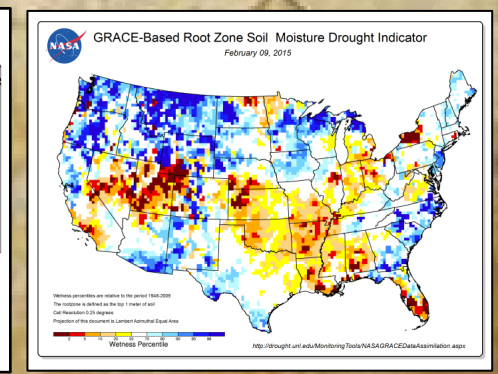
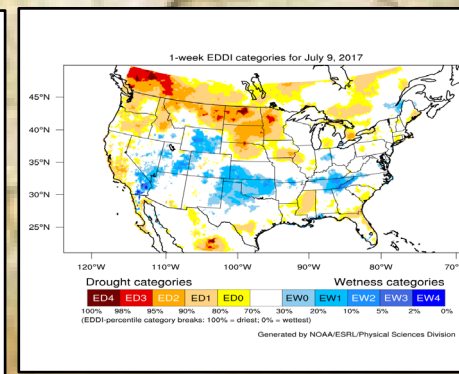
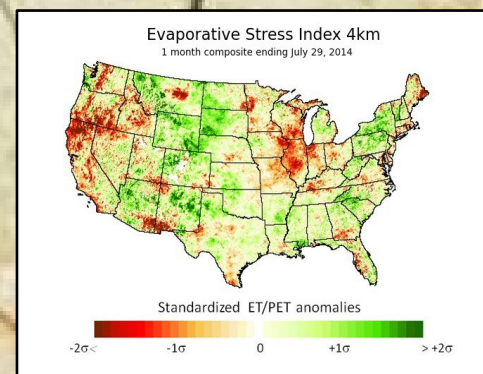
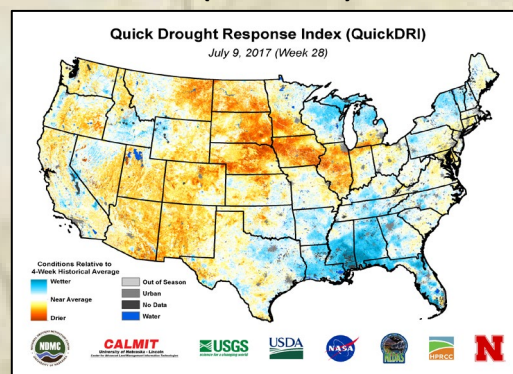
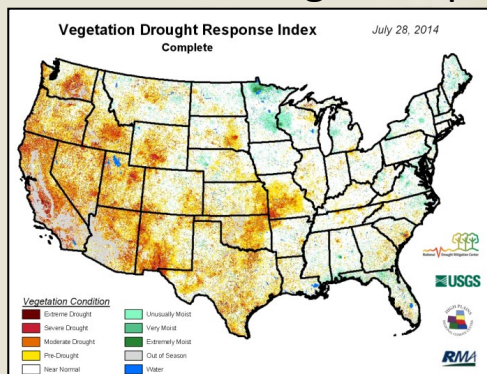
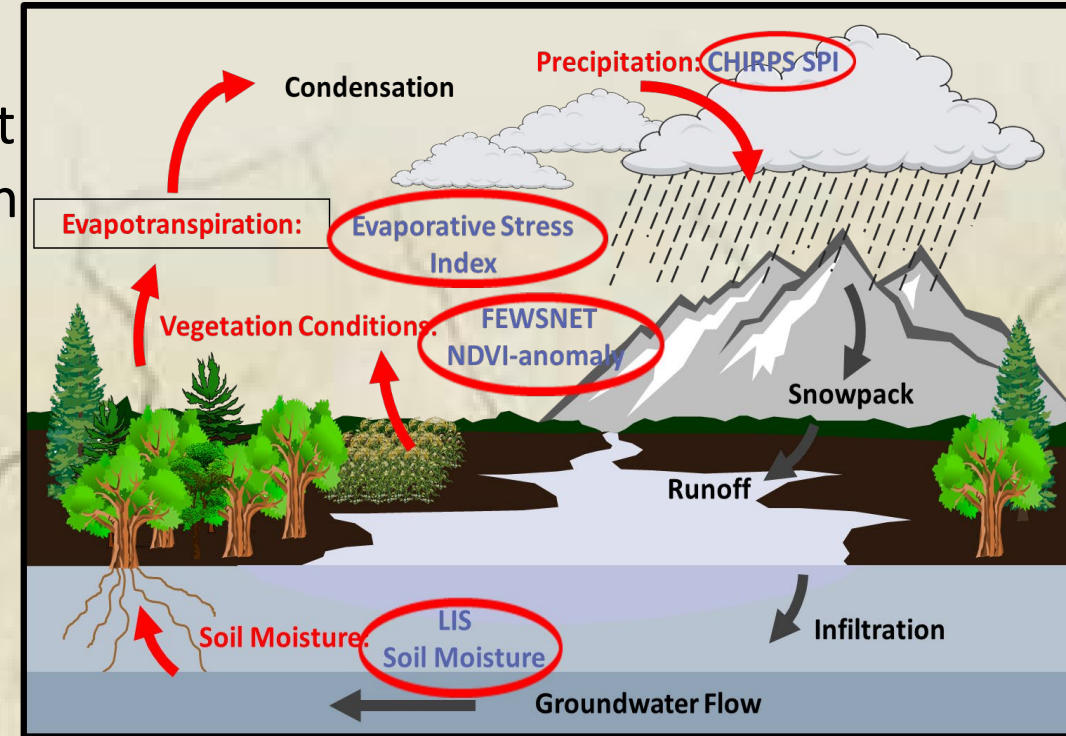


# Emerging Satellite-based Observations and Products

Over the past ~5-10 years, a number of satellite remote sensing-based (and modeled) tools and **products** **characterizing different parts of the hydrologic cycle** that influence drought conditions have been developed, which have allowed us to better track **“flash + eco droughts”**

## 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)
- SMAP, SIF, VPD and others...including next gen models (NLDAS)
- Grass-Cast
- Forest Drought Response Index (ForDRI)



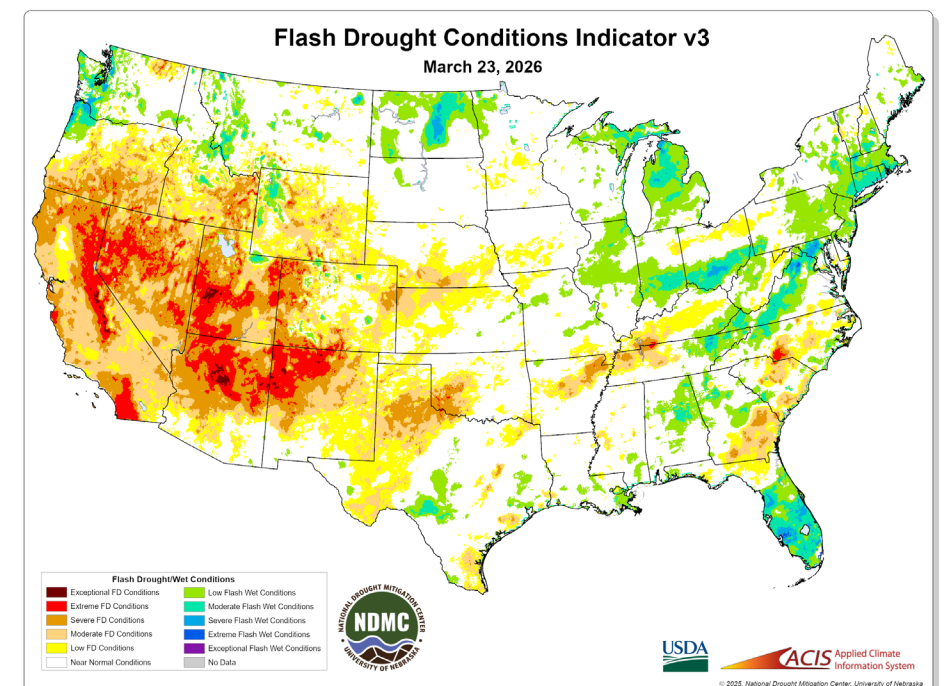
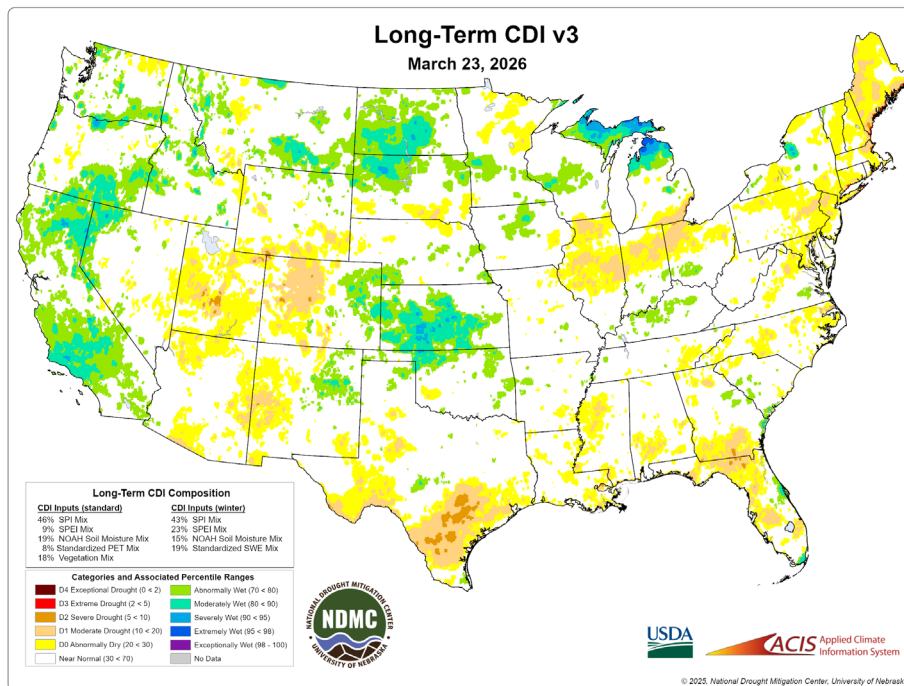
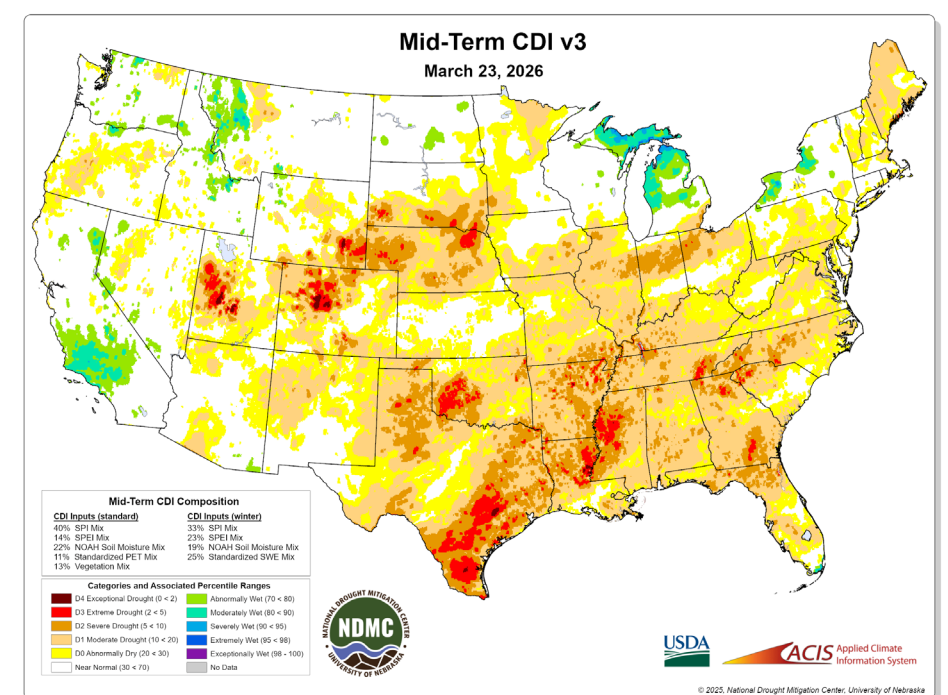
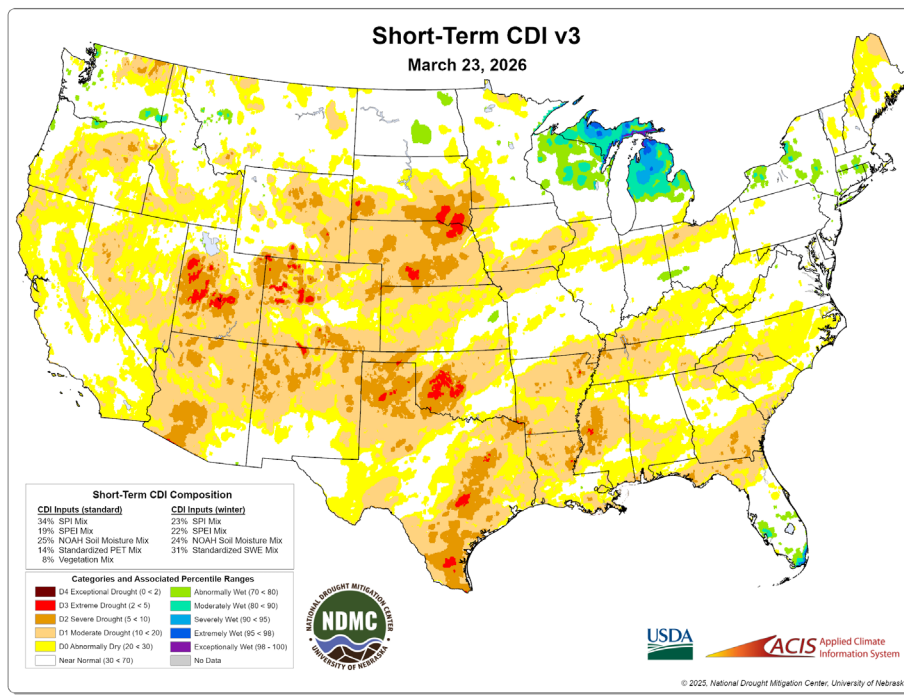
A look ahead:

Rise of the Machines!

New generation of ML-based Drought Indicators(CDI) developed to better account for regional + seasonal characteristics



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# Why Track Drought Impacts?

- All droughts and their *impacts* are **LOCAL!**
- Establish an impacts *baseline* for monitoring now and in the future
  - The “face” of drought (vulnerability)
  - Climate change
- To know where to direct *relief*
- To reduce *vulnerability* in advance of the next drought
- **“Ground truth”** indices, models, USDM
- No single method exists for collecting and/or *quantifying* drought losses
- Very little in the way of *environmental* or *qualitative* collection



# Impacts: The Face of Drought



**NDMC** Condition Monitoring Observer Reports (CMOR) 2022  
National Drought Mitigation Center, University of Nebraska

CMOR Filter Options

Select Date Range  
Predefined Calendar

- Year to Date
- Past 30 Days
- Past 7 Days
- Period of Record
- 2021
- 2020
- 2019
- 2018

Reset

Select State  
Select one or more

Select County  
Select State First

Select How Dry or Wet  
Select one or more

1000 km  
600 mi

Esri, USGS | Esri, Garmin, FAO, NOAA, EPA | The U.S. Drought Monitor is produced through a partnership between the  
Click on the Layer icon at the top-right of the map to view reports by impact category and CMOR report

[DROUGHT] Condition Monitoring Observer Reports (CMOR) for May 17-23, 2022

Drought Monitor Discussion Group <DROUGHT@LISTSERV.UNLEDU>  
To: DROUGHT@LISTSERV.UNLEDU  
Mon 5/23/2022 2:59 PM

CMOR received 30 reports in the past week, from North Dakota (13 reports), New Mexico (5), Georgia (4), Montana (2), Wyoming (2), California, Florida, Louisiana, and New York. Livestock issues were the top concern, followed by fire risk, crop issues, and wildlife issues.

From McKinley County, New Mexico:  
"We ranch in McKinley and Cibola Counties, and I have never seen it like this. We are unable to use our forest allotment this spring because of no water. We have one spring that we pipe water out of that has never gone dry in 90 years that we know of and it is now just a trickle, so is of no use on that 40,000 acre allotment, from 11,700 elevation down to 6,500 feet."

This week's photo is from Morgan County, Georgia:  
"Feeding cows hay on home place because of no available forage and discontinued planting because cannot till or plant because of no available moisture 10 miles away from home farm on rented land."

## Submit condition/impact reports to the NDMC's CMOR database/viewer

- <https://droughtimpacts.unl.edu/Tools.aspx>

**COCORAHS & DROUGHT**  
HOW HAS THE LACK OF RAIN IMPACTED YOU? LET US KNOW

[WWW.COCORAHS.ORG](http://WWW.COCORAHS.ORG)

ARE YOUR COWS ONLY DRINKING POWDERED MILK? YOUR FAVORITE FISHING HOLE DRY? LET US KNOW HOW DROUGHT HAS AFFECTED YOU ... YOUR COMMENTS ARE VERY IMPORTANT!

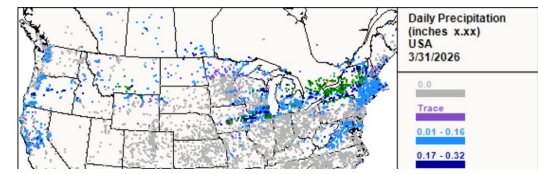
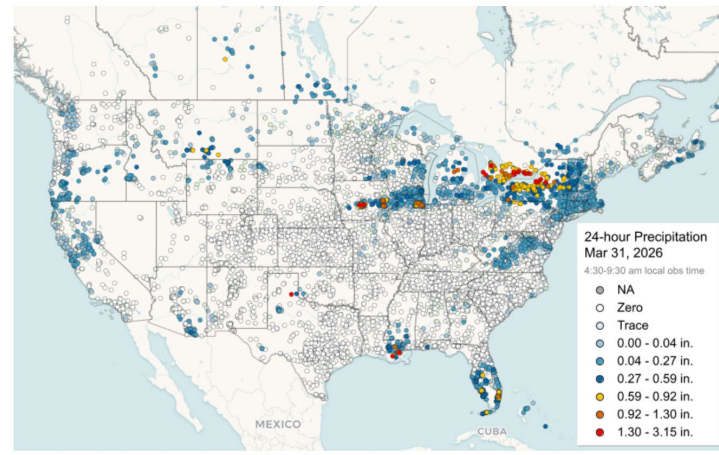
Welcome to CoCoRaHS! "Volunteers working together to measure precipitation across the nations."

**Rain Gauge Rally 2026**  
April 1-30, 2026

How many new volunteers can you recruit in your state?

Reports received today 3/31/2026 as of 6:24 PM EDT

Daily	Multi-day	SigWx	Hail	Condition	ET
11,238	137	10	34	14	17



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COCORAHS TESTIMONIALS  
TELL US YOUR STORY!

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TRAINING

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**Drought Impact Reports**

**DROUGHT IMPACTS REPORTING RESOURCE PAGE**

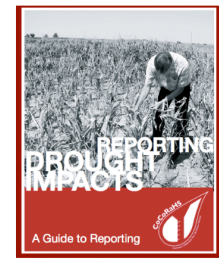
Has your community been **IMPACTED BY DROUGHT?**  
Tell us by submitting a "CoCoRaHS Drought Impact Report"

Please take a moment to view the "Drought Impacts Reporting Guide" below and then go ahead and submit an "Impact Report" on-line.

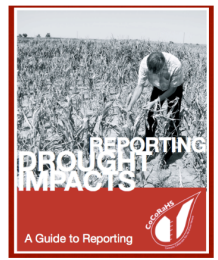
[View Drought Impact Reports](#)

**DROUGHT IMPACT REPORTING GUIDE**

View our short guide on Reporting Drought Impacts by clicking on the icon below:



HTML Slideshow



Downloadable PDF

**NATIONAL DROUGHT MITIGATION CENTER (NDMC)**

To find out more about drought and view the latest "Drought Impact Reporter" click on the logo below:



<https://www.cocorahs.org/content.aspx?page=droughtimpactreports>



**COWS GIVING POWDERED MILK?**

*CoCoRaHS Drought Impacts*

Report how drought is impacting your community with a "Drought Impact Report"

**DRINKING WATER TASTE DUSTY?**

*CoCoRaHS Drought Impacts*

Report how drought is impacting your community with a "Drought Impact Report"



# Thoughts on Drought Impacts

- All droughts and their **impacts** are **LOCAL!**
  - Monitoring local/basin/regional/tribal/national/global (bottom-up or top-down or a combination of both)
  - Planning local/regional/national (**Vulnerability assessment critical**)
  - Connected globally however...
- Droughts are one of the globe's **leading causes of economic loss...**
  - Large spatial footprint, long duration, many affected
  - Water and food security issues at play
  - Indirect impact: loss of life via famine
- **Impact collection/monitoring must be an integral part** of any drought early warning information system
- **The Drought Impact Reporter: (<http://droughtreporter.unl.edu>)**



# What is “Flash” Drought?

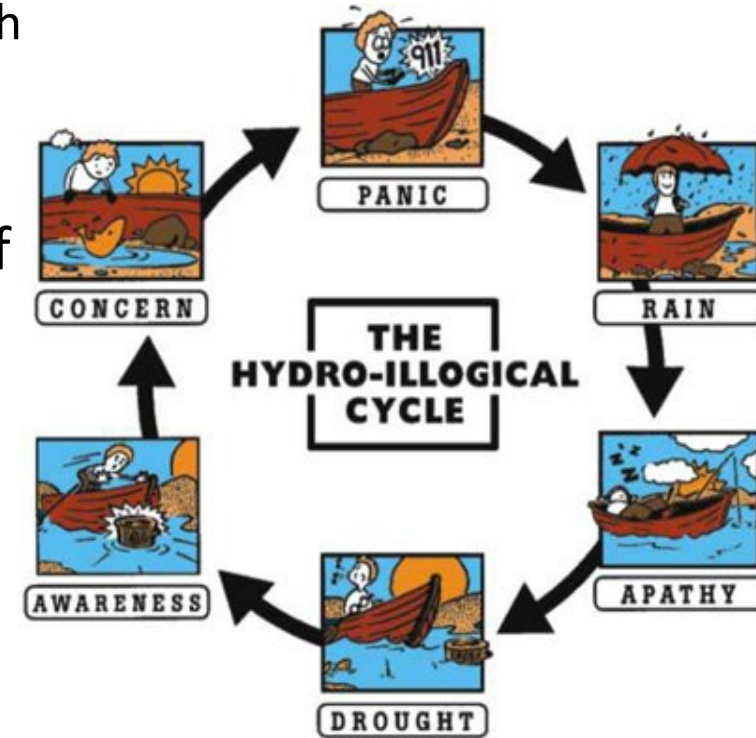
An unusually ***rapid onset drought*** event characterized by a multiweek period of ***accelerated intensification*** that ***culminates in impacts*** to one or more sectors (agricultural, hydrological, etc.). American Meteorological Society, 2020: Flash Drought. Glossary of Meteorology, <http://glossary.ametsoc.org/wiki/climatology>

Otkin, J. A., M. Svoboda, E. D. Hunt, T. W. Ford, M. C. Anderson, C. Hain, and J. B. Basara, 2018: Flash droughts: A review and assessment of the challenges imposed by rapid-onset droughts in the United States. *Bull. Amer. Meteor. Soc.*, **99**, 911–919, <https://doi.org/10.1175/BAMS-D-17-0149.1>.



# Flash Drought and Early Warning Challenges/Opportunities

- Drought early warning = **monitoring and forecasting**
  - **Days to Decades Spectrum!**
  - Diligent weekly monitoring and forecasting (**S2S—sub-seasonal to seasonal**) need to work in concert and both need to get better
  - Climate Prediction Center: new flash drought forecast
- **No single driver** provides a complete depiction of flash drought
- Flash drought can serve as the **torch bearer for better drought “early warning”** allowing more proactive action to be taken in order to reduce impacts and in changing our decision making and policy mindset
- There is **no excuse** for having drought sneak up on us!
  - **Apathy is a key part of the hydro-illogical cycle...** ☹️



# A Flash Drought Thought or Two

- ***Dealing with Flash Drought isn't just about changing our "tool set", but rather our "mindset", planning and decision making!***
  - Changing our "slow onset" mentality in the context of early warning to better account for "rapid onset"
  - Can't let the idea that drought is only a slow-onset disaster become the only doctrine...
  - Must bridge early warning systems into planning and policy (mitigation and response)
- Bottom line, just as is the case with other types of drought, there is ***no universal definition of "flash drought"***
- ***Appeal to the shorter decision time line/horizon*** of decision makers, resource managers and policy makers. This is an opportunity to get drought on their "radar" and begin integration into process, practice and policy





MIKE LUCKOVICH

ATLANTA JOURNAL-CONSTITUTION @ 10/21/17 AR.com  
?



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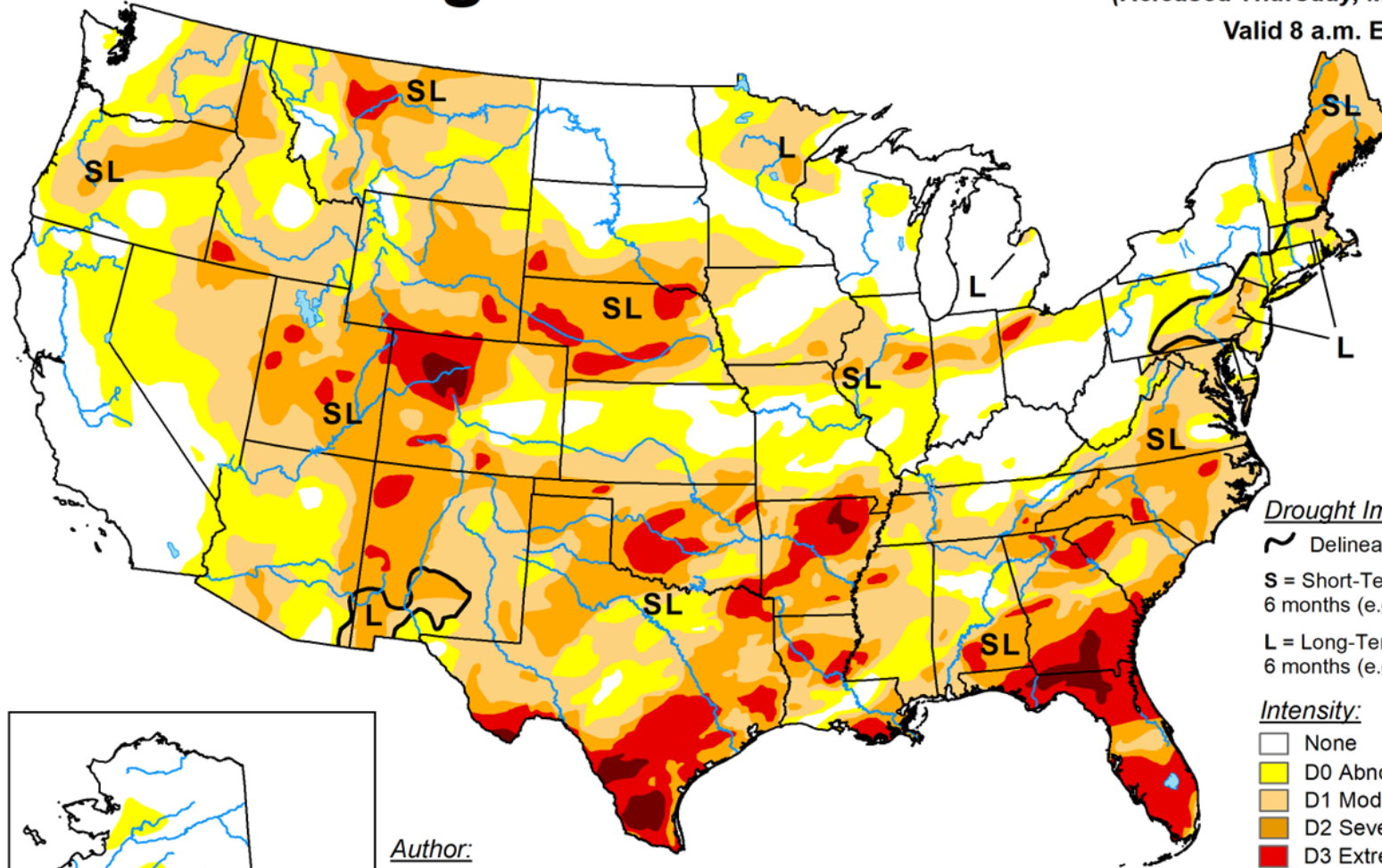
# Looking ahead in 2026....



# U.S. Drought Monitor

March 24, 2026  
(Released Thursday, Mar. 26, 2026)

Valid 8 a.m. EDT

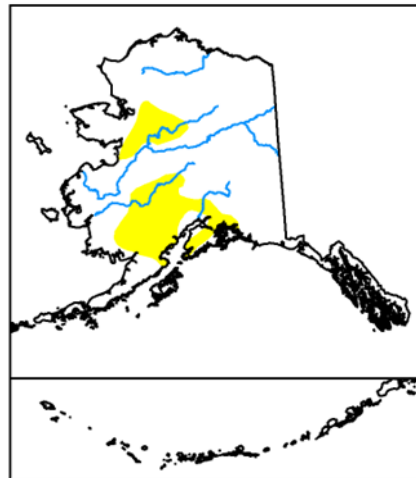


### Drought Impact Types:

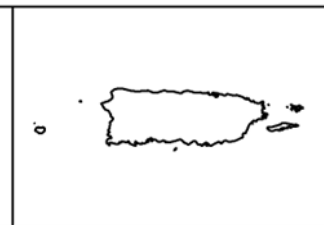
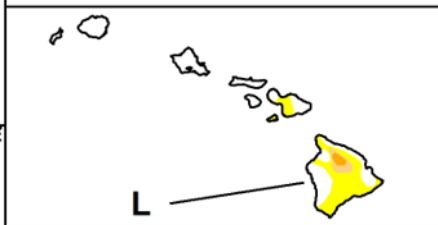
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

### Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought



Author:  
Rocky Bilotta  
NCEI/NOAA

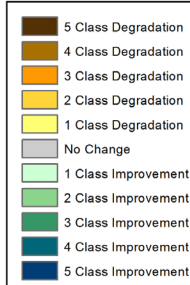
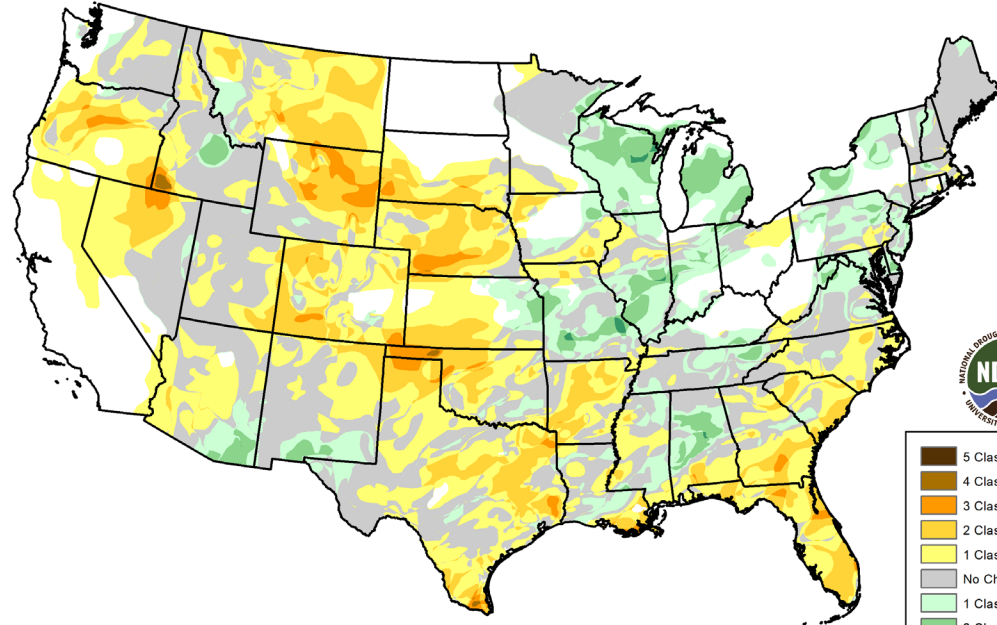


The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



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

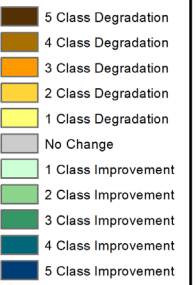
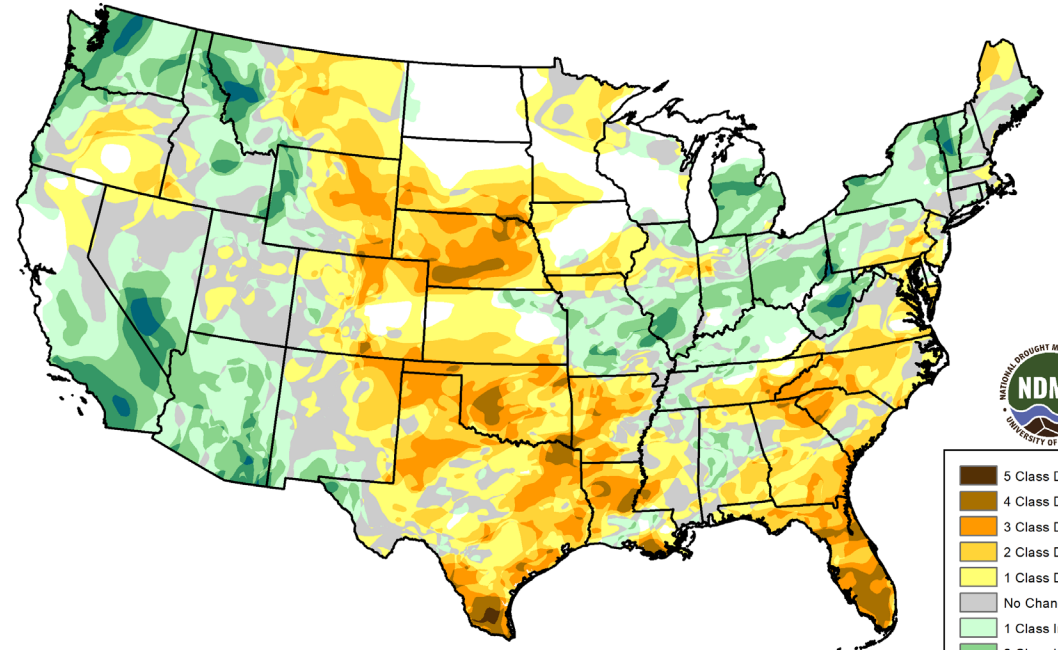
**U.S. Drought Monitor Class Change - CONUS**  
Start of Calendar Year



March 24, 2026  
compared to  
January 6, 2026

droughtmonitor.unl.edu

**U.S. Drought Monitor Class Change - CONUS**  
Start of Water Year



March 24, 2026  
compared to  
September 30, 2025

droughtmonitor.unl.edu



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**Snow Water Equivalent Percentile (POR)**  
 March 31, 2026, end of day

- ≥ 85
- 71 to 84
- 57 to 70
- 43 to 56
- 29 to 42
- 15 to 28
- < 15

⊖ Observation missing

**Watershed Boundaries**

- Region (HUC2)
- Sites with less than 20 years of data or low variability excluded

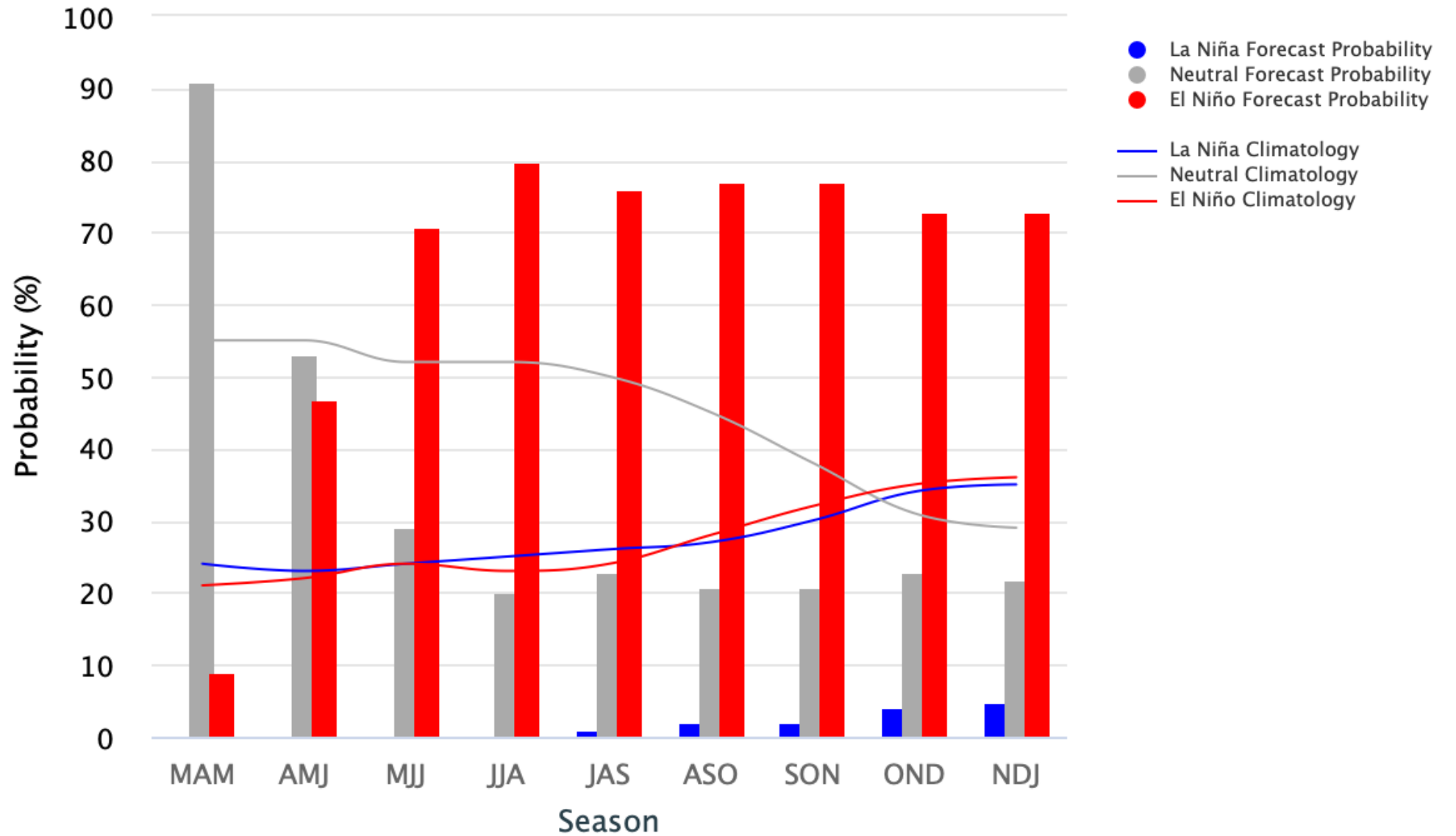
**NRCS** Natural Resources Conservation Service  
 Created 4-01-2026, 11:42 AM CDT



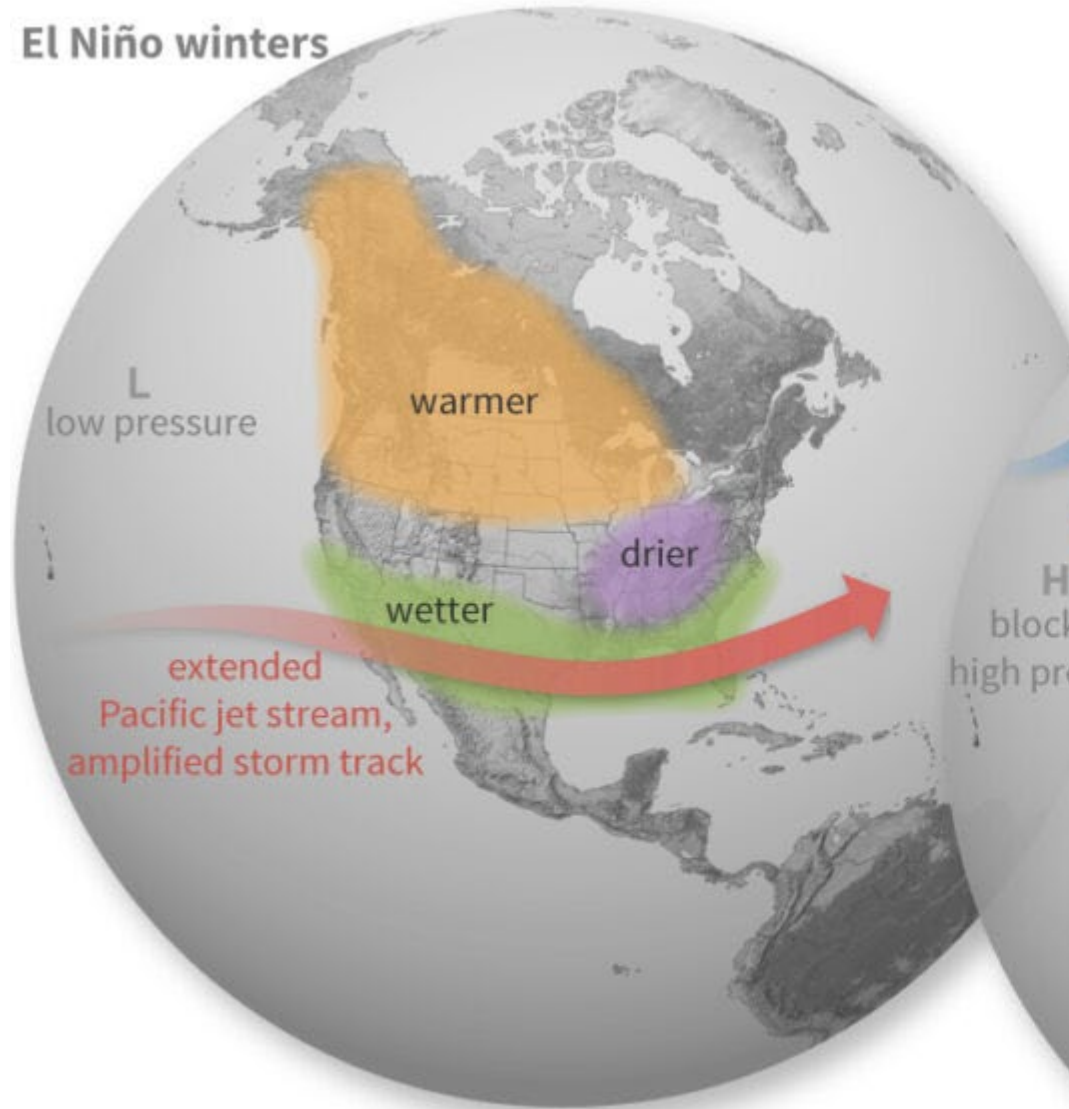
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# Mid-March 2026 IRI Model-Based Probabilistic ENSO Forecasts

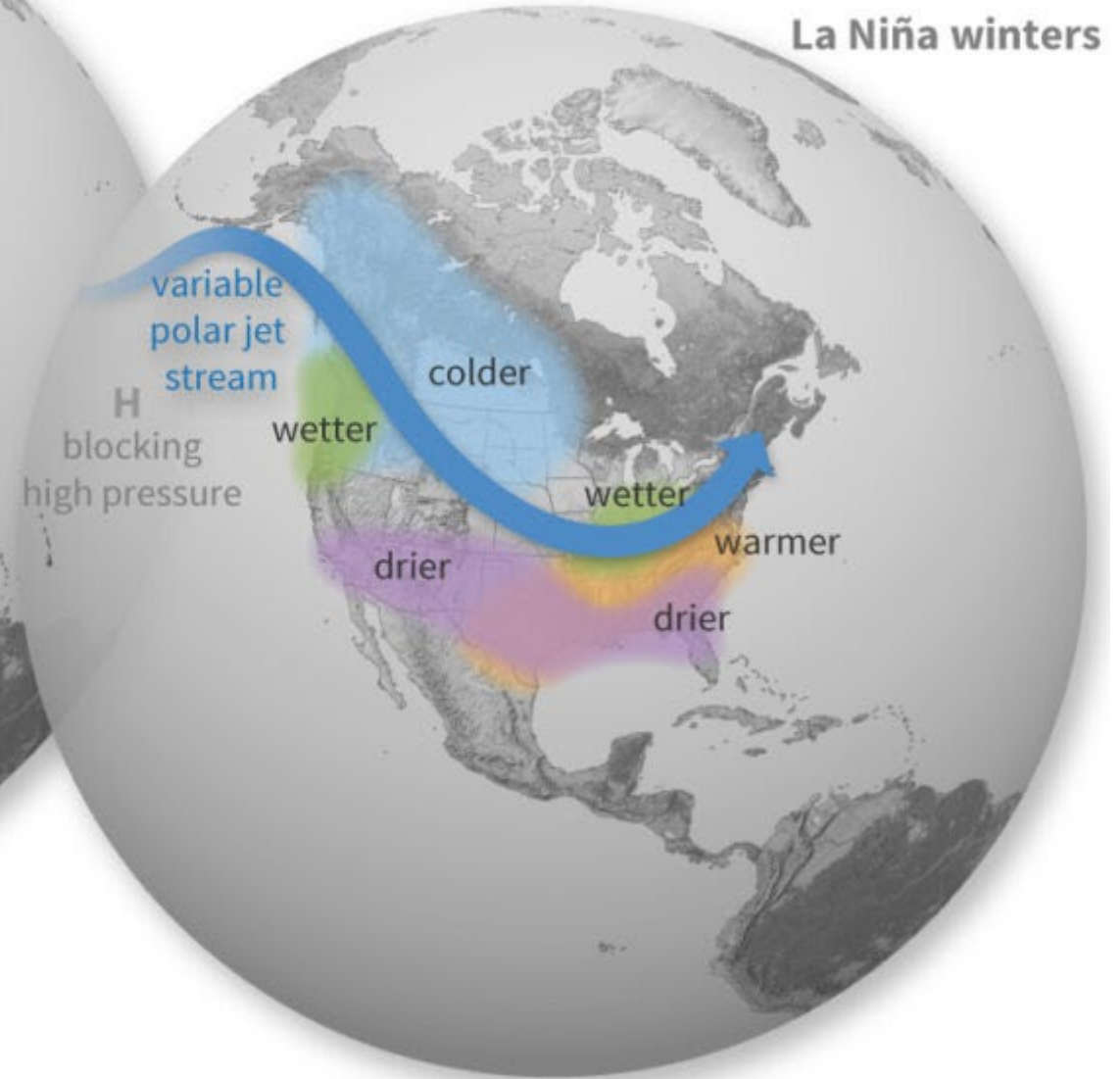
ENSO state based on NINO3.4 SST Anomaly Neutral ENSO:  $-0.5\text{ }^{\circ}\text{C}$  to  $0.5\text{ }^{\circ}\text{C}$

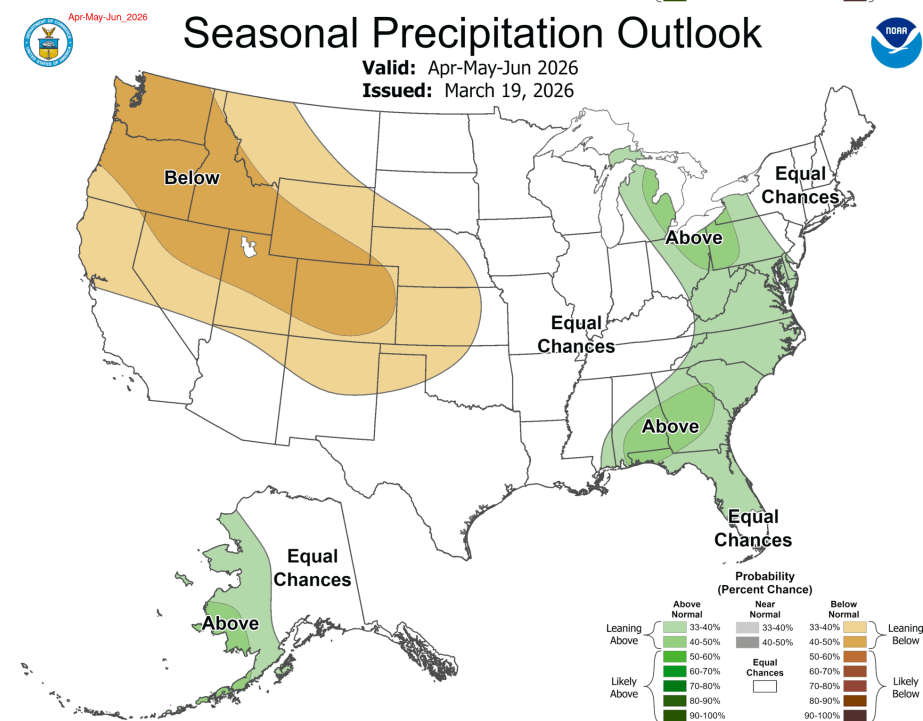
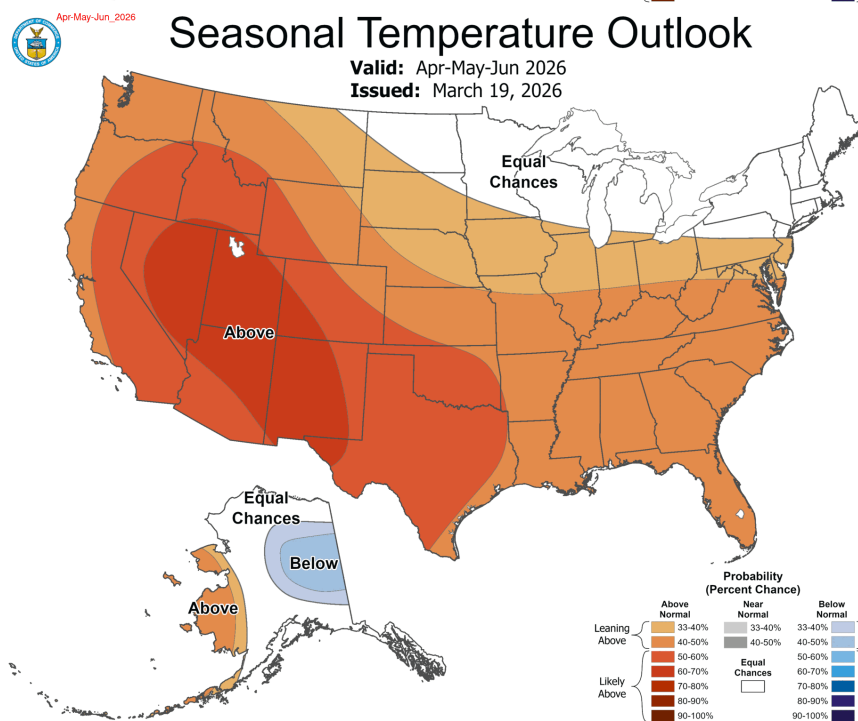
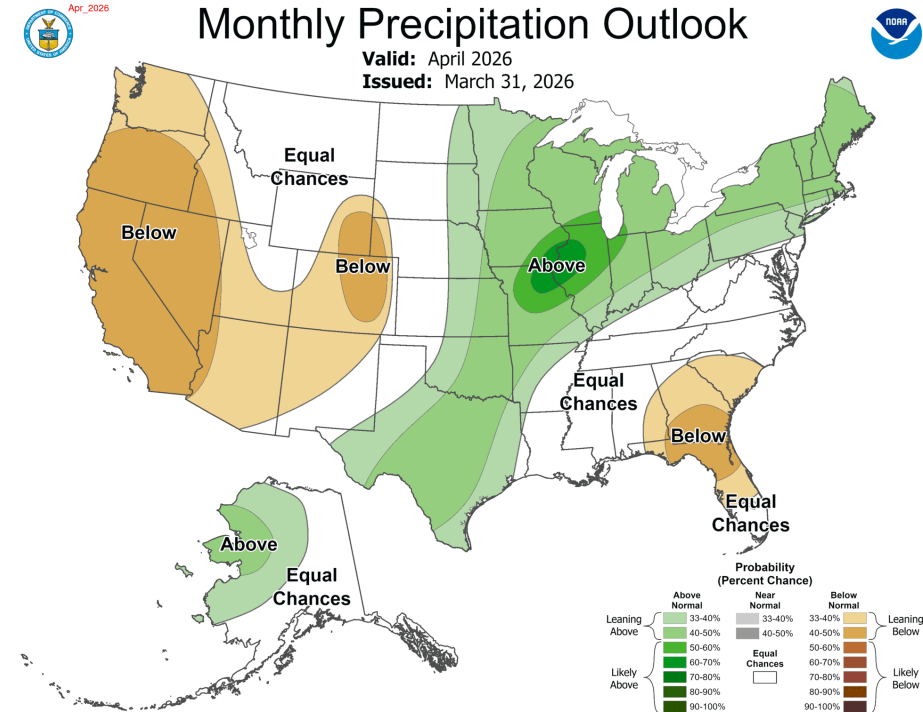
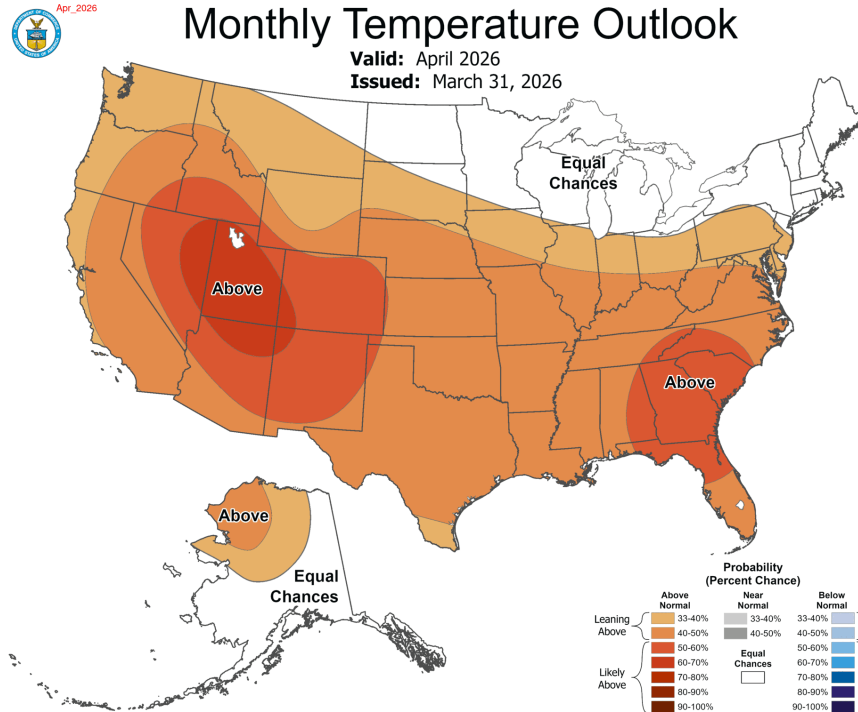


## El Niño winters



## La Niña winters





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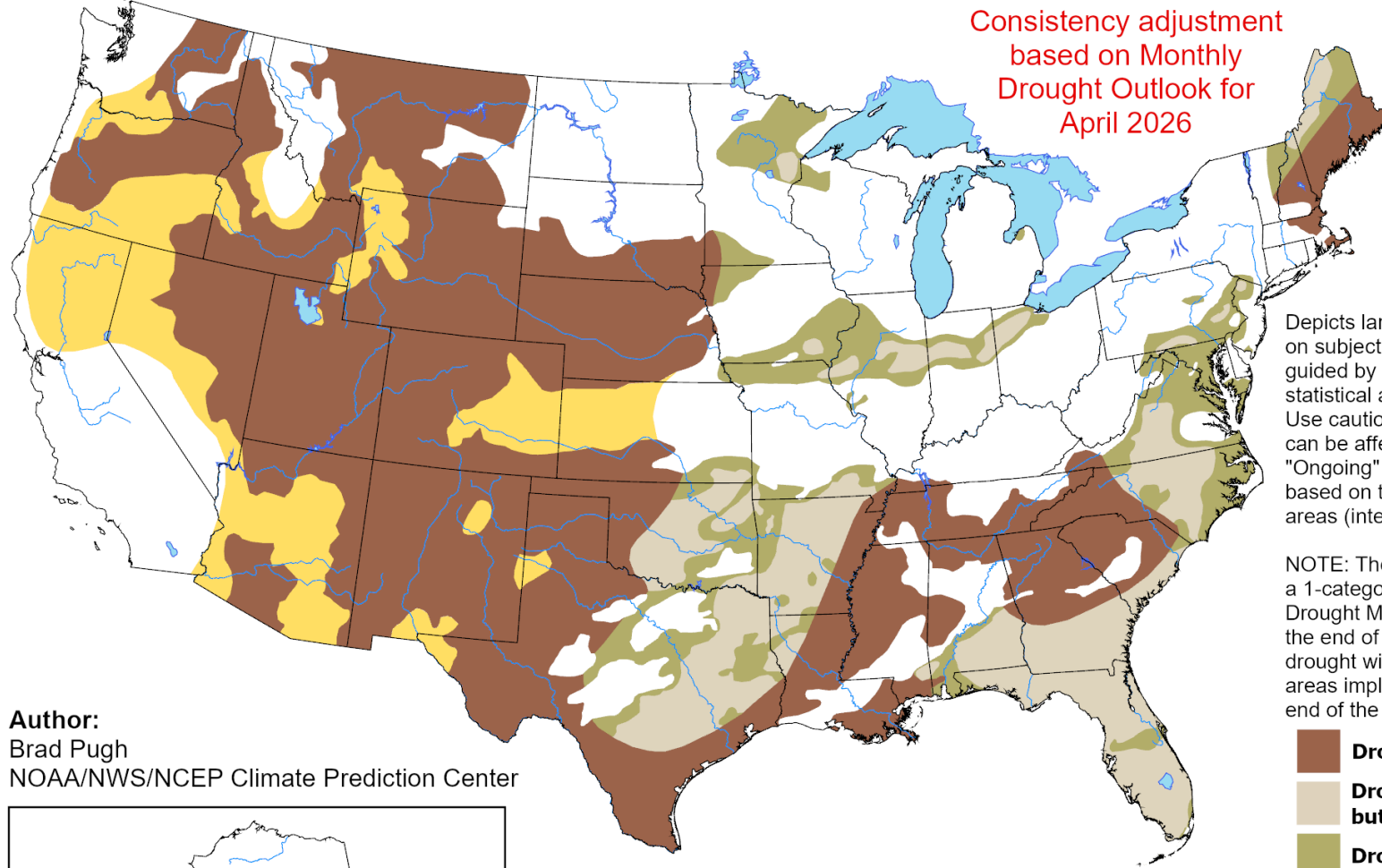
# U.S. Seasonal Drought Outlook

## Drought Tendency During the Valid Period

Valid for April 1 - June 30, 2026

Released March 31, 2026

Consistency adjustment  
based on Monthly  
Drought Outlook for  
April 2026

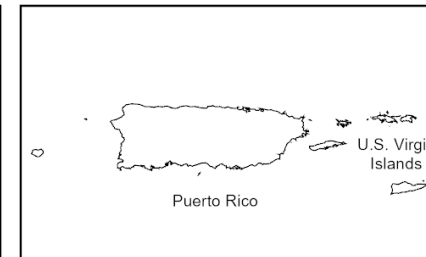
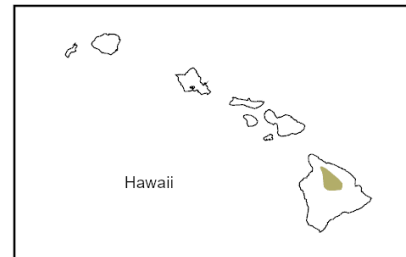


Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists
- Drought remains, but improves
- Drought removal likely
- Drought development likely
- No drought

**Author:**  
Brad Pugh  
NOAA/NWS/NCEP Climate Prediction Center



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<https://go.usa.gov/3eZ73>

# Final Drought 2025-2026 Thoughts

- 2025-26 Fall and Winter **none-too-kind** thus far!
  - Recent snow storm helps, but.....
- **Spring rains will be critical** for soil moisture recharge (grain/forage prospects tied to this)
- **No large buffer/carryover coming into 2026**, ...so for many, they will be living rain event to event much earlier...heat waves likely again if below-normal soil moisture recharge takes place.





“There’s nothing more frightening than being without water.”

Mayor Campbell, Edina, MO, May 1989



# DROUGHT: Future Challenges and Opportunities

- Climate change/*flash/eco droughts*
- Public *health* issues
- *Trans-boundary* issues
- Food and water *(in)security*
  - *Climate shocks*
- Impacts aren't created equally
  - Vulnerability/risk
  - Can be **BOTH** negative and positive in nature
- Promote and Encourage *Citizen Science*
  - Capitalize on *social media and cellular* technology/culture
  - **What you are doing matters!**
- Risk management
  - *Mitigation* applications
  - *Planning* activities at all scales
  - Improved *monitoring and prediction*
  - *Decision support and information delivery*



# Thank You!



DROUGHT.UNL.EDU

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 /NationalDroughtMitigationCenter

 @droughtcenter

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**402-472-8238**

