

# Soil Moisture Applications/Needs at the NDMC: The United States Drought Monitor Process and BEYOND

Brian Fuchs and Mark Svoboda  
National Drought Mitigation Center  
University of Nebraska-Lincoln  
School of Natural Resources



2018 MOISST Workshop  
June 5-7, 2018  
Lincoln, NE

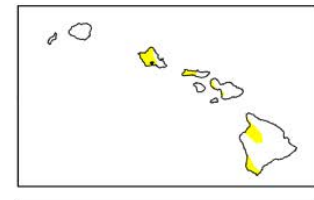
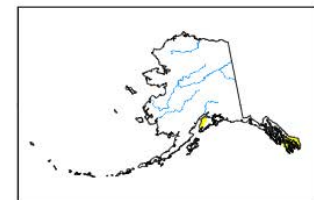
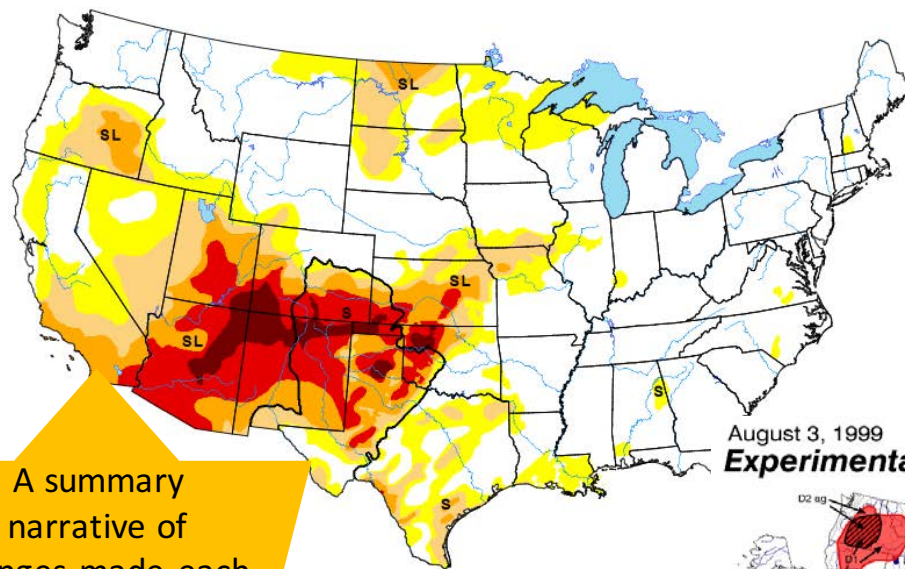


# The United States Drought Monitor

- Hosted by the NDMC as part of a 3-way partnership with NOAA and USDA
- Weekly maps provided since 1999
- Over 450+ “Local Experts” participating each week
- Over 12.5 million hits a year
- Used in several USDA programs
- Used by the IRS for tax deferrals
- Many others !

## Map for May 31, 2018

Data valid: May 29, 2018 | Author: [Anthony Artusa](#), NOAA/NWS/NCEP/CPC



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



A summary narrative of changes made each week, by region, can be found in the **“Drought Summary”**

- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)

- Delineates
- S - Short-Term in
- L - Long-Term in

“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 (D3-D4) to extreme (D4)

**Crosshatching** - Overlapping drought type areas

**Drought type** (used when impacts differ)

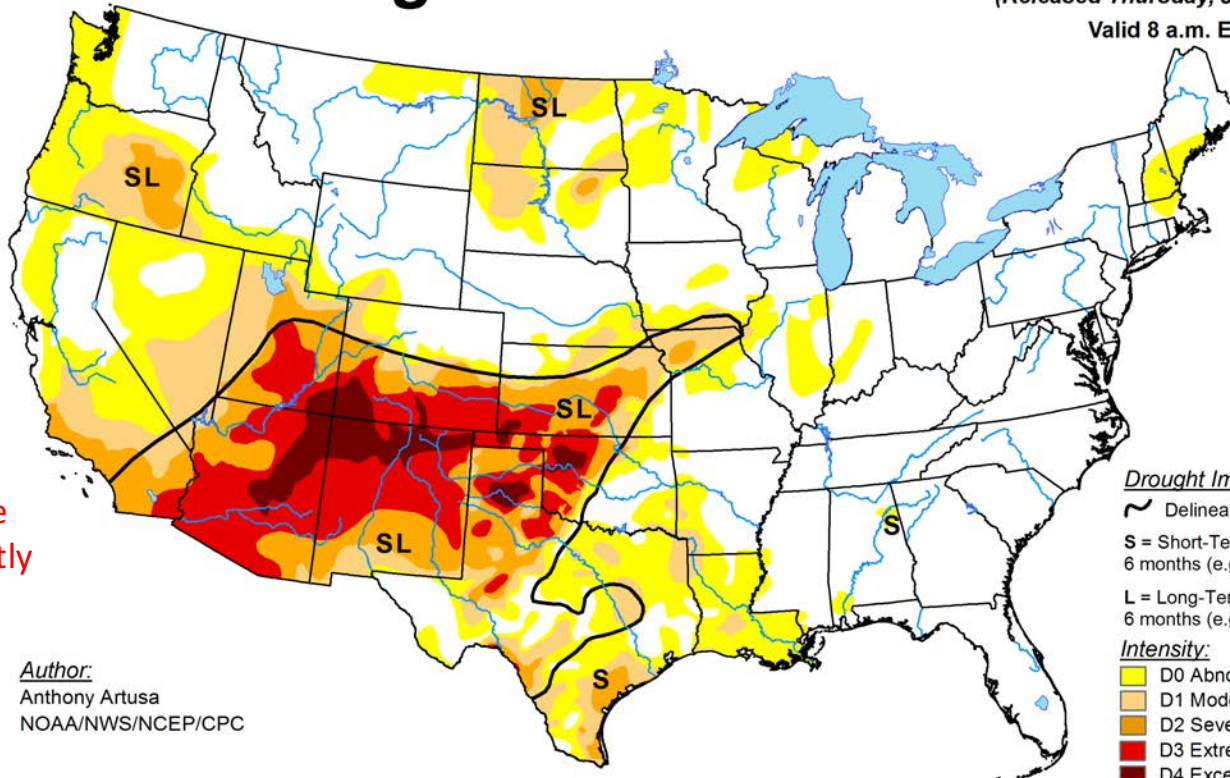
- Ag = agricultural (crops, grasslands)
- Fire = forestry (wildfire potential)
- Hydro = hydrological (rivers, wells, reservoirs)

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



# U.S. Drought Monitor

June 5, 2018  
(Released Thursday, Jun. 7, 2018)  
Valid 8 a.m. EDT



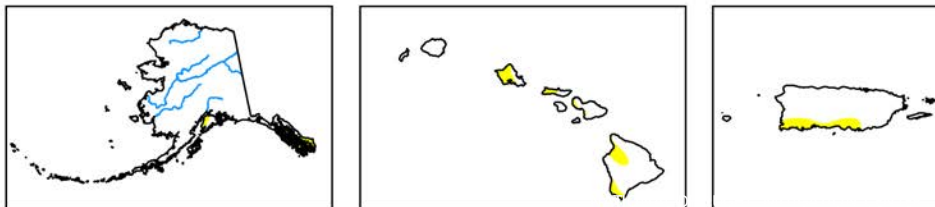
22.63% of the country currently in drought

*Author:*  
Anthony Artusa  
NOAA/NWS/NCEP/CPC

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:**
- 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.



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	} 4 Drought intensities
	D3 Extreme Drought	
	D4 Exceptional Drought	

# U.S. Drought Monitor Objectives








- Assessment of **current** drought conditions and **current** drought impacts
- The U.S. Drought Monitor is **NOT** a model
  - The map is made manually each week based off the previous map
- The U.S. Drought Monitor is **NOT** interpreting just precipitation
- The U.S. Drought Monitor is **NOT** a forecast or drought declaration
  - Can be used by decision makers in this way though
- Identifying **impacts**
  - “**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
  - 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 and indicators **must** support the depiction on the map
  - Impact data validates physical data

# Percentiles and the U.S. Drought Monitor

## Advantages of percentiles:

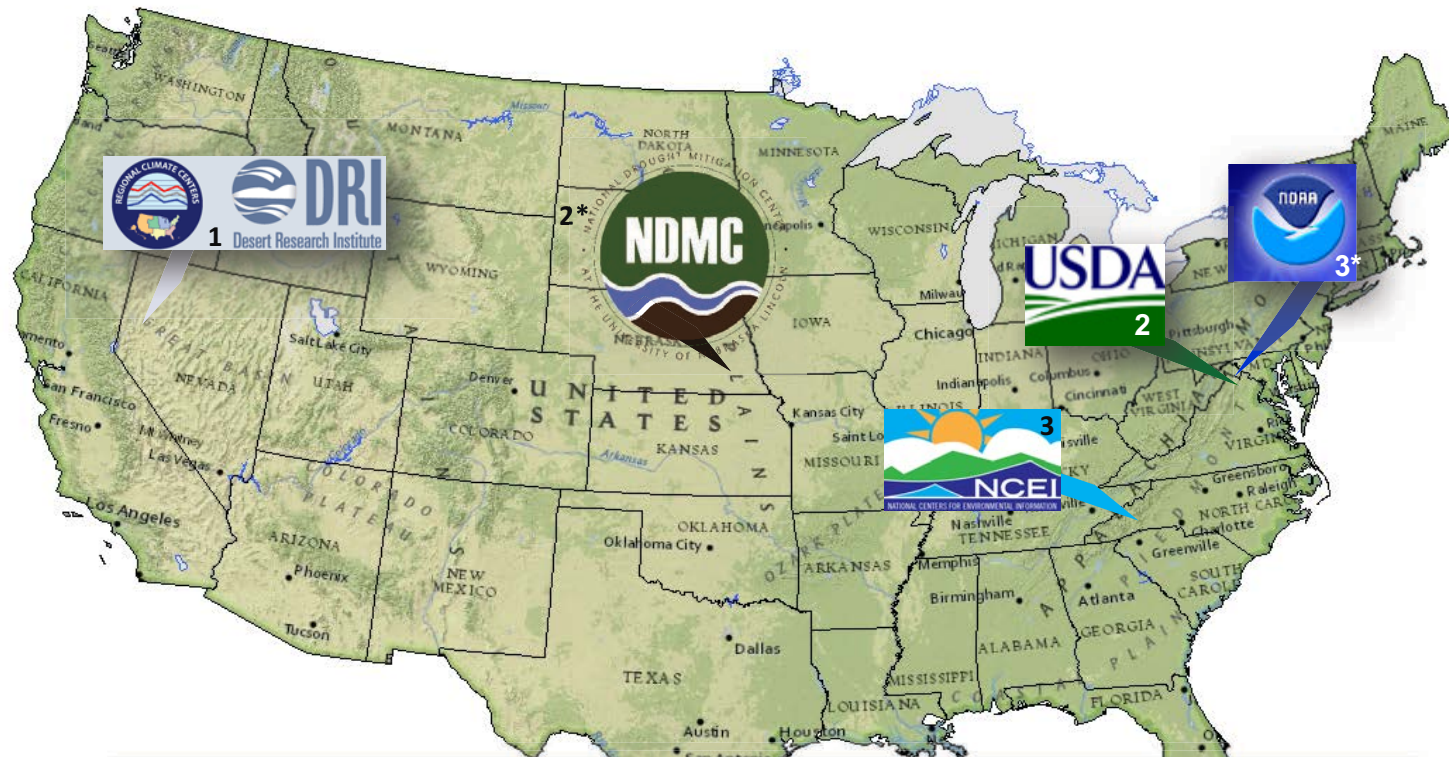
- Can be applied to any parameter used in the drought analysis
- Can be used for indicators of any length of data record
- Puts drought in historical perspective:

**How many occurrences in a given period of time**

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

# How is all of this done?



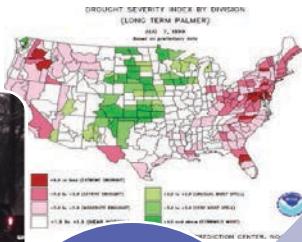
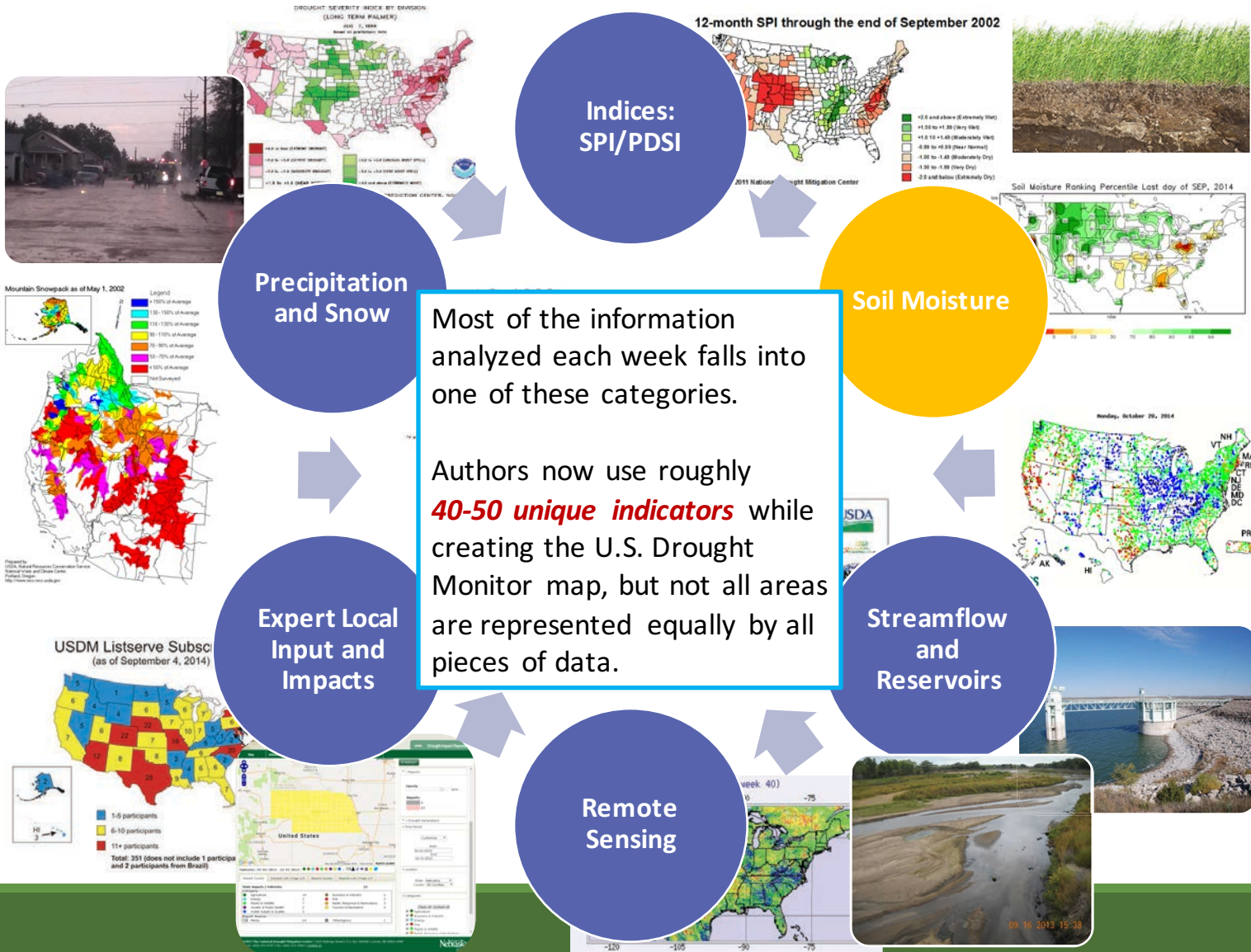


**Requirement: Authors must work at a regional or national “center”, government or academia/research**

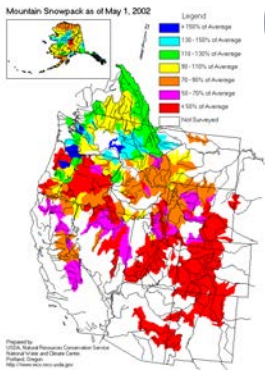
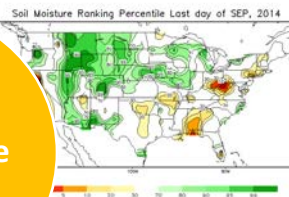
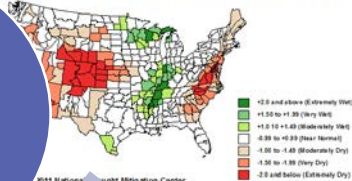
**There are currently 11\* authors, and all are volunteers**







12-month SPI through the end of September 2002

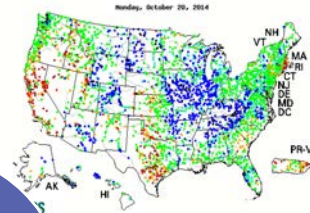


**Precipitation and Snow**

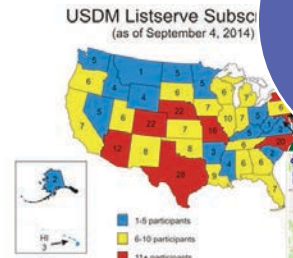
Most of the information analyzed each week falls into one of these categories.

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**

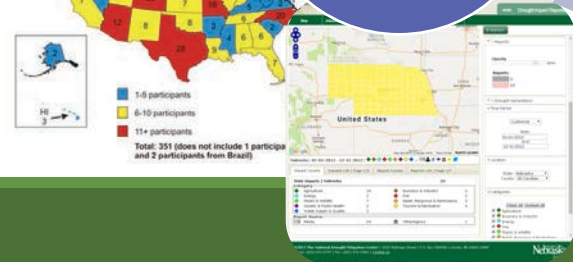
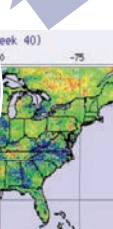


**Streamflow and Reservoirs**



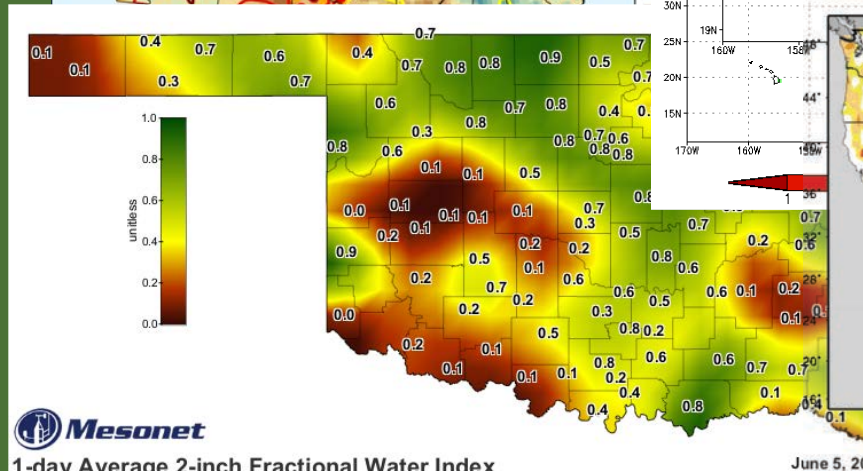
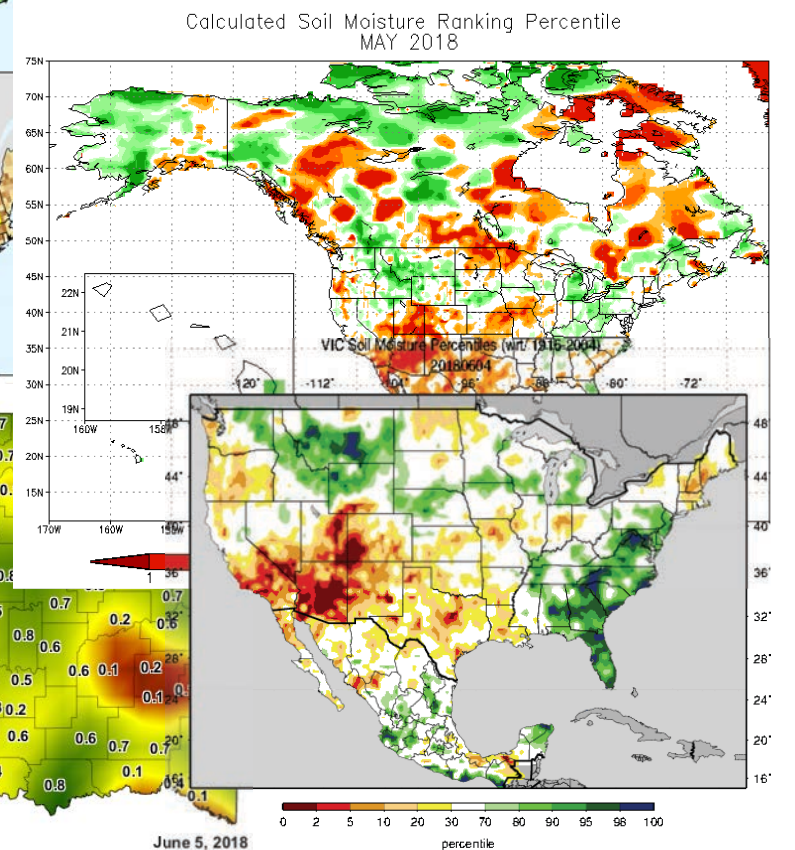
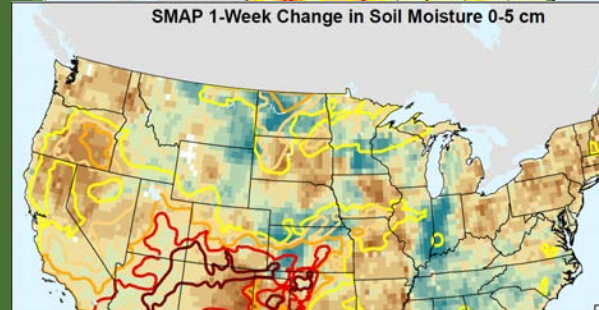
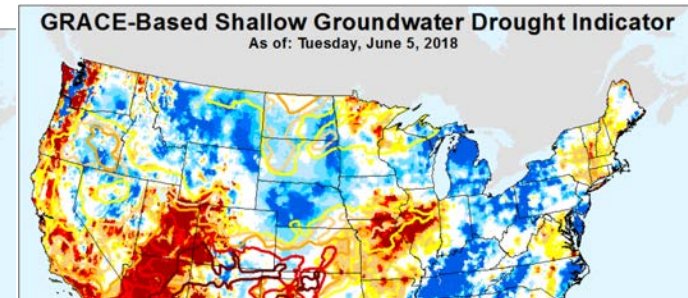
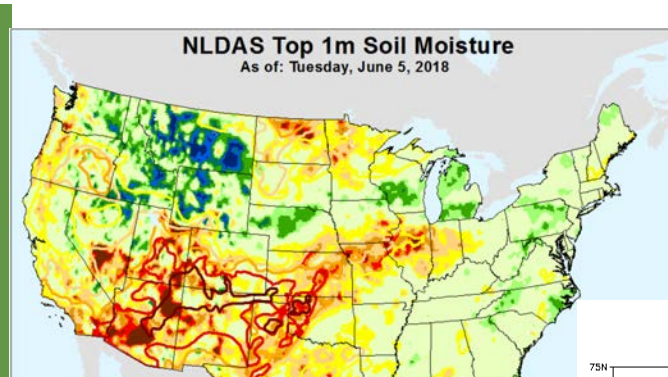
**Expert Local Input and Impacts**

**Remote Sensing**



# Soil Moisture Data used in the USDM production

- ❖ NLDAS
- ❖ SMAP
- ❖ SCAN
- ❖ GRACE
- ❖ Mesonets
- ❖ VIC
- ❖ Sacramento
- ❖ CPC
- ❖ And others.....



# USDM Soil Moisture

## “Wish List”



- Keep working towards a coordinated soil moisture product for the CONUS based upon in situ data
- Provide data in percentiles and in a GIS compatible format so the USDM Authors can ingest the data each week into their analysis
- Develop a soil moisture climatology going as far back as possible
- Provide guidance on the limitations of any aggregated products
- Weekly updates of these soil moisture products if not near-real time
- Develop hybrid products along with the remote sensing community using both in situ and satellite data for the CONUS
- Utilize existing federal platforms (SCAN, CRN, etc) and state/regional networks to expand our soil moisture monitoring efforts



**And now....BEYOND the USDM**

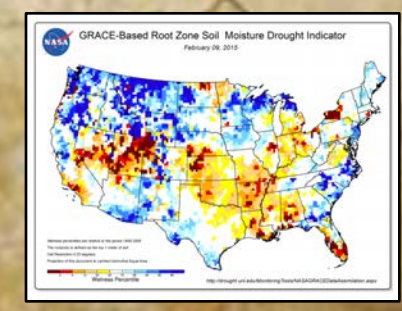
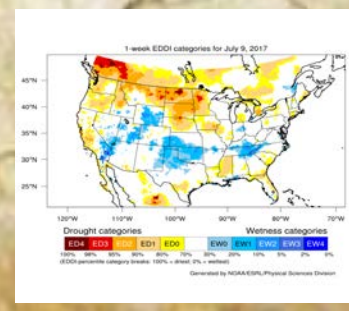
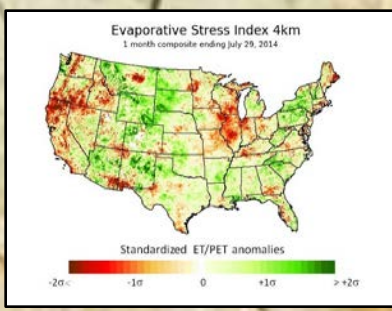
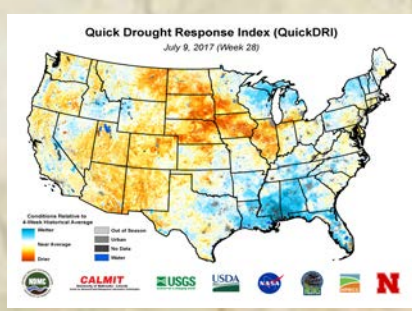
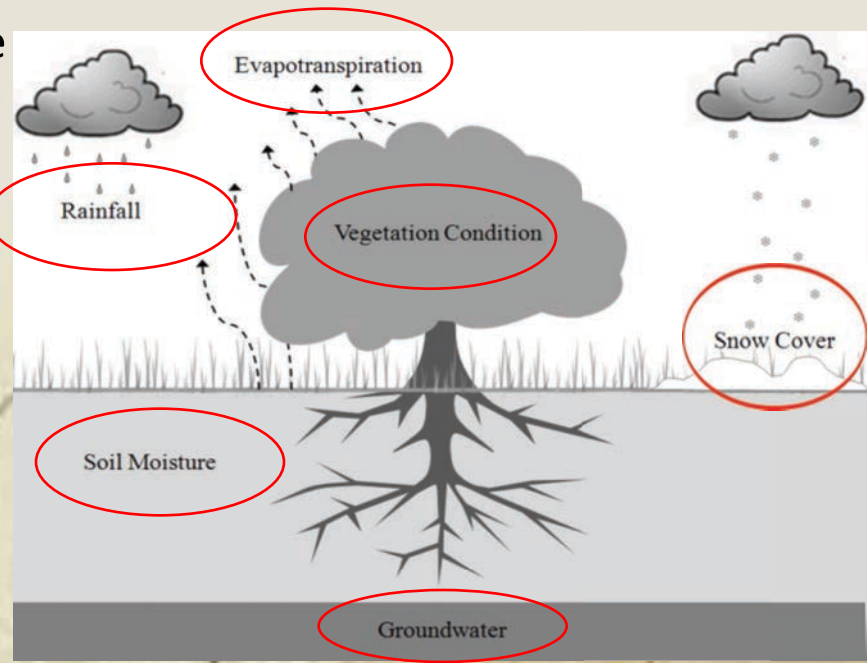
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# Emerging Satellite-based Observations and Products

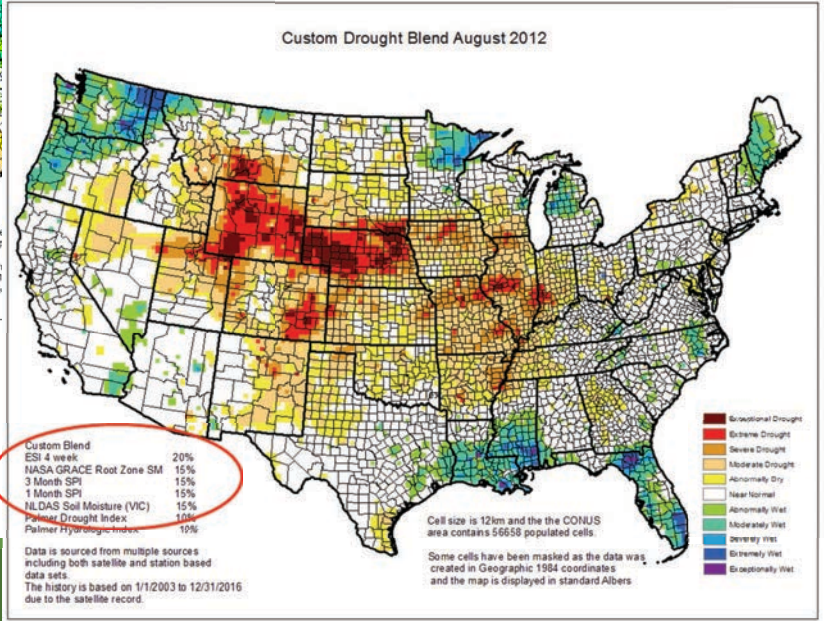
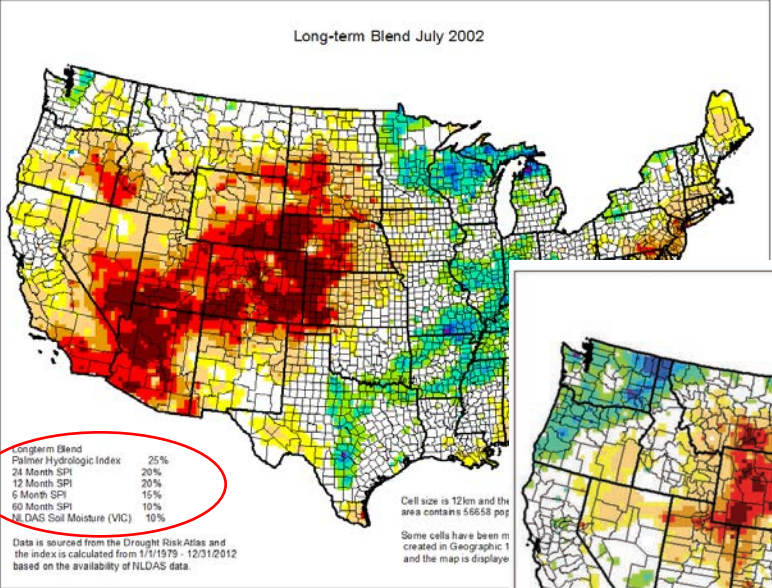
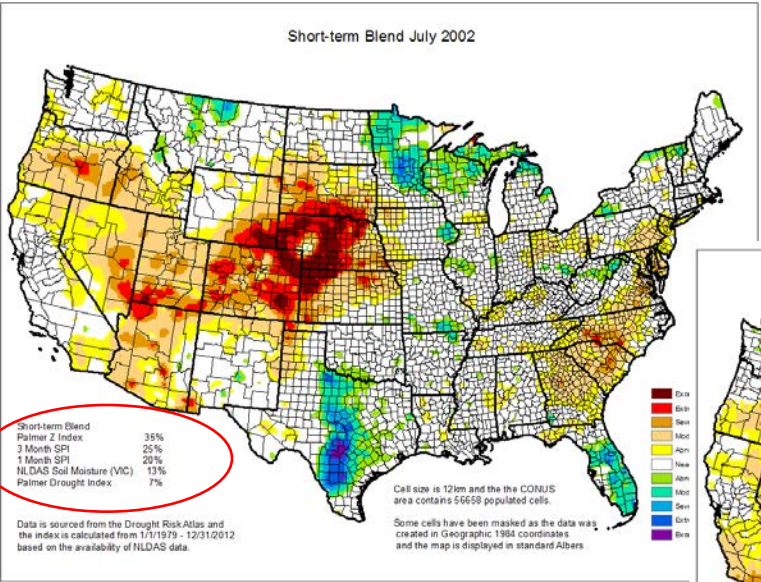
Over the past 10+ years, a number of satellite remote sensing-based tools and **products characterizing different parts of the hydrologic cycle that influence drought conditions** allowing new composite drought indicators to be developed.

## 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)



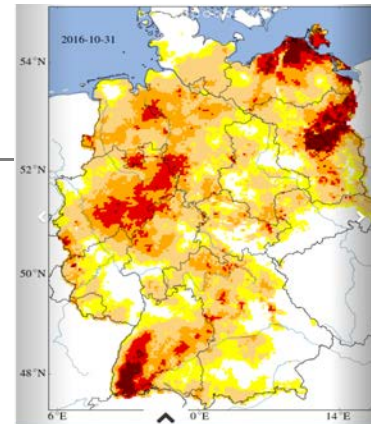
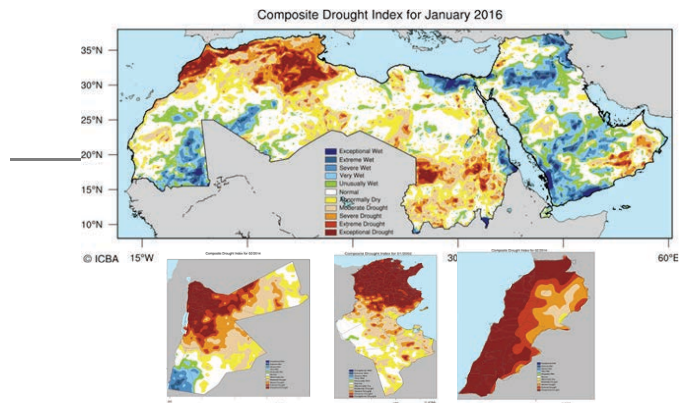
# Blending it all together....



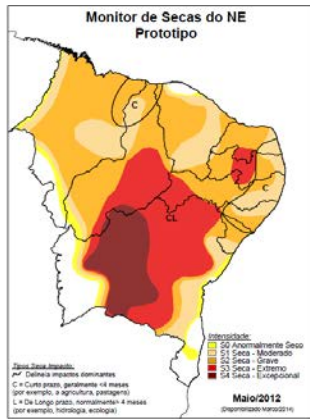
- Flash drought
- Snow drought
- Hydro drought
- Eco drought
- Ag drought
- Capture regional/seasonal differences in drought
  - Characteristics and climatologies...
- Take advantage of machine learning/geospatial techniques

# International CDI Activities

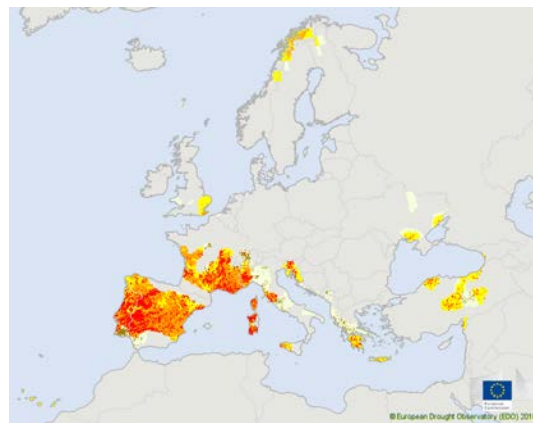
## MENA



## Czech Republic

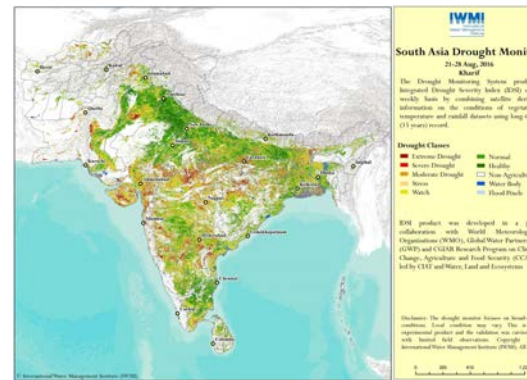


## Brazil

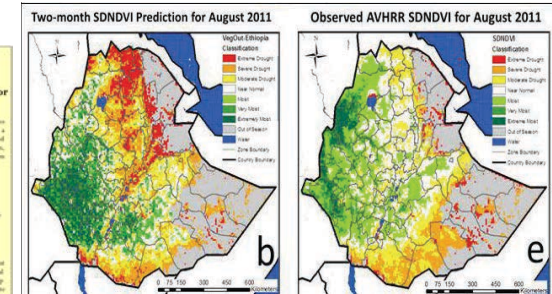


## JRC-EDO

## Germany



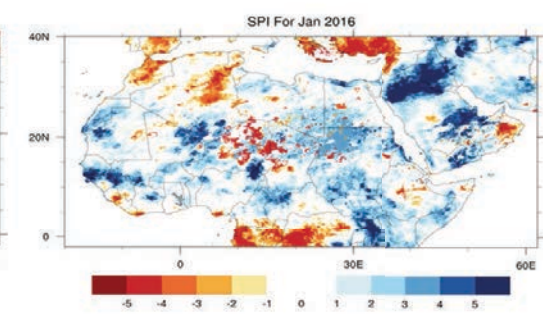
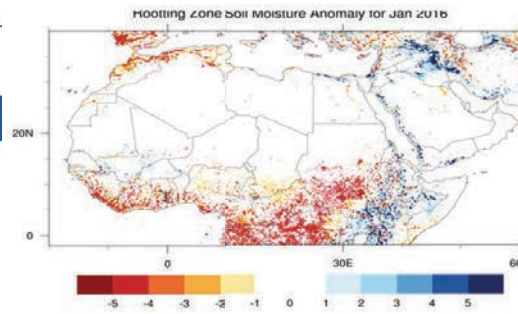
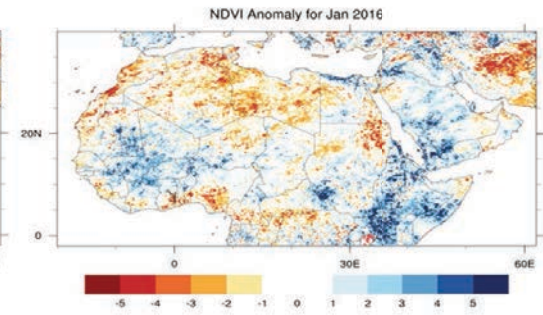
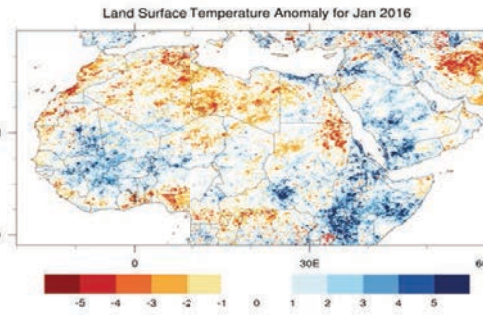
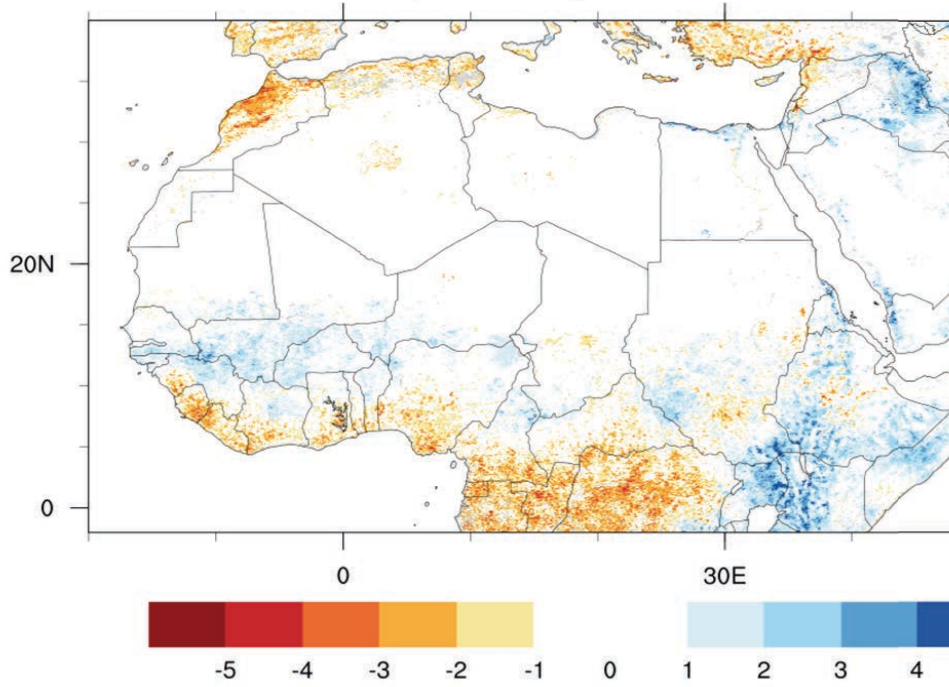
## IWMI-South Asia



## Greater Horn of Africa

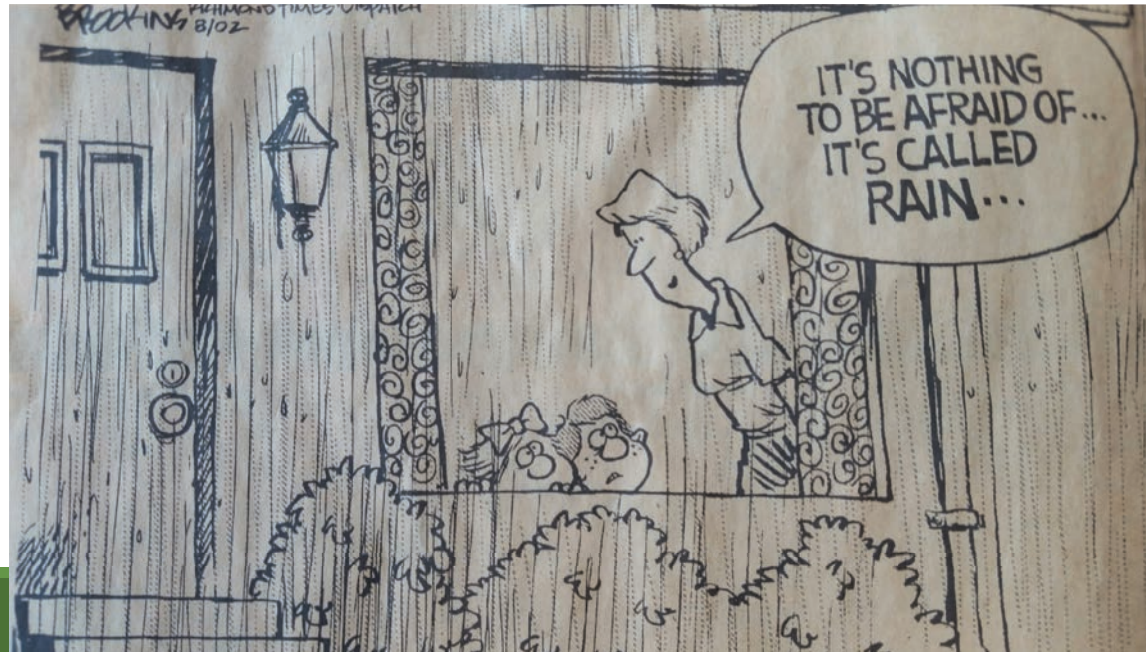
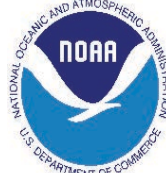


# Composite Drought Index for Jan 2016





# OUR PARTNERS



# Any Questions ?



DROUGHT.UNL.EDU

e | [ndmc@unl.edu](mailto:ndmc@unl.edu)

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 @droughtcenter

**Brian Fuchs**  
**[bfuchs2@unl.edu](mailto:bfuchs2@unl.edu)**  
**402-472-6775**

**Mark Svoboda**  
**[msvoboda2@unl.edu](mailto:msvoboda2@unl.edu)**  
**402-472-8238**

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