Exploring SMAP Applications into Drought Monitoring at the NDMC

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National Drought Mitigation Center

NOAA's Drought Risk Management Research Center

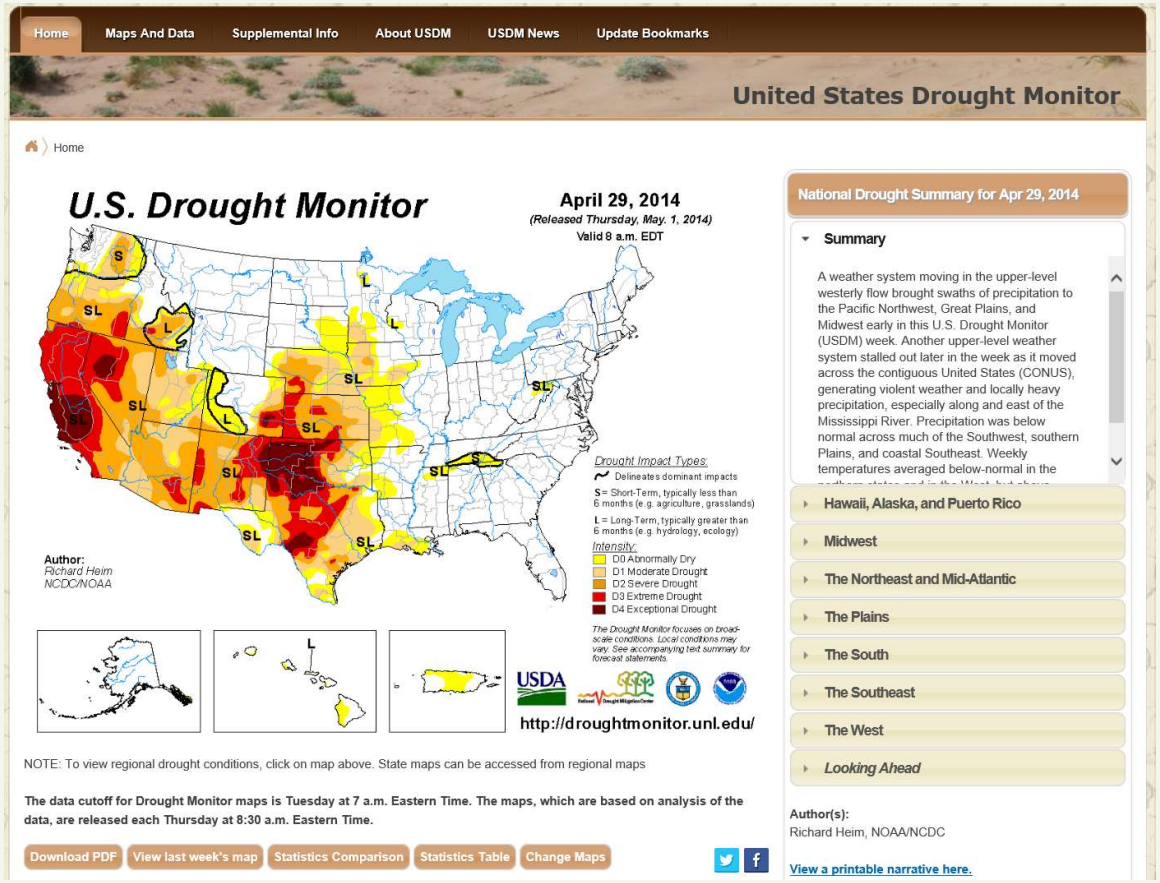
University of Nebraska-Lincoln

SMAP Early Adopter Telecon, January 12, 2017

National Drought Mitigation Center

U.S. Drought Monitor (USDM): • *droughtmonitor.unl.edu*

- **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
- **Policy implications in** Farm Bill (USDA), IRS, NOAA-NWS and several state drought plans and task forces
- **"Go to source"** for media and the public



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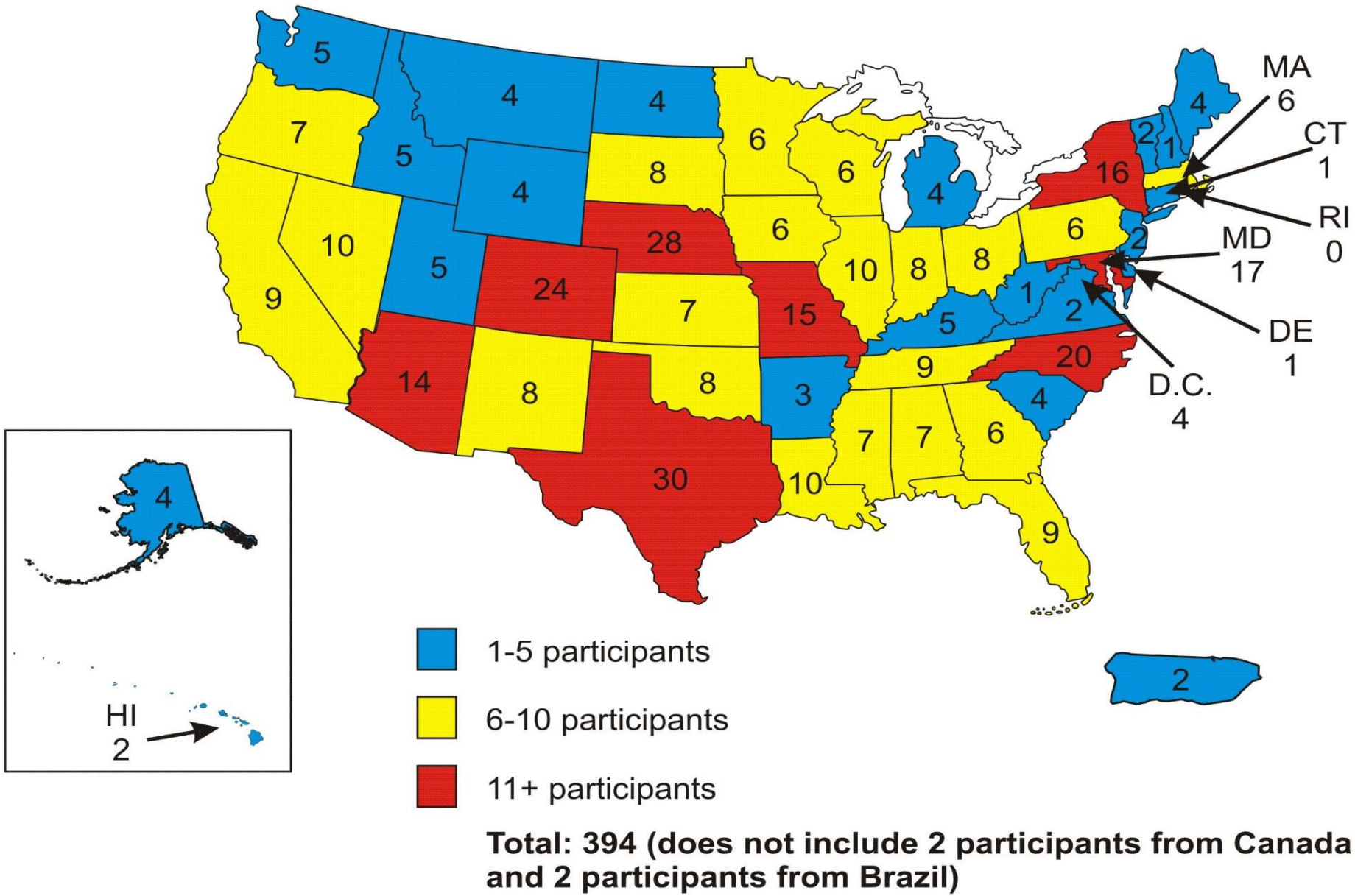
USDM Listserve Subscribers

(as of August 24, 2016)



Total: 394 (does not include 2 participants from Canada and 2 participants from Brazil)

USDM/NADM Feedback

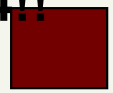
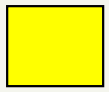
- Lincoln, NE, November 2000
- Asheville, NC, April 2002
- NADM, Asheville, June 2003
- Cedar City, UT, October 2003
- NADM, Regina, SK, October 2004
- Washington, D.C., October 2005
- NADM, Mexico City, October 2006
- Portland, OR, October 2007
- NADM, Ottawa, October 2008
- Austin, TX, October 2009
- NADM, Asheville, April 2010
- Washington, D.C., April 2011
- NADM, Cancun, Mexico, April 2012
- West Palm Beach, FL, Spring 2013
- NADM, Toronto, Canada, 2014
- Reno, NV, Spring 2015
- NADM, Ft. Worth, TX, Spring 2016
- USVI/Puerto Rico, August 2016
- Rapid City, SD, April 2017

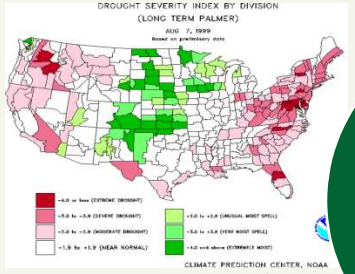
–Percentiles and the U.S. Drought Monitor

- **Advantages of percentiles:**
  - Can be applied to any parameter

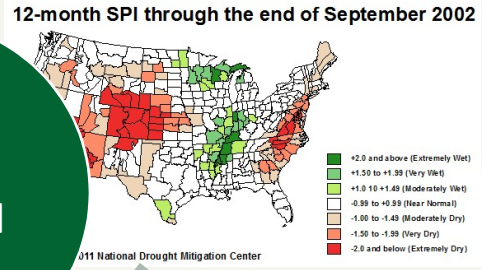
–The drought categories are associated with historical occurrence/likelihood (percentile ranking)

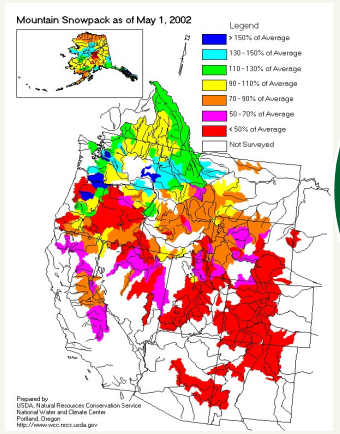
–It is not anecdotal or subjective, like "It's really, really dry!!" ….or, "I don't remember it ever being this dry, we have to be D4!!"

- D4, Exceptional Drought:  1 in 50+ years **(2 %tile)**
- D3, Extreme Drought:  1 in 20 to 50 years **(5)**
- D2, Severe Drought:  1 in 10 to 20 years **(10)**
- D1, Moderate Drought:  1 in 5 to 10 years **(20)**
- D0, Abnormally Dry:  1 in 3 to 5 years **(30)**

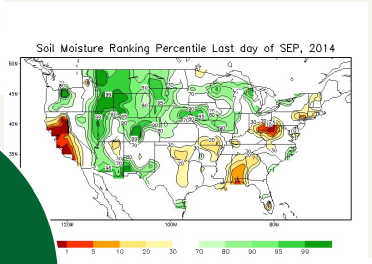


Indices: SPI/PDSI

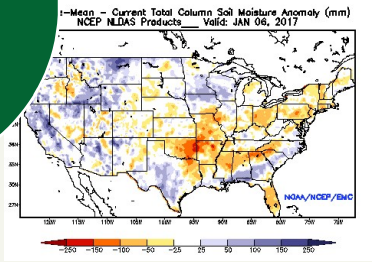


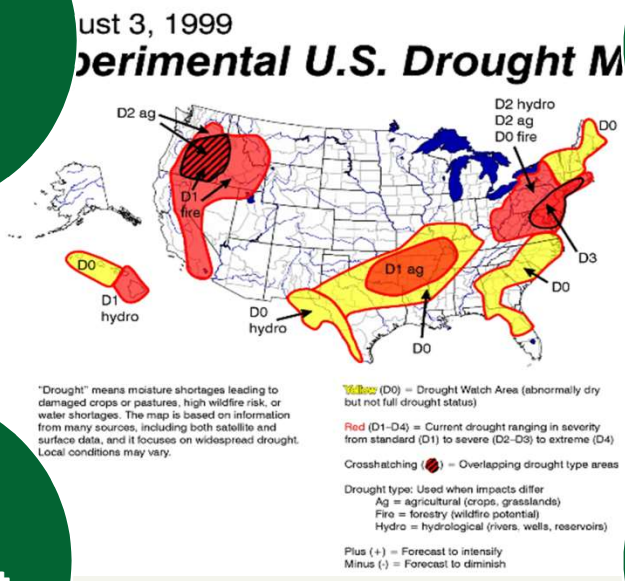


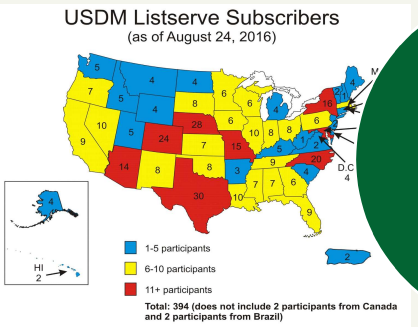
Snow



Soil Moisture

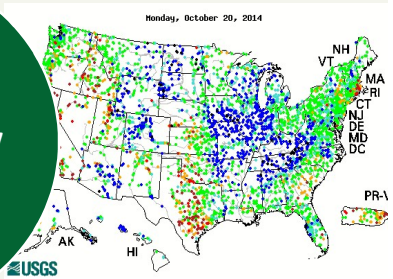




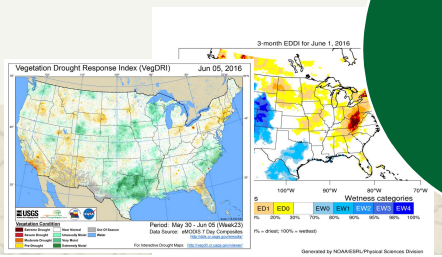


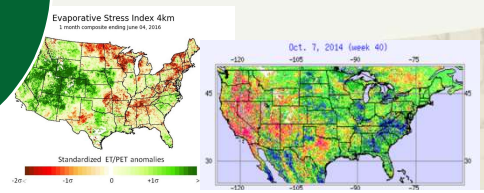
Expert Local Input

Streamflow



Remote Sensing





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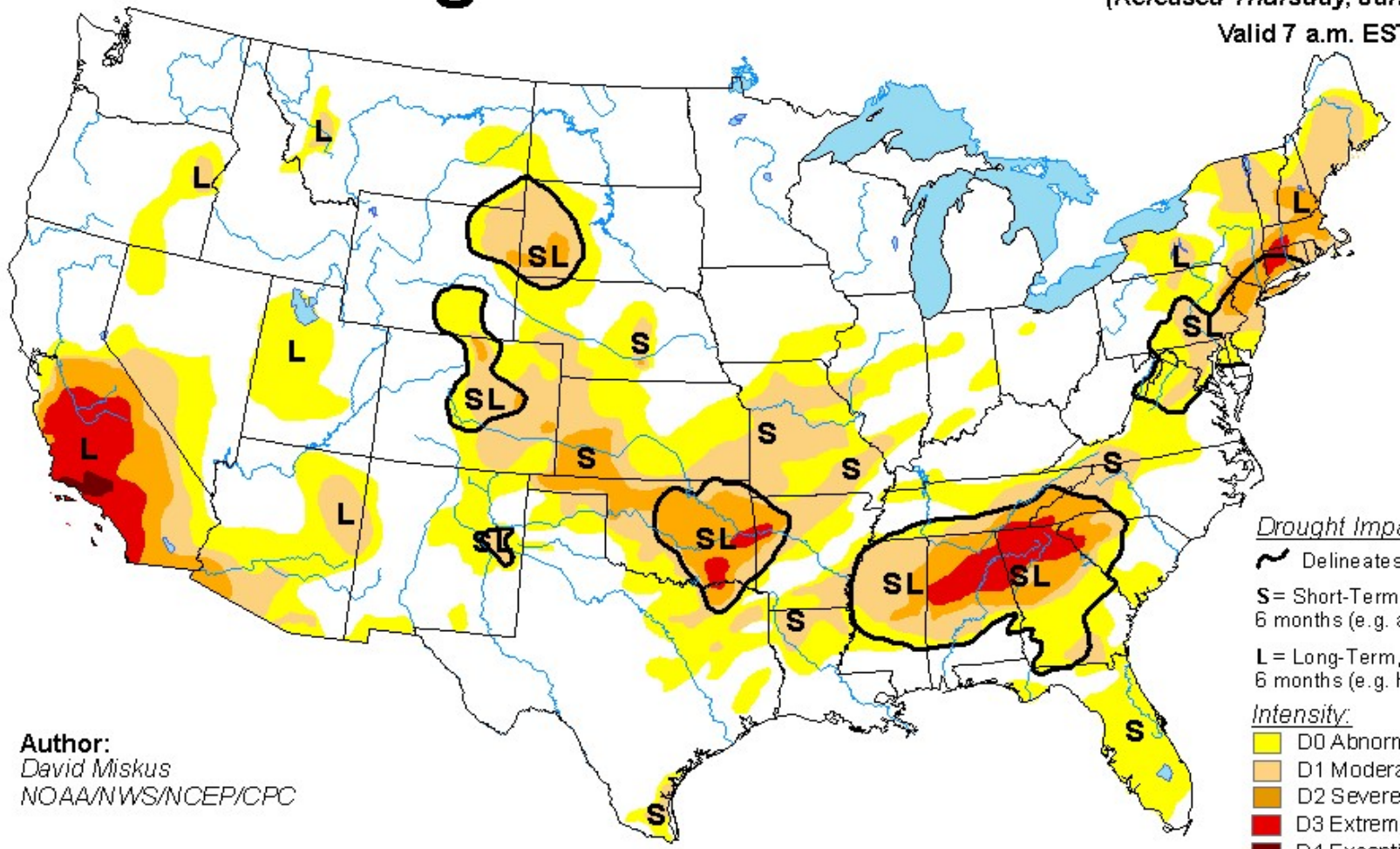
U.S. Drought Monitor

January 10, 2017

(Released Thursday, Jan. 12, 2017)

Valid 7 a.m. EST



Author:
David Miskus
NOAA/NWS/NCEP/CPC

Drought Impact Types:

Delineates dominant impacts

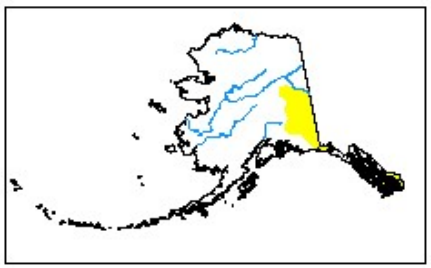
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

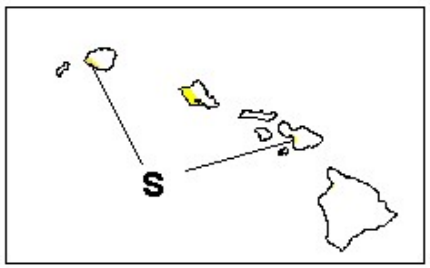
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

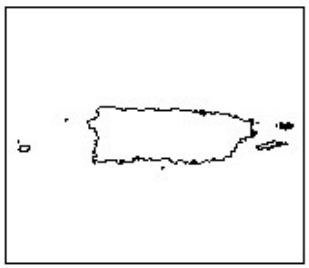
Intensity:

- 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.







USDA

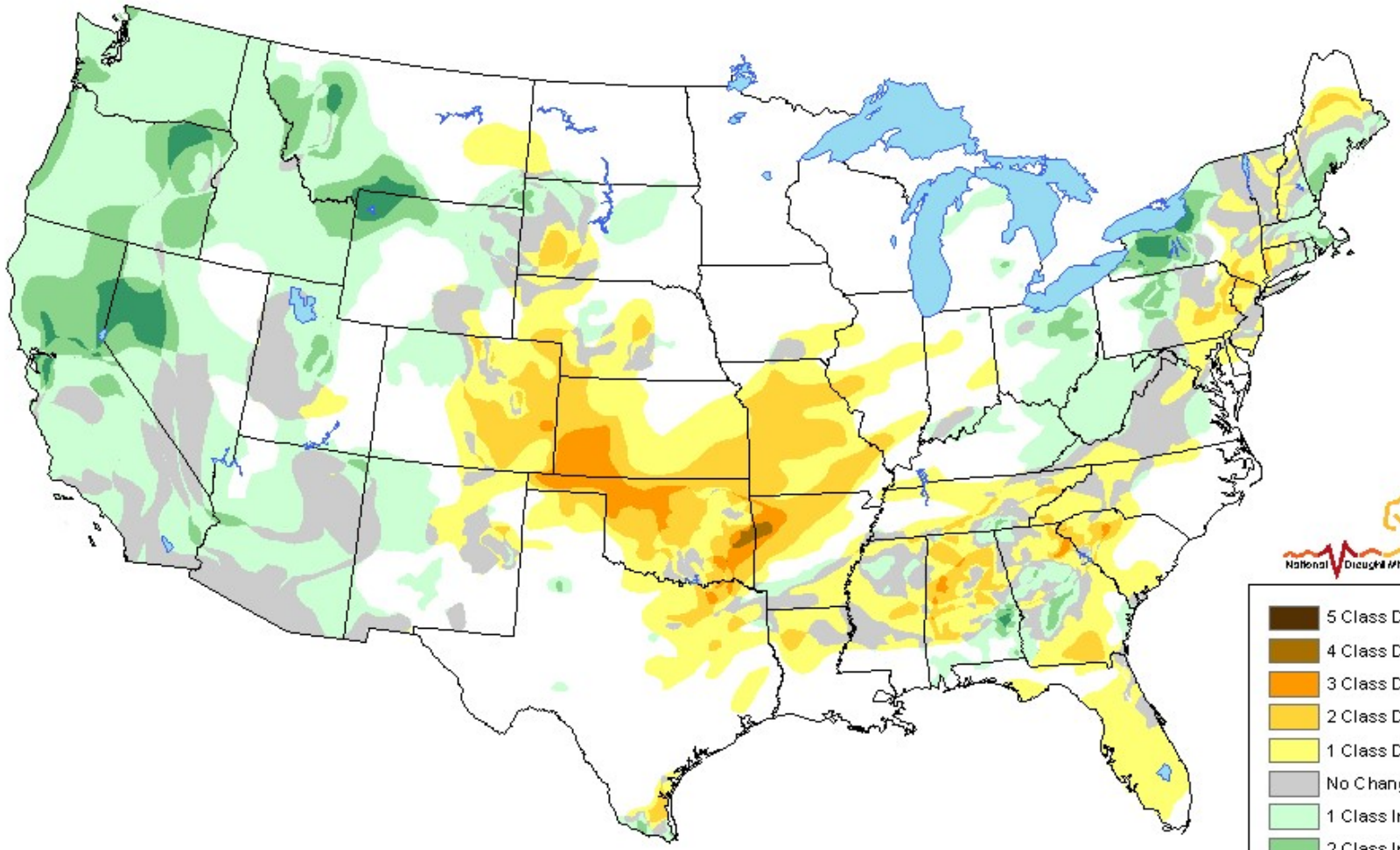
National Drought Mitigation Center

NOAA

http://droughtmonitor.unl.edu/

U.S. Drought Monitor Class Change

Start of Water Year



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- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

January 10, 2017
compared to
September 27, 2016

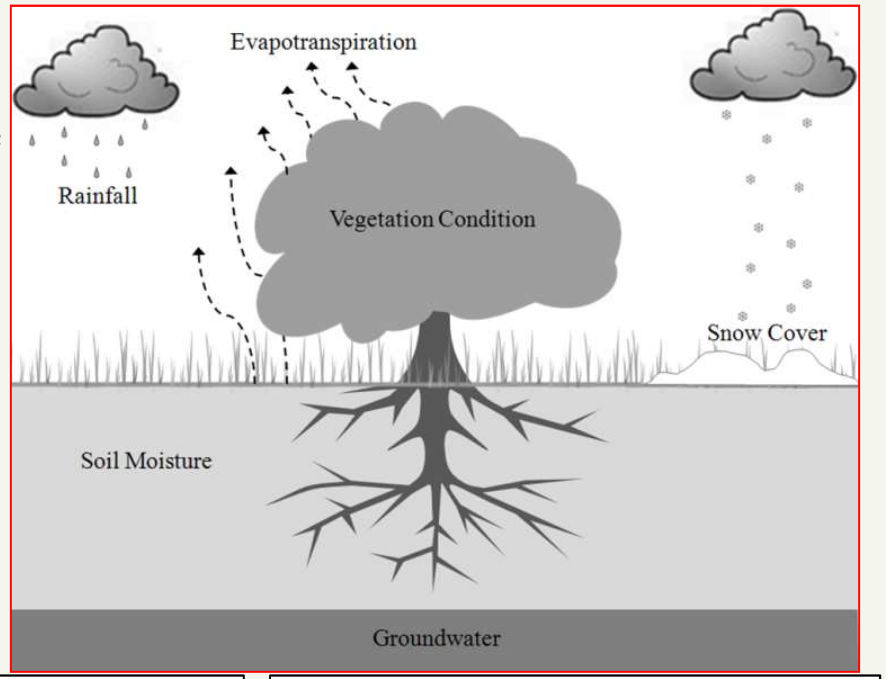
http://droughtmonitor.unl.edu

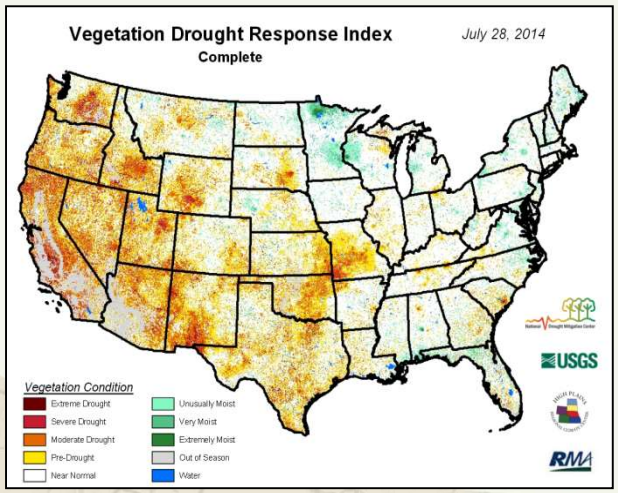
Emerging Satellite-based Drought Monitoring Tools

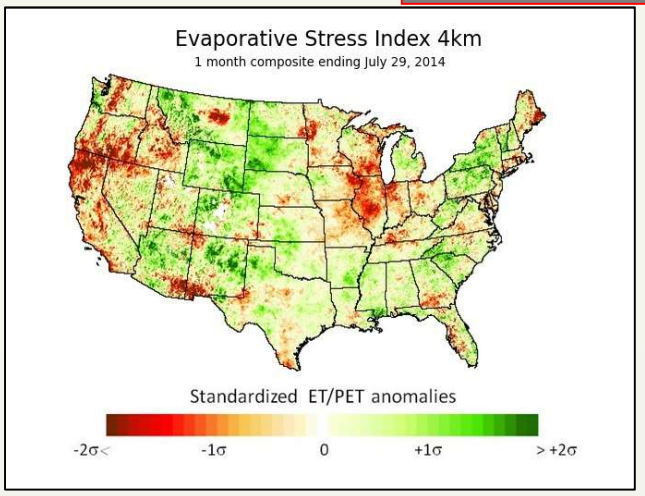
Over the past 10+ years, there has been a rapid development of remote sensing-based drought monitoring tools characterizing different parts of the hydrologic cycle that influence drought conditions.

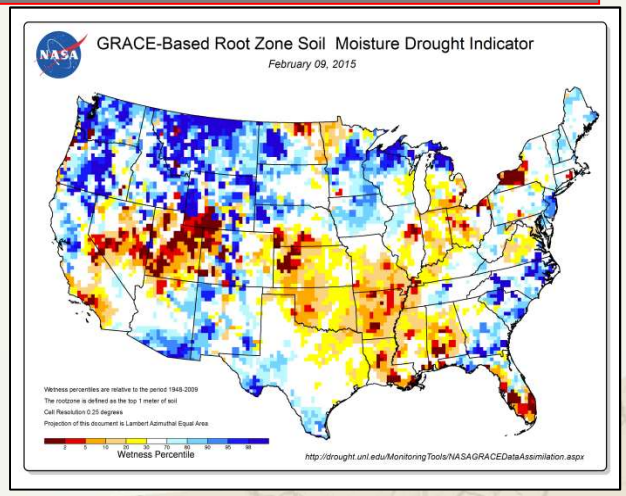
Examples:

- **Evaporative Stress Index (ESI)**
- **Soil Moisture Active/Passive (SMAP)**
- **GRACE Terrestrial Water Storage (TWS) anomalies**
- **Vegetation Drought Response Index (VegDRI)**









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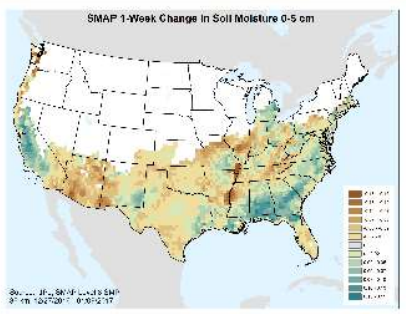
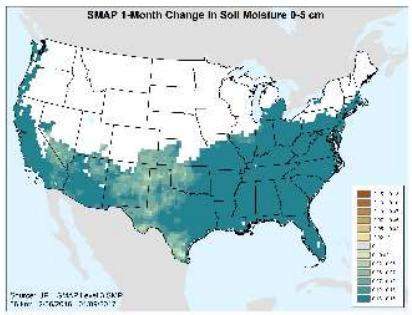
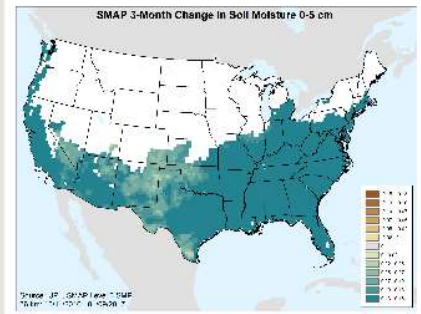
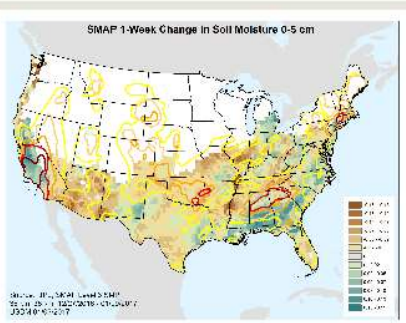
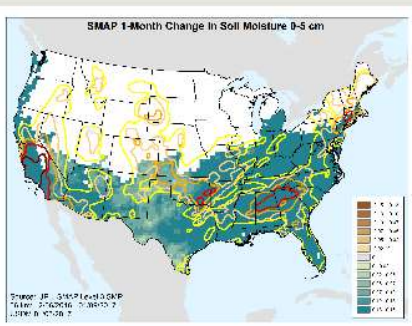
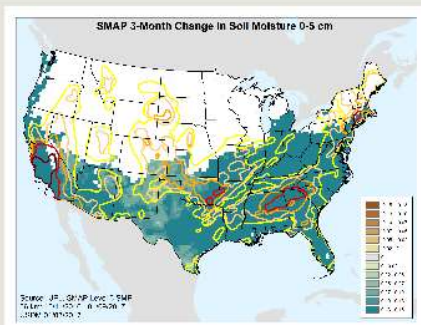
Soil Moisture Active Passive (SMAP)

These are experimental products that are still being evaluated and improved. We encourage your specific, constructive feedback as this phase of development proceeds.

Maps

1-week	1-month	3-month
		
PNG | PDF	PNG | PDF	PNG | PDF
		
PNG | PDF	PNG | PDF	PNG | PDF

About SMAP

SMAP Level 3 soil moisture passive (L3_SM_P) data are products derived from NASA's Soil Moisture Active Passive (SMAP) mission. L3_SM_P products are daily composites of Level 2 surface soil moisture passive (L2_SM_P) products that are based on satellite-based radiometer brightness temperature measurements sensitive to soil moisture. These measurements provide remote sensing of soil moisture in the top 5 cm of the soil column with an accuracy of ~0.04 m^3/m^3 over region <= to 5 kg/m2 vegetation-water-content. The L3_SM_P data have a resolution of 36 km and typically a 3-days revisit time. The NDMC will be producing composited maps of the difference between weekly mean soil moisture in one week, one month, and three months. The NDMC will also be posting GeoTiffs of these derived maps.

Reference

Entekhabi, D., S. Yueh, P. O'Neill, K. Kellogg et al., SMAP Handbook, JPL Publication JPL 400-1567, Jet Propulsion Laboratory, Pasadena, California, 182 pages, 2014.

More Information

For more information conact Narendra Das: nndas@jpl.nasa.gov

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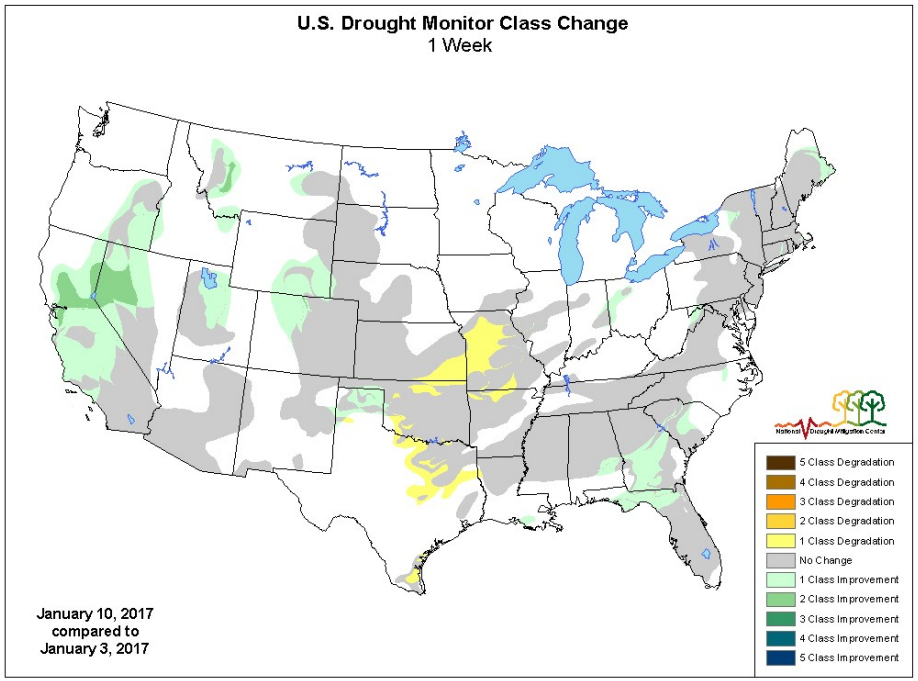
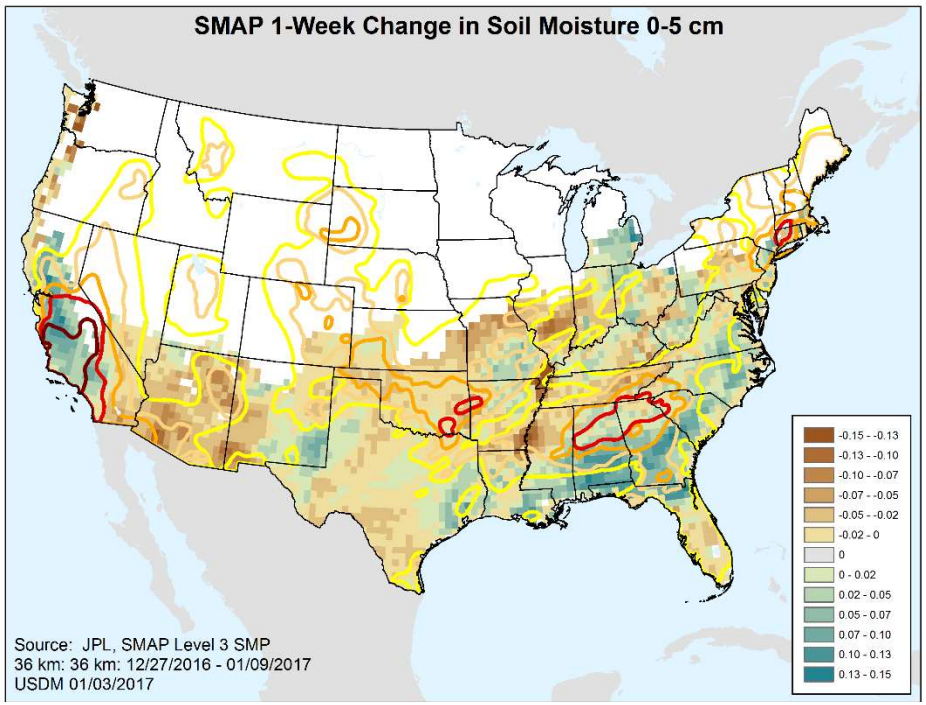
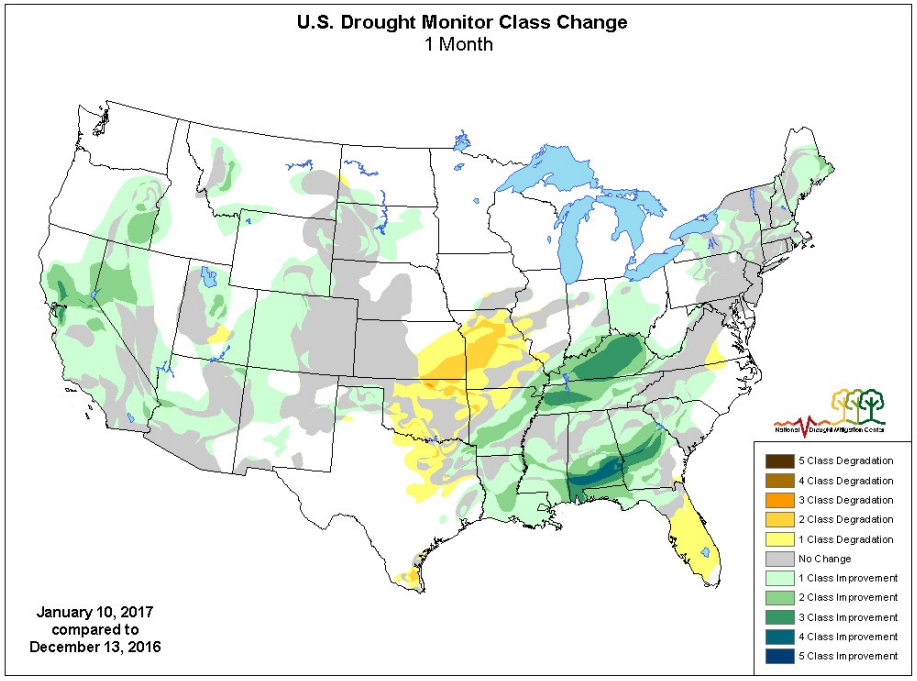
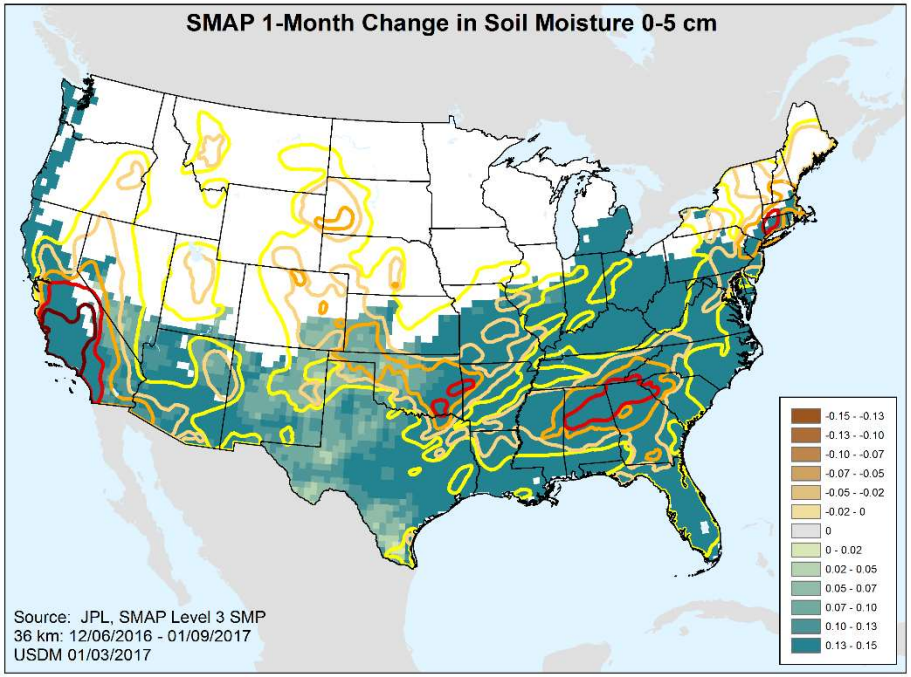
http://drought.unl.edu/MonitoringTools/NASASMAP.aspx









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Final Thoughts

- Seeing a ***shift toward more development*** of remotely sensed, modeled, gridded and/or combined/composite indicators *(e.g. NLDAS, MDSI, QuickDRI, ESI, EDDI, SMAP…)* being ***integrated into the USDM (and stand alone)*** as well as regional drought early warning capacity via the National Integrated Drought Information System (NIDIS) and USDM expert list server community ***(400+)***
- ***Augment in situ data*** in data poor regions and help validate various indicators/indices in data rich regions
- ***Strength of USDM*** is found in its ability to ***integrate and ingest new data sources*** as they mature and come on-line after a transparent vetting period…
  - Helping ***increase resolution and accuracy*** of the USDM
- ***Increasing flash drought detection capacity*** within the USDM (e.g. 2016 in the Black Hills and Southeast)
  - We didn't have this capacity (w/in the USDM) for the iconic 2012 flash drought event

Questions?

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http:/drought.unl.edu

Photo Credit: Daniel Griffin