

# Quick Drought Response Index (QuickDRI)

## A Composite Index for Monitoring Short-Term Drought Conditions

Brian Wardlow<sup>1,2</sup>, Mark Svoboda<sup>2</sup>, Tsegaye Tadesse<sup>2</sup>, Jesslyn Brown<sup>3</sup>,  
Martha Anderson<sup>4</sup>, Chris Hain<sup>5</sup>, Matt Rodell<sup>6</sup>, and David Mocko<sup>6</sup>

<sup>1</sup>Center for Advanced Land Management Information Technologies (CALMIT), University of Nebraska-Lincoln

<sup>2</sup>National Drought Mitigation Center (NDMC), University of Nebraska-Lincoln

<sup>3</sup>USGS Center for Earth Resources Observation Science (EROS)

<sup>4</sup>USDA Agricultural Research Service (ARS)

<sup>5</sup>NASA Marshall Flight Center

<sup>6</sup>NASA Goddard Space Flight Center (GSFC)

*2017 Drought Monitor Forum*  
*April 3-5, 2017*



# What is QuickDRI?

**QuickDRI** is a shorter-term, composite indicator sensitive to the early stage onset and/or rapidly changing drought conditions (e.g., flash drought) on vegetation. The intent is to serve as *an “alarm” for emerging or rapidly changing drought conditions.*

## *Rationale:*

- 1. Early-stage drought conditions and rapidly intensifying drought events are challenging to identify** in near real-time. A tool tailored to these characteristics can improve our responsiveness to emerging drought conditions.
- 2. Over the past decade, a number of satellite remote sensing products characterizing different components of the hydrologic cycle have become available** to evaluate drought conditions from different perspectives.
- 3. Individual drought indicators have their own strengths and weaknesses.** A multi-indicator composite index like QuickDRI can collectively leverage strengths of individual indicators while overcoming some of their limitations.

# Origins of QuickDRI

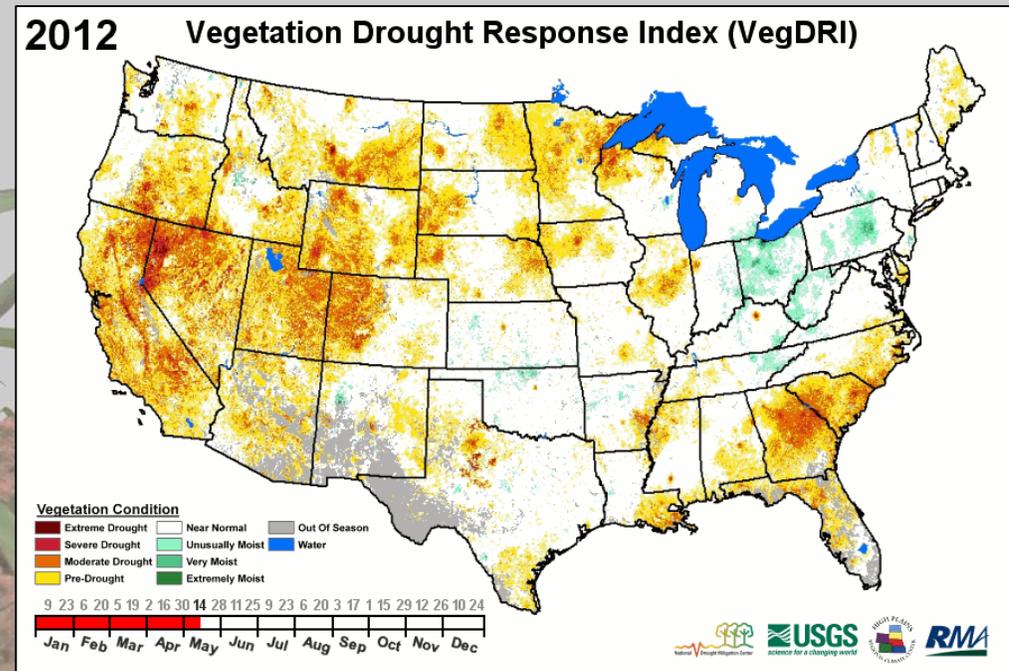
## *The Vegetation Drought Response Index (VegDRI)*

**VegDRI** is a ‘composite’ drought index that integrates:

- satellite-based observations of vegetation conditions (NDVI-based)
- climate-based drought index data (36-weekly SPI and self-calibrated PDSI)
- **biophysical characteristics of the environment (land cover, soils, etc.)**

to produce 1-km spatial resolution maps that depict ‘*drought-related*’  
*vegetation stress*.

Operational agricultural drought monitoring tool over the CONUS since 2008. Proven to be a useful **indicator of ‘seasonal’ drought effects on vegetation conditions**, but has limited ability to characterize rapid, short-term changes in conditions.

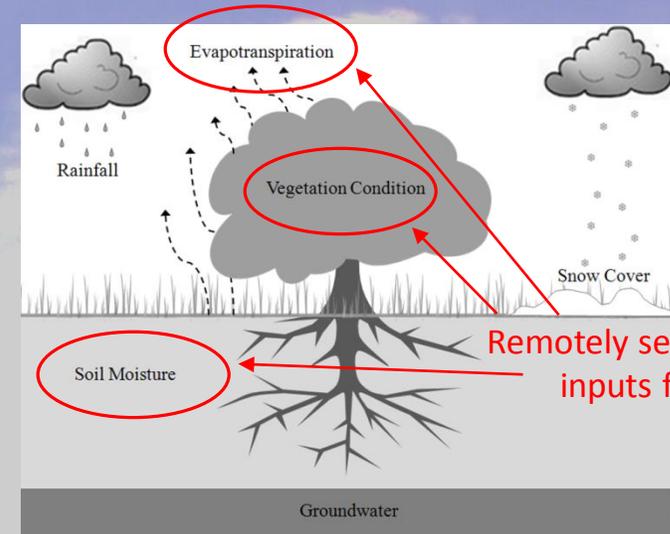


# Emerging Satellite-based Observations and Products

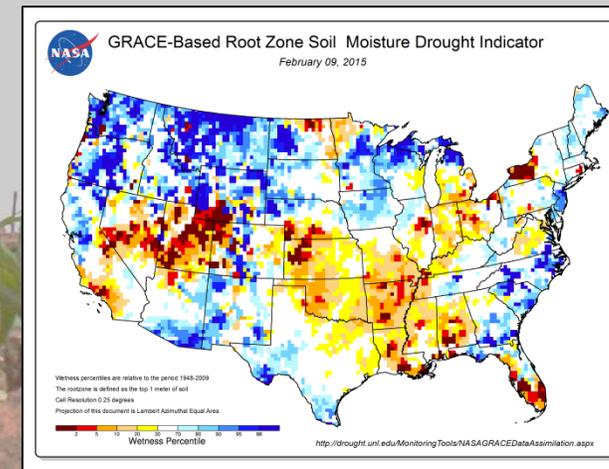
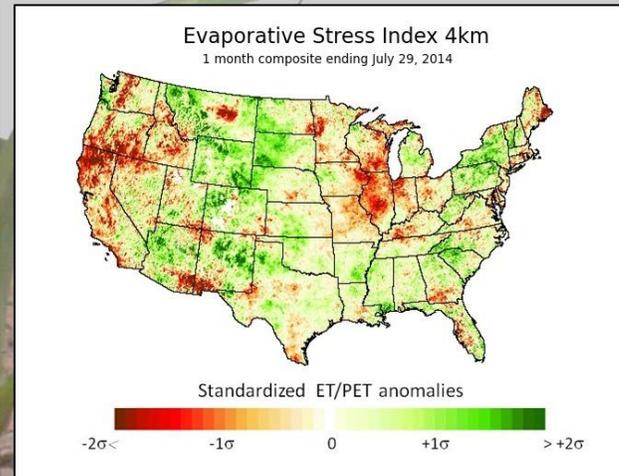
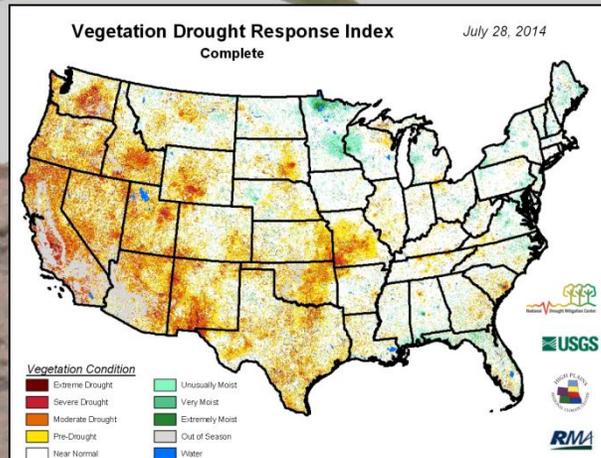
Over the past 10+ years, a number of satellite remote sensing-based tools and products characterizing different parts of the hydrologic cycle that influence drought conditions allowing new types of drought indicators to be developed.

## Examples

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



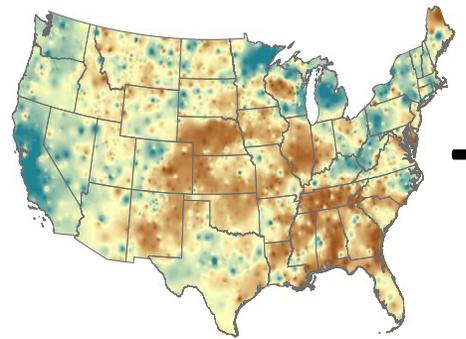
Remotely sensed or modeled inputs for QuickDRI



# Quick Drought Response Index (QuickDRI)

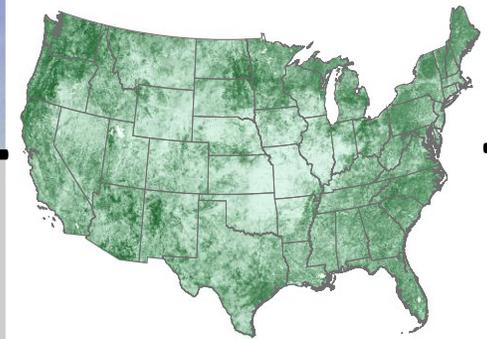
QuickDRI is a 'composite' drought index that monitors rapid, short-term changes in drought conditions through the integration of:

Precipitation



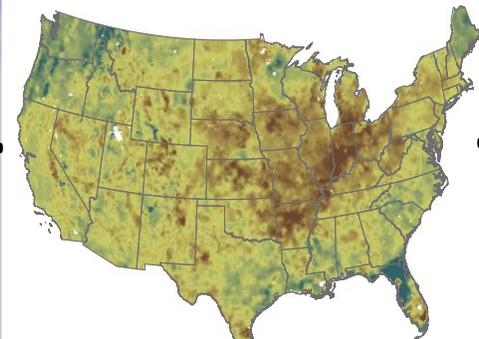
- 4-week Standardized Precipitation Index (SPI)

General Vegetation Health



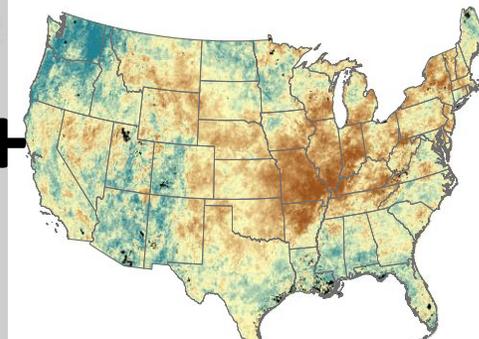
- Standardized Vegetation Index (SVI)

Root-zone Soil Moisture



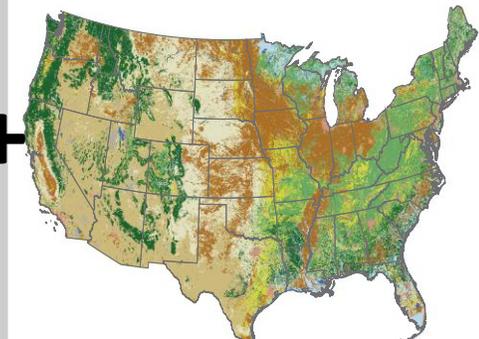
- 1-month, root-zone soil moisture anomaly from VIC

Evapotranspiration (ET)



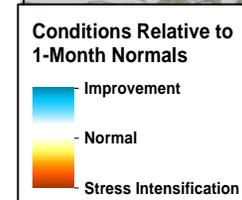
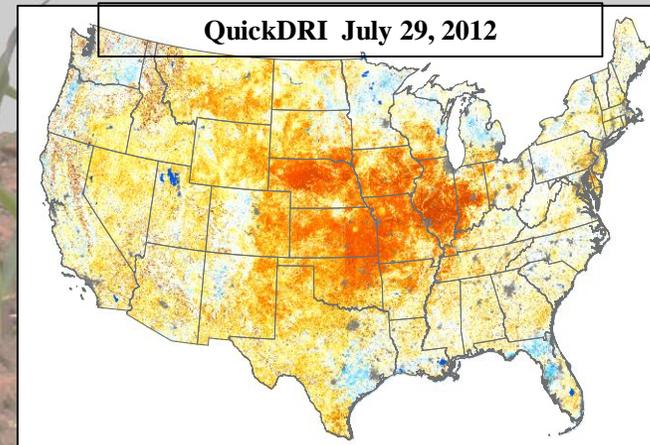
- 1-month Evaporative Stress Index (ESI)

Other Environmental Characteristics



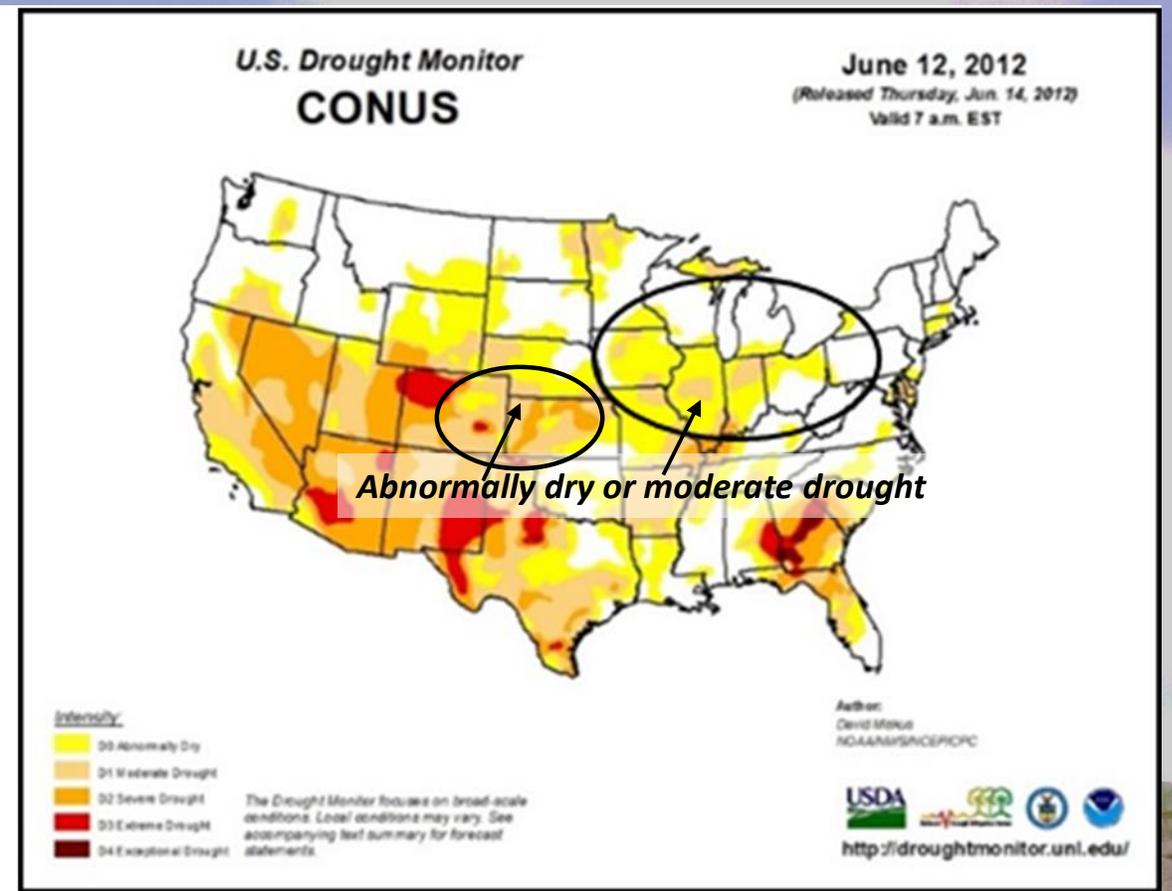
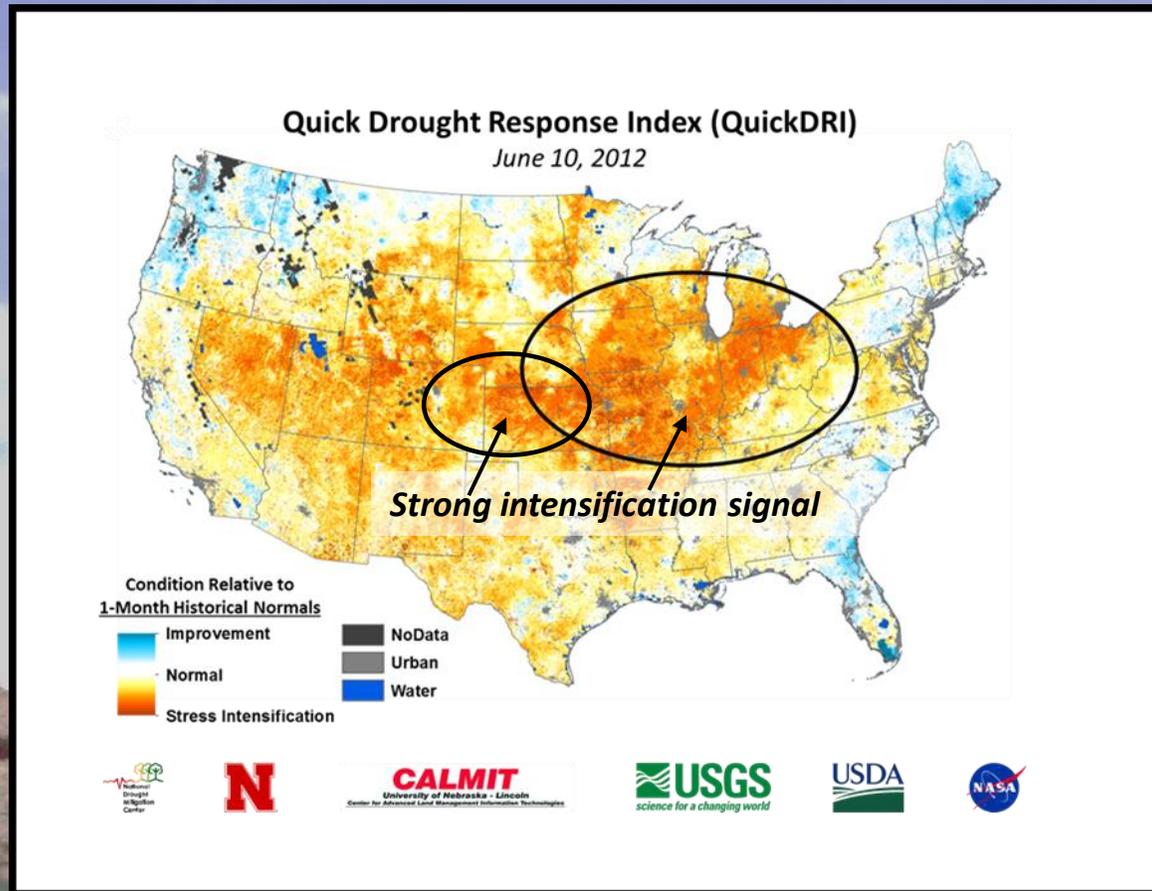
- Land use/land cover
- Irrigation
- Soil available water holding capacity
- Elevation
- Start of season anomaly

**Goal:** Use recently available remote sensing products that are shorter-term indicators of drought-related environmental conditions to develop a composite drought index that characterizes shorter-term and rapidly developing drought stress on vegetation conditions on the order of weeks to a month.



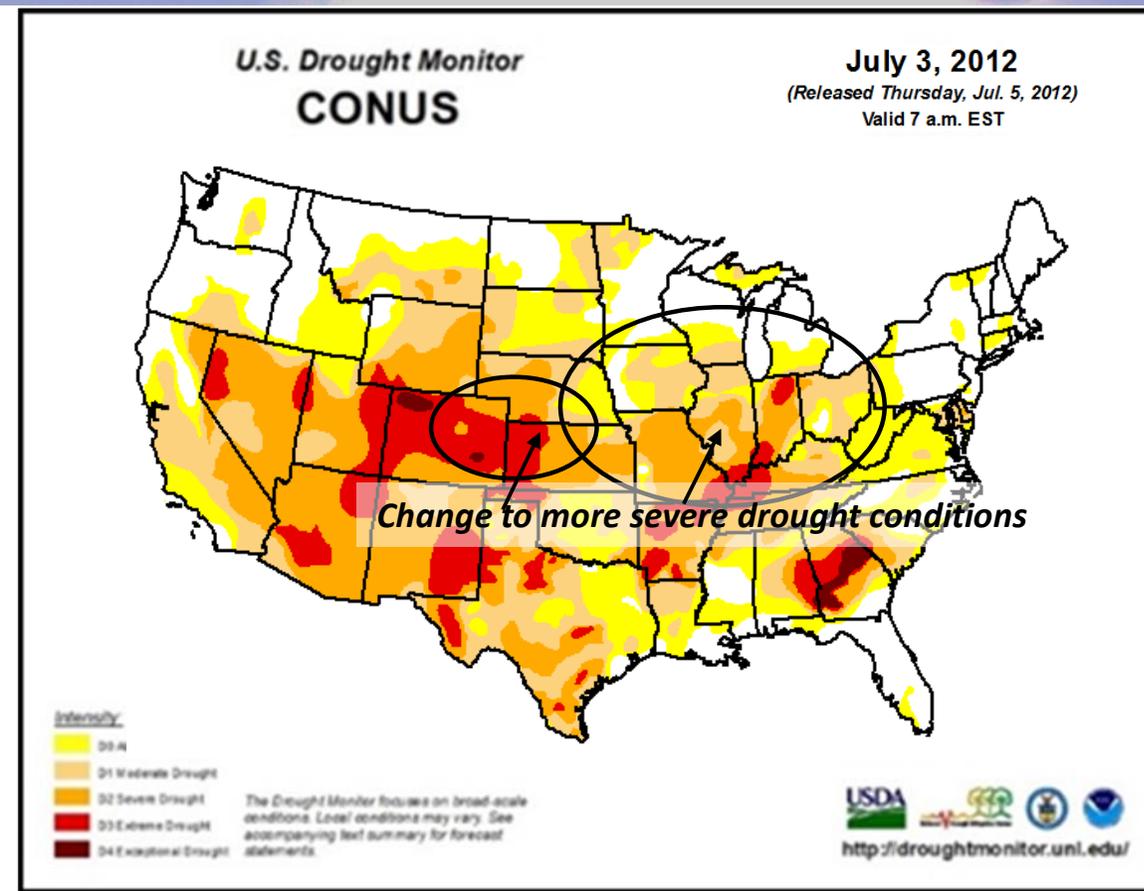
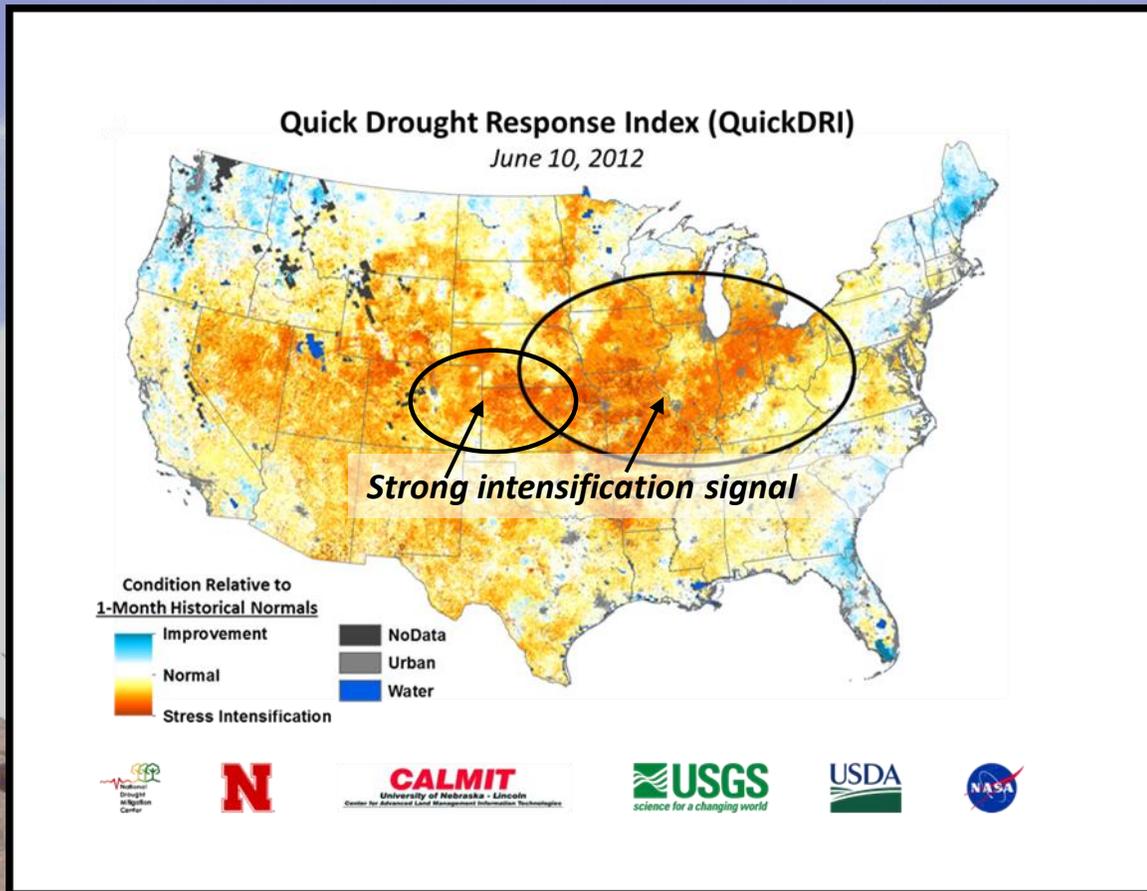
# QuickDRI During 2012 Drought

## Rapid Onset of Drought Conditions Over U.S. Corn Belt



# QuickDRI During 2012 Drought

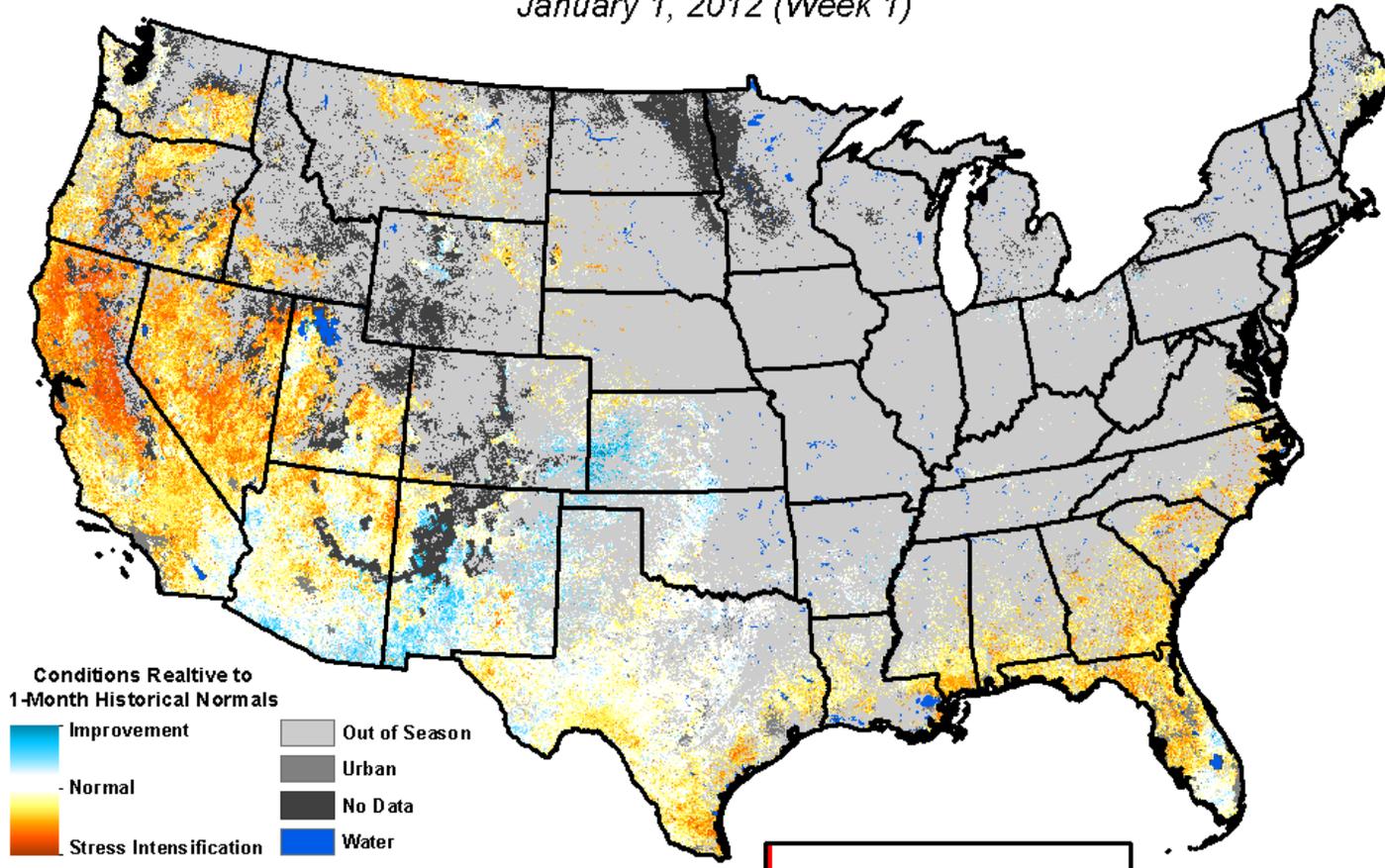
## Rapid Onset of Drought Conditions Over U.S. Corn Belt



# QuickDRI Time Series for 2012 Drought

## Quick Drought Response Index (QuickDRI)

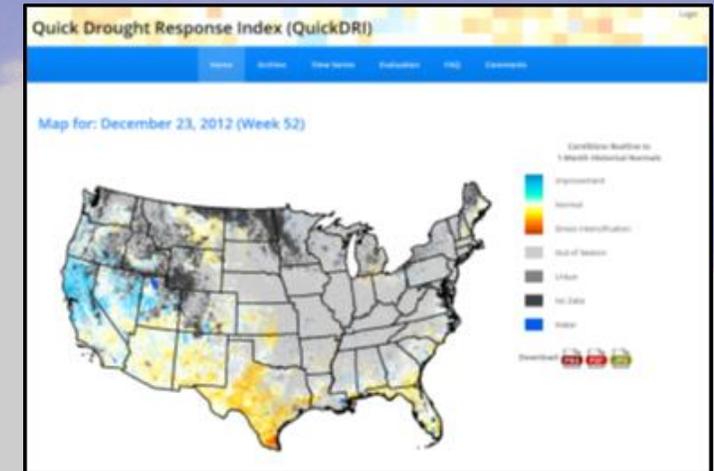
January 1, 2012 (Week 1)



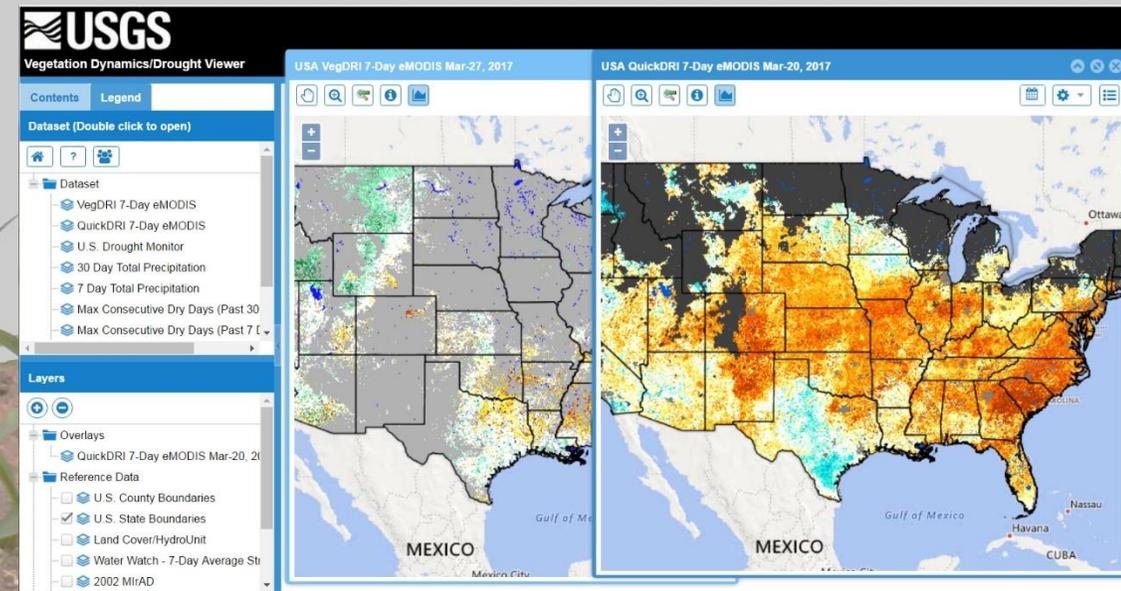
# Operational QuickDRI Tool and Products

Operational QuickDRI tool and products will be available in *late Spring 2017* through a QuickDRI website hosted by the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln and gridded data on the USGS Drought Viewer.

- **1-km QuickDRI gridded data** for the continental United States
- **Weekly map updates**
- **16+ year history of weekly maps** dating back to 2001
- **Value-added information products** available will include:
  1. **Current and historical maps** at national and state levels
  2. **Annual animations of QuickDRI maps** for each year in historical record
  3. **Suite of other current drought indicator maps** (e.g., soil moisture and evapotranspiration) to analyze in combination with the QuickDRI map.
  4. **Evaluation forms to provide feedback** on the accuracy and potential applications of the QuickDRI information



Beta version of the front page of the QuickDRI website.



USGS Drought Viewer (<https://veg dri.cr.usgs.gov/viewer/>)

For more information about QuickDRI, please contact:

**Dr. Brian Wardlow**

Director and Associate Professor

Center for Advanced Land Management Technologies (CALMIT)

School of Natural Resources

University of Nebraska-Lincoln

[bwardlow2@unl.edu](mailto:bwardlow2@unl.edu)

