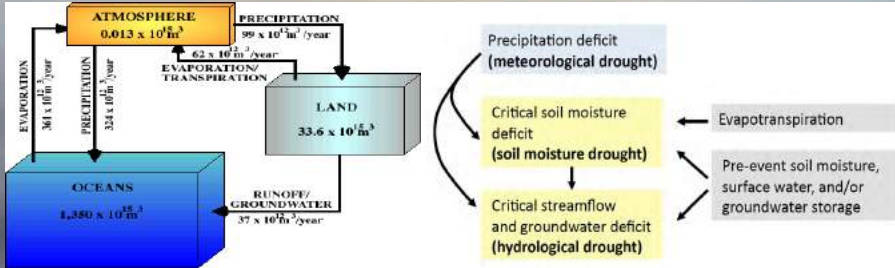
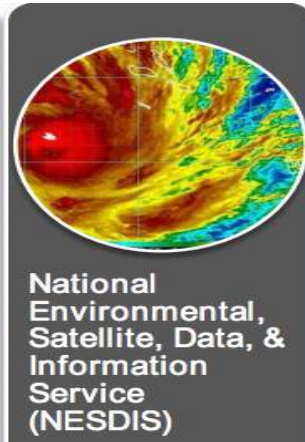
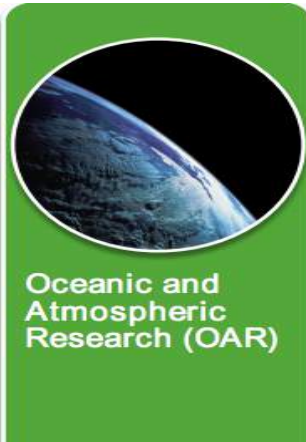


# The National Integrated Drought Information System: An Overview

Roger S. Pulwarty  
NOAA



# What is the Outcome? End-to-End capabilities linking climate intelligence and resilience



Understanding and Modeling



Observing Systems, Monitoring,



Predictions and Projections



Assessments



Informing Decisions



Communication and Education

Research

Services

# Three major tasks under NIDIS

(Public Law 109-430, 2006; 113-086, 2014)

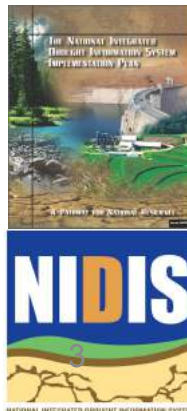
*“Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts”*

## (I) Provide effective drought early warning systems

(a) collect and integrate key indicators of drought severity and impacts; and (b) produce timely information that reflect local, regional, and State differences;

## (II) Coordinate and integrate as practicable, Federal research *and monitoring* in support of a drought early warning system-including research relating to the role of extreme weather events and climate variability in drought.

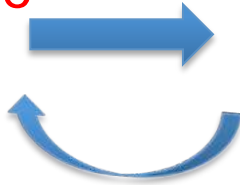
## (III) Build upon existing forecasting and assessment programs and partnerships





# Monitoring and Predictability: Pathways

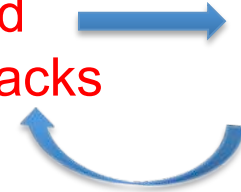
Sea surface temperature variations



Global-Scale Atmospheric Changes



Regional Forcing and land feedbacks



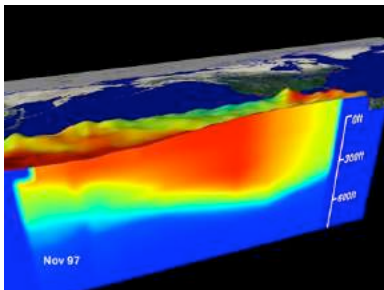
Local Impacts, Info needs

ENSO, PDO, AMO, warm pool variability, Global Warming, etc

planetary waves, hydrological cycle, monsoons, Hadley Cell, Walker Circulation

precipitation, soil moisture, snow, low level jets, dust, vegetation, land/ atmosphere contrasts, changes in weather

soil moisture, stream flow, precipitation, ground water, lakes, reservoirs



Key Phenomena, variables

# NIDIS Partnerships (Federal, States, Tribes, Private)

**Monitoring & Forecasting**

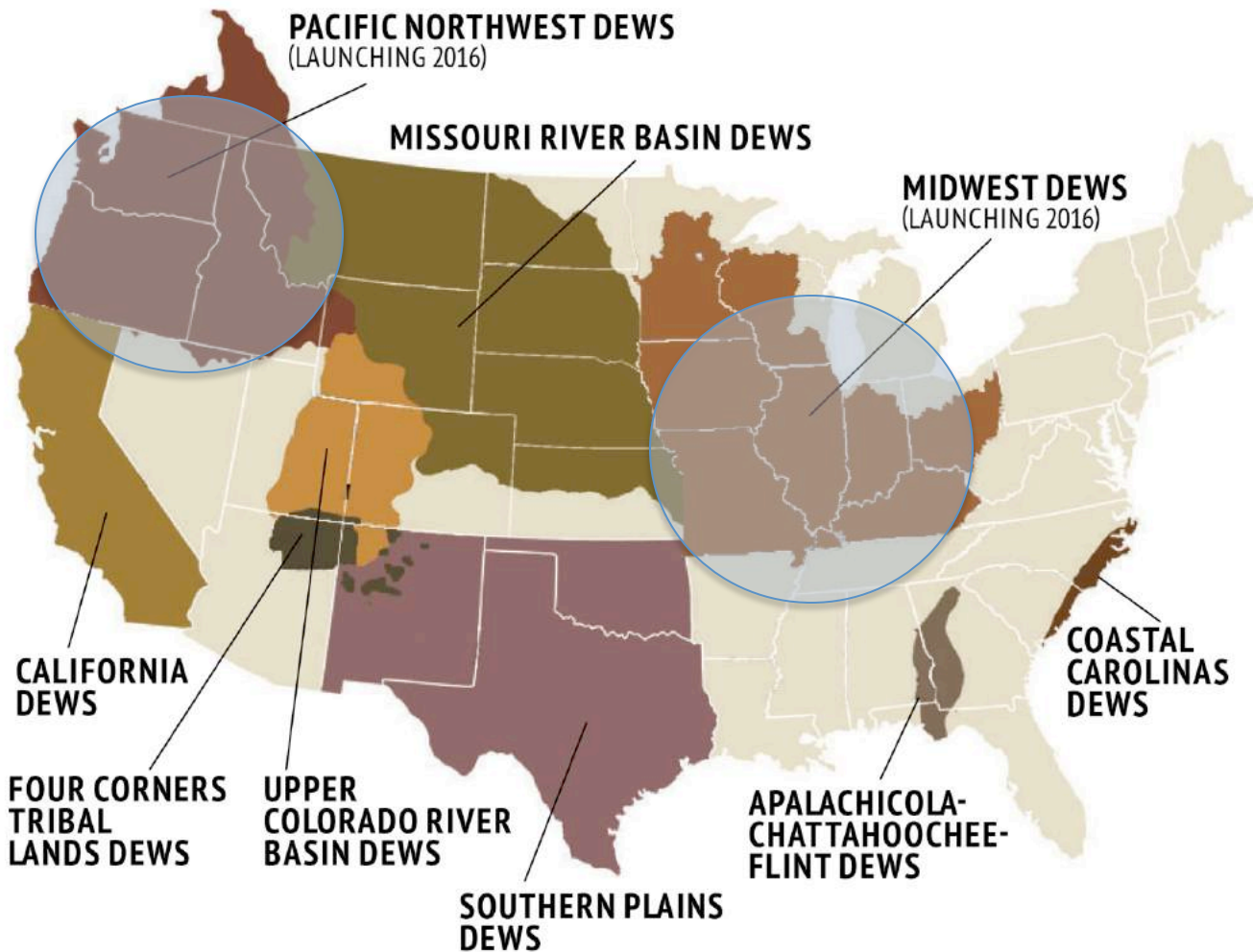
**Drought and Flood Impacts  
Assessments and Scenarios**

**Drought Early Warning  
Information  
Systems**

**Communication and Outreach**

**Engaging Preparedness &  
Adaptation**

# NIDIS Drought Early Warning Systems

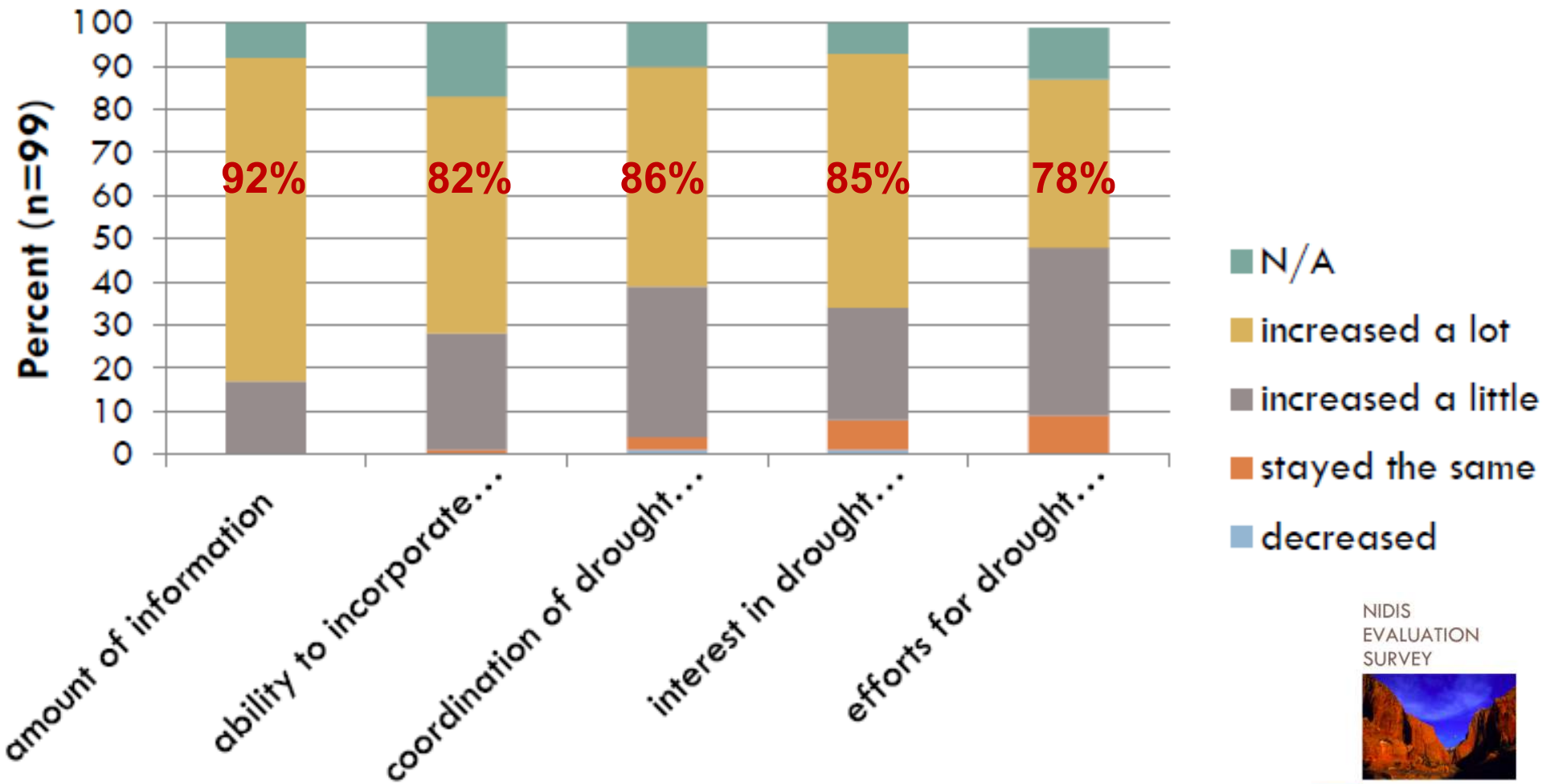


## Governance Attributes: Agility, Alignment, Adaptability

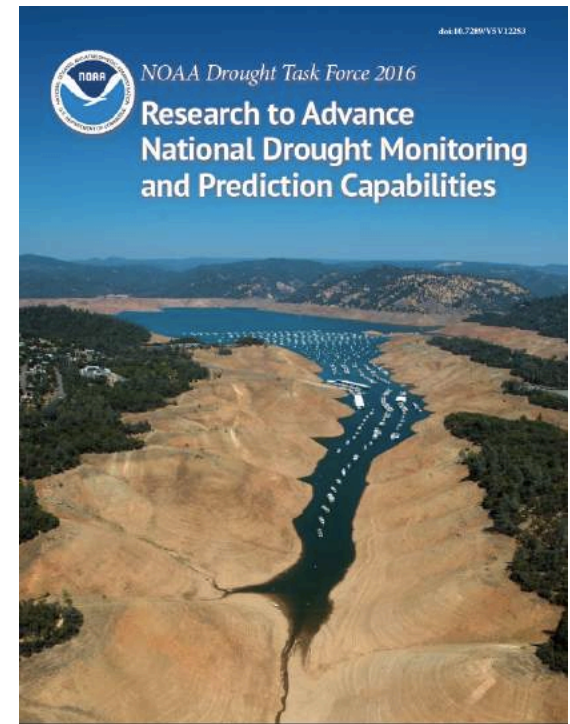
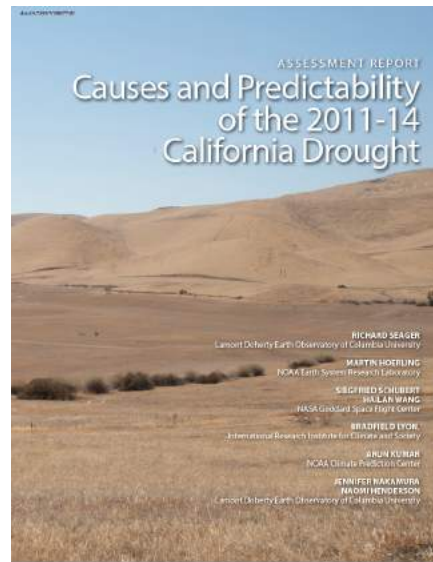
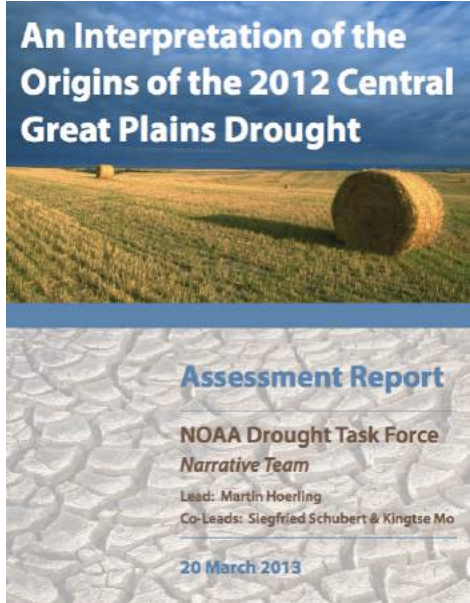
**Network coordination, Integrated Information** (monitoring, forecasting, risk assessment), **Drought risk management capacity**, communication (e.g. outlook forums) and planning

# NIDIS Evaluation Survey Example

## drought before 2002 with now...







# National Drought Forum

*Summary Report and Priority Actions*

February 2016







RAIN



Apathy

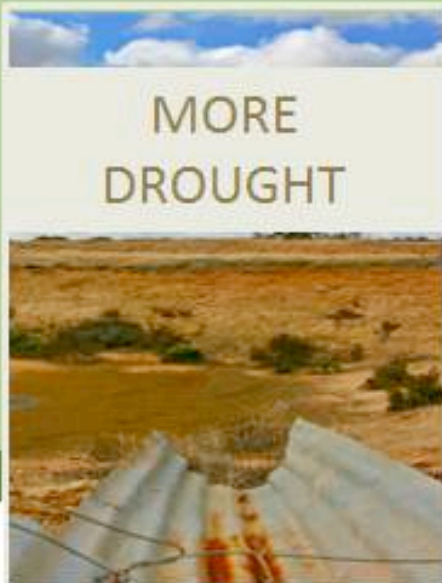


DROUGHT

# "Hydro-Illogical" Cycle



Panic



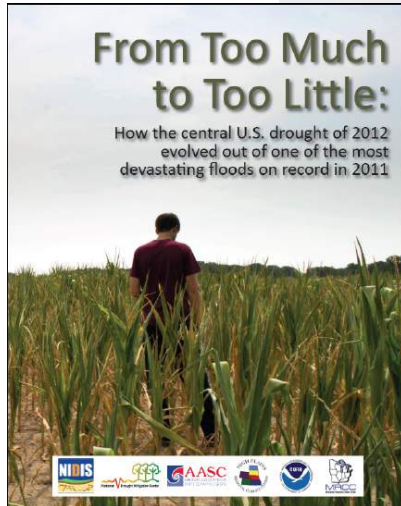
MORE DROUGHT



Concern

# From Too Much to Too Little:

How the central U.S. drought of 2012  
evolved out of one of the most  
devastating floods on record in 2011



2010-12: First time U.S. corn yield fell three  
years in a row since 1928-30 (USDA)

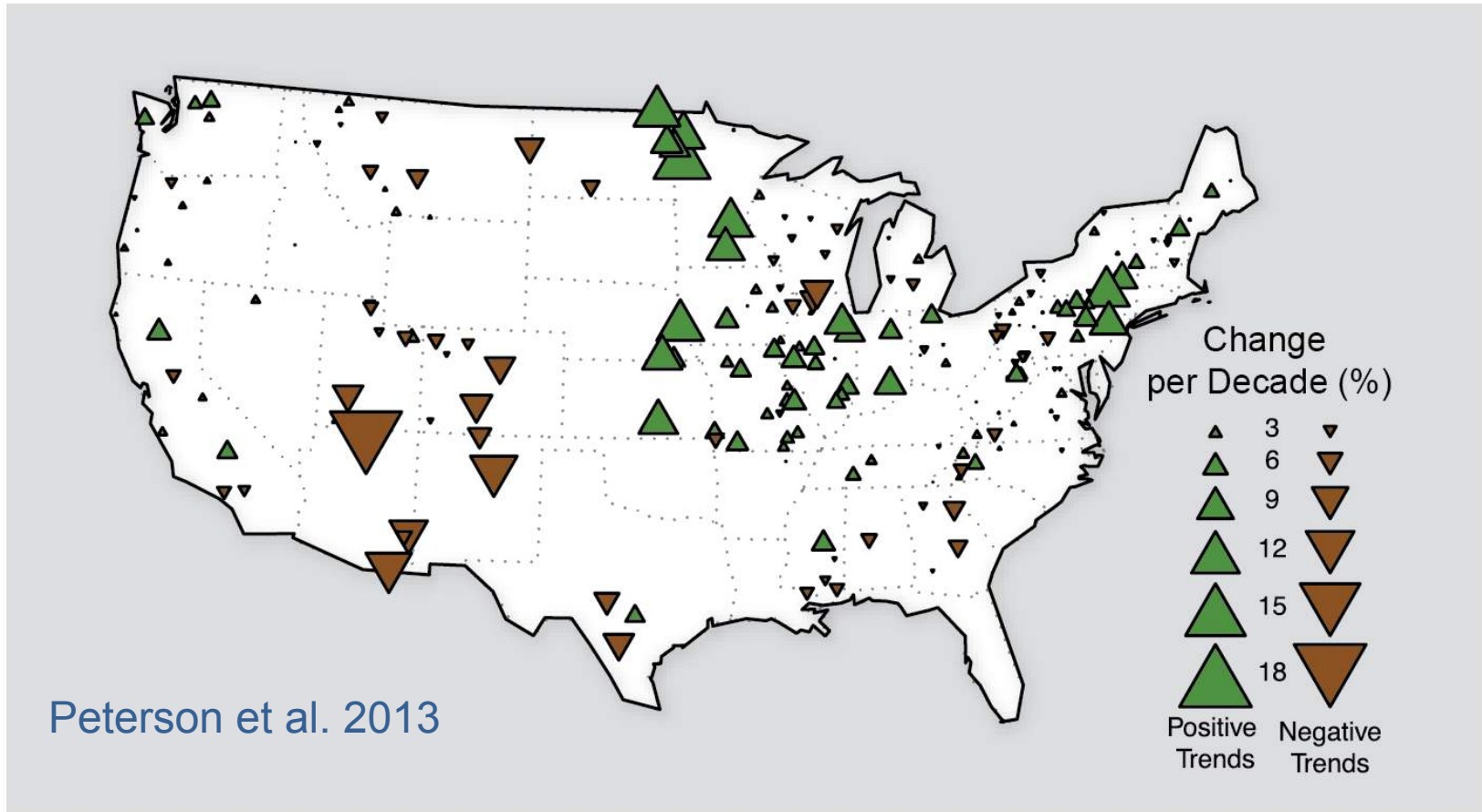
## “Climate Extreme Drought To Extreme Flood: Weather Whiplash Hits The Midwest”

Weather Underground Climate Guest Contributor Apr 19, 2013

NIDIS Reauthorization P.L. 113-086, 2014

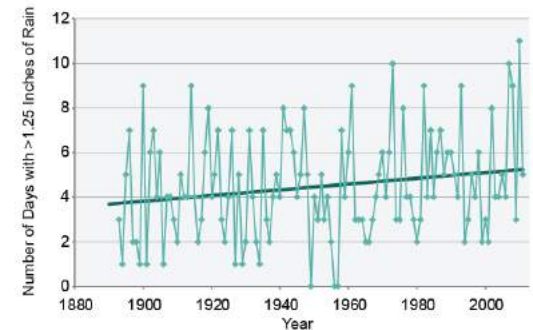
*“include research relating to the role of extreme weather  
events and climate variability in drought”*

# Trends in Flood Magnitude



Peterson et al. 2013

Takle et al 2014  
Iowa precipitation  
1895-2010





# 2012 Evaporative Demand Drought Index

**May to August 2012: Areal extent of drought jumped from 30% to over 60% of the US**

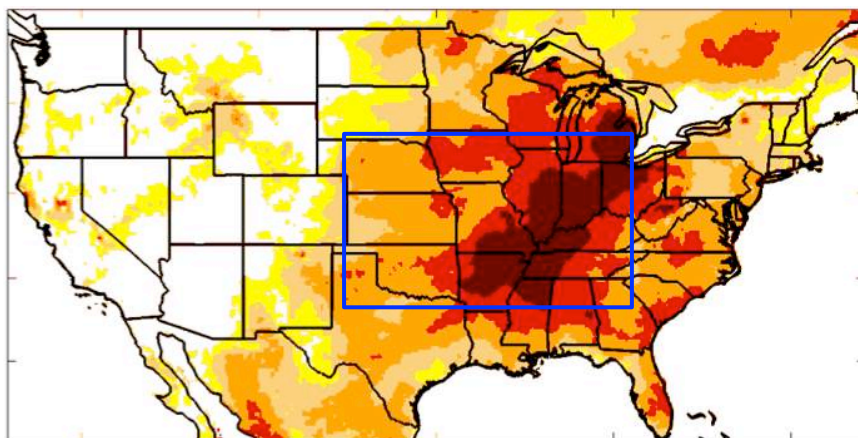
US

May 7

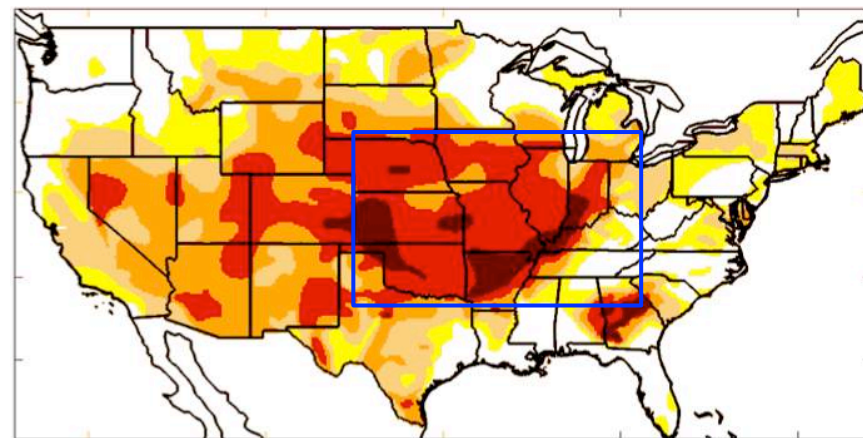
$$EDDI_j = \frac{\sum_{t=i}^j (ET_{0t} - \overline{ET}_{0t})}{\sigma_{\overline{ET}_{0t}}}$$

2-week EDDI

USDM



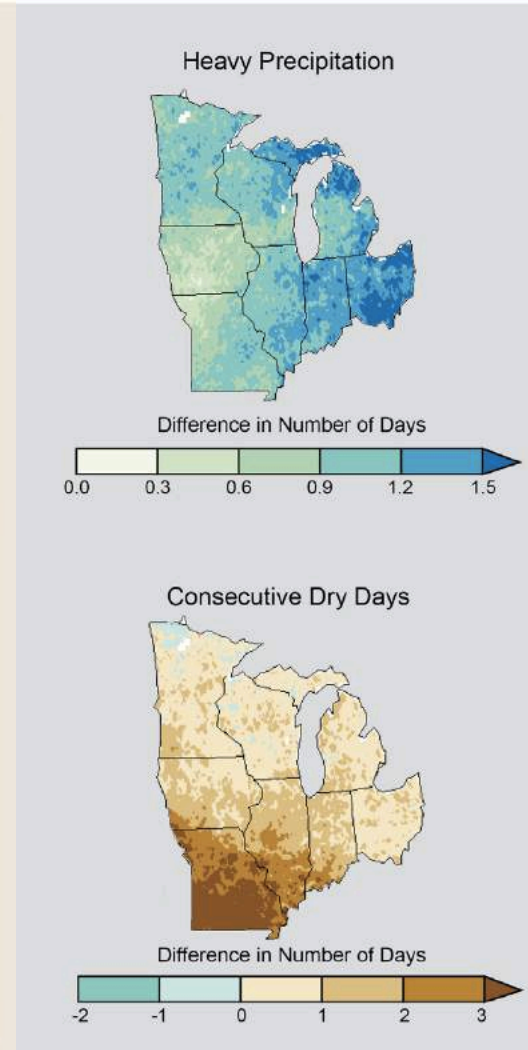
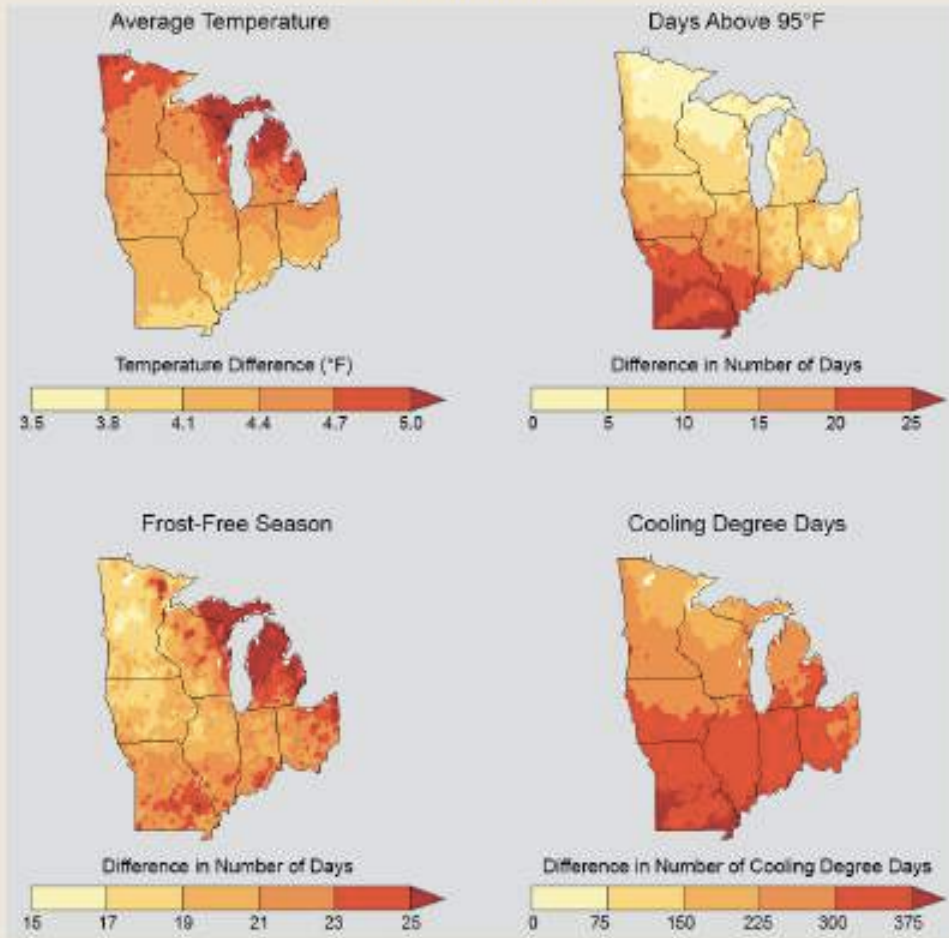
High in MO, AR, OK, NE, SE  
note little drought in western US



High in MO, AR, OK, NE, SE  
Drought in NE, OK, AR, MO, NE, SE  
Drought in NE, OK, AR, MO, NE, SE  
Drought in NE, OK, AR, MO, NE, SE

- Due to land-atmosphere feedbacks, evaporative demand ( $E_0$ ) reflects surface moisture conditions, *often before ET does*,
  - responds positively to both flash droughts and sustained droughts.

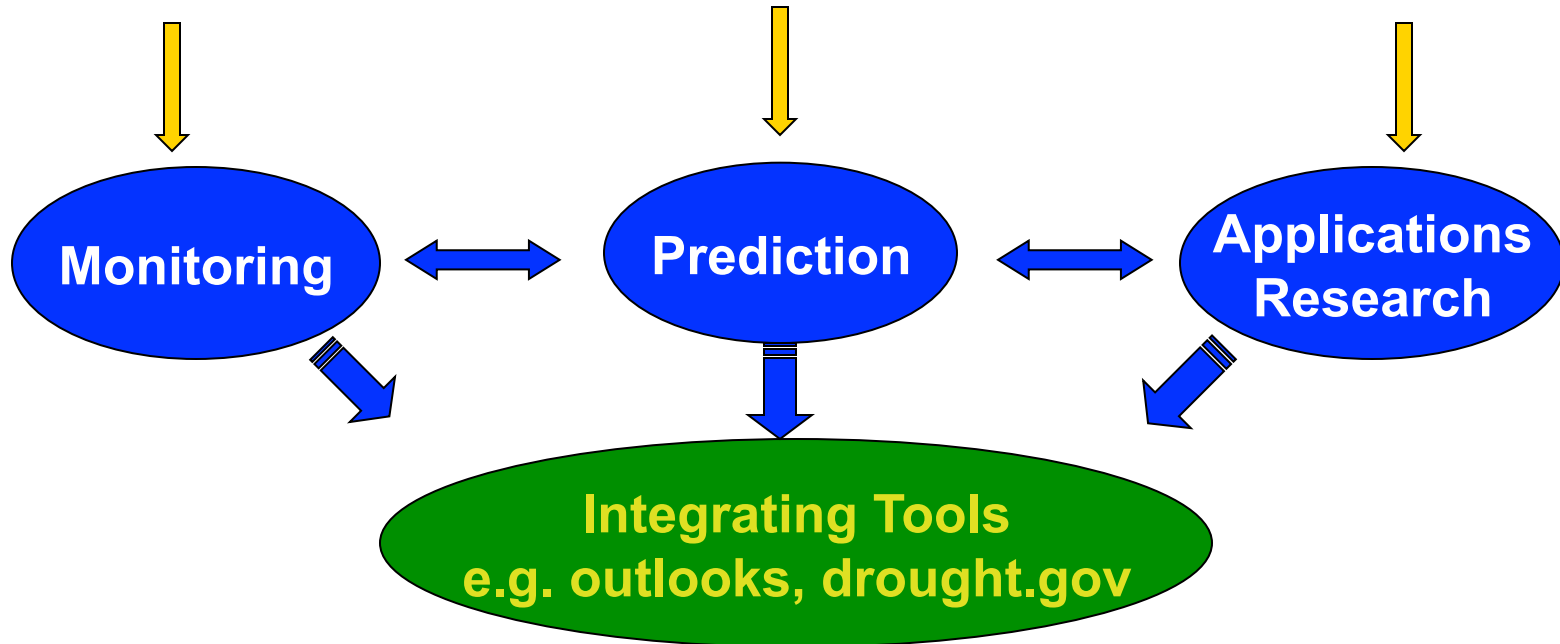
# Projected Mid-Century Temperature Changes in the Midwest



Weather to climate: across timescales  
Agriculture, Heat-Health, Energy, other?

# NIDIS Process Model: Implementing NIDIS Early Warning Systems

Coordinating federal, state, and local drought-related information (e.g., within watersheds and states)



Identifying, assessing and diffusing strategies for drought risk communication and preparedness

**Proactive  
Planning**

**Impact  
Mitigation**

**Improved  
Adaptation**



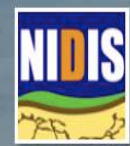
# Are we better off? NIDIS goals

- The number of states, communities, and institutions with improved capacity to inform risk management and reduce exposure to climatic risks (compared to previous droughts)
- The number of staff in or working with those institutions trained to develop and communicate local drought information and help reduce impacts
- The number of research projects that conduct and update drought impacts and user needs assessments in drought-sensitive parts of the US and communicate the results to the public
- The percentage of the U.S. population covered by adequate drought early warning information systems

# Ancient Chinese Characters:



River + Dike = Political Order



NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM  
**MIDWEST DROUGHT EARLY  
WARNING SYSTEM**

Thank you!

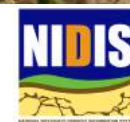
[roger.pulwarty@noaa.gov](mailto:roger.pulwarty@noaa.gov)



<http://go.funpic.hu>



Science-informed Preparedness  
& Adaptation

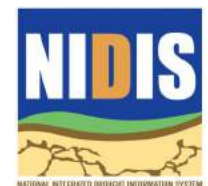


# Developing a Coordinated National Soil Moisture Network

- Develop a sub-national pilot system (completed)
- Develop a nationwide “best available” product by blending data from disparate sources

NIDIS complements the National Drought Resilience Partnership goals:

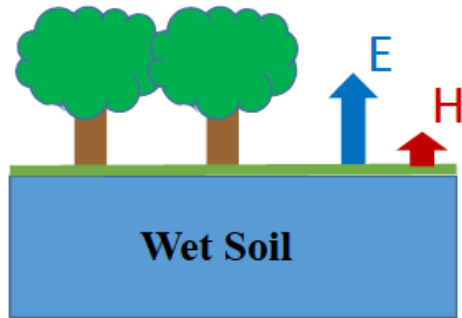
- integrates information on key indicators of drought and drought impacts
- Provides usable, reliable, and timely forecasts of drought drought and impacts





Soil moisture memory. An initial anomaly can influence surface energy balance at subseasonal-to seasonal timescales-perhaps influencing weather variables at these leads

Wet soil  $\Rightarrow$  higher evap., lower sensible heat flux



*This can affect local air temperature:*

- $\Rightarrow$  more evaporative cooling
- $\Rightarrow$  lower air temperature

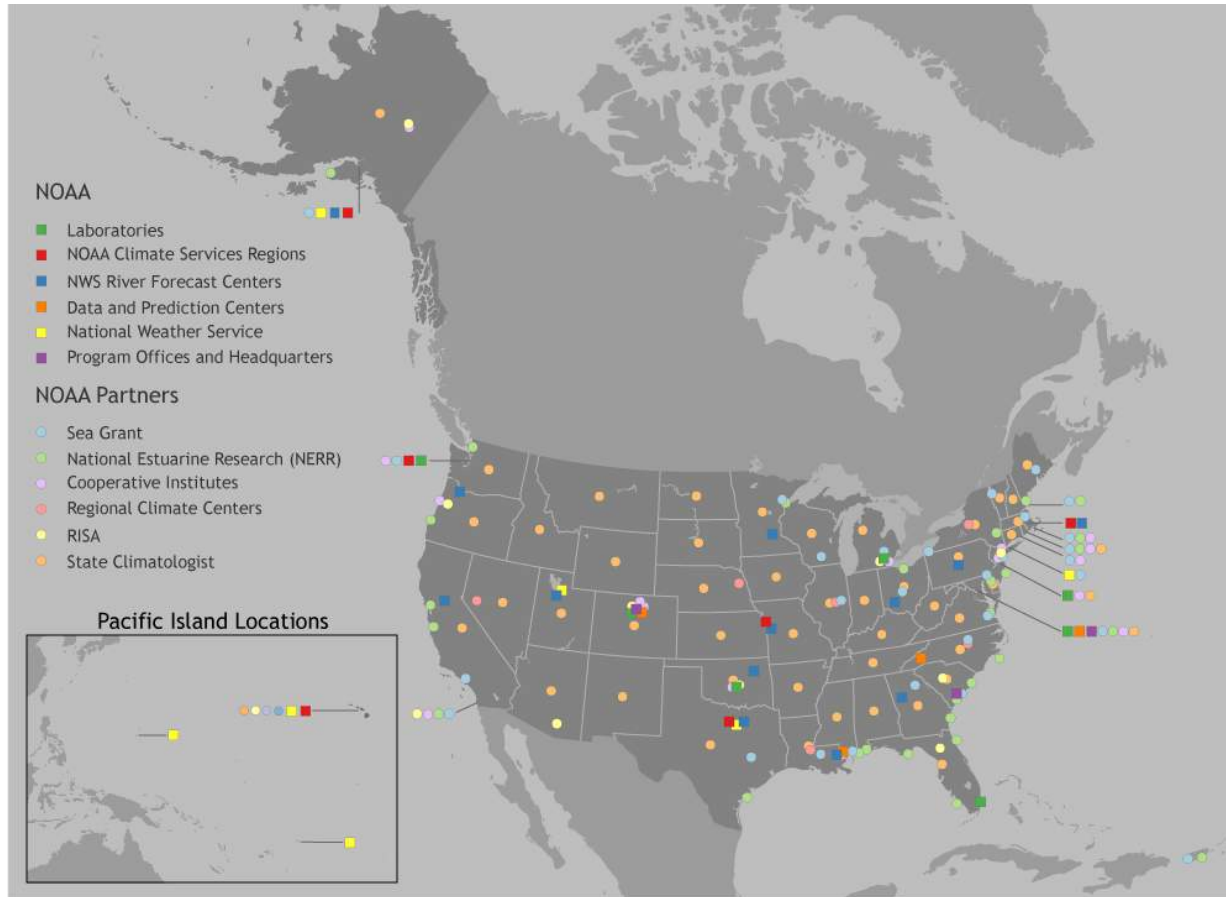
*It can also affect local precipitation:*

- $\Rightarrow$  boundary layer modification
- $\Rightarrow$  conditions more conducive  
(or perhaps less conducive)  
to onset of moist convection

Several studies have shown that while SST anomalies contribute to the development of drought, particularly in the cold season, soil moisture deficits act to extend the drought into summer.

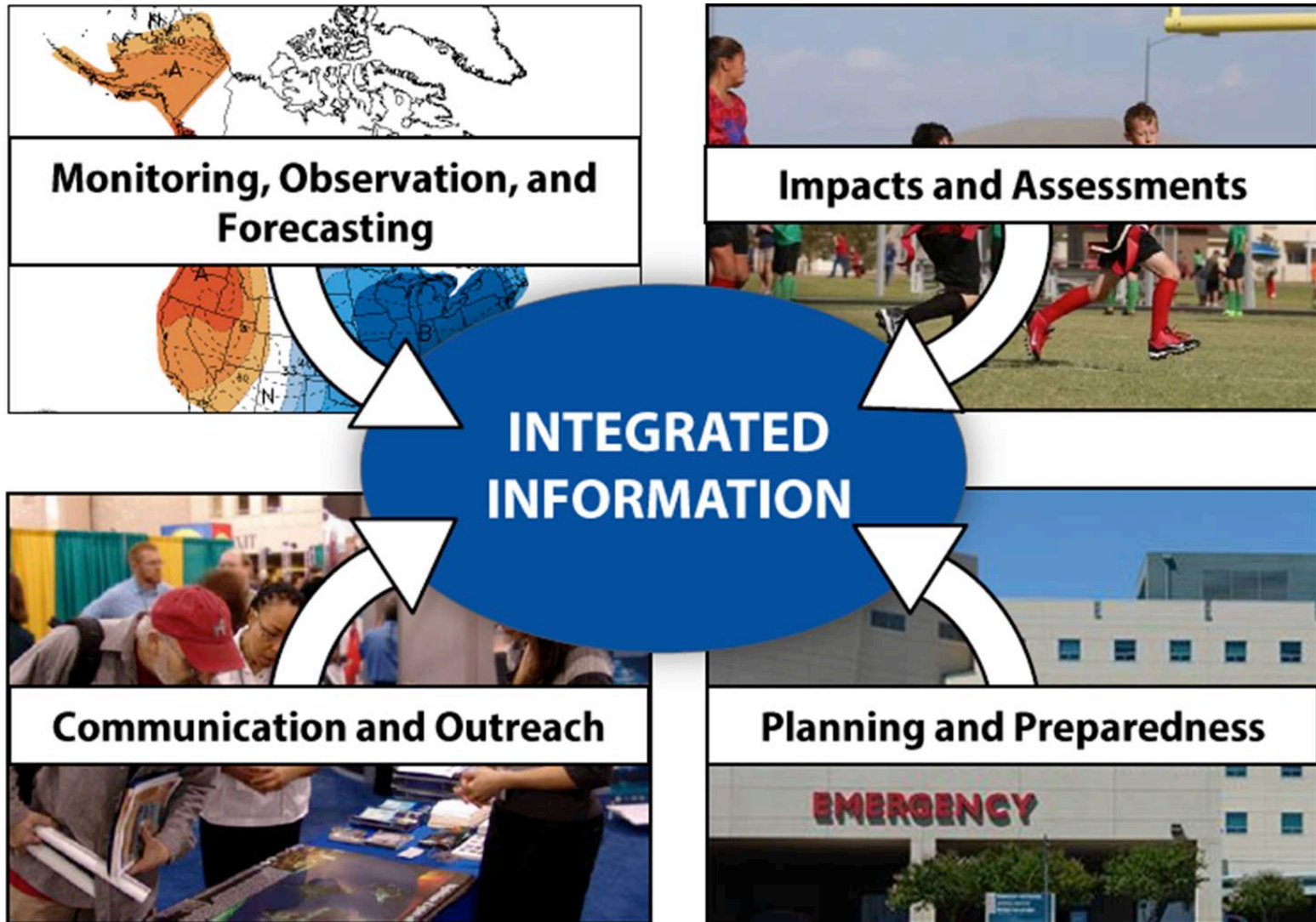
(Koster 2014)

Most decisions related to preparedness and adaptation are **local**- NOAA and its partners invest in regional networks



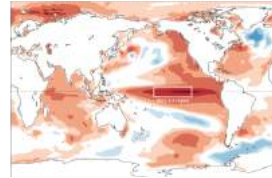
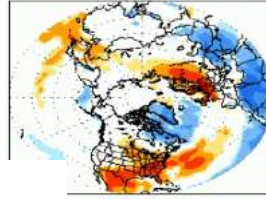
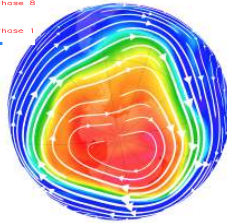
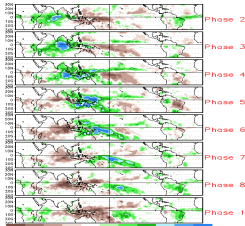
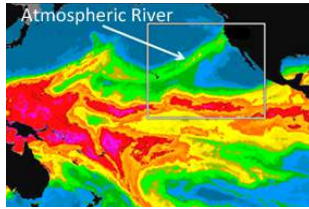
NOAA is positioned nationally and internationally to make data and information actionable. Most climate decisions are regional or local, and NOAA is structured to have multiple entry points at regional, state, and local levels.

# Integrated Information Systems





# Foundational Strengths



**Tornadoes**  
**Snowstorms**  
**Hurricanes**  
**Typhoons**  
**Atmospheric Rivers**

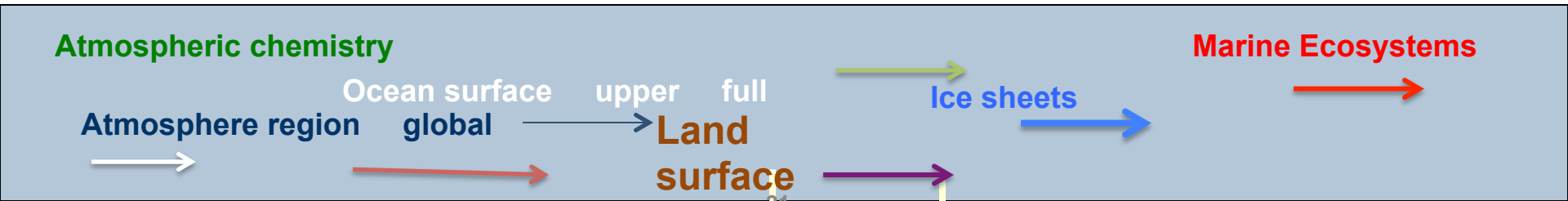
**Heat Waves**  
**Storm Track Variations**  
**MJO.....**

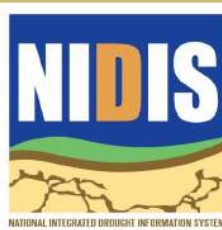
**El Niño-Southern Oscillation.....**

**Decadal Variability**  
**Solar Variability**  
**Deep Ocean Circulation**  
**Greenhouse Gases**



**Early warning...resource allocation... Infrastructure Design**





# NIDIS Drought Early Warning Pilot in the Apalachicola, Chattahoochee, and Flint River Basin: Evaluation of Activities and Outcomes



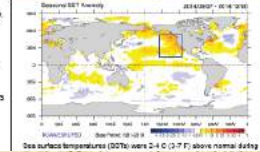
NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM NEWSLETTER  
NOVEMBER 2014 // WWW.DROUGHT.GOV // VOLUME 4 ISSUE 2

## Quarterly Climate Impacts and Outlook

### Regional Impacts for September-November 2014

**Drought, Flooding and Water Resources**  
Storage in northern California's Lake Oroville bottomed out Nov 21 at 698,221 acre-ft, 42% of historical average capacity. This is among lowest storage amounts on record.  
Nearly all of OR's major reservoirs are below 50% average capacity; NV and eastern OR reservoirs low as well.  
Wells in rural CA communities continue to run dry; residents relying on bottled or transported water. Tulare, San Mateo counties hardest hit.  
California passed groundwater management legislation, voters approved \$7.5B in water bonds. After 3+ years of drought, increased public and political attention.

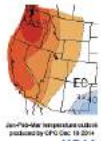
### Exceptionally warm ocean temperatures off US West Coast



### Agriculture, Wildlife and Fisheries

Increase in lemon and lime prices; production fell for rice, grapes, oranges, pistachios, etc.  
Due to drought, fewer and smaller grapes produced; small pelts of ducks and other waterfowl.  
Beaver encounters with humans Sierra Nevada and Oregon.  
**Fires**  
In September, the King Fire of Sierra Foothills west of Sacramento structures and cost \$50 million.

### Regional Outlook



Above normal temperatures at departure from normal in Oct the northern tier of the region

### NOAA

Above normal temperatures at departure from normal in Oct the northern tier of the region

### NMME Precipitation

The National Multi-hazard Early Warning System (NMME) is an experiment to improve performance of different seasonal models. Past performance has been modest, at best, and methods. The NMME for January-February pattern as well as normal conditions across the Great Basin, and California. If normal conditions are projected, Washington, the Idaho panhandle, western Montana as well as in western Oregon. The NMME is the official seasonal outlook above.

Contact: NIDIS Drought (NIDIS) Center Director (NIDIS) Center  
Kathy Riedinger (NIDIS) Center

## From Too Much to Too Little:

How the central U.S. drought of 2012 evolved out of one of the most devastating floods on record in 2011



## MANAGING DROUGHT IN THE SOUTHERN PLAINS

You are invited to join us in a webinar (web-based seminar) series to discuss drought conditions, impacts and resources available to help manage drought in the Southern Plains. Webinars will be held on the 2nd Thursday of each month at 11:00 A.M. Central Time. A shortened briefing will also be offered on the 4th Thursday. The content is geared toward a general audience - anyone who has responsibility to manage or assist others in managing drought and its related impacts.

If you would like to join in these webinars, you need to register via the SCIPP website: <http://www.southernclimate.org> or e-mail [scipp@mesonet.org](mailto:scipp@mesonet.org). For each webinar, you will receive an e-mail with the link to access the webinar. Each webinar will last 45-60 minutes.

Each webinar will include an overview of the current drought assessment and outlook, summary of impacts across the region, and a topic or resource, such as La Niña or wildfire conditions. You will have an opportunity to suggest topics for following webinars. The primary focus is in the states most heavily impacted from the current drought - Texas, Oklahoma and New Mexico - but participation from surrounding states is encouraged.

The webinar series is sponsored by a partnership of the National Integrated Drought Information System (NIDIS), National Oceanic and Atmospheric Administration (NOAA), National Drought Mitigation Center, Southern Climate Impacts Planning Program, Climate Assessment for the Southwest, and the region's State Climatologists.

Information from the webinars will be posted on a website linked through <http://www.southernclimate.org>. A two-page summary will be produced and posted for each webinar. Please pass on this announcement to relative organizations or groups that are involved in managing or monitoring drought and its related impacts.

To register or for more information, contact:

Southern Climate Impacts Planning Program  
<http://www.southernclimate.org>  
405-325-2541 or [scipp@mesonet.org](mailto:scipp@mesonet.org)

### Webinar Topics

- La Niña
- Cattle & Livestock
- U.S. Drought Monitor
- Ecological Impacts
- Seasonal Forecasting
- Flash Drought
- Water Supply
- Wildfire
- Drought Ready Communities
- Agricultural Impacts



## ASSESSMENT REPORT Causes and Predictability of the 2011-14 California Drought

## An Interpretation of the Origins of the 2012 Central Great Plains Drought



## Assessment Report

NOAA Drought Task Force  
Narrative Team

Lead: Martin Hoerling  
Co-Leads: Siegfried Schubert & Kingtse Mo

20 March 2013

