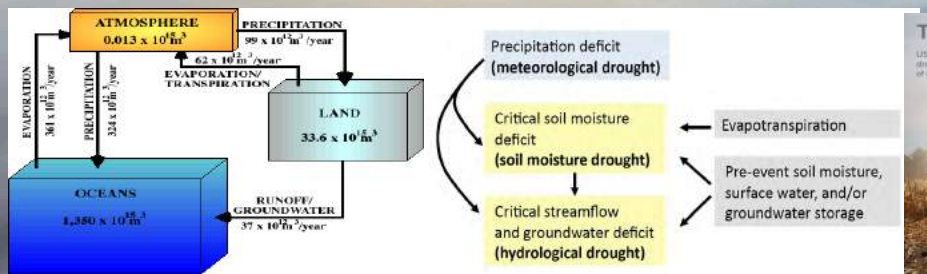
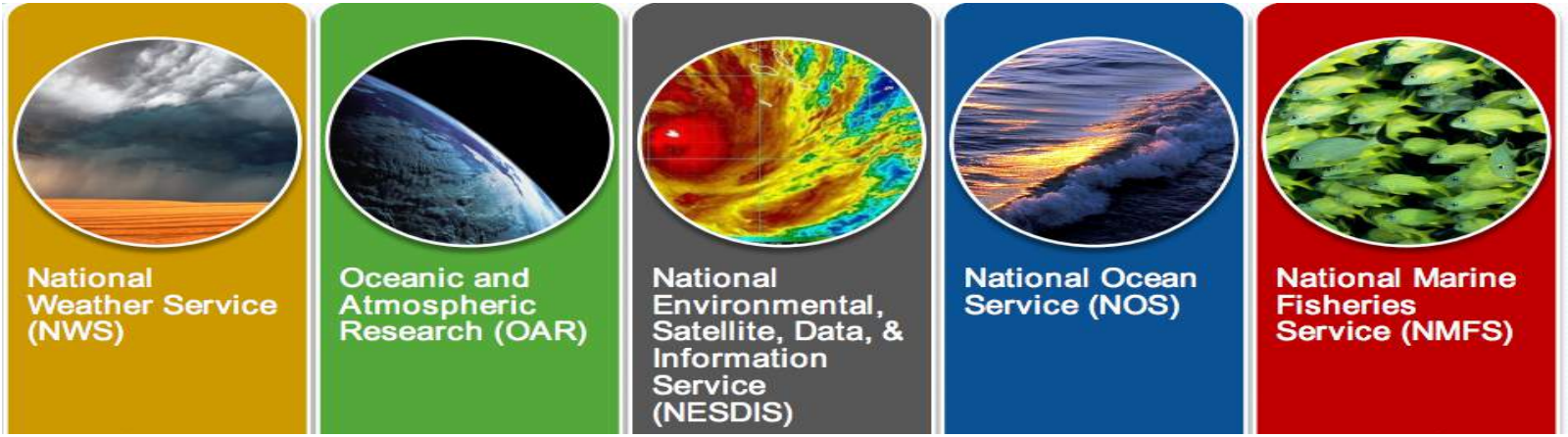
The National Integrated Drought Information System: An Overview

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)

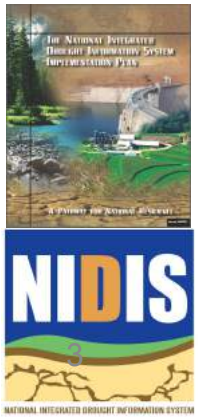
"Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts"

(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

Key Phenomena, variables

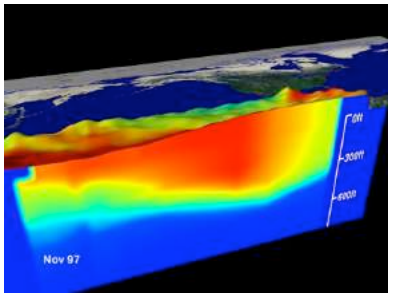
Sea surface temperature variations

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

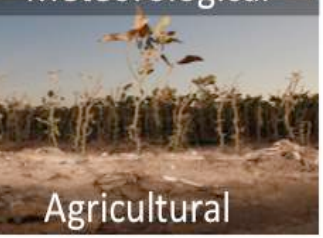
soil moisture, stream flow, precipitation, ground water, lakes, reservoirs

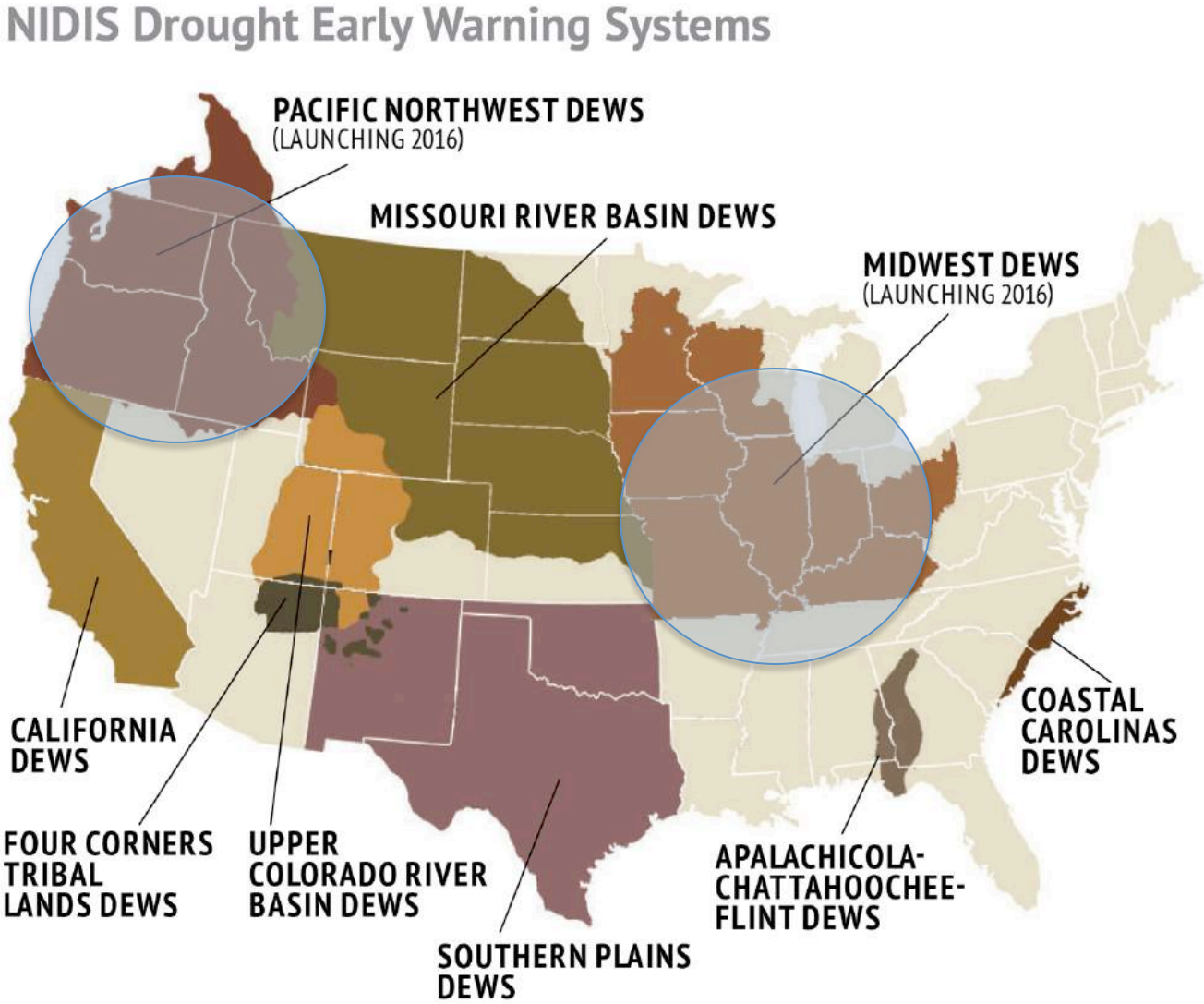
NIDIS Partnerships
(Federal, States, Tribes, Private)

Drought Early Warning

Information

Systems

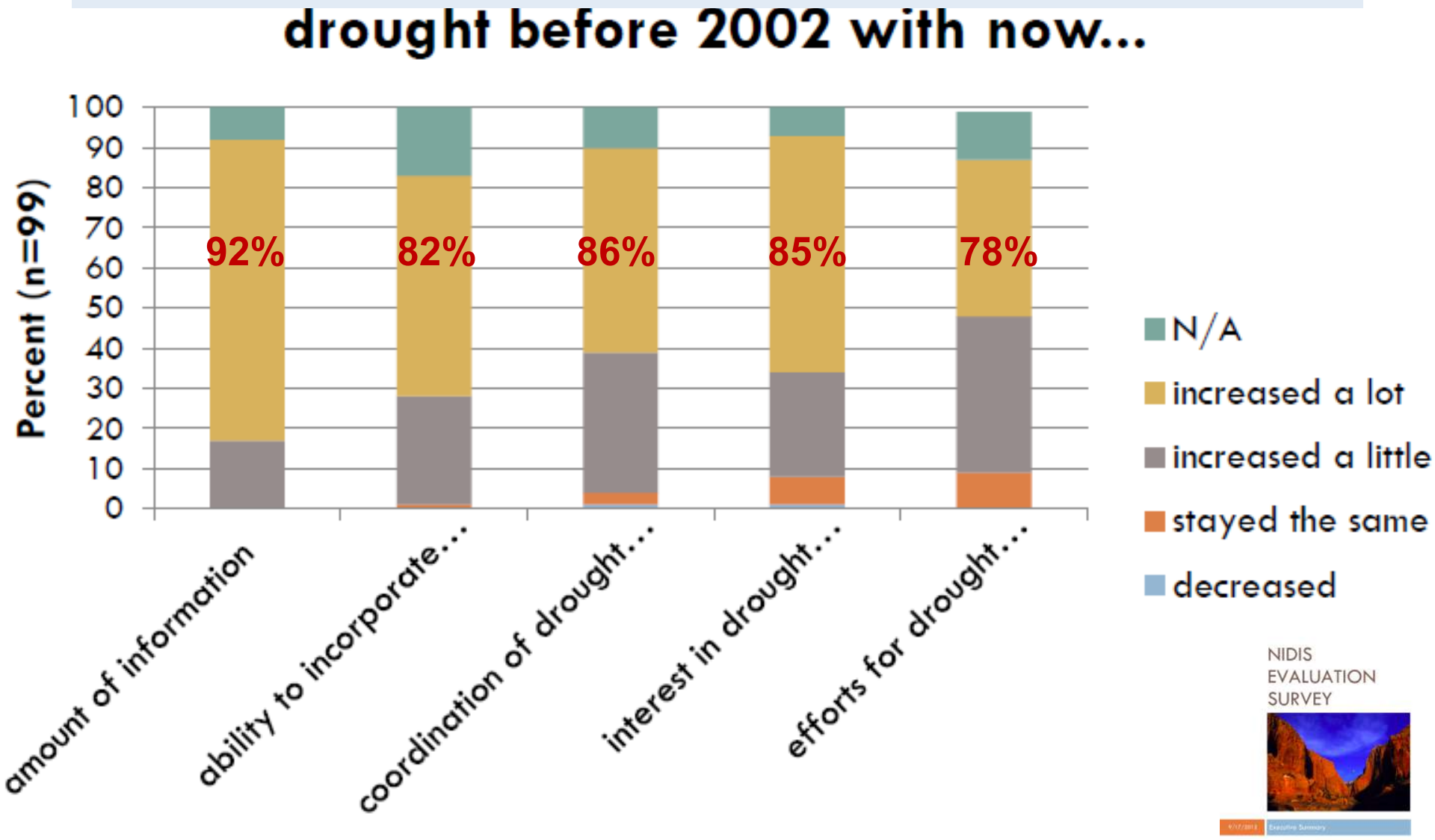


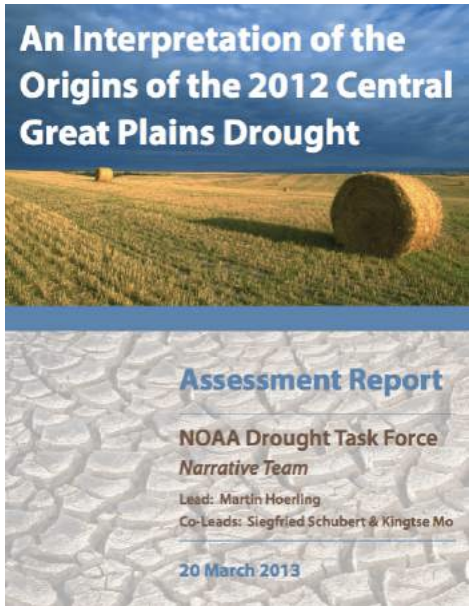


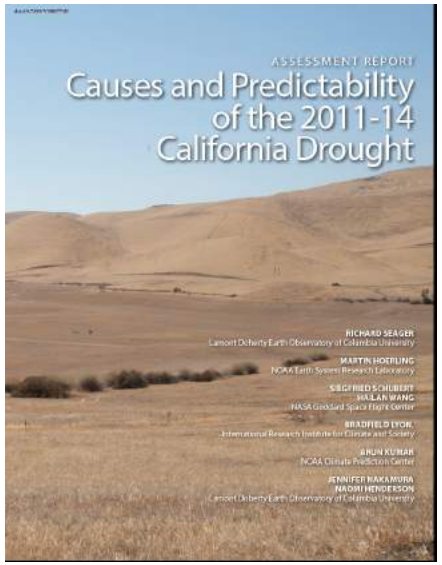
Governance Attributes: Agility, Alignment, Adaptability

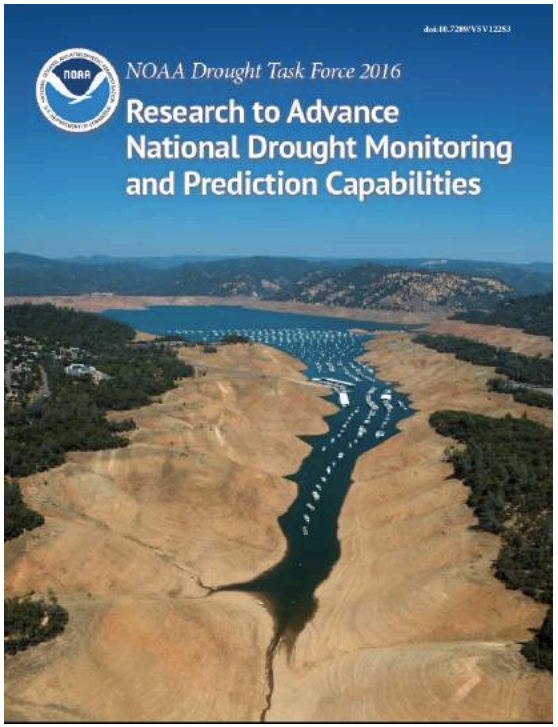
Network coordination, **Integrated Information** (monitoring, forecasting, risk assessment), **Drought risk management capacity,** communication (e.g. outlook forums) and planning

NIDIS Evaluation Survey Example









National Drought Forum

Summary Report and Priority Actions

February 2016

USDA

USGS
science for a changing world

NASA

"Hydro-Illogical" Cycle

RAIN

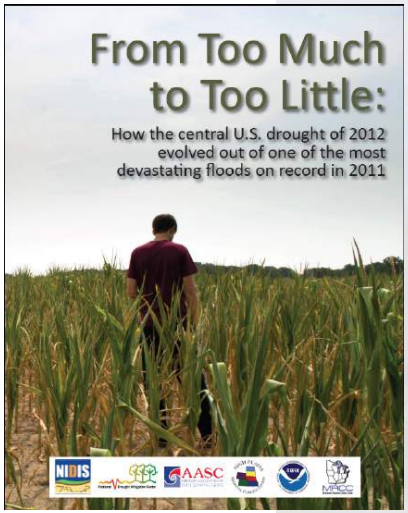
Apathy

DROUGHT

Concern

MORE DROUGHT

Panic



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)

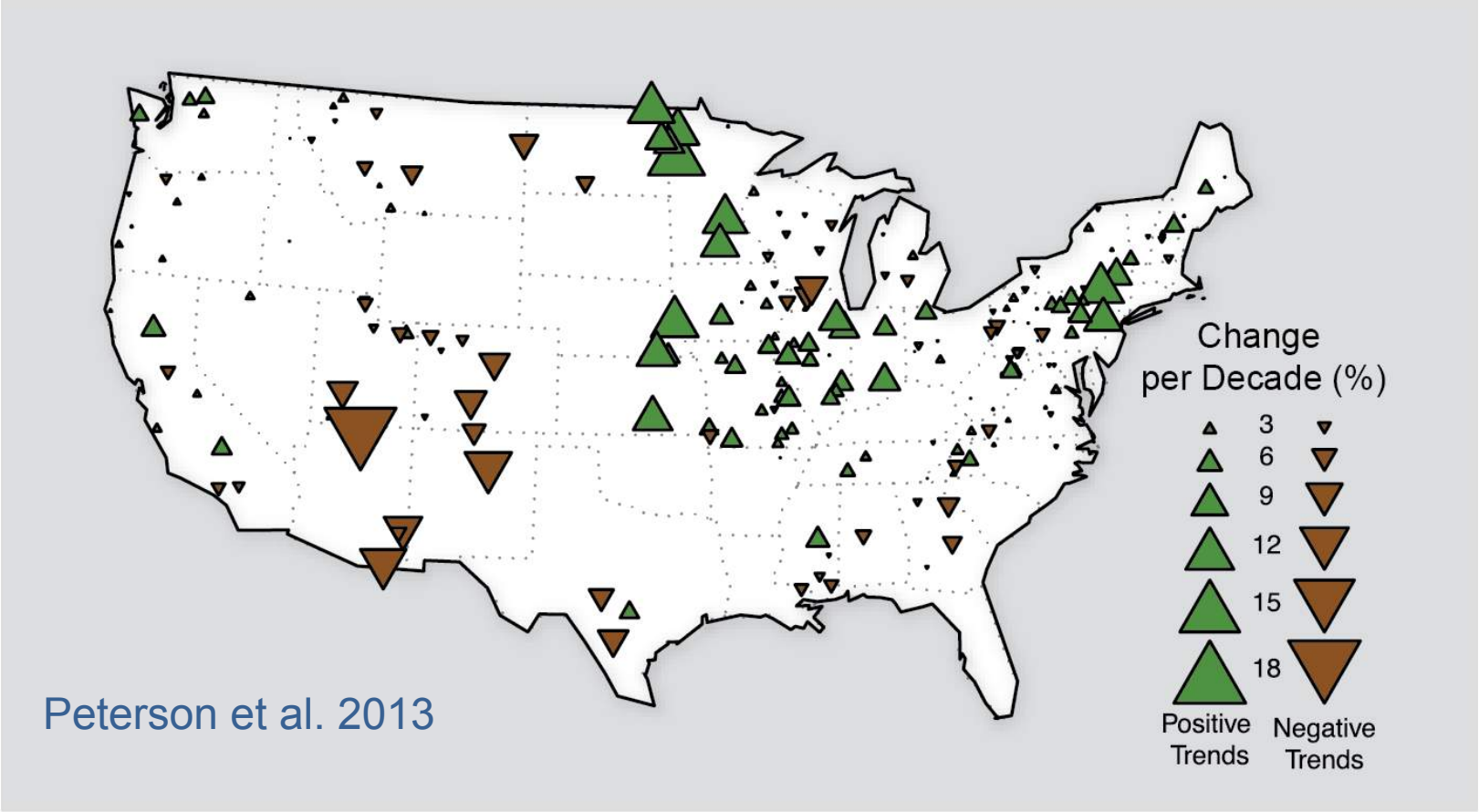
"Climate Extreme Drought To Extreme Flood: Weather Whiplash Hits The Midwest"

Weather Underground Climate Guest Contributor Apr 19, 2013

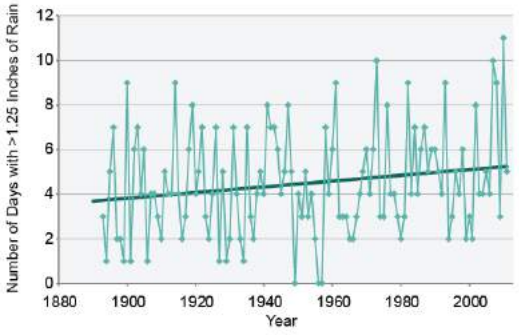
NIDIS Reauthorization P.L. 113-086, 2014

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

Trends in Flood Magnitude



Peterson et al. 2013



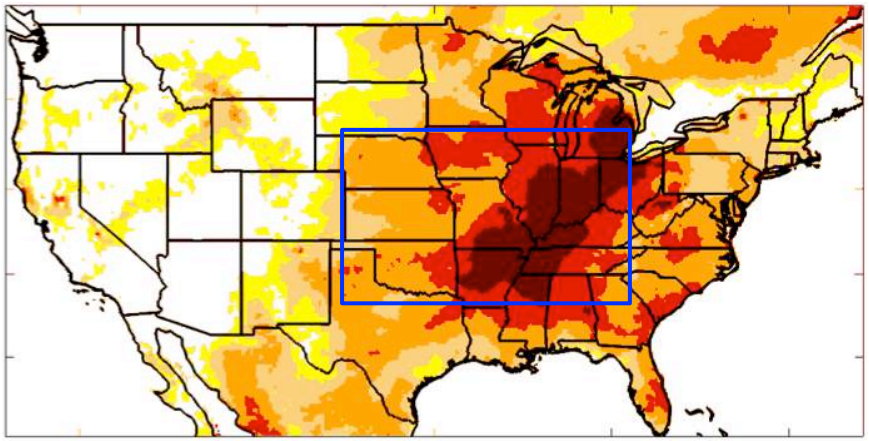
Takle et al 2014
Iowa precipitation
1895-2010

2012 Evaporative Demand Drought Index

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

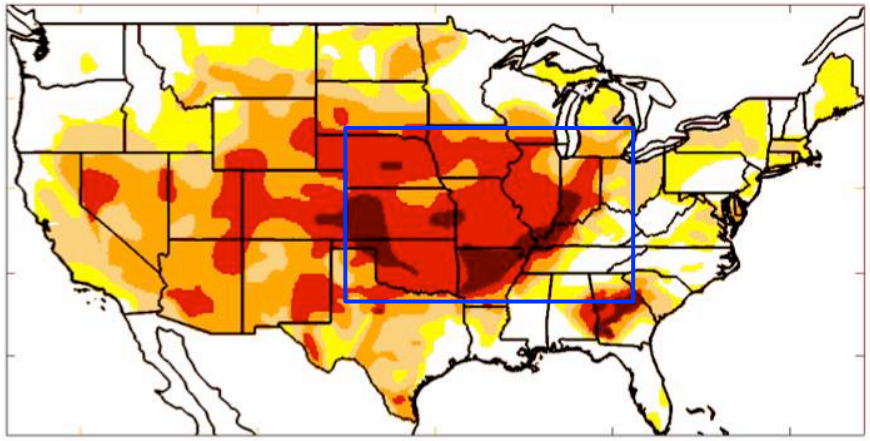
$$EDDI_j = \frac{\sum_{t=i}^{j}\left(ET_{0_t} - \overline{ET_{0_t}}\right)}{\sigma_{\overline{ET_{0_t}}}}$$

2-week *EDDI*



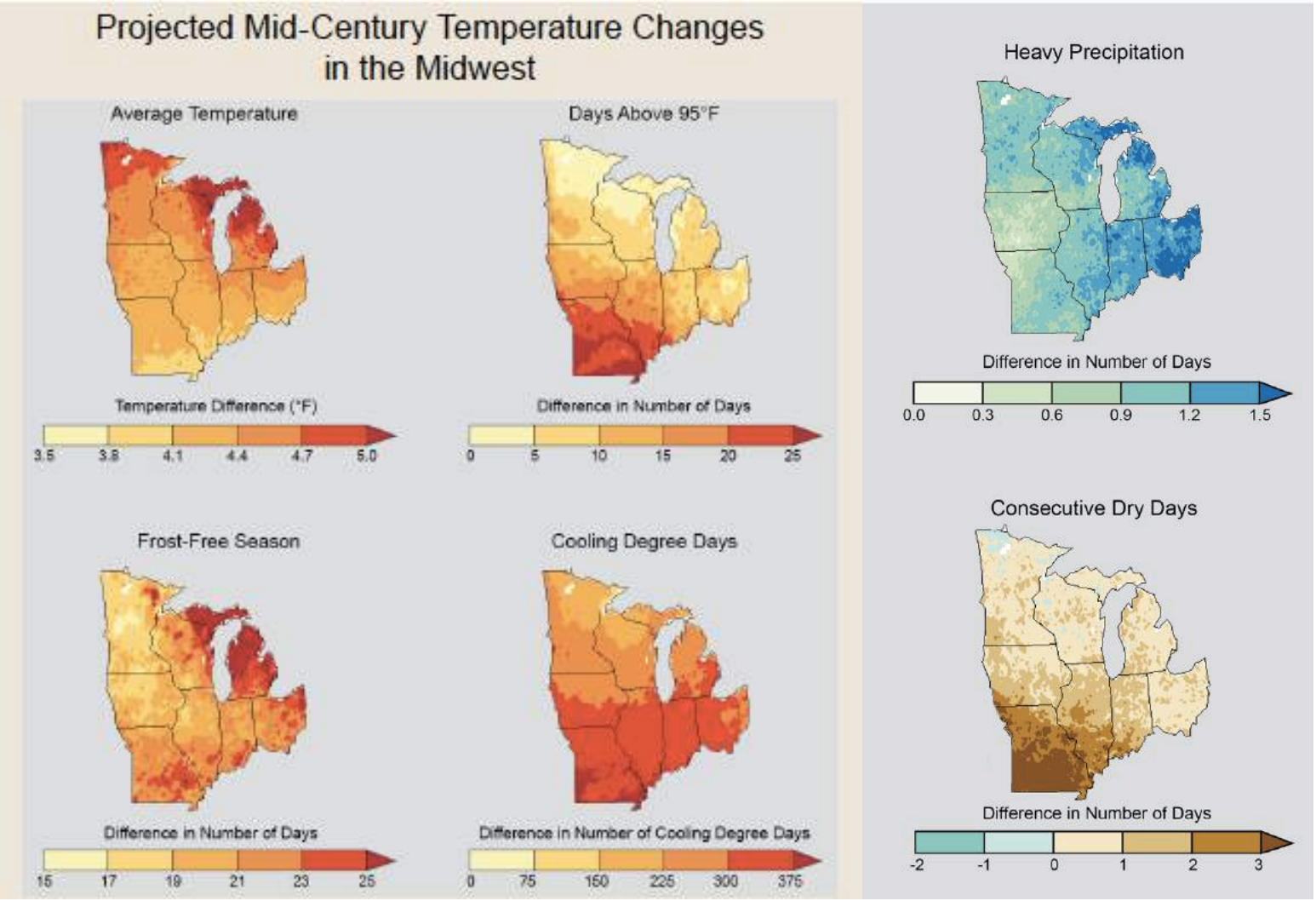
note little drought in western US

USDM



drought in NY, PA, and VA, 2 months after *EDDI*

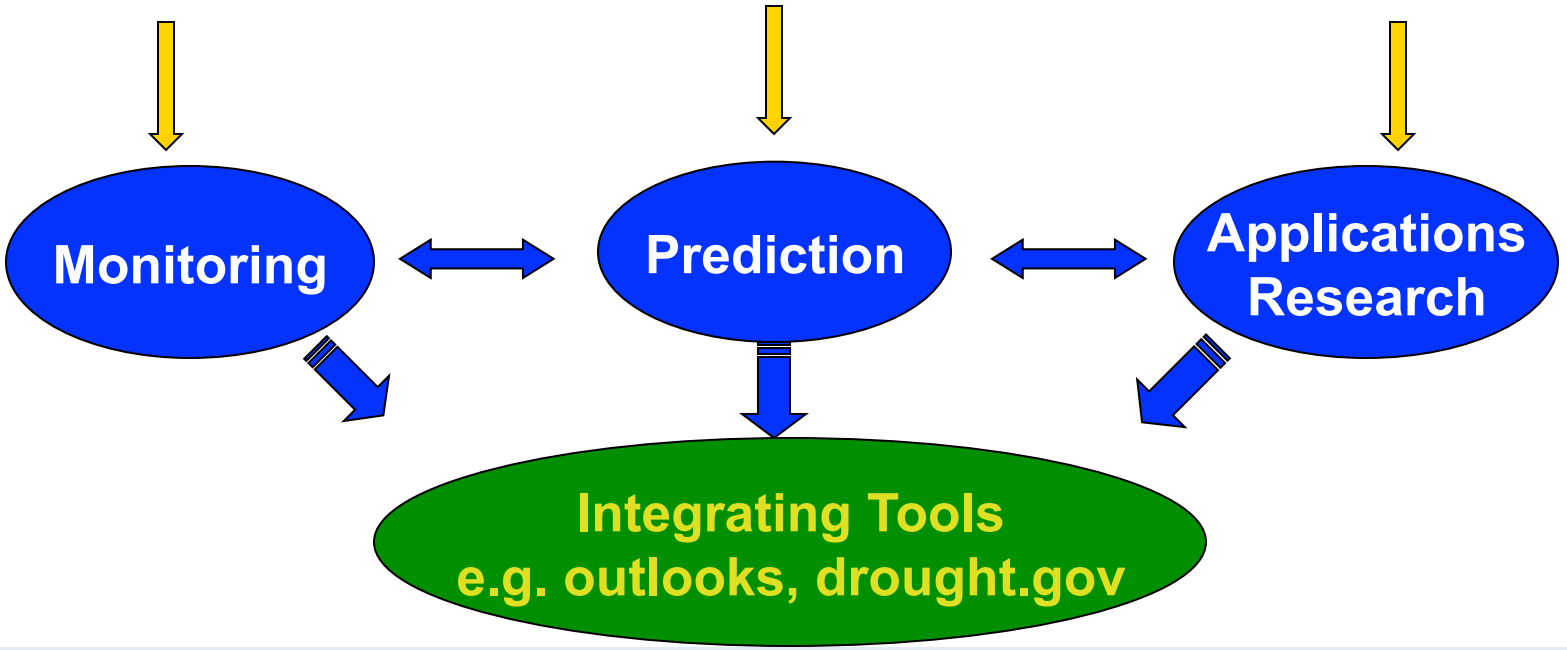
- Due to land-atmosphere feedbacks, evaporative demand (E_0) reflects surface moisture conditions, *often before ET does*,
  - responds positively to both flash droughts and sustained droughts.



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

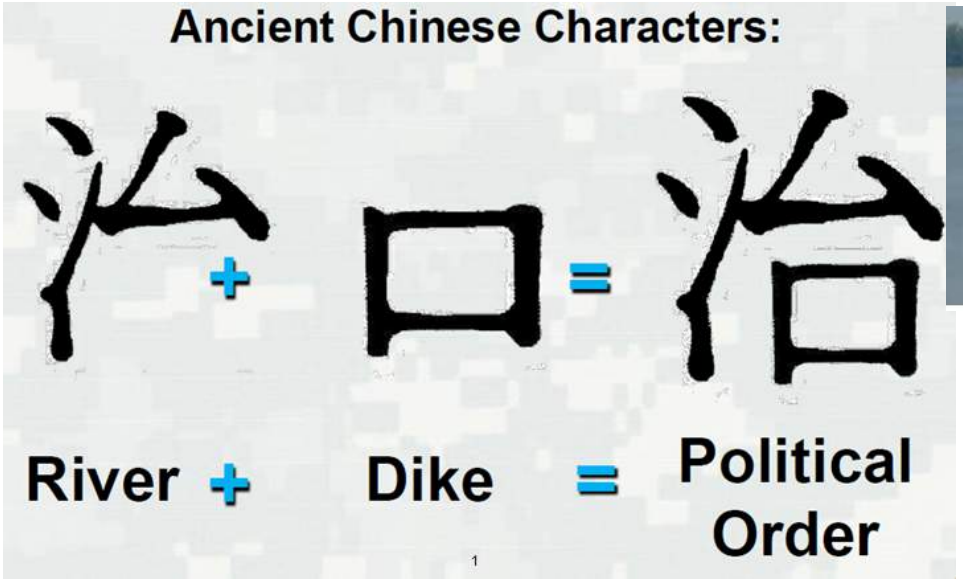
Are we better off? NIDIS goals

- 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



Thank you!

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NIDIS

NDMC

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

USDA

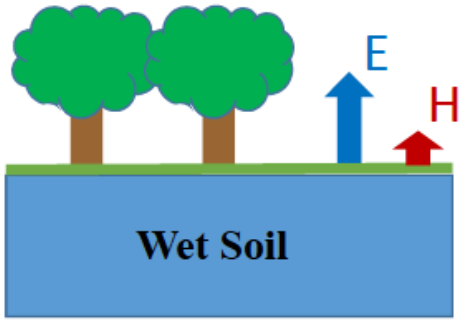
USGS science for a changing world

NASA

TEXAS A&M UNIVERSITY

NIDIS

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 ⇨ higher evap., lower sensible heat flux

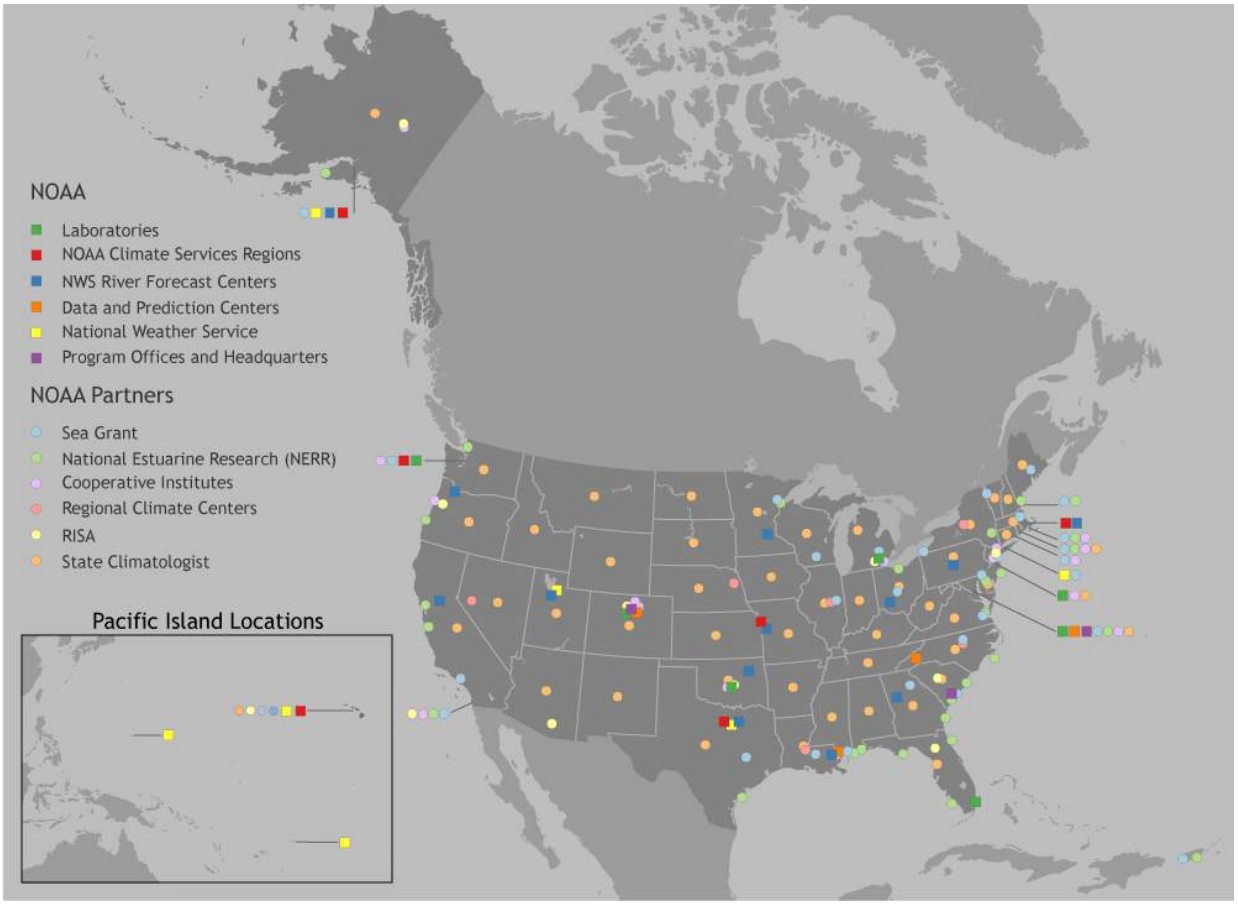
This can affect local air temperature:
- ⇨ more evaporative cooling
- ⇨ lower air temperature

It can also affect local precipitation:
- ⇨ boundary layer modification
- ⇨ 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.

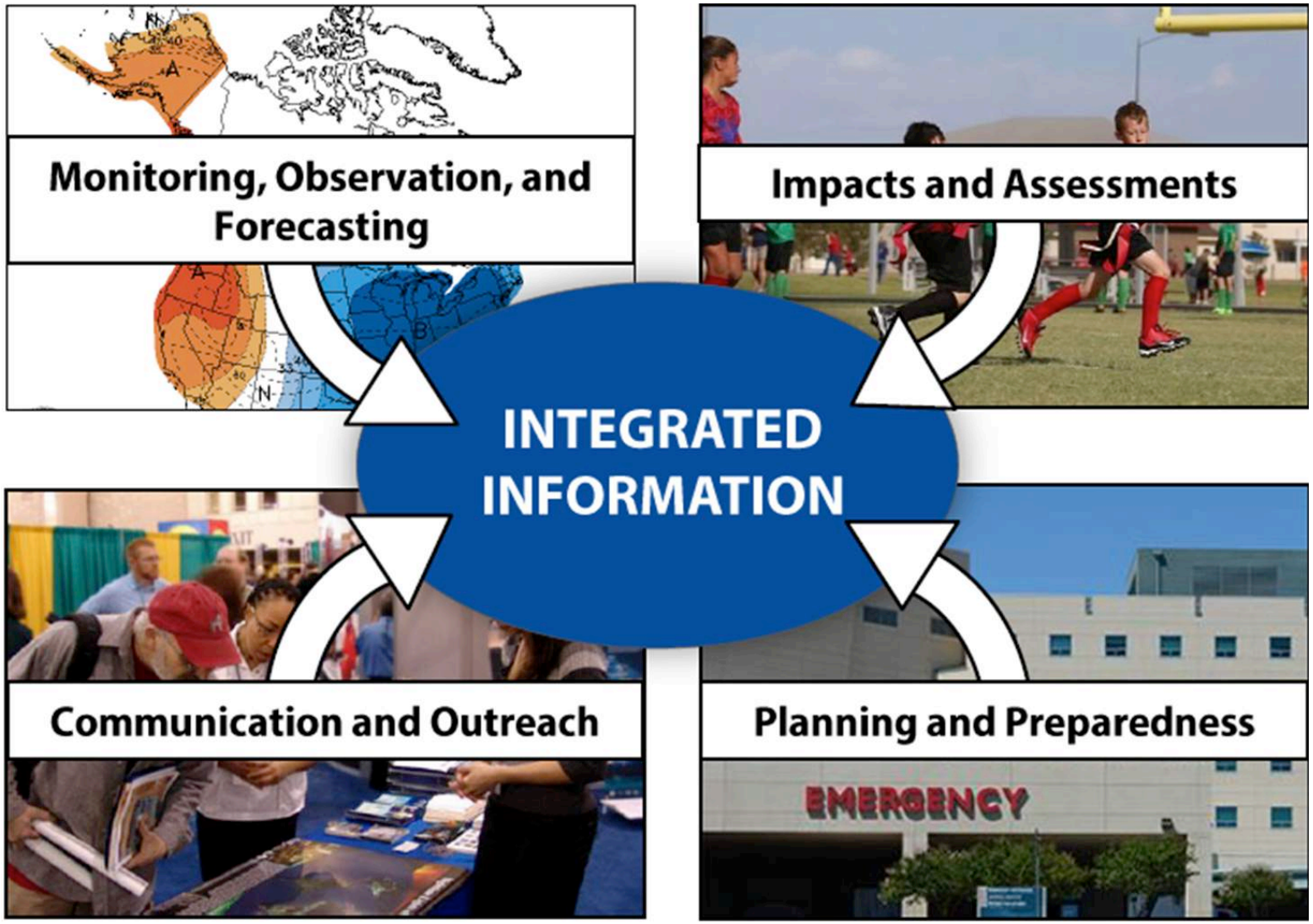
(Koster 2014)

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

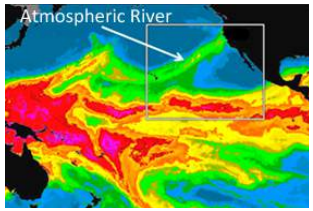


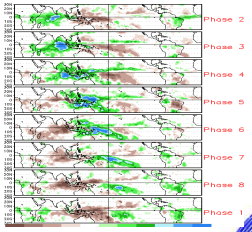
NOAA is positioned nationally and internationally to make data and information actionable. Most climate decisions are regional or local, and NOAA is structured to have multiple entry points at regional, state, and local levels.

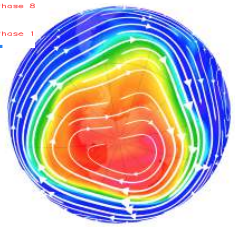
Integrated Information Systems

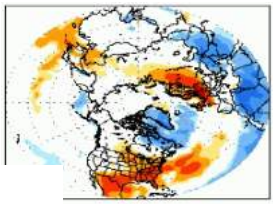


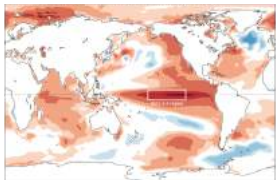
Foundational Strengths











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

1 DAY | 30 DAYS | 1 SEASON | 3 YEARS | 10 YEARS | 30 YEARS | 100 YEARS

SHORT-TERM | INTERANNUAL | DECADE-TO-CENTURY

Early warning....resource allocation…. Infrastructure Design

Atmospheric chemistry

Marine Ecosystems

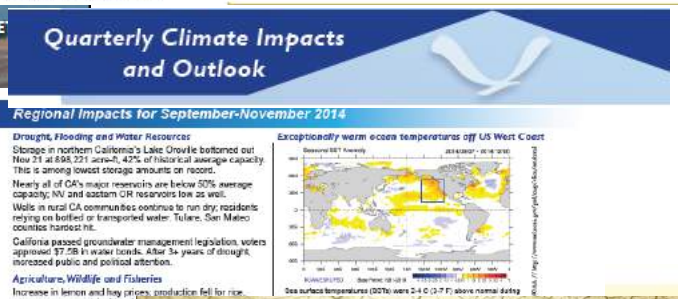
Ocean surface upper full

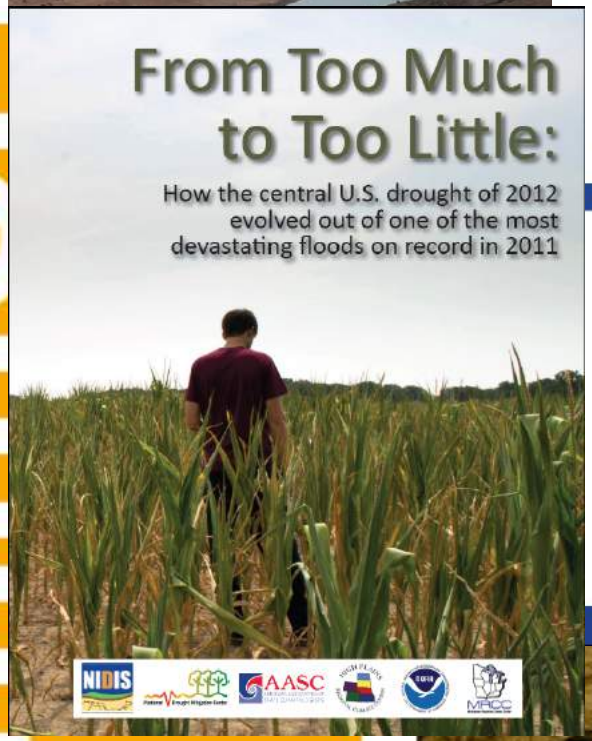
Ice sheets

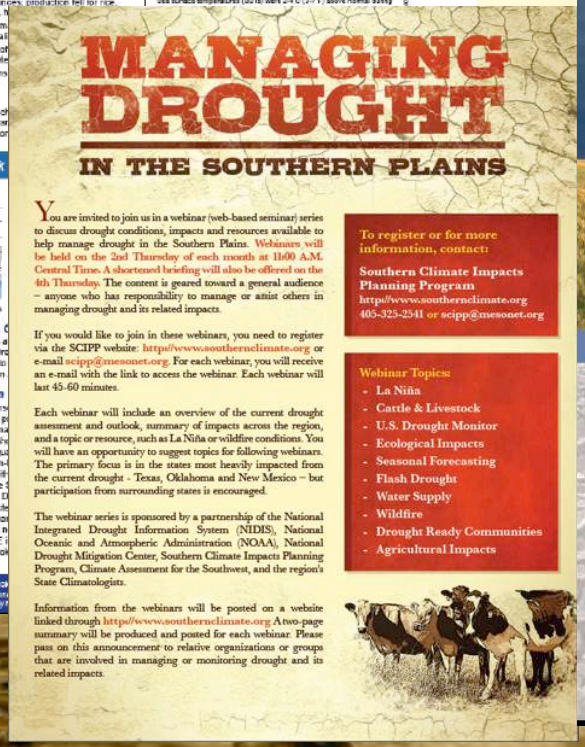
Atmosphere region global

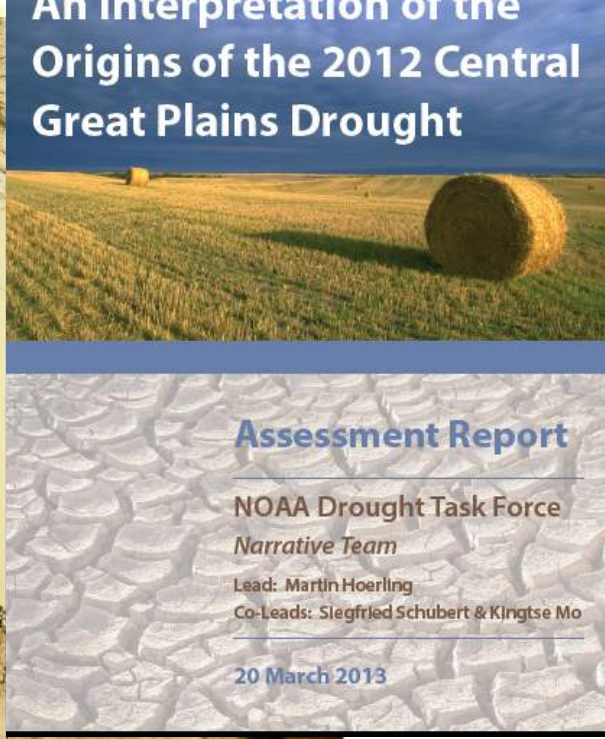
Land surface

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









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