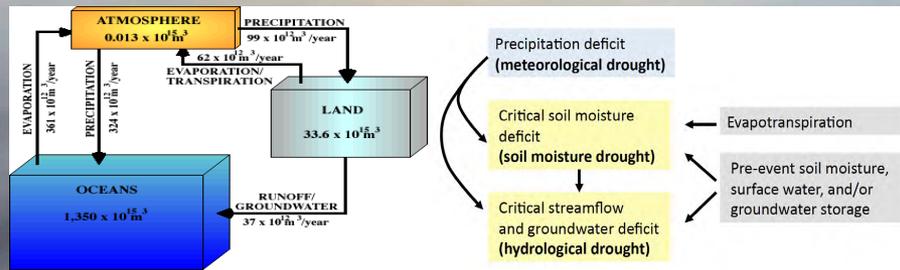


# The National Integrated Drought Information System V1.0



R. S. Pulwarty  
NOAA  
A. Willardson  
WSWC



# Three major tasks under NIDIS

(Public Law 109-430, 2006)

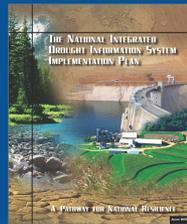
*“Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts”*

## (I) Provide effective drought early warning systems

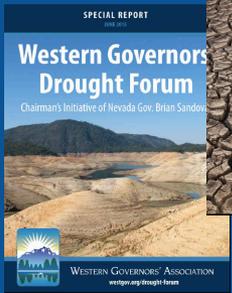
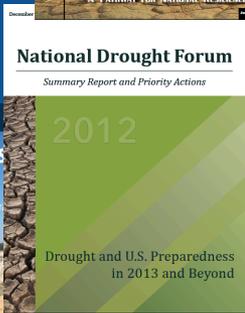
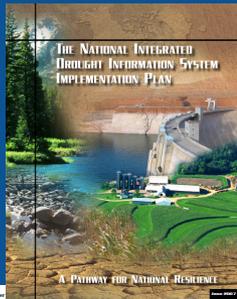
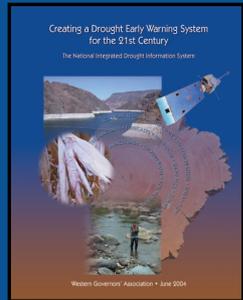
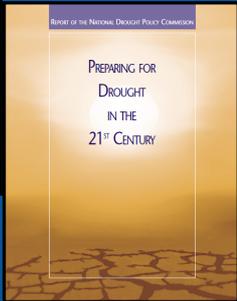
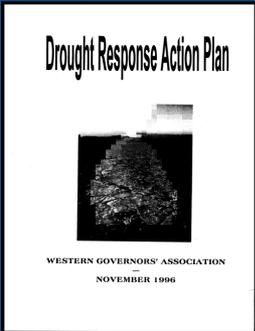
- (a) collect and integrate key indicators of drought severity and impacts; and
- (b) produce timely information that reflect local, regional, and State differences;

## (II) Coordinate and integrate as practicable, Federal research *and monitoring* in support of a drought early warning system

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



1996



2015

# Integrating Observations and Data Systems WGA NIDIS (2004)

## Key Variables for Monitoring Drought

- ▶ climate data
- ▶ soil moisture
- ▶ stream flow
- ▶ ground water
- ▶ reservoir and lake levels
- ▶ short, medium and long range forecasts
- ▶ vegetation health/stress and fire danger

## Current Observations and Data Systems

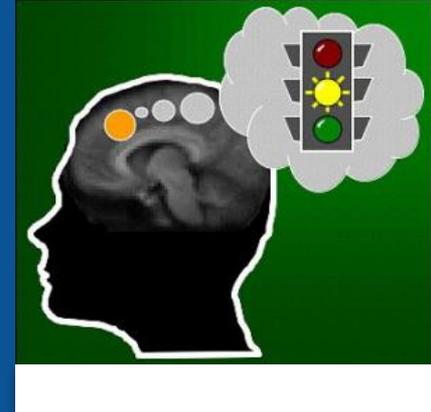
Drought planning and mitigation will be based upon the gathering of high quality information related to a variety of physical, environmental and human conditions. The gathering and integration of data includes making more efficient use of existing data as well as “filling in the holes” in local, state,

regional and federal networks. Characterization of drought requires a combination of two types of information:

1. Observations of past and current physical states of the environment and their context within the relevant historical record.
2. Documented impacts on human and natural systems that are a consequence of the physical conditions.

# What is an early warning information system?

The development and delivery of a forecast, projection.... AND .....



The systematic collection and analysis of relevant information about and coming from areas of impending risk that:

- (a) Inform the development of strategic responses to anticipate risks and opportunities and their evolution; and
- (b) Communicate options to critical actors for the purposes of decision-making and response

**An “investment” not an “expenditure”**

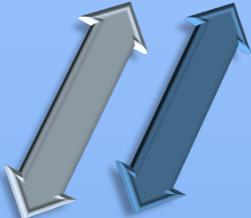
# NIDIS Research and Applications:



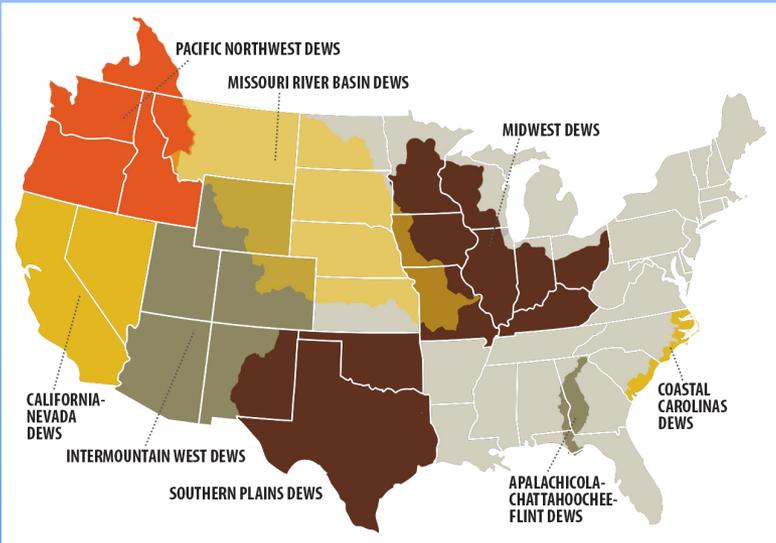
**Regional Integrated Sciences and Assessments (RISA)**

**Modeling Analysis Predictions and Projections (MAPP, NCEP)**

- Support cross-regional efforts to assess predictability, user needs
- Test drought-focused decision support tools



**Sectoral Applications Research Program (SARP)**



**Drought.gov.  
Soil moisture sensors (NCEI, ARL)**



- Identify socio-economic effects of drought, data and info needs of resource managers and policy/decision makers

**NWS (CPC, RFCs, CSD), NCEI (RCSDs, RCCs), NOS, NMFS**

- Transition and communicate drought information products for operations and response

- Drought Preparedness planning**
- **State-level partnerships**
  - **Federal agencies**

NIDIS Technical  
Working  
Groups

Integrated  
Monitoring and  
Forecasting

NRCS, USGS  
River Forecast Center, BoR  
Climate *Prediction* Center  
USDA

Interdisciplinary  
Needs Assess.,  
Research,  
Applications

Regional Integrated Sciences  
and Assessments  
Regional Climate Centers  
NCAR

Regional Drought  
Early  
Warning Systems

U.S.  
Drought Portal

NCDC  
NDMC-NOAA, USGS, USDA,  
USBoR

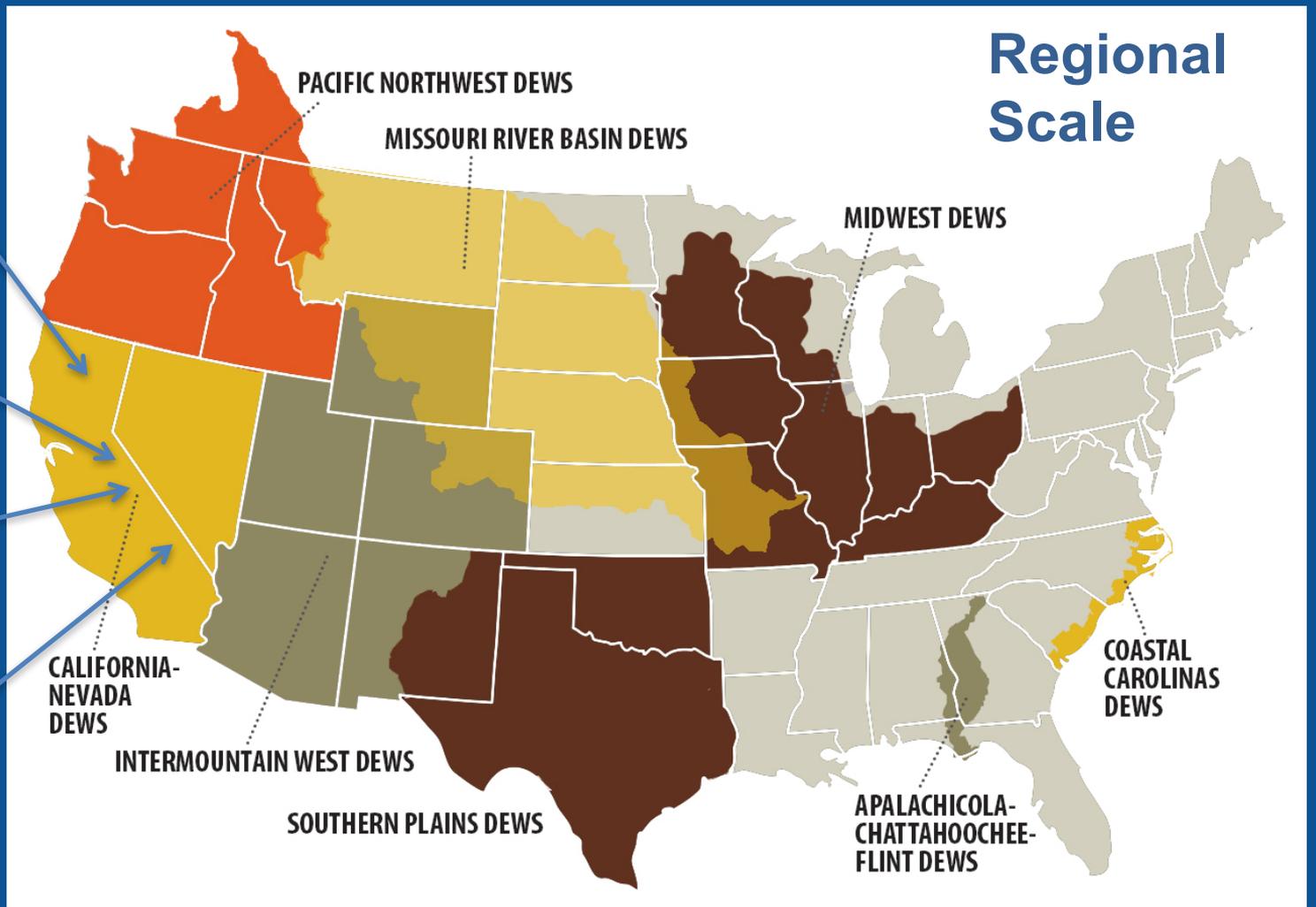
**NIDIS  
Implementation**  
Over 50 Federal, state,  
tribal and private  
sector representatives  
nationally

Public Awareness  
And Education

State Climatologists, NWS-  
CSD  
USDA Extension

Engaging  
Preparedness  
Communities

NDMC  
State and Tribal Offices,  
RISAs  
US BoR, USACE, Counties



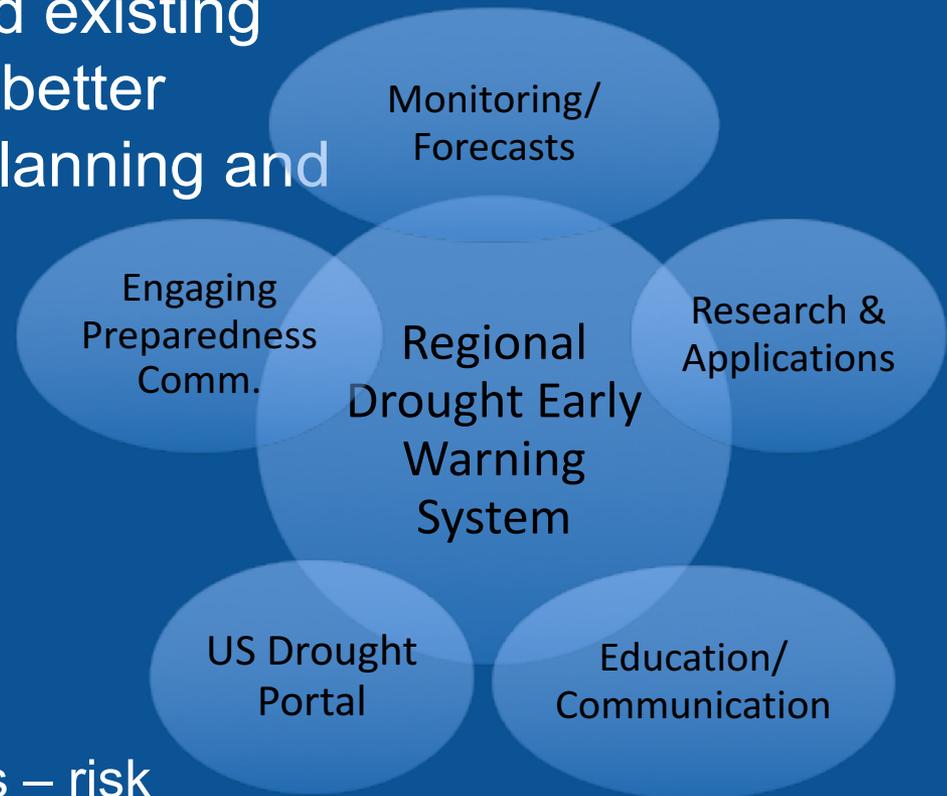
## Governance Attributes: Agility, Alignment, Adaptability

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

# Regional Drought Early Warning Systems (DEWS)

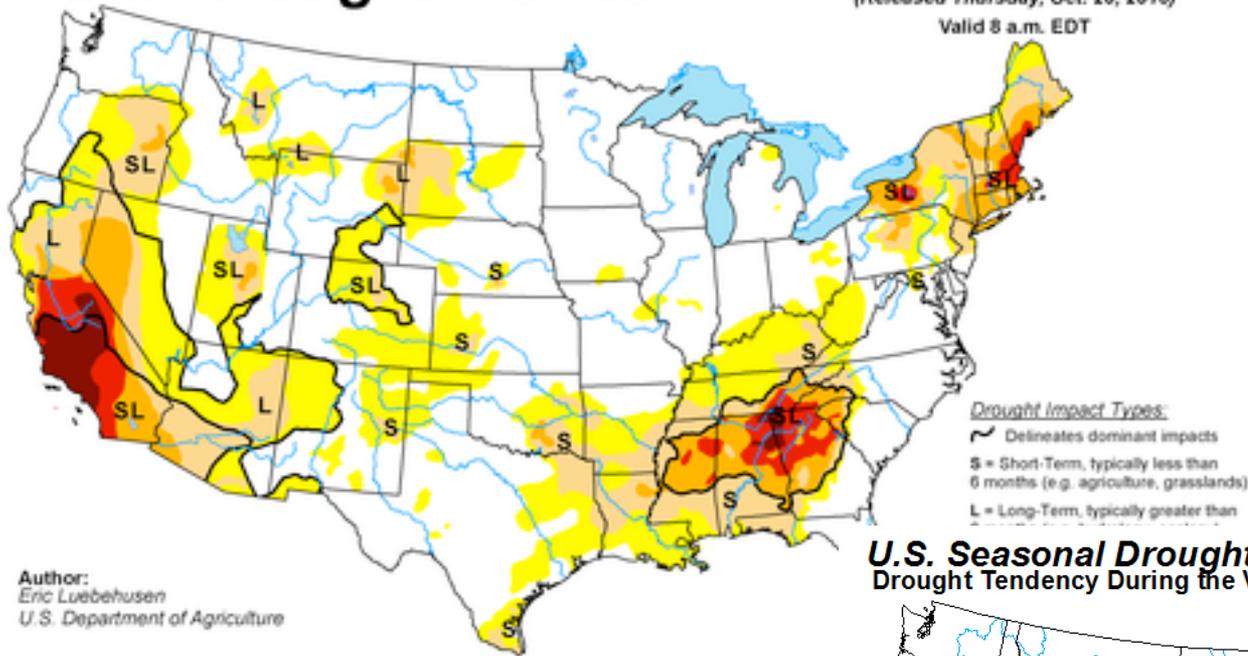
Working with communities and existing networks to build capacity for better decision making for drought planning and mitigation.

- Drought assessments
- Climate outlook forums
- Education and outreach webinars – risk management
- Engaging the preparedness community
- Builds capacity to utilize existing products

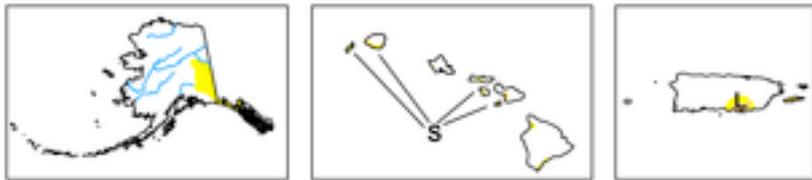


# U.S. Drought Monitor

October 18, 2016  
 (Released Thursday, Oct. 20, 2016)  
 Valid 8 a.m. EDT

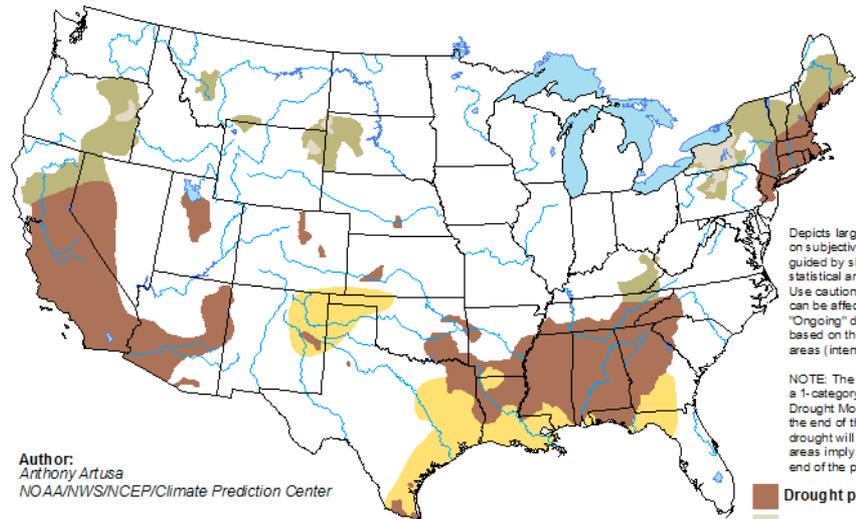


Author:  
 Eric Luebbehusen  
 U.S. Department of Agriculture

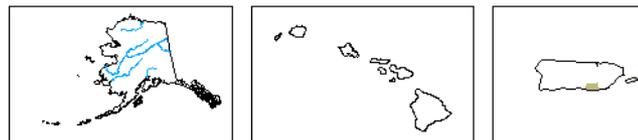


## U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for October 20 - January 31, 2017  
 Released October 20, 2016



Author:  
 Anthony Artusa  
 NOAA/NWS/NCEP/Climate Prediction Center



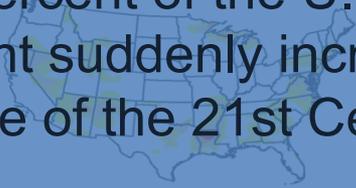
- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely



<http://go.usa.gov/3eZ73>

# The weather-climate continuum

The percent of the U.S. experiencing moderate to severe drought suddenly increased and remained at elevated levels during the first decade of the 21st Century

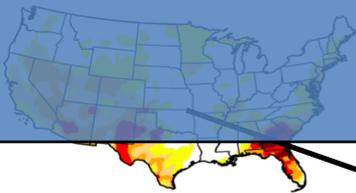


2000  
8% moderate to exceptional

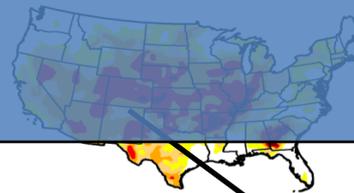


2001  
28% moderate to exceptional

Even a perfect sea surface temperature prediction would “likely” capture much less than half the total variance in annual precipitation over North America



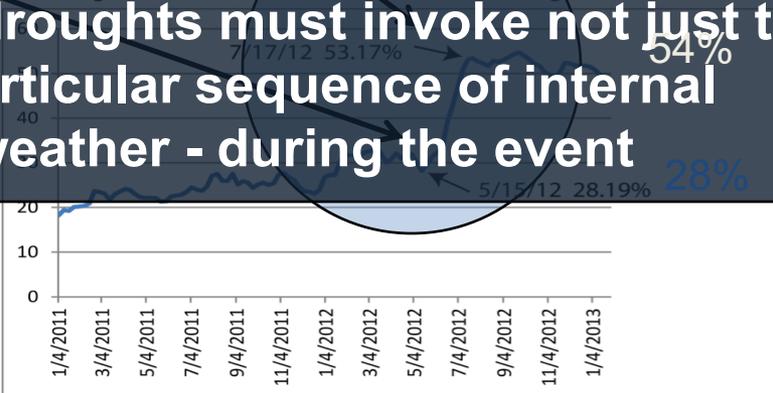
May 2012  
35% moderate to exceptional



July 2012  
64% moderate to exceptional

**A complete explanation of these droughts must invoke not just the ocean forcing but also the particular sequence of internal atmospheric variability - weather - during the event**

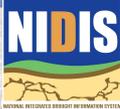
Area (%) of the US (including Alaska, Hawaii and Puerto Rico) categorized as D1, D2, D3 or D4 on the US Drought Monitor



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 & Kingste Mo

# Evaporative Demand Drought Index

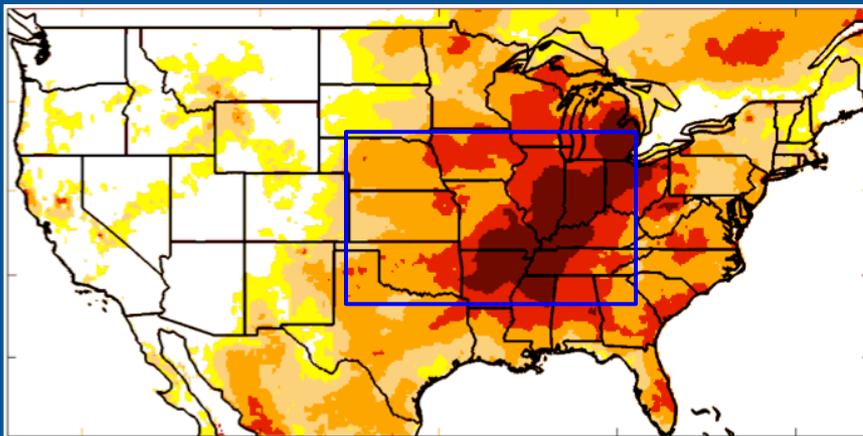
*EDDI* shows strong early warning potential-2012

May 7

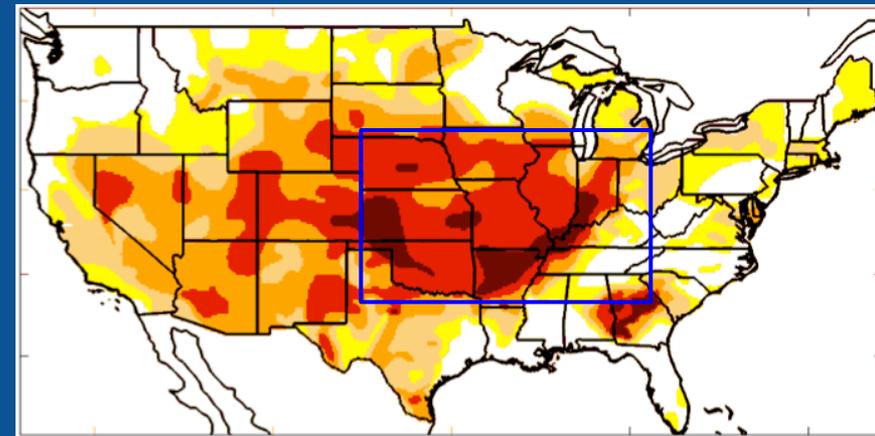
$$EDDI_j = \frac{\sum_{t=i}^j (ET_{0t} - \overline{ET}_{0t})}{\sigma_{\overline{ET}_{0t}}}$$

2-week *EDDI*

US Drought Monitor



flash drought in MO, AR, KS, IL, IN, OH region  
note little drought in western US



Double drought in MO, AR, KS, IL, IN, OH region  
drought in NY, MA, AR, OK, NE 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.



# NOAA AND THE CALIFORNIA WATER ACTION PLAN

# Partnering for resilience

## Seasonal drought outlook



Legend: Brown = Drought persists or intensifies; Yellow = Drought development likely. <http://www.cpc.ncep.noaa.gov/>

In response to the ongoing California drought, Gov. Edmund G. Brown Jr. released the California Water Action Plan (CWAP) in 2014, directing the California Natural Resources Agency, the California Environmental Protection Agency, and the California Department of Food and Agriculture to identify key actions for the next one to five years, to (1) address urgent needs and (2) provide the foundation for the sustainable management of California's water resources.

NOAA and its partners have been providing California with research, analyses, publications, forecasts, communications and stakeholder engagements to support drought preparedness, mitigation and recovery. Collaborations among NOAA, NIDIS and California partners are long-standing, predating the present drought, focused on linking research and products to management. The NOAA activities listed below illustrate the agency's ongoing commitment to support the state in addressing specific issues and actions identified in the CWAP.

## UNCERTAIN WATER SUPPLIES

- NOAA actions:
- **Analysis of the effects of climate change and climate variability** on water supplies and resources.
  - **Development and distribution of public briefing documents** about the most up-to-date science regarding influences of droughts, atmospheric rivers, and El Niño on water supply variability and reliability.
  - **Construction of future climate scenarios** to assess potential impacts and trajectories.

**RESOURCES AND LINKS**

[California Climate Data Archive](#)  
[Great Basin Weather and Climate Dashboard](#)  
[Will El Niño Make a Difference?](#)  
[Our Changing Climate 2012: Vulnerability and Adaptation to the Increasing Risks from Climate Change in California](#)  
[California Climate Extremes Workshop Report 2011](#)  
[Southwest Climate Assessment Summary for Decision Makers 2012](#)  
[Statistical Downscaling Using Localized Constructed Analogs \(LOCA\)](#)

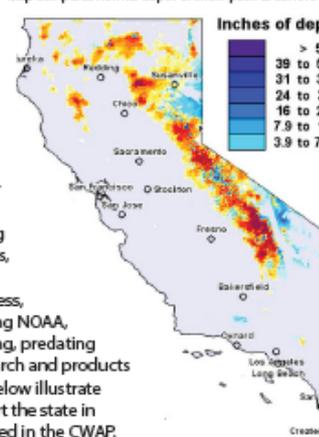
## WATER SCARCITY/DROUGHT

- NOAA actions:
- **Documentation of the surprisingly strong role of major storms and floods** in ending previous droughts in California, and the role of the occurrence or absence of any major atmospheric river storms in cycles of plenty and drought.
  - **Within-season monthly monitoring of fallowed land** extent in the Central Valley using Landsat imagery. Knowledge of the amount and spatial distribution of fallowing helps agricultural communities and government make informed decisions to reduce the impacts of water shortage and have helped the state locate county food banks.

**RESOURCES AND LINKS**

[Atmospheric rivers as drought busters on the U.S. west coast](#)  
[Drought and the California Delta—A matter of extremes: San Francisco Estuary and Watershed Science](#)  
[Flooding on California's Russian River—Role of atmospheric rivers](#)  
[National Geographic issue on the 2014 California Drought](#)

## Snow depth: departure from normal



## POOR WATER

- NOAA actions:
- **Evaluation of major storms** on sea level rise and how those impact with modern water procedures.
  - **High-resolution saltwater inundation**
  - **Quantification of the drought** through coordination with S Oceanography.

**RESOURCES AND LINKS**

[Climate change project along the California coast](#)  
[Contemporaneous Salt Overtopping Potential Delta](#)  
[Ongoing drought-induced saltwater intrusion](#)  
 (In press): Promoting a snowmelt-fueled biogas by restoring river-flood California's Central Valley

## DECLINING GROUNDWATER

NOAA actions:  
 ■ **Development of simulation models** that couple climate change projections directly to and through groundwater flow and storage simulations for the Central Valley.

**RESOURCES AND LINKS**

[Integrated simulation of consumptive use and land subsidence in the Central Valley, California for the past and for a future subject to urbanization and climate change](#)  
[A method for physically-based model analysis of conjunctive use in response to potential climate changes](#)

## DECLINING NATIVE FISH SPECIES AND LOSS OF WILDLIFE

NOAA actions:

- **Characterizing the historic role of major atmospheric-river storms** in initiating ecologically beneficial inundations (Yolo Bypass of the Sacramento River, floodplains along the unregulated Cosumnes Riv., as proxies for floodplain habitats in the Central Valley).
- **Development of indicators** to protect fish populations in the Russian River through work with stakeholders to study hydrologic extremes.

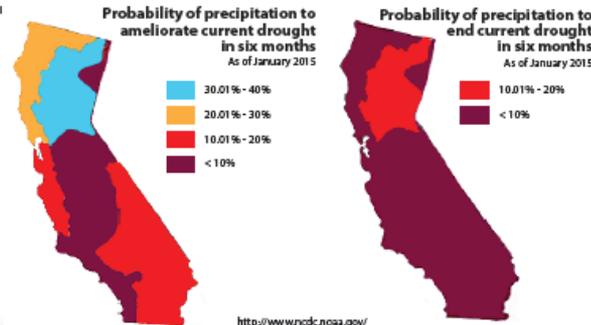
## FLOODS

NOAA actions:

- **Research on atmospheric rivers** to understand and better predict major flood events in California, and help communities to reduce their vulnerability.
- **Examination of stakeholder perspectives** on vulnerabilities and preparedness for an extreme storm event in the greater Lake Tahoe, Reno, and Carson City region.
- **Characterization of the historic role of atmospheric-river storms** in causing levee breaks in the Central Valley and Delta, where levees are still the primary defense against salinity intrusions.

**RESOURCES AND LINKS**

[Flooding on California's Russian River—Role of atmospheric rivers](#)  
[Atmospheric rivers, floods, and the water resources of California](#)  
[Storms, floods and the science of atmospheric rivers](#)  
[Historical and national perspectives on extreme west-coast precipitation associated with atmospheric rivers during December 2010](#)



## LOOKING AHEAD: MANAGING AND PREPARING FOR DRY PERIODS

NOAA actions:

- **Develop and provide drought early warning information** to decision makers throughout California, including leading drought preparedness activities, involving more than 100 water agencies, organizations, industries, tribes, and other stakeholders. Partners include the California Rural Water Association, California Department of Water Resources, and California-Nevada Applications Program (CNAP).
- **Address drought issues and water demands in urban areas** of Southern California, where water supplies are primarily imported and water demands are heavily residential. NOAA works with stakeholders to develop indicators for drought assessment and forecasting of direct relevance to stakeholders, and to assess drought conditions.
- **Characterize and understand historic droughts** using stakeholder-informed indicators. For example, NOAA developed a percentile-based indicator system for assessing present drought in the context of the frequency and severity of historic events. Among the findings: the severity of drought conditions developing in early 2014, based on a 12-month precipitation anomaly, would be expected to occur less than once every 10,000 years.
- **Development of Forecast-Informed Reservoir Operations (FIRO)**, a management strategy that uses data from watershed monitoring and weather

**RESOURCES AND LINKS**

[Improving Drought Prediction](#), April/May 2013  
[Drought Impacts Reporting](#), August 2013  
[Small Water Systems Workshops](#), California Rural Water Association, California Water Commission 2013, [list of events](#)  
[California Drought Outlook Forum: What's Ahead and What We Can Do](#), February, 2014  
[Making Decisions in Dry Times: Science and Strategies for Dealing with Drought](#), May, 2014  
[Causes and Predictability of the 2011-14 California Drought](#), December 2014



and water forecasting to help managers selectively retain or release water in a manner that reflects current and forecast conditions.

■ **Develop an integrated water resources monitor and outlook** to represent the current and seasonally forecast state of water resources including precipitation, snow, runoff into reservoirs, soil moisture, and other variables important to water management (proposal under consideration).

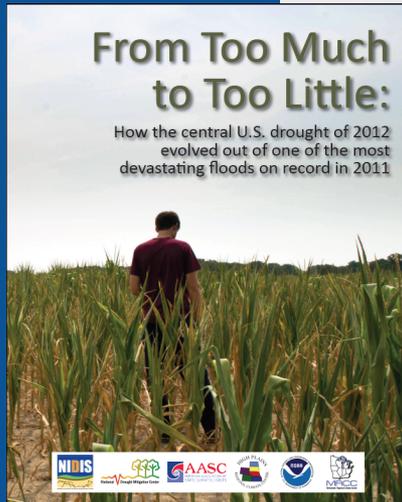
■ **Refinement to existing drought amelioration tools** to make them more relevant and useful to California's hydrology.

■ **A NOAA drought-related services assessment** (currently under review) to improve decision support for decision makers in the state.



# 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



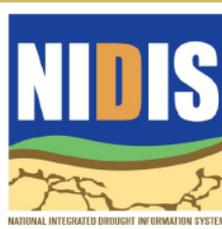
2010-12: First time U.S. corn yield fell  
three years in a row since 1928-30 (USDA)

## “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”*



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

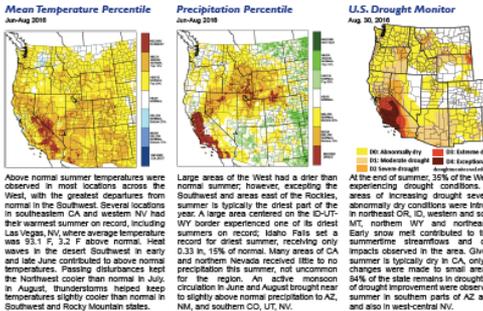
## Quarterly Climate Impacts and Outlook

### Significant Events for June - August 2016

**Record or near record warmth across southern portions of CA, NV, AZ**  
 CA statewide warmest summer on record  
 Below-normal summer streamflow in much of inland Northwest, Pacific Northwest  
 Some drought improvement in AZ, NM this summer with active monsoon during June-August  
 Warm water species found in 6 CA coastal waters for 3rd consecutive year due to above-normal ocean temperatures  
 ENSO-neutral conditions slightly favored to continue into autumn and winter

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 ENSO-neutral conditions slightly favored to continue into autumn and winter

### Regional Overview for June - August 2016



Contact: Kelly Redmond (kelly.redmond@noaa.gov)  
 Alicia Weiss (alicia.weiss@noaa.gov)

Western Region Quarterly Climate Impacts and Outlook | Sept 2016  
 Prepared by Nina Oakley, WRCC (nina.oakley@noaa.gov)

**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@noaa.gov](mailto:scipp@noaa.gov). 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.

## Drought Forum

RN GOVERNORS' [westgov.org/drought](http://westgov.org/drought)

Causes and Consequences of California Drought

**NAGING DROUGHT IN SOUTHERN PLAIN**

web-based seminar) series and resources available to Plains. Webinars will be held monthly at 11:00 A.M. All also be offered on the

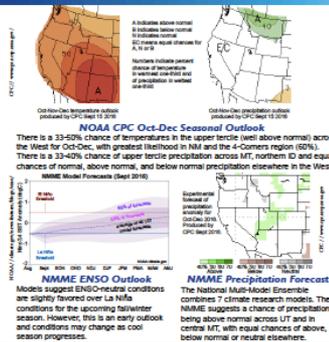
To register or for more information, contact Southern Climate Impacts Planning Program <http://www.southernclimate.org> 405-325-2541 or [scipp@noaa.gov](mailto:scipp@noaa.gov)

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

### Regional Impacts for June-August 2016

**Drought, Flooding and Water Resources**  
 85% of CA water districts say they have adequate supplies to handle 3 more years of drought  
 Late Mead outlook adequate to meet 2017 needs; however, AZ, NV may see first cuts in 2018  
**Fisheries**  
 West Coast ocean salmon fisheries featured less fishing opportunity and lower quota levels in 2016 than recent years due to reevaluated low abundance forecasts for several stocks  
 High water temperatures, low streamflow contributed to fish kill on Yellowstone. 3R in MT resulting in ~100 mi river closure  
**Forests and Agriculture**  
 66 million trees died in CA since 2010 due to drought and beetle kill (up from 29 million in 2015)  
 Drought cost CA farmers an estimated \$503M in 2016 to date, an improvement from \$2.7B in 2015  
 Dried hay harvest down 30-50% in MT with low wheat prices, rising hay prices, farmers opting to lease wheat for animal feed  
**Fire**  
 Doghead Fire in central NM burned 18k acres, 24 homes  
 Roaring Lion fire in western MT burned ~8k acres, 16 homes  
 High winds, dry conditions on Aug 21 caused outbreak of several fires near Spokane, WA that burned ~3k acres, destroyed multiple homes

### Regional Outlook for Oct-Nov-Dec 2016



Contact: Kelly Redmond (kelly.redmond@noaa.gov)  
 Alicia Weiss (alicia.weiss@noaa.gov)

NATIONAL OCEANOGRAPHIC OBSERVATORY OF COLUMBIA UNIVERSITY

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

**Active Fire Season in California**  
 Though the summer fire season was not particularly active across the US (number of fires 78% of normal; acres burned 63% of normal), CA experienced a large number of destructive fires, owing in part to the ongoing drought. Early this summer, fires in CA were showing signs usually observed in October. Periods of hot windy weather combined with dry fuels made for hazardous fire conditions. In 2015, CA had more fires and acres burned than in each of the previous 5 years. CAL FIRE alone spent roughly \$165M battling blazes this year. Some notable fires in CA this summer: Grakine Fire- most destructive of season, 49k acres, 285 homes destroyed; Sabawana Fire- 59k acres burned in July/Aug, 87 homes destroyed; Blue Gulch Fire- 27k acres, 105 homes destroyed; Sand Fire- 41k acres, 18 homes destroyed; Chimney Fire- 45k acres, 49 homes destroyed.



**Western Region Partners**  
 Western Regional Climate Center  
 National Integrated Drought Information System (NIDIS) - [drought.gov](http://drought.gov)  
 Western Governors' Association  
 westgov.org  
 Western States Water Council  
 westwater.org  
 NOAA/ES&P, Physical Sciences Division  
 es&p.noaa.gov  
 NOAA Climate Prediction Center  
 www.cpc.ncep.noaa.gov  
 National Center for Earth Info. (NCEI)  
 www.ncdc.noaa.gov  
 US National Water and Climate Center - [www.nwc.noaa.gov](http://www.nwc.noaa.gov)  
 National Interagency Fire Center  
 www.nifc.gov  
 NOAA's Western Regional Collaboration Team  
 www.regional.noaa.gov/western/western\_team.html  
 Western Water Assessment  
 www.colorado.edu  
 Climate Adaptation for the Southern African States  
 California Nevada Applications Program  
 climateandapp.org  
 Climate Impacts Research Consortium  
 pmrc.fresno.ca.gov  
 NWS River Forecast Centers  
 www.weather.gov/forecast/ship  
 NOAA Fisheries Service  
 www.nwr.noaa.gov  
 NWS Western Region Forecast Office  
 www.nwr.noaa.gov  
 State Climatologists - [statedata.noaa.gov](http://statedata.noaa.gov)

doi:10.7289/V5V1253

Task Force 2016 to Advance Drought Monitoring and Prediction Capabilities Early 2016



IN PILOT PRO

**Drought - A Guide to Com**



## NOAA's Sectoral Applications and Research Program (SARP) and Regional Integrated Sciences and Assessments (RISA), administer NIDIS-supported grants under the CWD initiative, in partnership with extramural communities. Examples

- Remote sensing tools to help mitigate crop losses and other drought-related damages using the Evaporative Stress Index (ESI) dataset and Geostationary Operational Environmental Satellite (GOES) thermal infrared imagery
- A customizable data app to cull climate, water, and water supply forecasts from disparate sources in the Klamath Basin working with fisherman and farmers
- A water deficit index to monitor drought conditions in Florida and Georgia, including impacts on subsurface environments
- Quantifying the role and improving forecasts of atmospheric rivers (atmospheric rivers move water vapor out of the tropics to other areas and result in high impact rainfall events) in ending or ameliorating drought severity and duration in the U.S. West

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY  
U.S. HOUSE OF REPRESENTATIVES

HEARING CHARTER

*Drought Forecasting, Monitoring, and Decision-Making: A Review of the National Integrated Drought Information System*

Wednesday, July 25<sup>th</sup>, 2012  
10:00 a.m. to 12:00 p.m.  
2318 Rayburn House Office Building

**NIDIS 2012**  
**S.3584**  
**HR 6849**

**PURPOSE**

On Wednesday, July 25<sup>th</sup>, 2012, the Committee on Science, Space, and Technology will hold a legislative hearing to examine the state of drought forecasting, monitoring, and decision-making and the role the National Integrated Drought Information System (NIDIS) serves in drought planning. Additionally, the Committee will receive testimony on draft legislation entitled, "The National Integrated Drought Information System Reauthorization Act of 2012." Witnesses have been asked to provide comments on and suggestions to this discussion draft.

literally looks like a desert. I was there last weekend.

First of all, Dr. Pulwarty, I would like to send a compliment your way. The Lower Colorado River Authority in Texas that you are familiar with has told me that they very much appreciate your willingness to disseminate information to them, to the landowners, to the farmers, to the policymakers as well, and they appreciate that good communication.

**Hon. L. Smith, TX)**

Original Article  
DOI 10.1087/s11027-012-9423-1

ORIGINAL ARTICLE

**A comprehensive review of climate adaptation  
in the United States: more than before,  
but less than needed**  
**NCA Adaptation**

Rosina Bierbaum • Joel B. Smith • Arthur Lee •

edge that NIDIS provides a successful example of achieving effective Federal-state partnerships by engaging both leadership and the public, and by establishing an authoritative basis for integrating monitoring and research to support risk management. Some of NIDIS' keys to success include:

- *Usable Technology and Information for Decision Support*: The U.S. Drought Monitor map, which integrates multiple indicators and indices from many data sources, was developed before NIDIS was established and has become a useful visual decision support tool for monitoring and characterizing drought onset, severity, and persistence. NIDIS has engaged regional and local experts in refining the regional details of this



WESTERN  
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400 N. Capitol Street, N.W.  
Suite 388  
Washington, D.C. 20001

202-624-5402  
Fax 202-624-7707  
www.westgov.org

October 10, 2012

Dr. Jane Lubchenco  
Administrator  
National Oceanic and Atmospheric Administration  
1401 Constitution Avenue, NW  
Room 5128  
Washington, DC 20230

Dear Dr. Lubchenco:

As you know, it has been a difficult year of extreme weather events in the West. I am writing to thank NOAA for its efforts to provide Governors and the general public with timely and important data to help prepare and respond to a variety of disasters including drought, wildfires, flooding and severe storms.

The Governors have been particularly focused on this year's drought and related wildfires. NOAA staff were helpful to us in preparing briefing materials for a conference call of the Governors and discussions at their meetings. In addition, we have gotten good feedback on the new quarterly drought outlook we started jointly producing this year.

We also appreciate NOAA's efforts to help inform policymakers and provide support on specific regional concerns including co-hosting the extreme weather forum in Seattle in April and the drought and flood forum in Bismarck in September. We would be interested in exploring a similar forum next year on fire related weather monitoring and forecasting.

Our partnership with NOAA began during the droughts of 2004-05. Our joint efforts helped pave the way for creation of the National Integrated Drought Information System in 2006. We look forward to working with NOAA and other stakeholders to assess NIDIS's role in helping prepare for this year's drought and making recommendations that will help improve our preparedness for the future.

Guided by the MOU the Governors signed with NOAA in 2011, we look forward to our continued partnership in 2013.

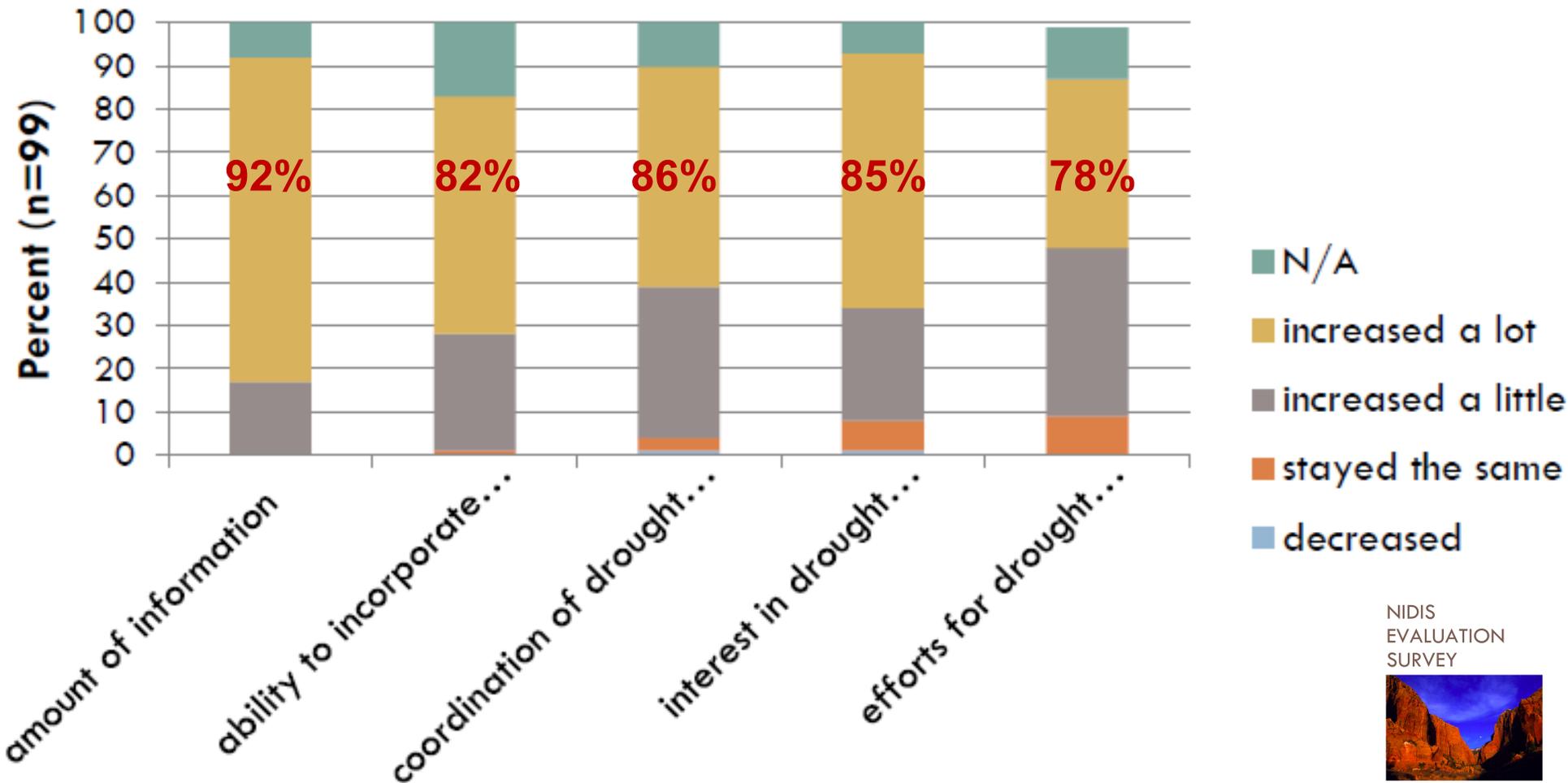
Sincerely,

Chris McKinnon  
Interim Executive Director

WGA

# NIDIS Evaluation Survey Example

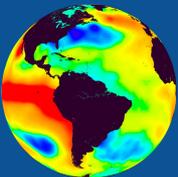
## drought before 2002 with now...



# The NIDIS Touch

- **Developing an Information Pedigree-Relevant, authoritative, accessible, compatible/usable**
  - No substitute for monitoring and understanding local climates
  - Place multiple indicators within a consistent triggering framework- (e.g. climate and vegetation mapping) before critical thresholds
  
- **Overcoming impediments to information flow**
  - Existing barriers to cross-agency collaboration to be addressed or least be made explicit
  - Innovations and new information to be introduced and tested, and
  - The benefits of participation in design, implementation and maintenance to be clarified

Mature prototypes become the regional early warning system and are more likely to be transferable



# Redesigned US Drought Portal drought.gov

## Launched April 6, 2016

What the redesign brings:

- Improved navigation: Landing page for data, maps, tools and other products
- Grid format: easier access to particular kinds of data, products and tools

U.S. North America Global Search NIDIS...  
Event Search Document Search Data Search

**NIDIS Drought.gov**  
U.S. Drought Portal

Home Data, Maps & Tools Regions Research Resources What is NIDIS? Calendar FAQs Contact Us

### Where is drought this week?

U.S. Drought Monitor U.S. Seasonal Drought Outlook Drought Impacts Report Wildfire Risks NIDIS in Your Region

As of October 12-18, drought (D1-D4) is impacting:

**18.5%** of the US and 22.1% of the lower 48 states.

**111.2 million** people in the U.S. and 111.1 in the lower 48 states.

### How is Drought Affecting your Neighborhood?

Enter your zip code for current conditions:

U.S. North America Global Search NIDIS...  
Event Search Document Search Data Search

**NIDIS Drought.gov**  
U.S. Drought Portal

Home Data, Maps & Tools Regions Research Resources What is NIDIS? Calendar FAQs Contact Us

## Data, Maps & Tools

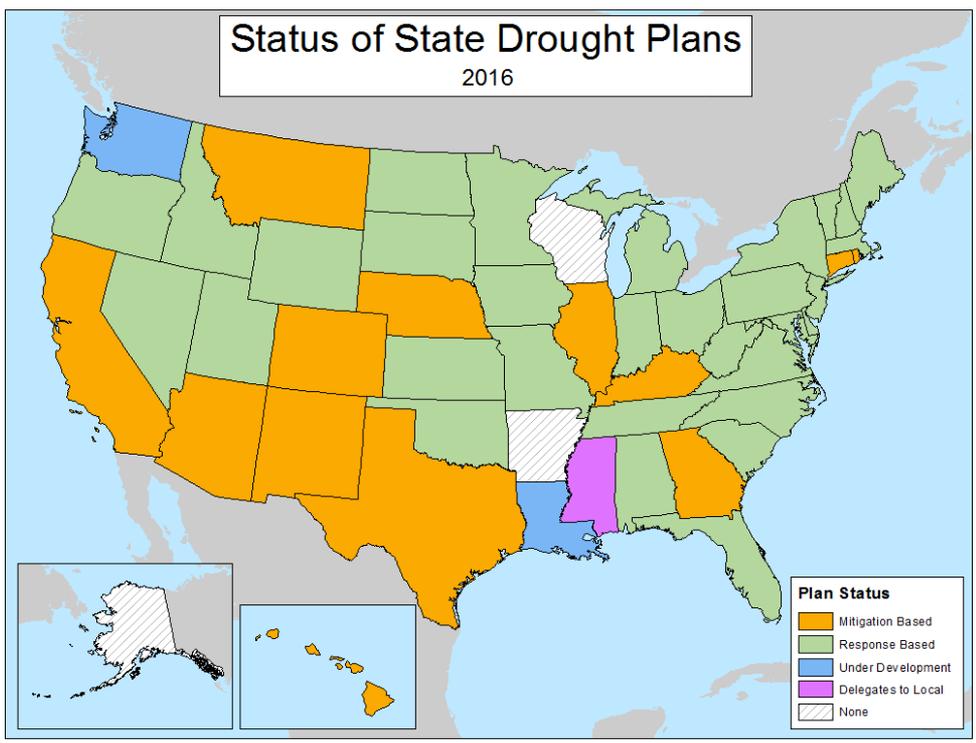
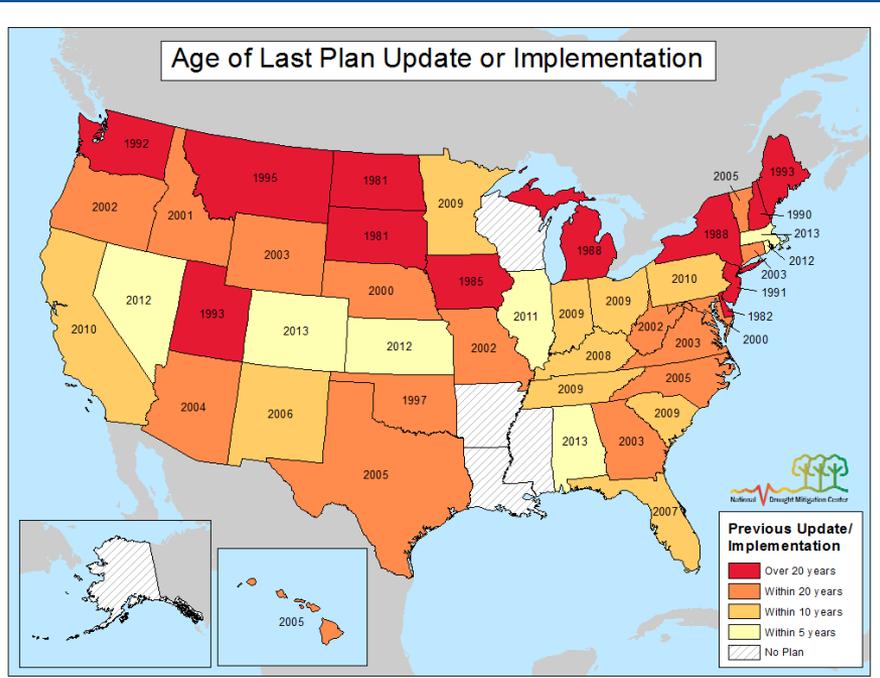
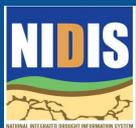
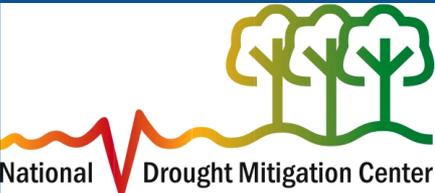
How to find your way through this section:

- By topic: Click on a topic on the grid below to find maps, data and links to information about that category. Some links may appear in more than one topic, such as soil moisture, vegetation and agriculture.
- By interactivity: The "Tools" page links to interactive sites where you can customize information to meet your needs. The tools allow you to customize information by designating locations; date ranges; comparisons among events and conditions; and more. Many of these applications will create charts or maps specific to the situation you design. Interactive tools also appear under specific topics.

The majority of the links show the continental U.S. For North American and Global data, go to the North American Drought Portal or the Global Drought Portal.

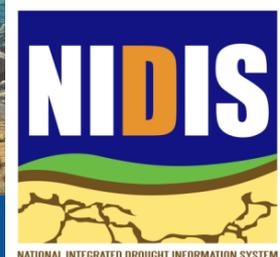
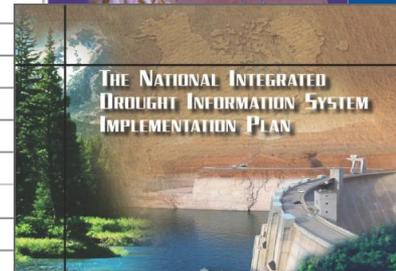
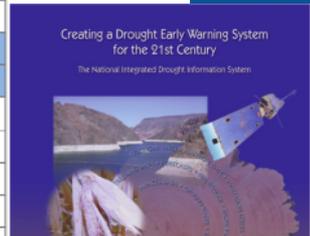
CURRENT CONDITIONS	OUTLOOKS & FORECASTS	IMPACTS
Areas of drought, precipitation/temperature averages and totals, more.	What's being predicted, for various timescales.	How drought is affecting agriculture, water supplies, wildfires and other sectors.
SOIL MOISTURE	VEGETATION	FIRE
Groundwater and surface water monitoring, crop moisture maps, more.	Vegetation Drought Response Index (VegDRI), greenness data, impacts.	Keetch-Byram Drought Index, National Interagency Fire Center data, GEOMAC.
TEMPERATURE & PRECIPITATION	AGRICULTURE	WATER SUPPLY
Amounts, anomalies, forecasts for precipitation and temperature.	Weather and crop bulletins; agricultural impacts; crop areas in drought.	Stream flows, surface water measurements, snowpack data, evaporative stress indices.

# NIDIS Drought Risk Management and Research Center (est. 2015) (NOAA, USDA/OCE)



**Table 1. NIDIS Implementation Milestones (FY 2007-2012, by year)<sup>19</sup>**

Activity	Milestone	07	08	09	10	11	12	13
1	Initial portal operational capability at drought.gov	█	█					
1	Advanced portal mapping capability with GIS tools		█	█				
1	Populate drought.gov website (portal, plans, reports, agency links)		█	█				
1	Operational portal communities and collaborations		█	█	█			
1	Enhance data management and distribution		█	█	█			
1	Portal extension to hemispheric and global domains		█	█	█	█		
2	Drought forecast regionalization studies		█	█	█			
2	Enhance soil moisture and temperature measurements		█	█	█	█	█	
2	Forecast verification and calibration to measurements					█	█	█
3	Coordinate with CPO Program Managers/agencies on interdisciplinary research goals	█						
3	Inventory drought-related service (federal/state/private)	█	█					
3	Assess national status of drought early warning	█	█					
3	Inventory drought-related research (federal/state/private)		█	█				
3	Coordinate drought preparedness plans		█	█				
3	Planning for adaptation			█	█	█		
3	Institutionalize "Drought Coordinator" network			█	█	█		
3	Enhanced regional impacts research						█	█
3	Implement adaptive management strategies						█	█
4	Pilot study scoping and selection	█	█					
4	NPIT workshops: Define criteria and assess partner interest and capacity for pilots		█					
4	First Workshop: Assessment of Drought Early Warning System Status in the United States		█					
4	Pilot study implementation			█	█			
4	Initial early warning prototypes				█	█		
4	Pilot study assessment and follow-on work				█	█	█	
5	Establish NIDIS Program Office, governance structure, and final Program Implementation Team	█	█					
5	Establish regional sub-team leads within NPIT	█	█					
5	Establish initial agency/state rotational assignment to NIDIS Program	█	█					
5	Establish NIDIS Interdisciplinary Research Coordination Board	█	█					
5	Extend NIDIS to National Governors' Association and Inter-basin Watershed Commission	█	█					
5	Operational workshops to assess national drought monitoring and forecasting gaps	█	█	█	█	█	█	



Shift 18-24 mths to the right-  
delay in funding

PL 109-430

\$\$

Reauth  
Hearing



# Are we better off ?

- 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-based 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



LONG-TERM DROUGHT  
RESILIENCE  
FEDERAL ACTION PLAN  
OF THE  
NATIONAL DROUGHT  
RESILIENCE PARTNERSHIP

MARCH 2016



# Drought-Resilience Goals

**Goal 1:** Data Collection and Integration  
–key data platforms, modeling and prediction

**Goal 2:** Communicating Drought Risk to Critical Infrastructure

**Goal 3:** Drought Planning and Capacity Building

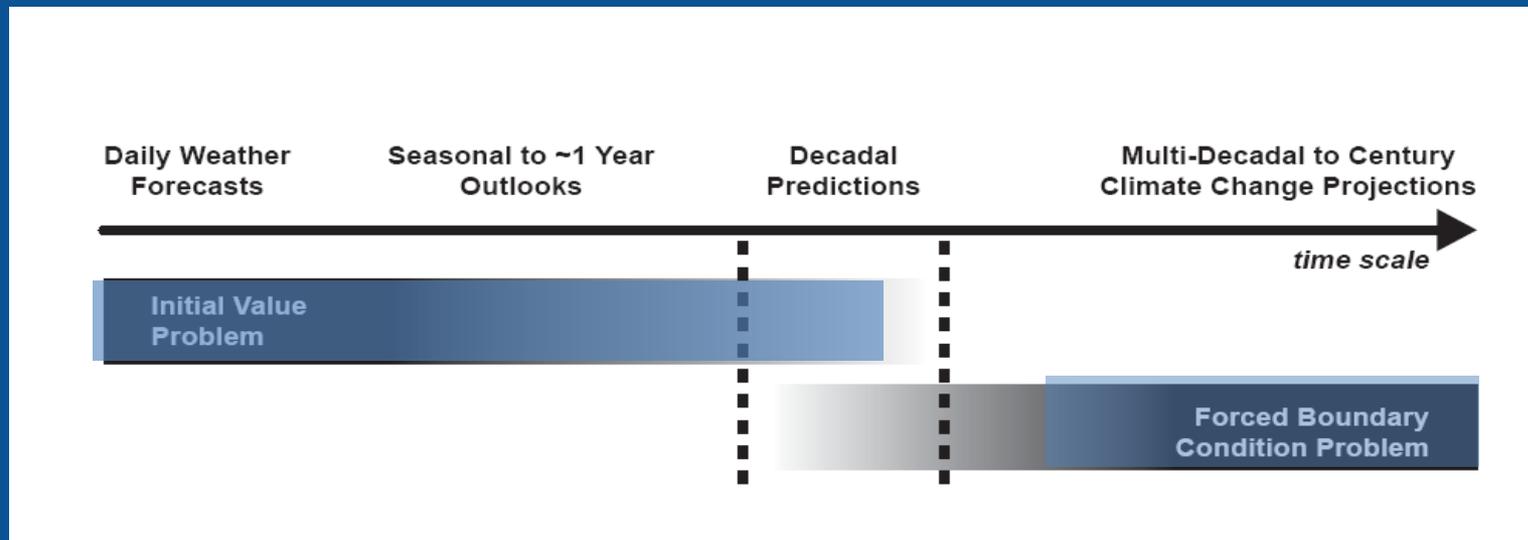
**Goal 4:** Coordination of Federal Drought Activity

**Goal 5:** Market-Based Approaches for Infrastructure and Efficiency

**Goal 6:** Innovative Water Use, Efficiency, and Technology

# Challenge:

Multi-year droughts are, at present, not addressed by any forecast system—clearly a gap in our capabilities



# Next Generation Earth System Prediction

## Improving Subseasonal to seasonal forecasts

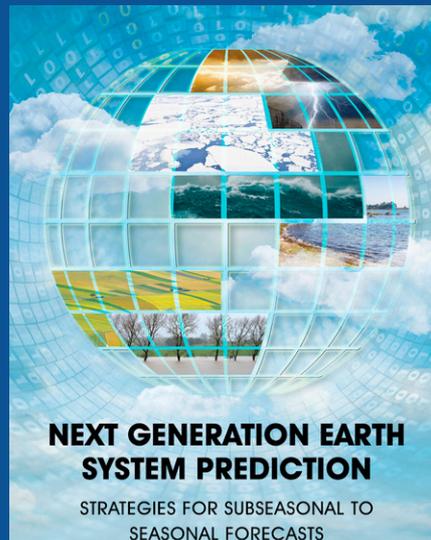
operational products

strategic decision support



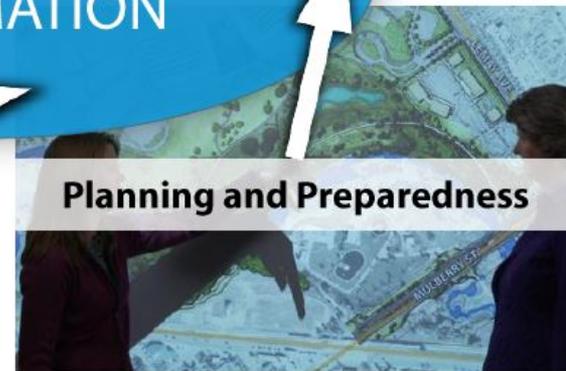
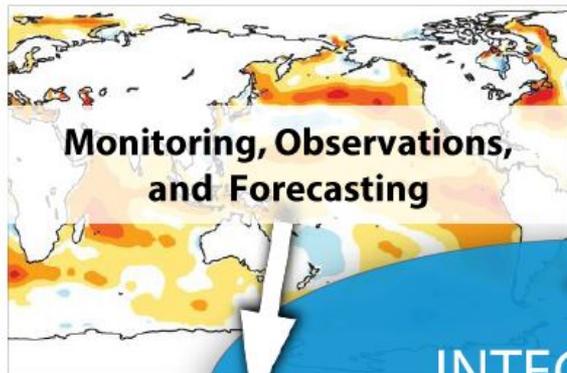
S2S

From initial to boundary conditions Goal: *Address gaps operational prediction capabilities at sub-seasonal to seasonal (S2S) timescales*





# From Risk to Resilience: NIDIS as a prototype Integrated Information System



## Science for Resilience

Program Office's research programs and expertise help the nation understand, anticipate and respond to climate-related changes in water resources and water-related hazards.

<p><b>Skill</b></p> <p>understanding the water cycle to inform water management and flood risk.</p> <p><b>LINKS AND RESOURCES</b></p> <ul style="list-style-type: none"> <li>Water and Monitoring</li> <li>Predictability</li> <li>Projections, &amp; Projections</li> <li>Extreme Weather and Climate Events</li> <li>Extreme Events Case Studies</li> <li>Pacific Northwest RISAI</li> </ul>	<p><b>Better Understanding</b></p> <p>NOAA aims to improve understanding of the role precipitation events and land surface conditions have on amplifying or reducing drought and flood impacts.</p> <p><b>LINKS AND RESOURCES</b></p> <ul style="list-style-type: none"> <li>Report: Origins of the 2012 Great Plains Drought</li> <li>SARF Case Studies: Water Resource Strategies and Information Needs in Response to Extreme Weather and Climate Events</li> <li>Pacific Northwest RISAI</li> </ul>	<p><b>Communication Tools</b></p> <p>NOAA is developing timely, accessible communication tools to inform preparedness and adaptation.</p> <p><b>LINKS AND RESOURCES</b></p> <ul style="list-style-type: none"> <li>U.S. Drought Monitor</li> <li>Managing Drought Risk on the Ranch</li> <li>Colorado Floods: Western Water Assessment</li> <li>Climate and Water Resources Data in the Klamath Basin</li> <li>SECC: Climate of the Southeast United States</li> </ul>
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## Coordination



To make the best decisions, stakeholders need access to more than just one piece of the puzzle. Integrated Information Systems are designed to evolve over time, offer opportunities for diverse participation, and integrate what we learn through practice.

- Overcoming impediments
  - Do this for a long time

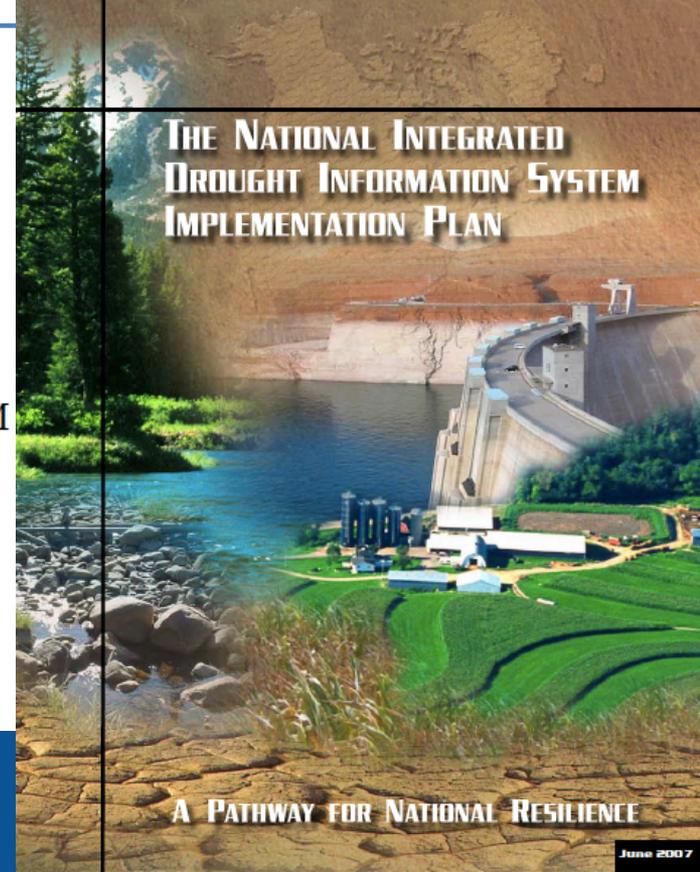
**LINKS AND RESOURCES**

- Floodplains by Design: [www.floodplainsbydesign.org/northern-chips](http://www.floodplainsbydesign.org/northern-chips)
- Regional Integrated Sciences and Assessment (RISA): [www.risa.gov](http://www.risa.gov)
- Weekly Colorado Drought Assessment Webinars: [www.coloradodrought.org/webinars](http://www.coloradodrought.org/webinars)
- Drought Impacts Reporter: [droughtreporter.usd.edu/](http://droughtreporter.usd.edu/)
- NIDIS portal: [www.drought.gov](http://www.drought.gov)

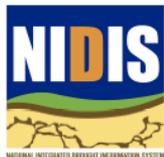
THE NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

# Report to Congress

January 2016



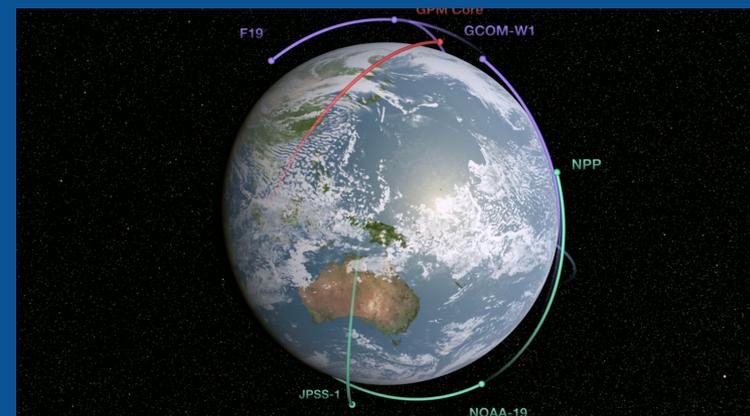
DRAFT



## Thank you

The National Integrated  
Drought Information System  
Implementation Plan

2016 Update





**Memorandum of Understanding  
Between the Western Governors' Association  
and the National Oceanic and Atmospheric Administration**

**Collaboration on Drought, Flooding, and Wildfire Preparedness:  
Sharing Information and Building Resilience in Planning for Extreme Events**

*June 9, 2014  
Colorado Springs, Colorado*



**WESTERN  
GOVERNORS'  
ASSOCIATION**

Drought  
Information  
System Act of  
2006.  
15 USC 311 note.  
15 USC 313d  
note.

**SECTION 1. S.**  
**This Ac**  
**Information**  
**SEC. 2. DEFIN**

**PUBLIC LAW 113-86—MAR. 6, 2014**

**128 STAT. 1015**

**MOU Between DOC and USDA**



**MEMORANDUM OF UNDERSTANDING  
BETWEEN THE  
U.S. Department of Commerce  
AND THE  
U.S. Department of Agriculture**

This Act may be cited as the “National Integrated Drought  
Information System Reauthorization Act of 2014”.

**SEC. 2. NIDIS PROGRAM AMENDMENTS.**

Information  
System  
Reauthorization  
Act of 2014.  
15 USC 311 note.

# Example: Colorado Basin Early Warning System research and stakeholder network

- Colorado Division of Water Resources (CDWR)
- Colorado State Climatologist
- Colorado River Water Conservation District (CRWCD)
- Colorado Water Conservation Board (CWCB)
- CU – Western Water Assessment, CIRES, and CADSWES
- Denver Water Board
- Northern Colorado Water Conservancy District (NCWCD)
- Wyoming State Engineer
- Wyoming State Climatologist
- Utah State Climatologist
- Western Regional Climate Center
- National Center for Atmospheric Research (NCAR)
- National Drought Mitigation Center (NDMC)
- USDA: Natural Resources Conservation Service
- USFS: Region 2
- USBR: Eastern Colorado Area Office, Great Plains Region, Office of Policy and Programs, Research and Development
- USGS: Colorado Water Science Center, Central Region, Grand Canyon Monitoring and Research Center
- NOAA: Earth System Research Laboratory, National Centers for Environmental Prediction, National Climatic Data Center, National Weather Service