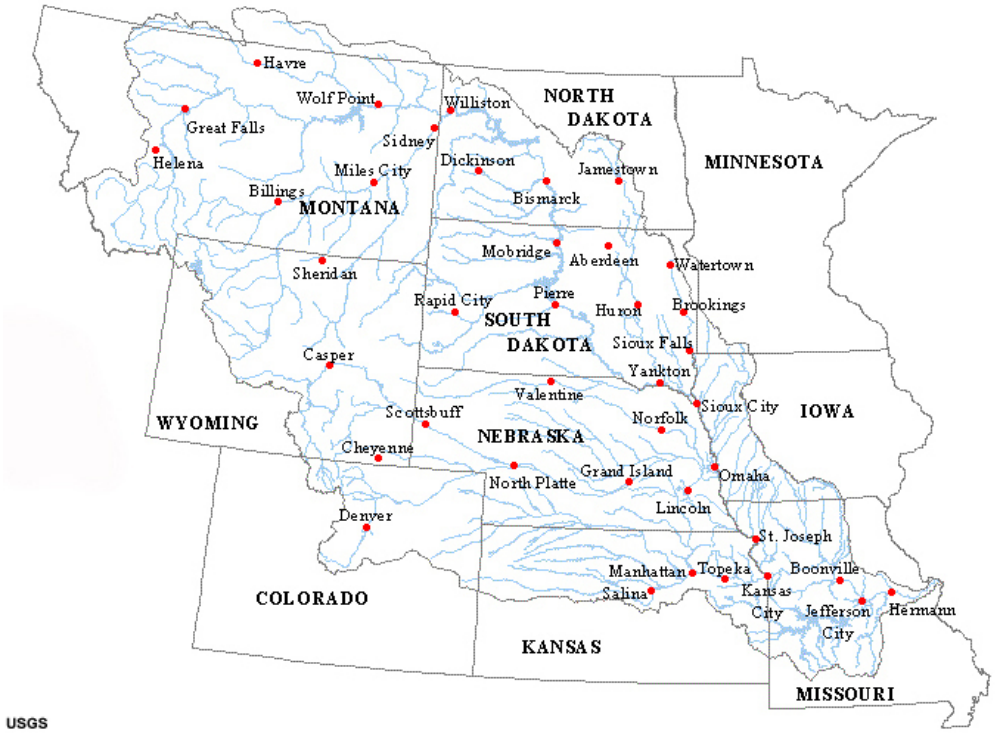

Building Drought Early Warning Capacity

Bozeman, MT: Training for Resilience

March 17-18, 2015

Chad McNutt, Roger Pulwarty, Veva Deheza, Kathleen Bogan, Alicia Marrs, Claudia Nierenberg, and Robert Webb

NOAA, National Integrated Drought Information System (NIDIS)

Agenda

- What is the National Integrated Drought Information System (NIDIS)

- Early Warning Framework
  - **Drought assessments**
  - **Climate outlook forums**
  - **Education and outreach webinars**
  - **Engaging the preparedness community**

- Missouri River Basin Pilot

NIDIS: Creating a drought early warning information system

- Public Law 109-430 (The NIDIS Act 2006)
  - "Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts"
  - "better informed and more timely drought-related decisions leading to reduced impacts and costs"

Drought Early Warning?

- Early warning: provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response- ***International Strategy for Disaster Reduction***
  - Allows timely and appropriate responses to droughts and famine in the form of food aid and other mitigation strategies
  - Involves forecasts and the area's drought history, possible outcomes of developing drought events, and answering questions about how long a drought might last and how severe it might be.
  - Effective early warning systems should involve both technology and all interested parties in drought planning and response.

NIDIS/Early Warning Framework

- **Drought assessments**
- **Climate outlook forums**
- **Education and outreach webinars**
- **Engaging the preparedness community**

U.S. Drought Portal

www.drought.gov

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Home | What is NIDIS? | Products | Tools | Regional Programs | Resources

ANNOUNCEMENTS

Apr 16, 2015
Midwest and Great Plains Drought Webinar
Apr 16, 2015

Apr 14, 2015
US Drought Monitor Forum
Reno, NV

Mar 19, 2015
Midwest and Great Plains Drought Webinar
Mar 19, 2015

Mar 17, 2015
ACF Drought Assessment Webinar -
Mar 17, 2015
Online

>> View Archive

REGIONAL UPDATES

View webinars on regional conditions:

>> Managing Drought in the Southern Plains

>> Upper Colorado River Basin Climate, Water and Drought Assessment

>> Appalachicola-Chattahoochee-Flint River Basin Drought Assessment

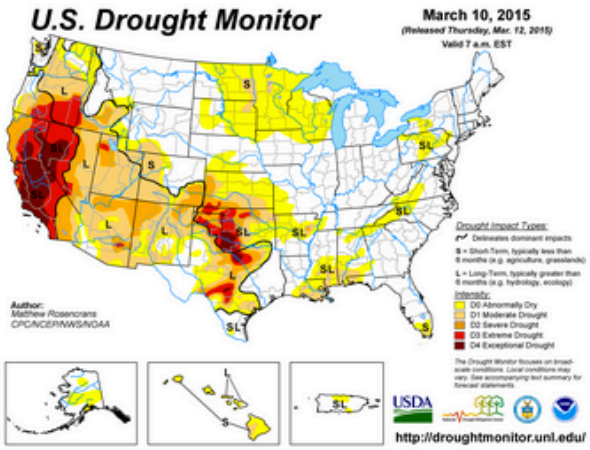
>> Midwest and Great Plains Drought Update

>>CALENDAR

NDRP

The National Drought Resilience Partnership (NDRP) comprises seven federal agencies which work collaboratively to support state, tribal, local, and private sector approaches to

Where is the drought? Will it change? What are its impacts?



Click a topic for more information:

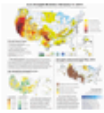
- U.S. Drought Monitor
- U.S. Seasonal Drought Outlook
- Drought Impacts Report
- Wildfire Risks
- Summary of Drought this week
- NIDIS in Your Region

Drought in your backyard

How is drought affecting you? Enter your zip code for current conditions:

Zip Code (5 digit): Go!

February national drought outlook features snowpack conditions in the West



The 2-page update shows how drought conditions have changed over the past year; the outlooks for drought, temperature, precipitation and wildfire through May; and how snowpack in the Northwest was far below the median despite near-normal precipitation since Oct. 1.

Download the pdf

Webinar series features Western experts on water and drought management

Inspired by its Drought Forum initiative, the Western Governors' Association is presenting a five-webinar series examining the challenges of drought management. Topics include re-used, produced and brackish water; reducing municipal water consumption; the role of data in understanding and predicting dry conditions; managing forests for water resource needs; and how local approaches to

Approach

- Working with communities and existing networks through:
  - **Drought assessment/monitoring groups**
  - Climate outlook forums
  - Education and outreach webinars
  - Engaging the preparedness community

Drought Assessment Groups

States

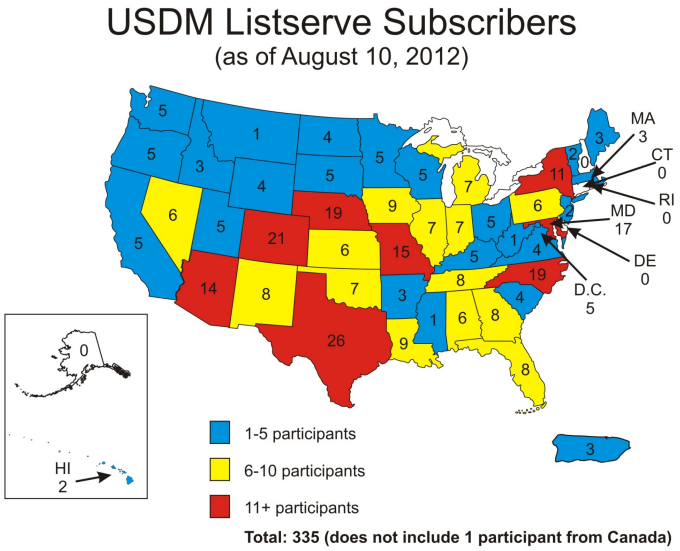
- Arizona
- Hawaii
- Texas
- New Mexico
- Alabama
- Colorado
- North Carolina
- Florida
- South Dakota
- Oklahoma

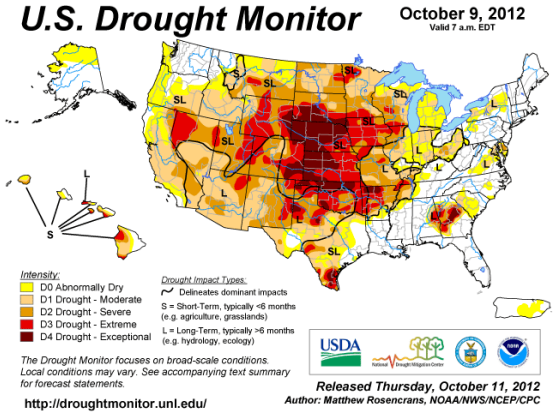
River Basins

- Upper Colorado
- Apalachicola - Chattahoochee-Flint

Tribes

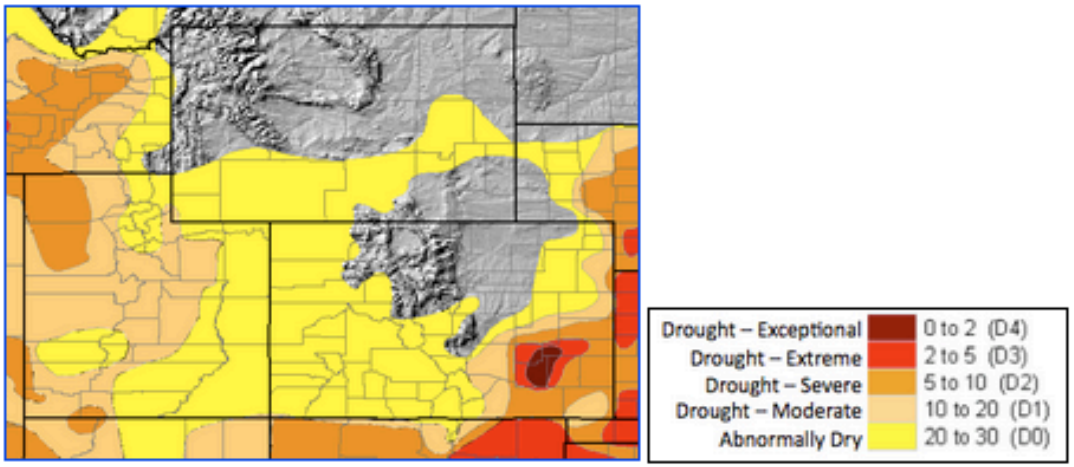
- Navajo Nation



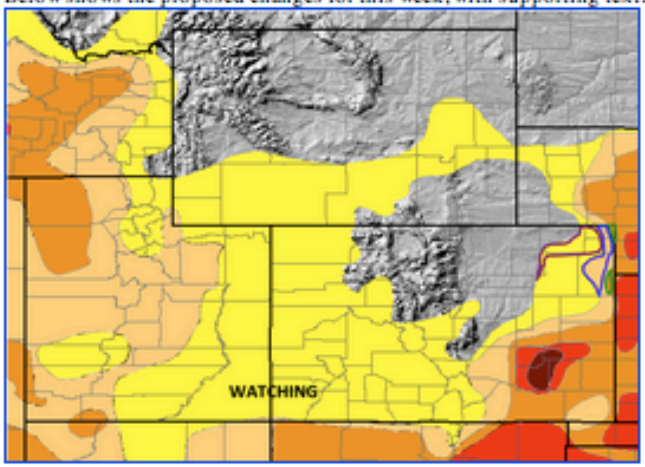


Colorado Drought Status Briefing

Precipitation | SNOTEL | SPI | Streamflow | Surface Water | Temperature | Outlook | US



Above is the most recent release of the U.S. Drought Monitor map for the UCRB region.
Below shows the proposed changes for this week, with supporting text.



Summary: February 25, 2014

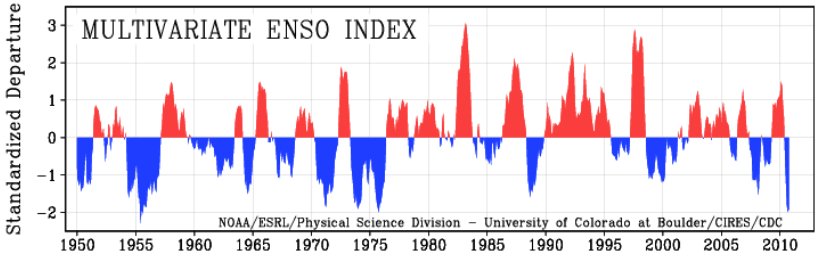
NIDIS
Upper Colorado River
Regional Drought Early Warning System

Approach

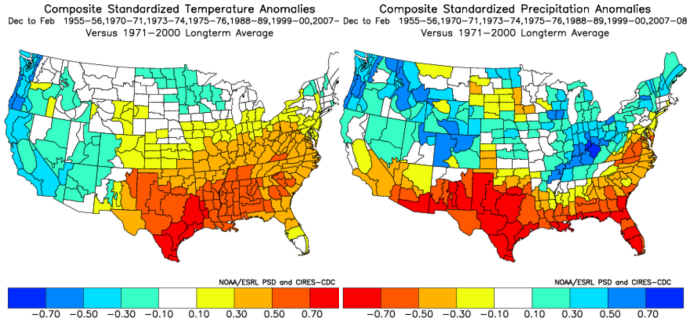
- Working with communities and existing networks of people through:
  - Drought assessments
  - **Climate outlook forums**
  - Education and outreach webinars
  - Engaging the preparedness community

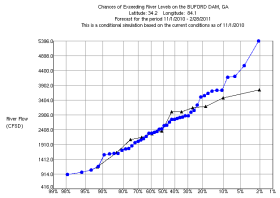
Seasonal Climate Outlook Forum

ENSO Status

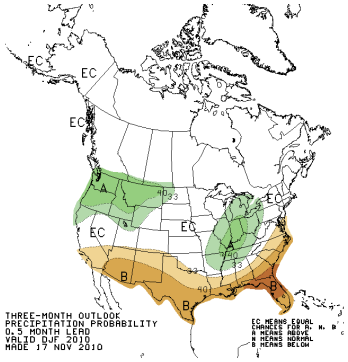


Effects of ENSO

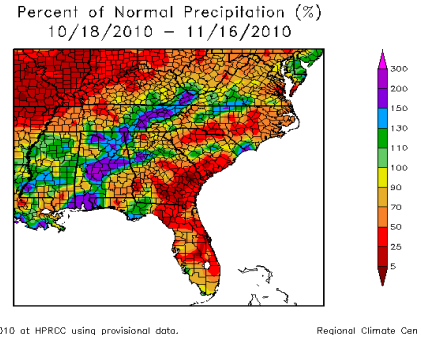




Impacts & Vulnerability



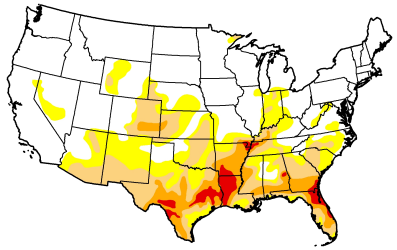
3-Month Seasonal Forecast



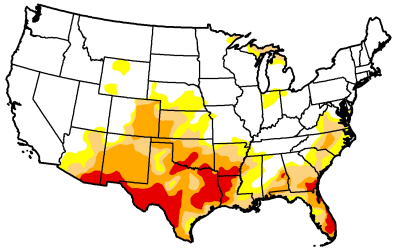
Current Conditions

Southern Plains Drought

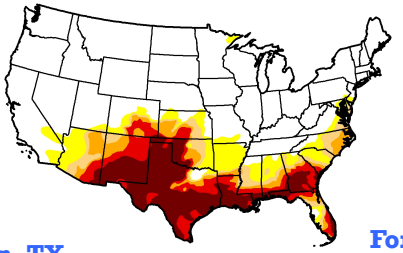
January 2011



April 2011

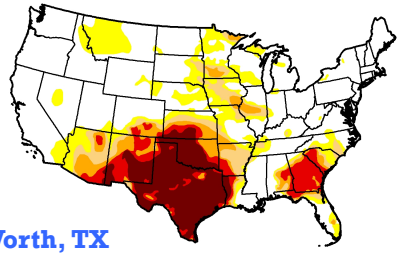


July 2011



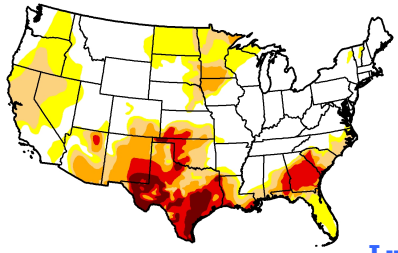
Austin, TX
July 2011

October 2011



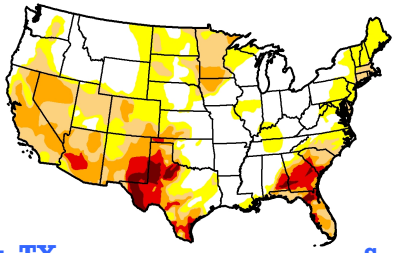
Fort Worth, TX
November
2011

January 2012

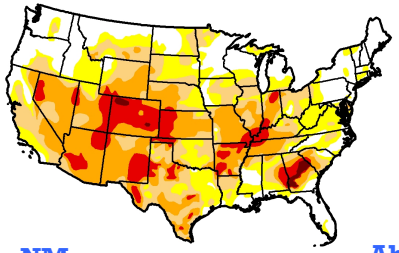


Lubbock, TX
April 2012

April 2012

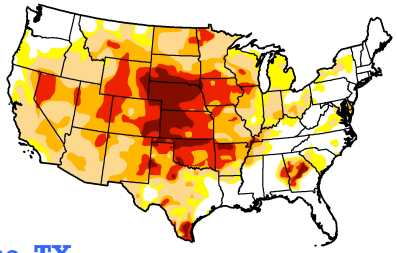


July 2012



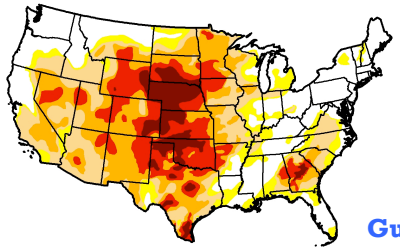
Santa Fe, NM
June, 2012

October 2012



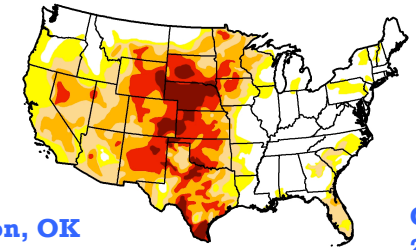
Abilene, TX
November, 2012

January 2013

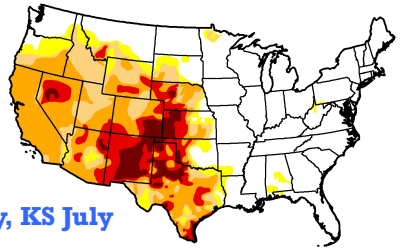


Guymon, OK
March 2013

April 2013

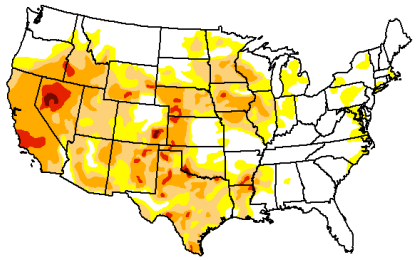


July 2013



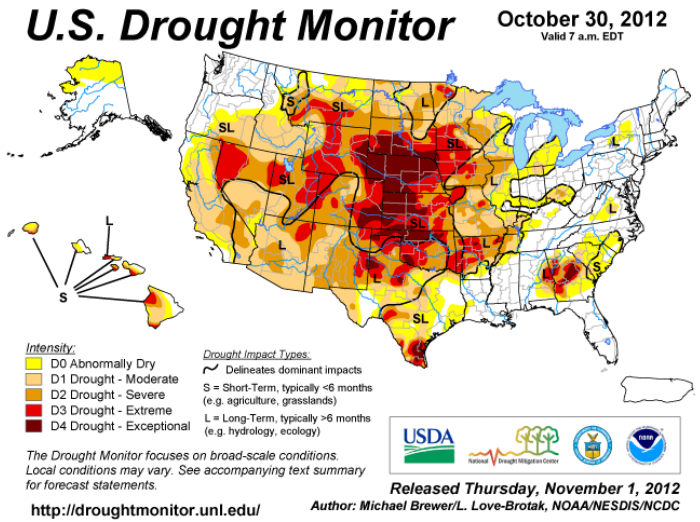
Colby, KS July
2013

October 2013



Abilene, TX

- What are current conditions?
- What can we say about the drought continuing into 2013?
- What can we say about long-term trends?
- What are information needs going forward?



Southwest drought ending with onset of El Nino

Southwest Farm Press *Aug. 28, 2012*

Limping El Niño Offers Little Hope for Drought Relief

By John Fleck / Journal Staff Writer on Thu, Oct 4, 2012

Approach

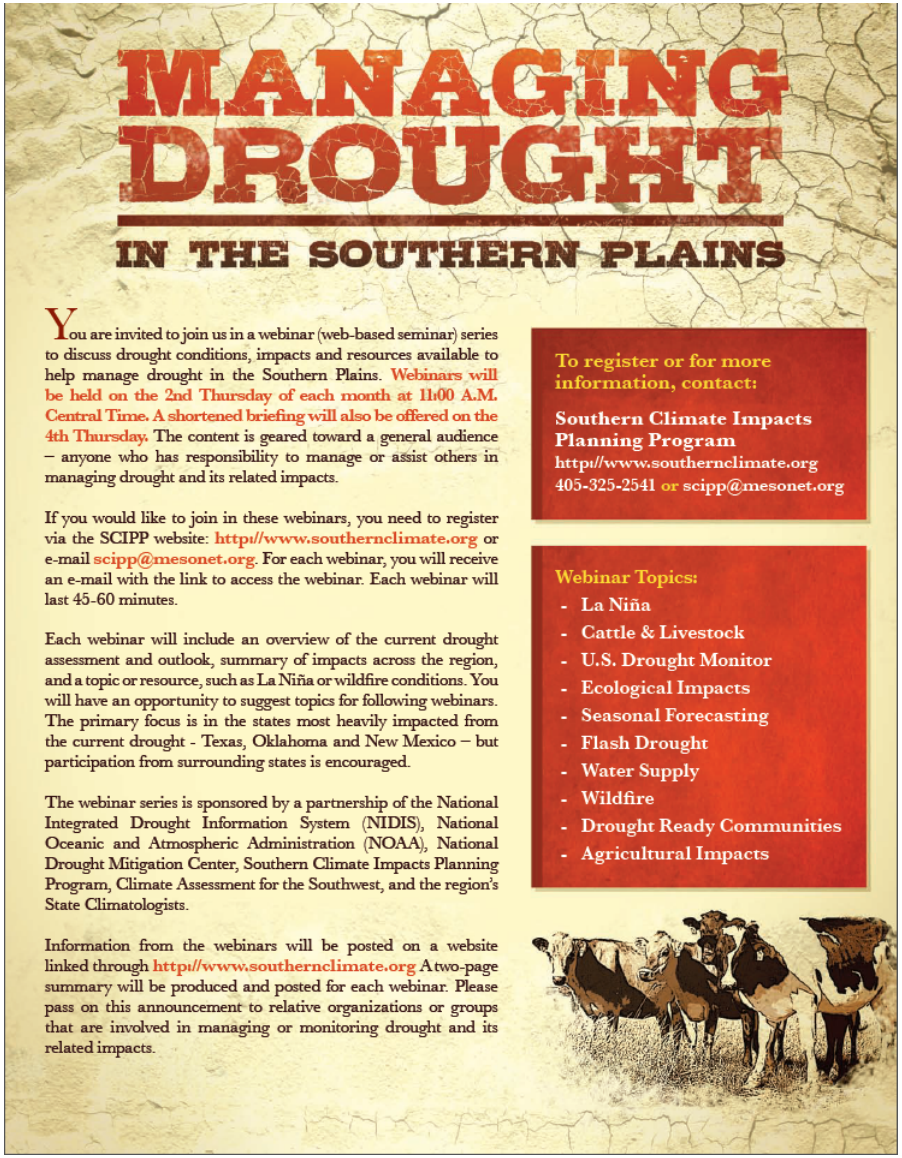
- Working with communities and existing networks of people through:
  - Drought assessments
  - Climate outlook forums
  - **Education and outreach webinars**
  - Engaging the preparedness community

Webinar Topics

- La Niña
- Flash Drought
- Water Resources
- Cattle Industry Response
- Seasonal Forecasts
- Wildfire
- U.S. Drought Monitor
- Wildlife

Webinars are posted on YouTube

Some webinars were geared to the press, others to stakeholders in general

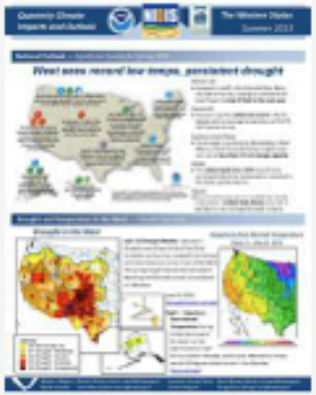


WESTERN GOVERNORS' ASSOCIATION

Serving the Governors of 19 States and 3 US-Flag Pacific Islands

West sees record low temps, persistent drought, according to 'Outlook' from WGA and NOAA

FOR IMMEDIATE RELEASE
June 27, 2013



Last year's drought covered two-thirds of the U.S. at its height, but has since receded from the East and remained severe across much of the West, according to the most recent **Quarterly Climate Impacts and Outlook**.

The publication also shows that the spring of 2013 set records for low temperatures in many states represented by the Western Governors' Association, including Alaska, Hawaii and the Dakotas.

The Outlook features a synopsis of drought conditions over the past three months as well as a glimpse of potential conditions through September. Though drought is receding in much of the Central Plains, it is likely to persist across much of the Central West and the coastal states. Additional information, such as reservoir levels, areas of above-average wildfire potential, is also included in the Outlook.

Contacts

Carlee Brown (WGA)

cbrown@westgov.org

(386) 559-0171

Quick Links

www.westgov.org

www.drought.gov

Twitter facebook YouTube

Tri-County Risk Management

Workshop: Tuesday, February 4, 2014

Create a risk management plan for your own operation.

This workshop will focus on opportunities and challenges of weather and climate-related risk management.

- Cody Knutson, UNL National Drought Mitigation Center: Why you need a written drought plan, and how to do it
- Laura Edwards. SDSU Extension Climate Field Specialist: Weather and climate monitoring
- Pete Bauman, SDSU Extension Range Field Specialist: Measuring grassland productivity
- Dr. Matt Diersen, SDSU Risk/Business Management Specialist: Using Pasture, Rangeland, Forage - Rainfall Index Insurance & Market outlook
- NRCS: SD Drought Tool and efficiency of soil infiltration, and NUTBAL program
- Roger Gates & Dave Olilla, SDSU Extension Range Specialist and Sheep Field Specialist: Best management practices for range

Location: SDSU Extension Center, Winner

Time: 9 am – 3 pm

No pre-registration required, but encouraged. Contact Bob below. Lunch will be provided.

For more information:
Bob Fanning, SDSU Extension in Winner, 842-1267
or Steve Higgins, NRCS in Winner, 842-0603
or Shane Reis, NRCS in Kennebec, 869-2216
or Brandon Walter, NRCS in Burke, 487-7501 x.3

Sponsored by:

North Central Risk Management Education Center

NIDIS

USDA
United States Department of Agriculture
National Institute of Food and Agriculture

Farm Credit Services of America

Local Sponsors:
Hamill Conservation District, Clearfield-Keyapaha Conservation District, Gregory County Conservation District, American Creek Conservation District, SDSU Extension Service, Natural Resources Conservation Service, First Fidelity Bank, Bankwest of Gregory, Winner & Kennebec, and Statewide Ag Insurance

Conservation Districts

NRCS Natural Resources Conservation Service

SDSU Extension

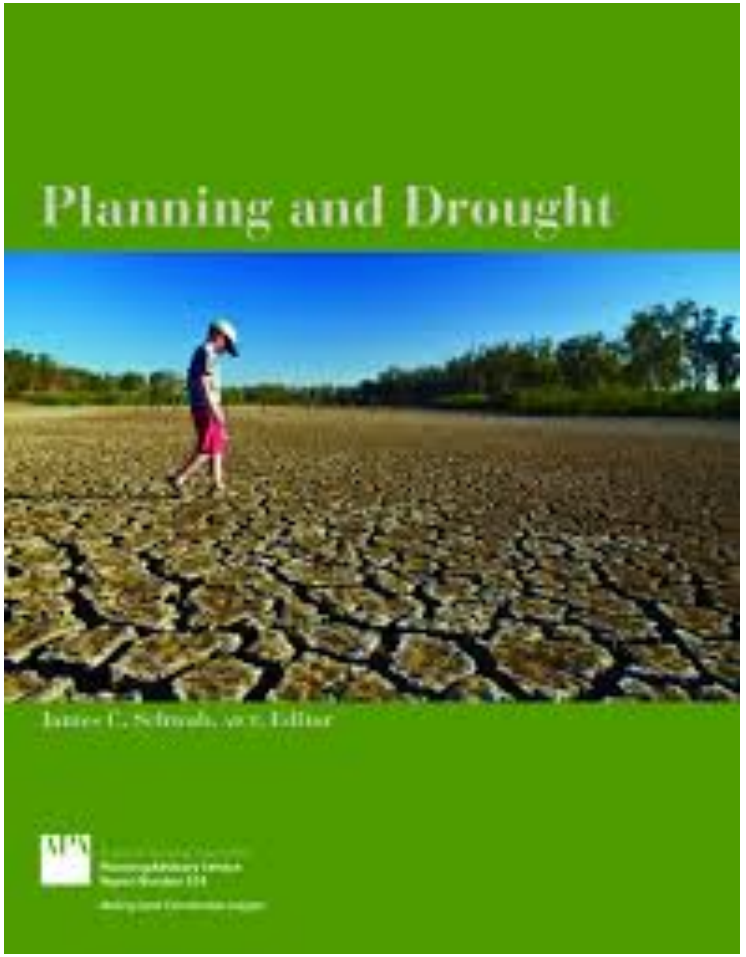
This program is based upon work supported by USDA-NIFA under Award Number 2013-49200-20032, with support from National Integrated Drought Information System and Farm Credit Services of America.
South Dakota State University, South Dakota counties, and USDA cooperating. South Dakota State University adheres to AA/EEO guidelines in offering educational programs and services.

Approach

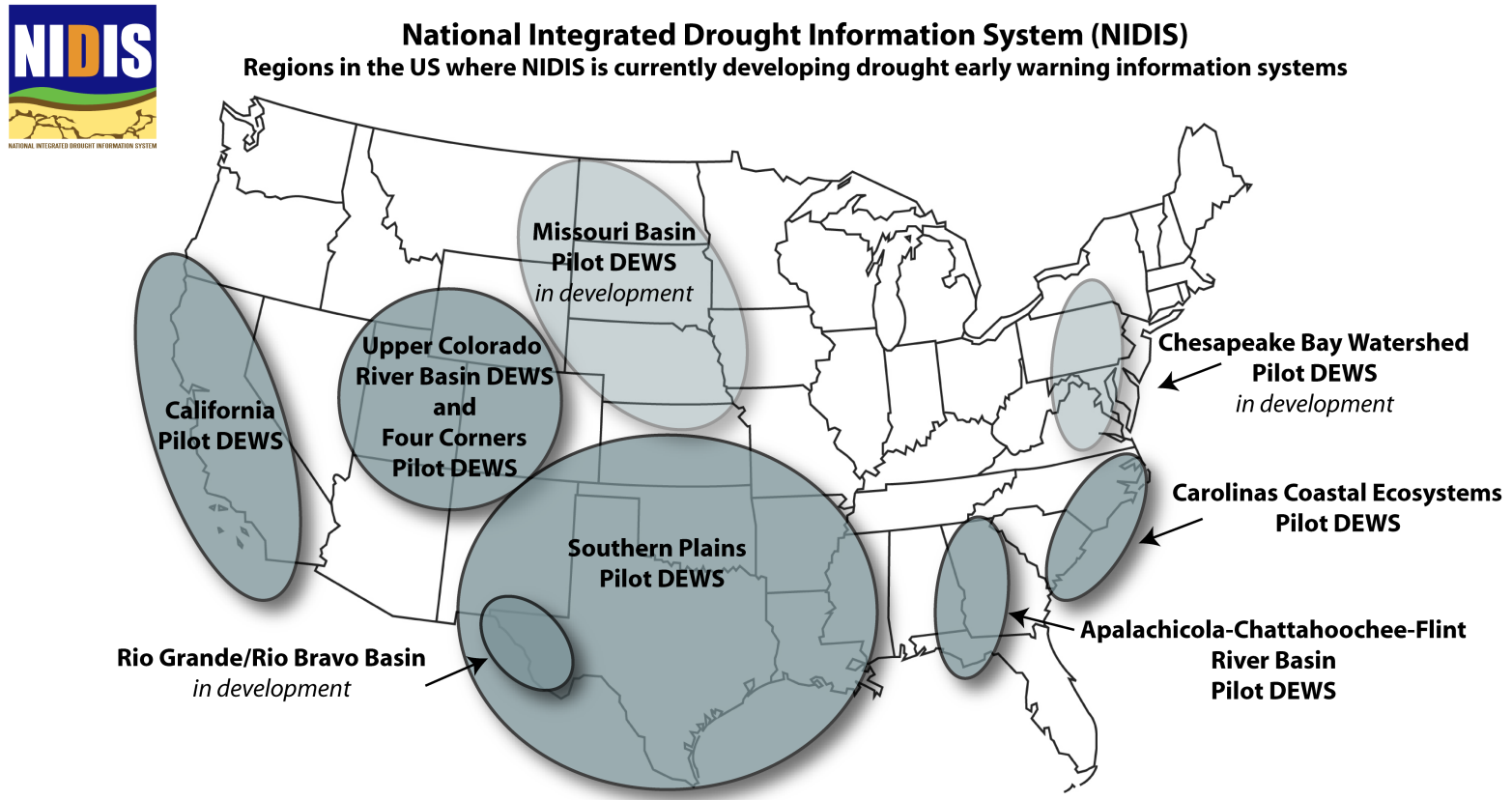
- Working with communities and existing networks of people through:
  - Drought assessments
  - Climate outlook forums
  - Education and outreach webinars
  - **Engaging the preparedness community**

Engaging the Preparedness Community

- Drought planning: American Planning Association-Public Advisory Service
- Webinars
- Developing drought coordinator network

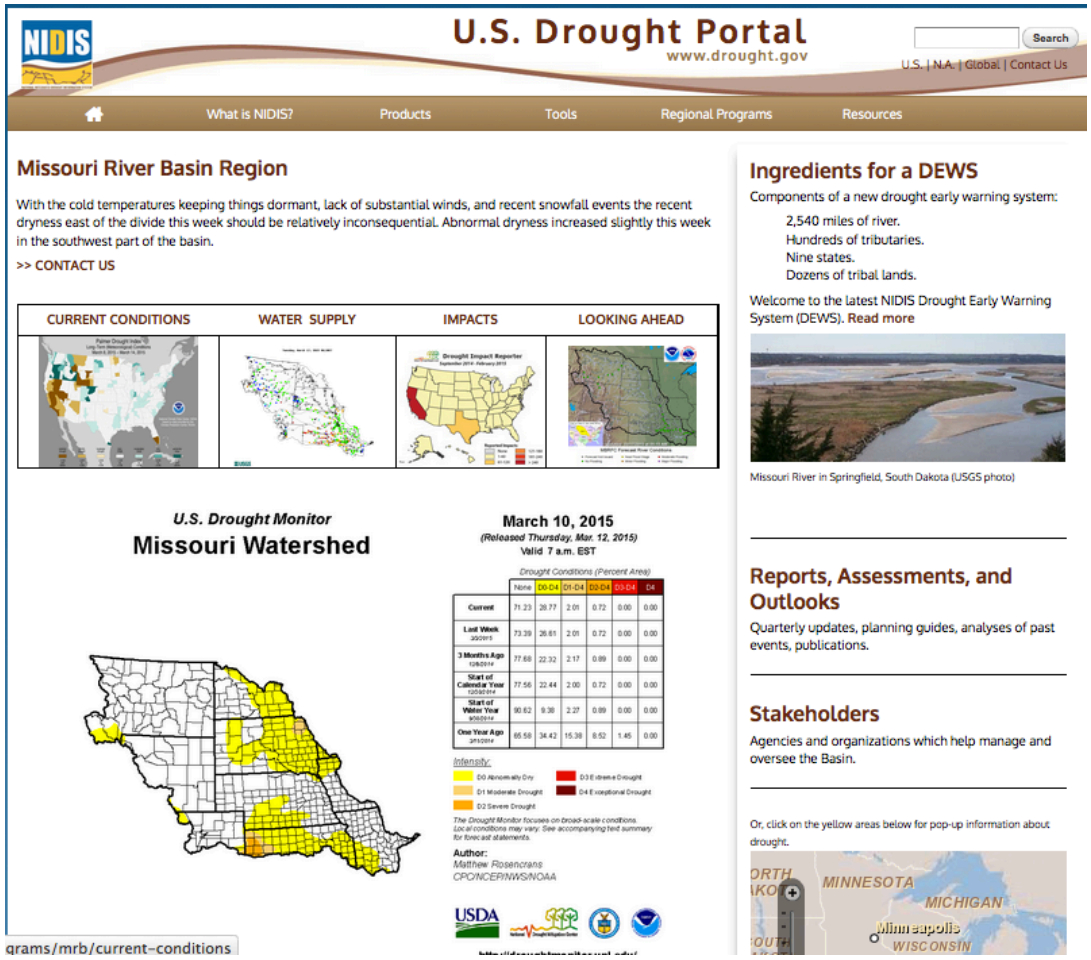


NIDIS Pilots Areas

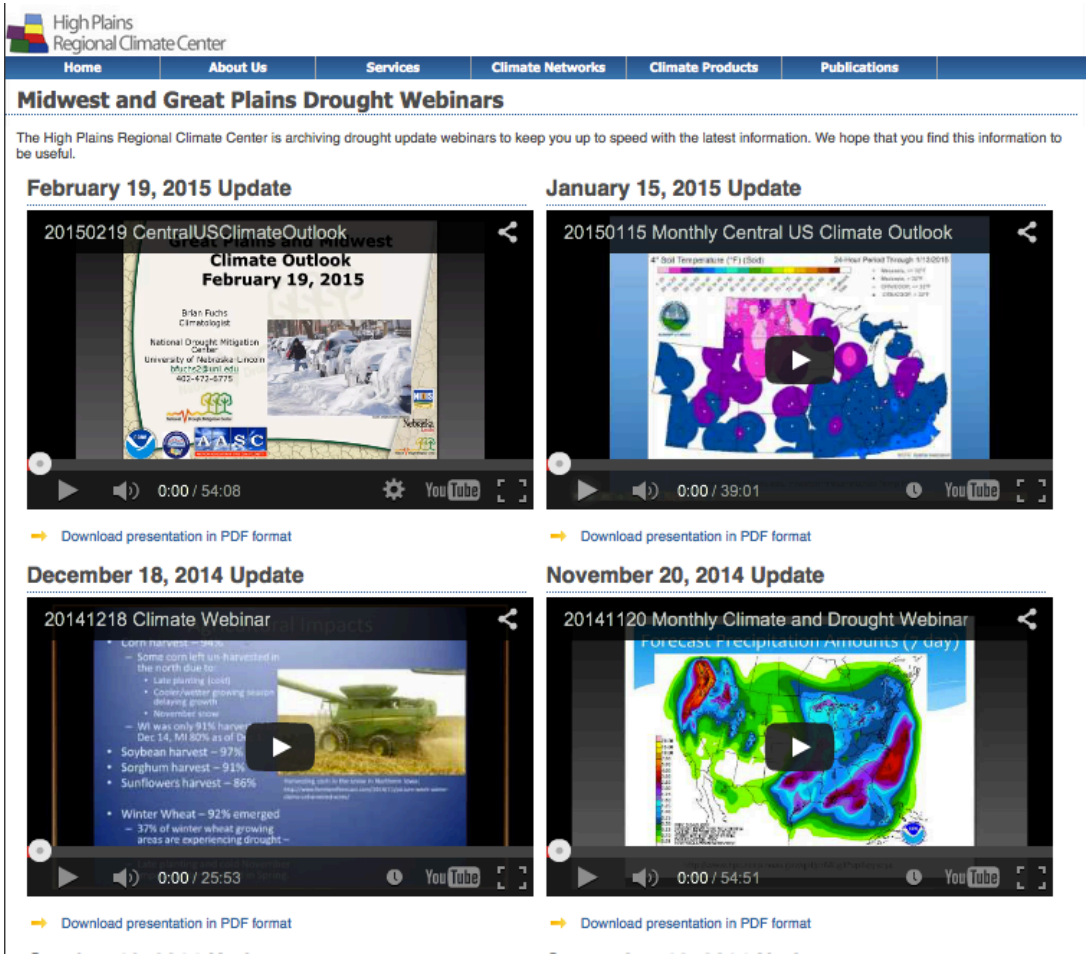


NIDIS is working toward a fully national drought information system through national, tribal and state partnerships
NIDIS-supported research and monitoring is conducted across the nation
For monitoring, forecasting, data products, research activities and information on NIDIS webinars and meetings, visit the drought portal - www.drought.gov

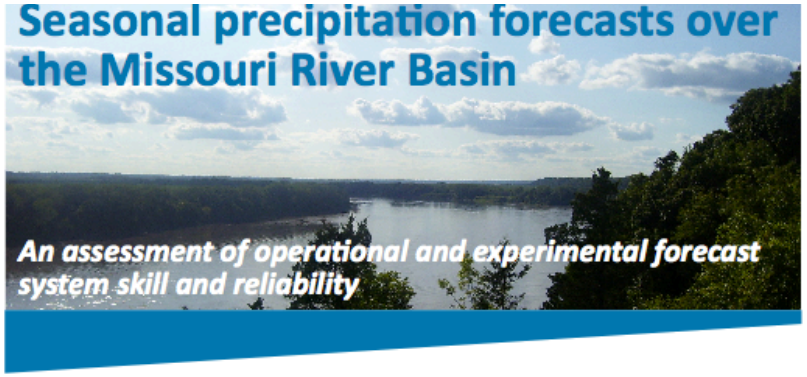
Missouri River Basin Pilot



Midwest and Great Plains Webinars



Assessments

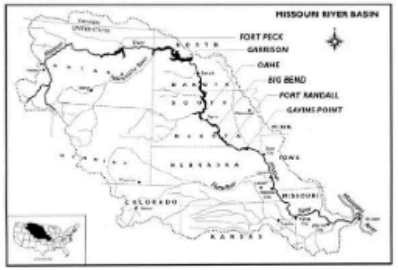


In 2011, the Missouri River Basin experienced devastating flooding, which caused significant property loss and disrupted thousands of lives. In 2012, the basin experienced extreme drought that impacted water supplies and downstream navigation. Historically, the climate of this region shows a general tendency for both very wet and very dry months in a given year. The ability to accurately predict seasonal flood and drought conditions between one and six months in advance was recognized to be extremely beneficial to water managers, emergency personnel, as well as the general public for planning purposes.

At the request of the Missouri River Basin Water Management office and the U.S. Army Corps of Engineers, NOAA's Earth System Research Laboratory and the University of Colorado's Cooperative Institute for Research in Environmental Sciences (CIRES) performed an assessment study to determine the skill and reliability of current state-of-the-art operational and experimental seasonal forecast systems in predicting the atmospheric conditions that led to the 2011 flood or the 2012 drought.

For the study, NOAA operational and experimental modeling systems were analyzed for December 2010 precipitation forecasts for the winter (January-February-March) and spring (April-May-June) of 2011. Likewise, December 2011 precipitation forecasts for 2012 winter and spring were analyzed. These 'retrospective' forecasts were compared to actual observations for just the Upper Missouri River Basin, for just the Lower Missouri River Basin, and for the entire Missouri River Basin.

The effects of El Niño and La Niña (together known as ENSO) on sea-

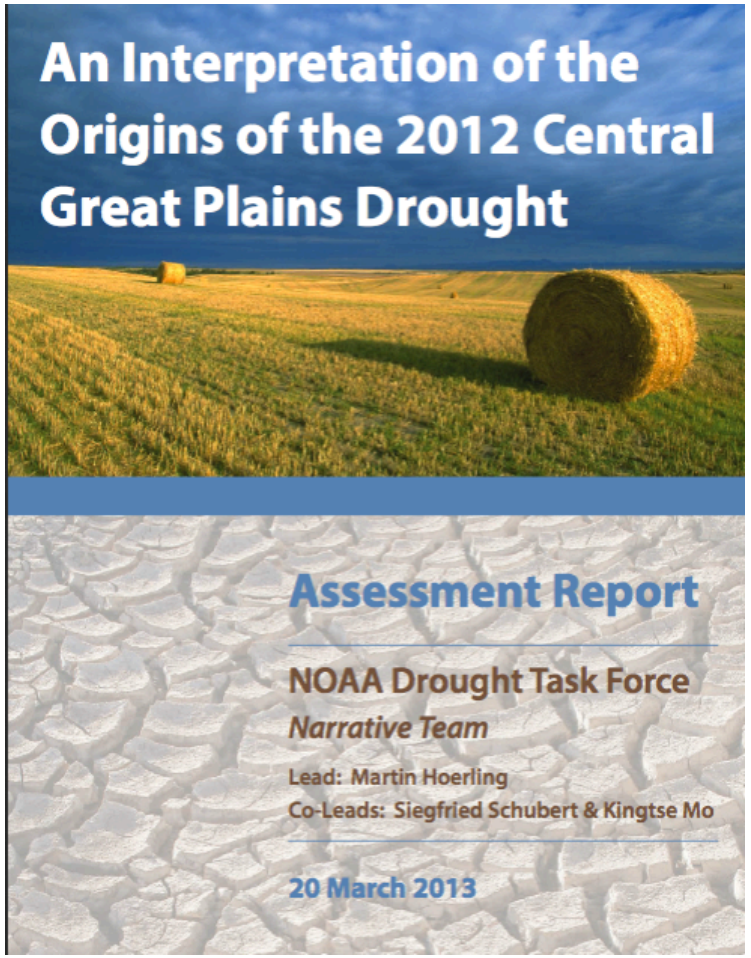


The Missouri River Basin, the Missouri River, and the main U.S. Army Corps of Engineers reservoirs (Image courtesy Missouri Department of Natural Resources).

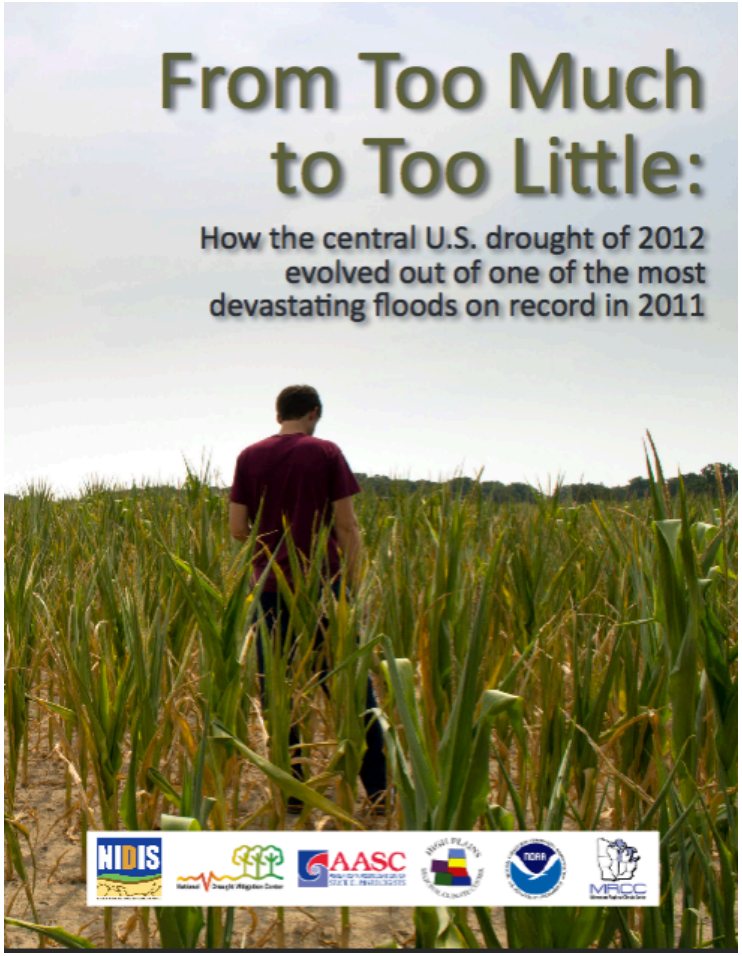
the U.S. Previous analyses have found increased forecast skill for the winter and early spring in some regions on the U.S. during El Niño and La Niña events. Thus, as an additional component of the study, data exclusively for neutral, El Niño and La Niña years were analyzed to assess if the forecast skill improved under these conditions.

Major Findings

Monthly and seasonal precipitation in the Upper Basin, in the Lower Basin, and entire Missouri River Basin is highly variable with standard deviations averaging close to 30 percent of the long term average.



Assessments



MRB Priorities

Drought impacts and vulnerability to drought

Partner with states and tribes for drought planning

Support/enhance Midwest and Great Plains Drought and Flood Webinar Series

Assess approaches for improved forecasts and long-term monitoring

Conduct regional or sub-basin meetings: understand impacts and ways to inform drought risk management

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

MISSOURI RIVER BASIN

DROUGHT EARLY WARNING SYSTEM

THE KICKOFF MEETING, FEB. 26-27 2014; NEBRASKA CITY, NEBRASKA

Teaming up for drought planning, preparedness, early warning systems

People from more than 70 federal, state, tribal, academic, regional and national institutions met in Nebraska City, Nebraska, in February 2014 to discuss the current state of drought awareness, planning and capacity across the Missouri River Basin.

The meeting was the first of a multi-year engagement process in the basin to better understand existing resources, vulnerabilities, impacts and priorities. The goal is to create a Drought Early Warning System (DEWS).

Regional DEWS (RDEWS), developed by the National Integrated Drought Information System (NIDIS), explore and demonstrate a variety of early warning and drought risk reduction strategies. They incorporate drought monitoring and prediction information in partnership with federal, state, tribal and local agencies, organizations and other users. Located throughout the contiguous U.S., RDEWS help regions plan for and establish best practices in drought-stressed times, and transfer this information to under-served regions of the country.

Key sponsors of the Nebraska meeting were NIDIS, the National Drought Mitigation Center (NDMC), Western Governors Association (WGA), U.S. Department of Agriculture (USDA), North Central Climate Science Center (NCCSC), South Dakota State University (SDSU) and the National Oceanic and Atmospheric Administration (NOAA).

ABOVE
The Missouri River near Yankton, South Dakota. Lewis and Clark Lake can be seen in the distance.
NATIONAL PARK SERVICE PHOTO

FOR MORE INFORMATION
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Doug Kluck (doug.kluck@noaa.gov)
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Vast, productive basin is vulnerable to drought and flood

The Missouri River Basin is known for intense weather and extreme climate variability, such as the stark differences between record high flows and flooding in 2011, followed by record low flows and drought in 2012. Drought is a normal part of climate throughout the Basin, causing devastating impacts during the 1930s Dust Bowl, the 1950s, 1988-89, 2000-2006, and 2012-13.

While the effects of flooding tend to be concentrated along waterways, the effects of drought spread across the landscape. Drought has direct impacts on agriculture, water supply, water quality, It has physical, economic and social effects on the well-being of people, families and communities. Widespread drought disrupts farming and livestock production, which can, in combination with market processes, increase food prices.

Many aspects of human activity affect vulnerability to flood and drought, including land and water use patterns, population shifts and agricultural practices. Warming climate adds urgency to the need to address drought in the basin, because heat contributes to drought. More frequent extreme weather such as the heavy precipitation that led to flooding

ABOVE LEFT
Brown areas on the map show below average plant growth during the drought in June and July of 2012.
NASA GRAPHIC

ABOVE RIGHT
North Dakota Air National Guards place sandbags alongside a home by the Missouri River in Bismarck, N.D., during the

Tribal Workshop

Explore opportunities to expand and strengthen monitoring capabilities throughout tribal lands

Investigate partnerships with tribal colleges to build capacity for climate and drought planning

Continue outreach to tribes through several mechanisms

Assess ways to expand funding potential with other federal agencies and programs

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM
MISSOURI RIVER BASIN
DROUGHT EARLY WARNING SYSTEM

TRIBAL ENGAGEMENT WORKSHOP, RAPID CITY, SEPT. 17-18, 2014

Participants from 18 tribes, academic institutions and federal and state agencies gathered at the Journey Museum and Learning Center in Rapid City for the two-day Missouri River Basin Tribes Workshop on Extreme Events and Drought Resiliency.

Tribes share observations, concerns, needs to develop drought resilience

Tribes in the Plains live in some of the most highly variable climatic locations in the U.S. The Missouri River Basin is known for extreme weather and climate variability, as evidenced by the stark contrast between flooding in 2011, followed by drought in 2012. Drought is a normal part of climate throughout the Basin, causing devastating impacts during the 1930s Dust Bowl, the 1950s, 1988-89, 2000-06, and 2012-13.

In September 2014 tribal representatives, scientists, academicians and members of both state and federal governments gathered in Rapid City, S.D., to discuss drought and climate change, drought impacts, early warning systems, and planning for extreme events.

The meeting, sponsored by the National Integrated Drought Information System (NIDIS), focused on engagement with the tribes in the

PARTICIPATING TRIBES
Standing Rock Sioux Tribe
Sisseton Wahpeton Sioux Tribe
Flandreau Santee Sioux Tribe
Crow Creek Sioux Tribe
Lower Brule Sioux Tribe
Rosebud Sioux Tribe
Oglala Sioux Tribe
Ponca Tribe of Nebraska
Santee Sioux Tribe
Iowa Tribe of Kansas and Nebraska
Sac and Fox Nation of Missouri in Kansas and Nebraska
Crow Tribe
Gros Ventre & Assiniboine of Ft. Belknap
Eastern Shoshone and Northern Arapaho Tribes of Wind River
Kickapoo Tribe in Kansas
Cheyenne River Sioux Tribe
Cheyenne & Arapaho
Iowa Tribe of Oklahoma

OTHER PARTICIPANTS
US Army Corps of Engineers
Kiksapa Consulting, LLC
Montana Department of Natural Resources and Conservation
NOAA National Weather Service
Louis Berger
Syntropy Energy / RE-AMP
United States Department of Agriculture – Agricultural Research Service
Little Big Horn College
South Dakota State University Extension
United States Department of Agriculture – Natural Resources Conservation Service – Central Technology Center
United States Department of Agriculture – Forest Service
National Oceanic and Atmospheric Administration
National Drought Mitigation Center, University of Nebraska – Lincoln
American Indian Higher Education Consortium

Outcomes

Assess tribally specific early warning systems for drought

- e.g. drought summaries

Drought and climate monitoring education

Leverage agencies for resources on planning and building resilience

Approaches to conduct vulnerability assessments of cultural and water resources

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM
MISSOURI RIVER BASIN
DROUGHT EARLY WARNING SYSTEM

TRIBAL ENGAGEMENT WORKSHOP, KANSAS CITY, MISSOURI; NOV. 21, 2014

Kansas tribes meet on extreme events, drought resiliency

On November 21, 2014, more than 35 individuals met in Kansas City at the National Weather Service Training Center to better understand drought and climate impacts on tribal lands; build partnerships to facilitate water management, drought early warning, and responses to extreme events; identify resources and points of contact for planning, natural resources, and environmental offices; and engage and leverage tribal colleges and universities.

Tribes in northeast Kansas live in a highly variable climate. The Missouri River Basin is known for extreme weather and climate variability, as evidenced by the stark contrast between flooding in 2011 and drought in 2012. Drought is a normal part of climate throughout the basin, causing devastating impacts.

Extreme events, such as drought, flooding and other climate and weather phenomena, will profoundly exacerbate growing demands on finite tribal resources. These extremes create new challenges and opportunities for problem-solving to ensure tribal sustainability and resiliency into the 21st Century.

The meeting featured discussion of these issues and focused on several key topics: availability of data and monitoring; vulnerability and cultural resources; and prediction and early warning in the context of drought and climate extremes impacts. This NIDIS-sponsored meeting was a follow-up to the Missouri Basin tribal meeting held in September in Rapid City, S.D. Four tribal governments participated in the November meeting, including the Kickapoo Tribe in Kansas, Sac and Fox Nation of Missouri in Kansas and Nebraska, Prairie Band Potawatomi Nation, and Iowa Tribe of Kansas and Nebraska. In addition, numerous federal and state agencies attended including the Kansas Water Office, FEMA Region VII, EPA Region 7, Army Corps of Engineers, USDA Rural Affairs, National Drought Mitigation Center, High Plains Regional Climate Center and Haskell Indian Nations University.

The participating tribes shared the conditions and experiences on their lands, and engaged with federal and state agencies as well as other partners, to better identify the needs and opportunities within tribal communities. Federal and state agencies shared the available resources and information to provide assistance in areas of resiliency and drought planning.

Outcomes and next steps include:

- Exploring tribally specific early warning systems for drought, including climate and drought summaries; education; and building capacity on monitoring of climatological and cultural aspects
- Familiarization and education on drought aspects of monitoring and climate data holdings
- Leveraging agencies for resources on planning and building resilience
- Potentially conducting vulnerability assessments of cultural and water resources
- Tribal adaptation training

Related activities from the meeting are underway, including visits of tribal members to the High Plains Regional Climate Center and National Drought Mitigation Center.

PARTICIPANTS

James Rattling Leaf, Meeting Facilitator
Kickapoo Tribe in Kansas
Sac and Fox Nation of Missouri in Kansas and Nebraska
Prairie Band Potawatomi Nation
Iowa Tribe of Kansas and Nebraska
National Oceanic and Atmospheric Administration (NOAA)
National Integrated Drought Information System (NIDIS)
National Drought Mitigation Center (NDMC)
High Plains Regional Climate Center (HPRCC)
Haskell Indian Nations University
Federal Emergency Management Agency (FEMA) – Region 7
Environmental Protection Agency (EPA) – Region 7
Kansas Water Office
United States Army Corps of Engineers (USACE)
United States Department of Agriculture (USDA)
Kansas Climate Office
University of Kansas
National Climatic Data Center

WHAT IS NIDIS?

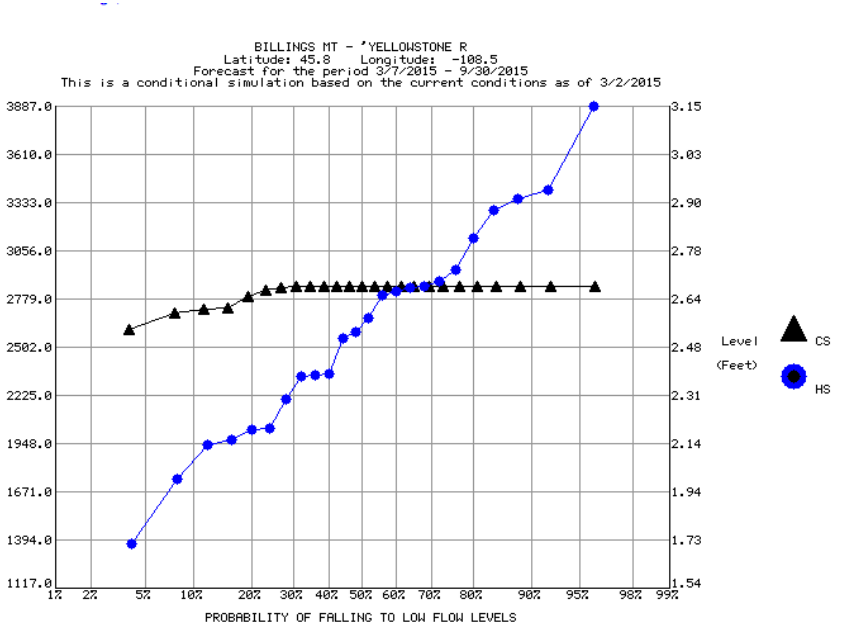
The National Integrated Drought Information System (NIDIS) promotes collaboration among government agencies, states, communities, tribes, and individuals at all levels to share information about drought, and provide resources for planning, forecasting, management and recovery. With partners, NIDIS pursues the goals of leadership and networking among all sectors; supporting research on the science of drought; creating local early warning systems for drought management; and developing educational resources to assist communities in dealing with drought.

Drought early warning and risk management at the state level

- States
  - Kansas
  - South Dakota
  - Nebraska
  - Funding sources (e.g. FEMA/Bureau of Reclamation)

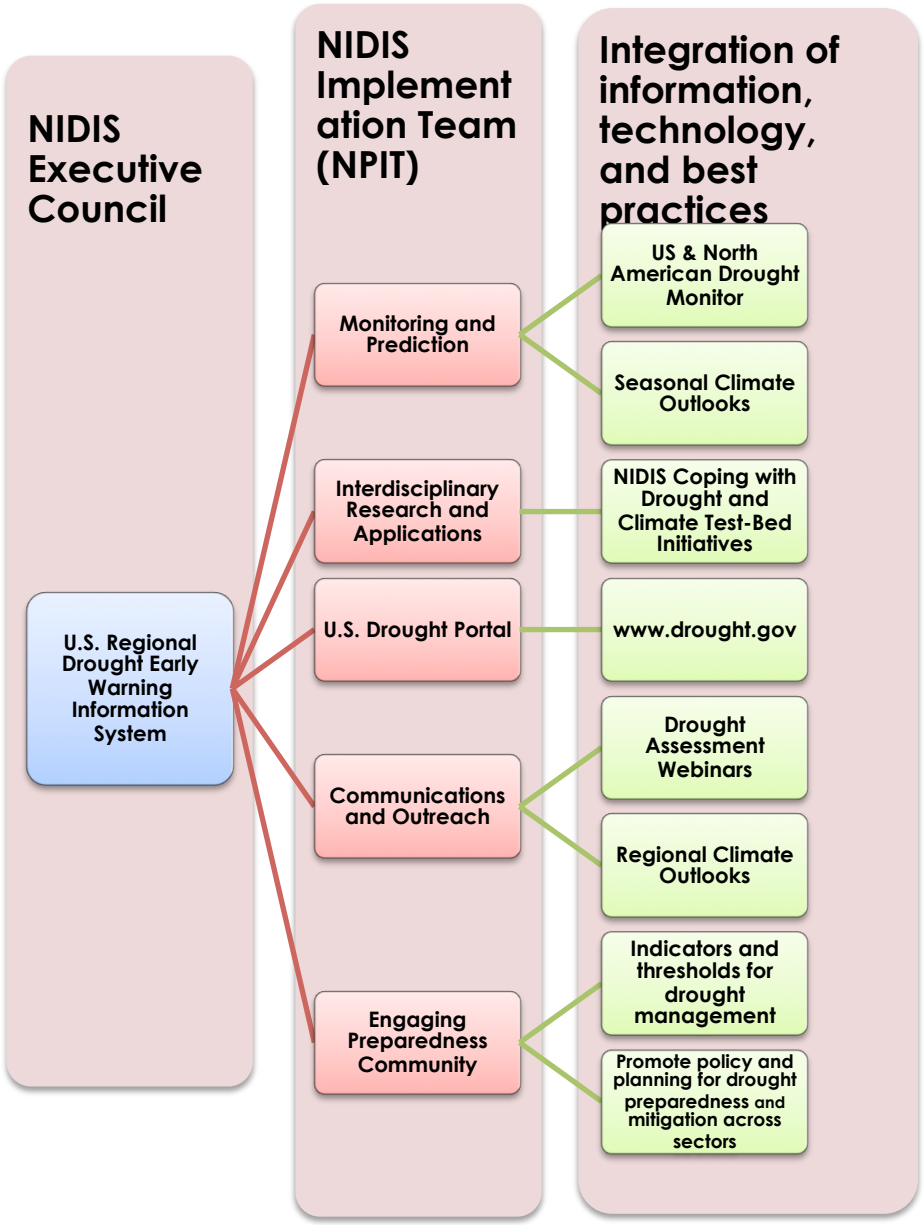
Monitoring/Forecast Improvements

- Upper Basin Soil Moisture & Snow Water Equivalent-WRRDA Bill
- National Soil Moisture Network
- NWS Low-flow forecasts

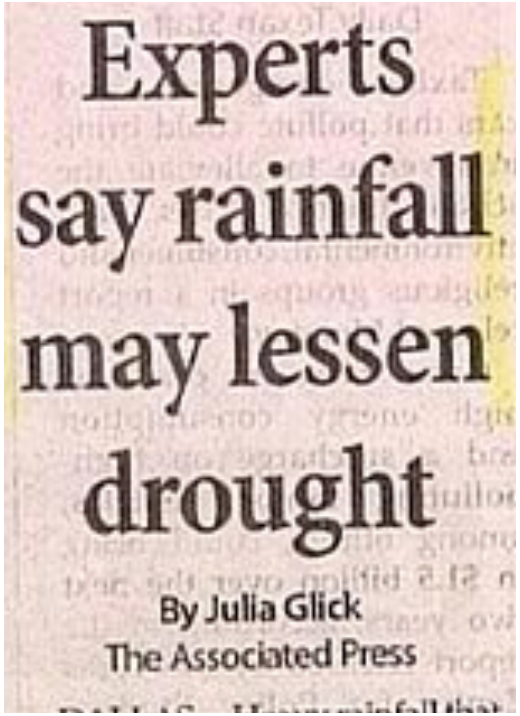


Summary

- NIDIS serving as coordination/ collaboration mechanism for drought risk reduction discussion: planning, data and information needs, sharing information/best practices
- Leadership and early adopters important
- Monitoring and Early Warning Information starting point for the engagement of stakeholders for risk management.



Thanks



Experts say rainfall may lessen drought

By Julia Glick
The Associated Press