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Winter 2019

## DroughtScape- 2019 Winter

National Drought Mitigation Center

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# DroughtScape

Quarterly Newsletter

**Winter** | 2019

**WHY STATES STARTED PLANNING FOR DROUGHT IN 2018**

**RECLAMATION ACCEPTING DROUGHT PLANNING GRANT APPLICATIONS**

**MISSOURI PUT NEW DROUGHT OBSERVATION FORM TO THE TEST**

**FEMA'S THREAT HAZARD IDENTIFICATION & RISK ASSESSMENT**

**PROCESS ADAPTED FOR DROUGHT**

**ON THE HORIZON**



NATIONAL DROUGHT  
MITIGATION CENTER  
UNIVERSITY OF NEBRASKA

*Drought Science. Planning Sense.*

## About the cover photo

Photo by Lauren Uhlig. Cheney Reservoir, west of Wichita, Kansas, on June 16, 2018, was one of many recreation areas affected by drought in the spring and summer of 2018. Learn more about [Lauren's research](#).

Photo by Lauren Uhlig

## From the director



**Mark Svoboda**

Hard to believe it's time to put another year in the books. As such, it means you can check out one of my favorite NDMC services, the annual summaries capturing the year's drought intensity and spatial footprint (pg. 5) along with its effects on the country (pg. 8). Speaking of impacts, the NDMC has been working to implement a new web-based drought observation form to help simplify and streamline the reporting process, which we hope will lead to more continual sharing of people's perceptions of conditions in their backyard (pg. 12).

On the planning side, take a look at the story centered on the latest drought planning initiatives in the U.S. (pg. 10). Note the relative

flurry of drought planning efforts since 2015. I have no doubt that the droughts of the past 5–10 years have spurred on the development, or updating, of state drought plans to account for the new planning and monitoring tools that are available these days. I should note that you will find planning efforts are not just handled at the state level, as we get a lot of requests to help in planning efforts at all scales, even down to the individual producer. If you find yourself needing help on how to revise, or begin this process, don't hesitate to reach out to the NDMC. Check out our planning resources at: <https://drought.unl.edu/droughtplanning/PlanningHome.aspx>. I might add that the NDMC is not a government agency, so we are not affected by the recent government shutdown. Our shop is open and we are here to help.

Finally, I'd like to give a shout-out to our team that worked to finalize and produce a Drought THIRA Toolkit based on the FEMA framework for other hazards. In particular, I'd like to highlight the partnerships with the University of Nebraska's Public Policy Center along with the High Plains Region Climate Center, located at the University of Nebraska-Lincoln. It is always good to see the fruits from internal collaborations, given the strengths and expertise that these Nebraska-based institutions bring to the table.

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# Drought intensified in California and Nevada, eased elsewhere

**By Claire Shield**

National Drought Mitigation Center  
Climatologist

*Drought classifications are based on the U.S. Drought Monitor. Details on the extent and severity of drought are online: [droughtmonitor.unl.edu](http://droughtmonitor.unl.edu).*

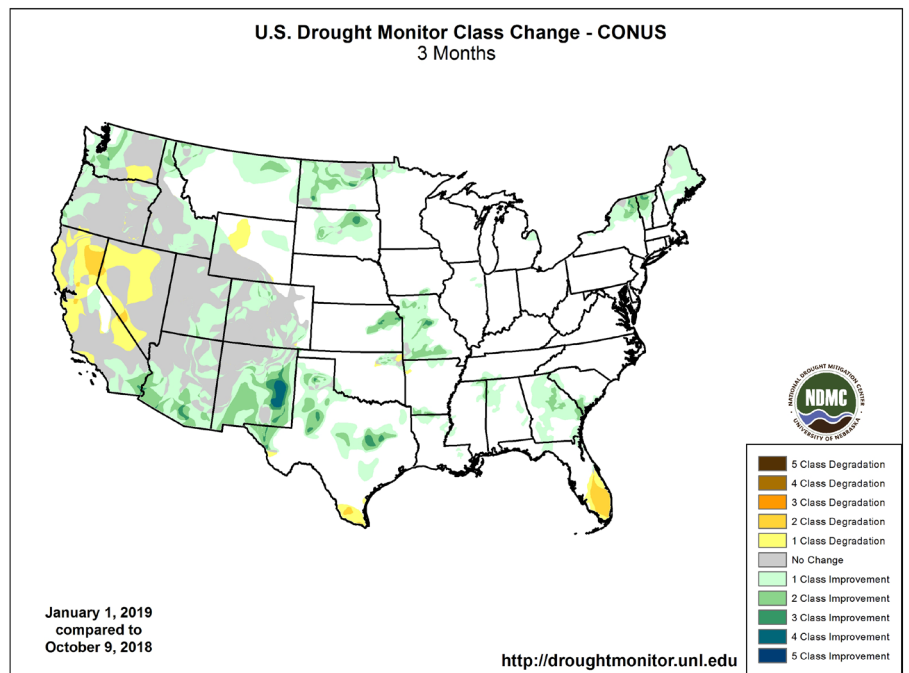
*The outlook integrates existing conditions with forecasts from the National Oceanic and Atmospheric Administration's Climate Prediction Center: [www.cpc.ncep.noaa.gov](http://www.cpc.ncep.noaa.gov).*

## National Summary

During the fourth quarter of 2018, parts of the Southeast and the western and northern parts of the West saw the warmest conditions compared to normal, with temperatures ranging from 2 to 6 degrees above normal. The remainder of the West saw more variable temperatures, ranging from 5 degrees below normal to 3 degrees above normal. The Plains, western Midwest, and northern New England saw widespread cool conditions, with temperatures primarily 4 to 1 degrees below average, while the eastern Midwest and northern parts of the Southeast saw temperatures primarily within 2 degrees of normal. Much of the eastern two-thirds of the country saw ample precipitation, ranging between 110 and 300 percent of normal in many areas. The western third of the country and the Dakotas saw more variable precipitation, with precipitation between 5 and 300 percent of normal.

## Drought

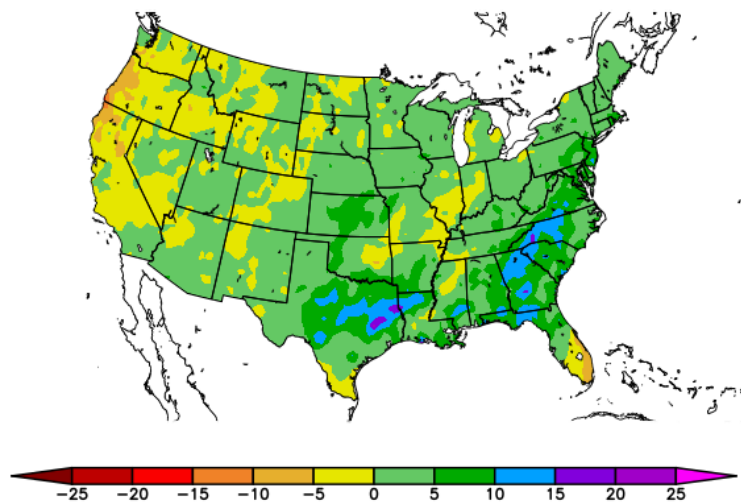
Nationwide coverage of each drought severity category decreased during the three-month period. Moderate drought was reduced 5.89 percent, leaving 18.69 percent of the country in drought. Severe drought was reduced 5.43 percent, leaving 9.13 percent areal coverage. Extreme drought was reduced by more than half, to only 2.75 percent of the country, and exceptional drought was *Continued on page 4*



**National Drought Mitigation Center**  
Drought improvement and removal east of the Rockies and in portions of the Four Corners states, and northern portions of the West; drought persistence and expansion in far southern Texas and Florida, and in parts of the West.

## Departure from Normal Precipitation (in)

10/1/2018 – 12/31/2018



**High Plains Climate Center**  
During the quarter, large precipitation surpluses were found in the Plains, the South, and the Southeast, while parts of the West remained very dry.

reduced from 1.45 percent to 0.95 percent. The population in moderate drought decreased modestly from 55.4 million at the beginning of October to 51.3 million at the end of the year, but the population in severe drought was reduced substantially from 37.2 million to 19.7 million. During the quarter, drought was completely eliminated in the Midwest, Northeast and all but 0.67 percent of the South.

## Precipitation

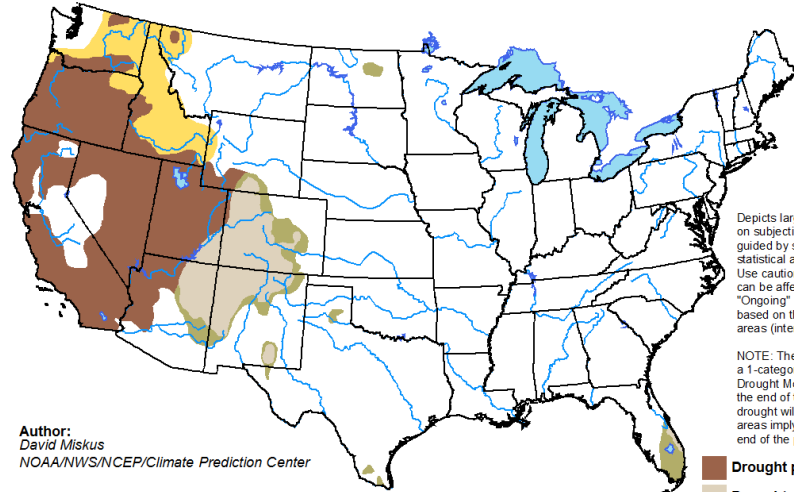
Many of the areas in western Washington, Montana, the Plains, the Midwest, the Northeast and the Southeast that were experiencing drought and dryness at the beginning of October saw precipitation totals between 100 and 300 percent of normal during the quarter, leading to drought removal. In fact, some areas in the South and Southeast saw precipitation surpluses of more than 15 inches during the quarter thanks to a number of heavy precipitation events. Precipitation amounts between 100 and 300 percent of normal were also found in smaller areas within far southeastern California, northwestern Colorado and northwestern Washington, and in parts of Arizona, Utah and New Mexico, leading to drought improvement and removal. Precipitation in the remainder of the West was generally only 5 to 90 percent of normal, resulting in drought persistence and expansion. Far southern portions of Texas and Florida were also dry, seeing only 25 to 70 percent of normal precipitation, leading to the introduction of dryness and moderate drought by the end of the quarter.

## Temperature

The western and northern portions of the West, along with the Southeast, were warm during the last quarter of 2018. Temperatures in these areas were generally between 1 and 6 degrees above average. On the other hand, Maine, the Plains, and the western Midwest were relatively cool, with temperatures between 1 and 5 degrees below normal. The Intermountain West saw a wide range of temperatures — between 5 degrees below normal and 3 degrees above normal, depending on the location. The eastern part of the Midwest saw temperatures generally within 2 degrees of normal. □

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

Valid for January 17 - April 30, 2019  
Released January 17



Author:  
David Miskus  
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

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

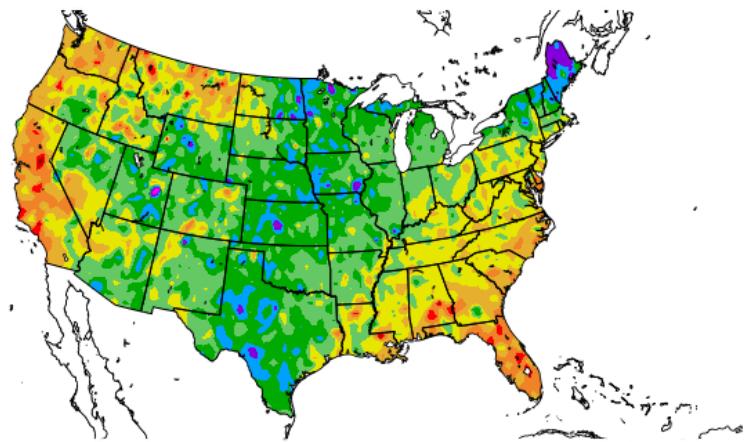


<http://go.usa.gov/3eZ73>

### Climate Prediction Center

Drought removal is expected for the current areas of drought in Alaska, North Dakota, Texas and Florida while drought improvement and removal is likely for current drought areas in southeastern Utah, northeastern Arizona, the majority of Colorado and New Mexico. Drought is expected to persist in the remaining drought areas in the West, with development likely in eastern and central Washington, Idaho, and far northwestern Montana. Hawaii and Puerto Rico are also expected to see drought persistence and expansion.

## Departure from Normal Temperature (F) 10/1/2018 - 12/31/2018



Generated 1/20/2019 at HPRCC using provisional data.

NOAA Regional Climate Centers

### High Plains Regional Climate Center

Florida, California and Washington were all warmer than normal during the 4th quarter of 2018.

# Year in Review: Drought spread and intensified in the West; record precipitation in the East

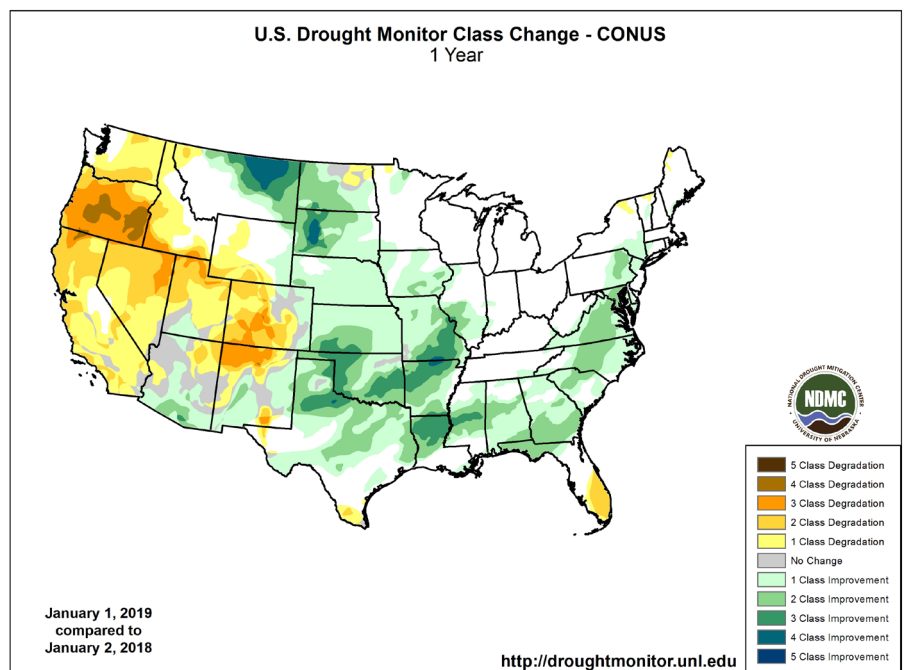
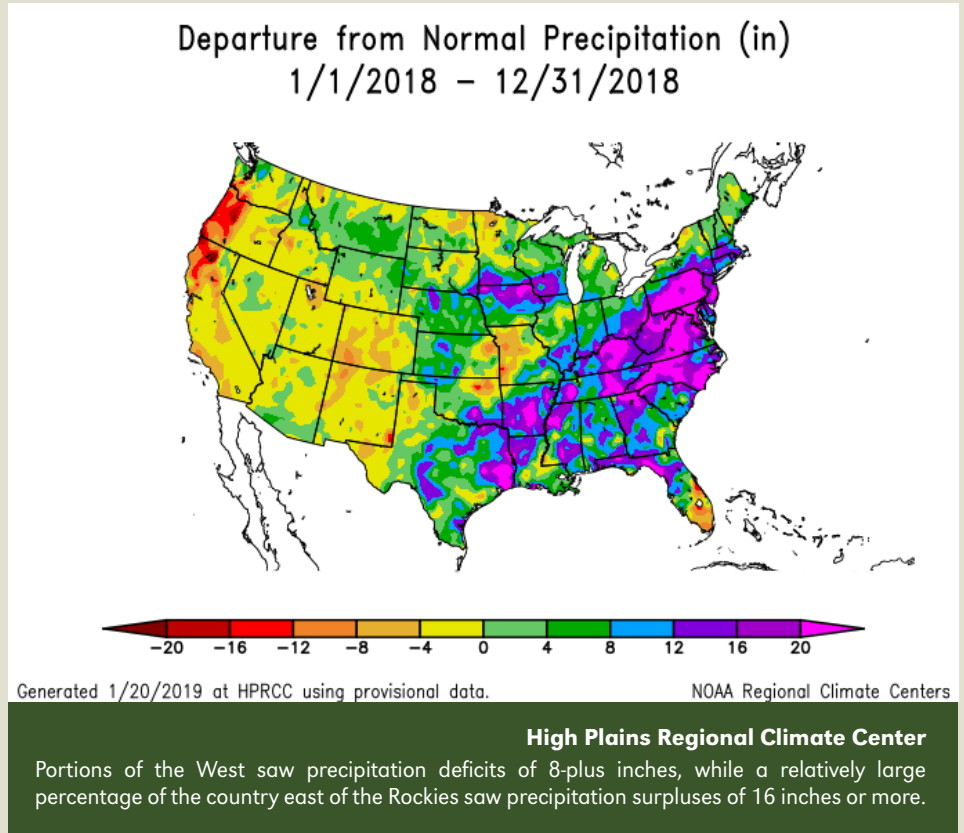
**By Claire Shield**

National Drought Mitigation Center  
Climatologist

At the beginning of 2018, eastern Montana and the Dakotas were beginning to recover from extreme drought. Meanwhile, drought was emerging in the Four Corners states and in the southern and central Plains. Exceptional drought was first introduced in Texas, Oklahoma and southeastern Kansas in March, in the Four Corners region in April, and northeastern Kansas and Missouri in July. Drought areas in Texas, Oklahoma, Kansas and Missouri fluctuated spatially and in severity throughout the summer before drenching rains brought improvement and removal of drought in September and October. Exceptional drought, however, persisted in the Four Corners region through the end of the year. Parts of the Midwest, Northeast, South and Southeast were impacted primarily by moderate and severe drought throughout the year, but by the beginning of November, drought was almost completely eradicated east of the Rockies thanks to a series of systems with heavy precipitation. In fact, hundreds of cities in the eastern U.S. saw record-breaking precipitation in 2018, with many of those stations besting the old records by multiple inches. Moderate, severe and extreme drought expanded in the remainder of the West during 2018, leaving previously drought-free portions of California, Oregon, Nevada and Washington in drought conditions by December.

In January, 23.18 percent of the country was in drought. That number

*Continued on page 6*



**National Drought Mitigation Center**  
During 2018, drought was removed in most areas east of the Rockies. Drought intensified and spread in much of the West.

peaked twice — to 33.13 percent in February and to 30.69 percent in August — before being reduced to 18.69 percent by the end of the year. In contrast, the percent of the country in severe and extreme drought increased during 2018. At the start of the year, 6.24 percent of the country was in severe drought and 0.69 percent was in extreme drought. Percentages of severe and extreme drought peaked at 17.60 percent and 7.94 percent, respectively, before falling to 9.13 and 2.75 percent, respectively, by the end of the year. Additionally, exceptional drought was introduced in 2018, peaking at

2.06 percent of the country in May and finishing the year at 0.95 percent. The population affected by drought was variable during the year: 51.4 million people ended the year under drought conditions, which was an improvement to the 62 million people experiencing drought in January 2018. The population in drought peaked in February when 90.5 million people

were in drought. At the beginning of the year, just over 150,000 people were affected by extreme drought, with none in exceptional drought. Those numbers increased to 15.4 million and 1.3 million, respectively, over the summer before falling to 2.2 million and 425,000 by the end of the year. □



**MONTHLY DROUGHT AND IMPACT SUMMARIES**

For a more detailed review of conditions, please visit [drought.unl.edu/newsoutreach/monthlysummary.aspx](http://drought.unl.edu/newsoutreach/monthlysummary.aspx)

## Drought impact summary for 4<sup>th</sup> quarter 2018

**By Denise Gutzmer**

National Drought Mitigation Center  
Impacts Specialist

The Four Corners region remained the epicenter of drought in the U.S. during the last quarter of 2018. Drought relief arrived in many parts of the country, but intensified in California and Nevada. During this time, the NDMC added 90 impacts to the Drought Impact Reporter, with most of those impacts describing water supply concerns in Colorado. California and Oregon followed with 13 and 12 impacts, respectively, documenting fire and water issues in California and water supply shortages in Oregon.

Some of the more notable drought impacts from the last part of 2018 included:

### Dry water year in Colorado

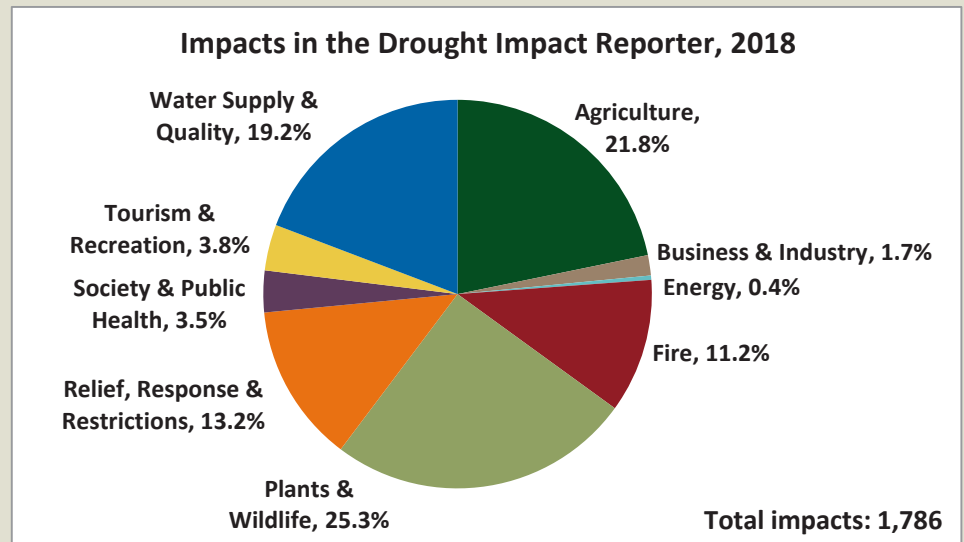
The 2018 water year was one of the driest in recorded history for the Upper Colorado River Basin, similar to 2002 and 1977. The water year ending Sept. 30, had the third-lowest unregulated flow into Lake Powell, at 43 percent of average for 4.62 million acre-feet, according to preliminary figures from the Bureau of Reclamation. Thirty percent of U.S. Geological Survey stream gauges in the Intermountain West were at record-low seven-day average stream flows during the last two weeks of September.

At the start of the water year on Oct. 1, key reservoirs along the Colorado River were at their lowest

point in nearly 40 years, at 47 percent of collective capacity. The previous low point occurred in 2004 after several consecutive dry years. Several communities along the Colorado River still had restrictions on water use because rivers were low, and hydropower production was hampered in southwestern Colorado as drought retained its grip on the region.

[“Colorado’s 2018 water year closes as one of driest on record,” by Heather Sackett, The Aspen Times \(Colo.\), Oct. 2, 2018](#)

[“Colorado River Reservoirs Start Water Year At Lowest Point Since Filled,” by Luke Runyon, KUNC \(Greeley, Colo.\), Oct. 16, 2018](#)



National Drought Mitigation Center

### Colorado River Basin Drought Contingency Plan

Southwest states worked to devise drought plans to sustain the Colorado River system and increase the level of Lake Mead to avoid a reduction in water deliveries as the basin’s reservoirs declined after years of below-normal rainfall. Colorado River Basin states strove to put together a drought contingency plan, which was to be completed by the end of the year, but they missed the deadline. Arizona and some California water agencies

*Continued on page 7*

were still working out details among stakeholders in December.

Bureau of Reclamation Commissioner Brenda Burman gave water managers in the Colorado River Basin until Jan. 31, 2019, to finalize a drought plan for the basin. If the January deadline is not met, the Bureau of Reclamation may impose unprecedented restrictions on water supplies.

[“Southwest states eye drought plans ahead of expected Lake Mead shortages,” by Yvonne Gonzalez, Las Vegas Sun, Dec. 12, 2018](#)

[“Correction: Colorado River Water-Drought story,” by Ken Ritter, The Associated Press, Dec. 18, 2018](#)

[“US water official: Feds will protect Colorado River without state drought plans,” by Tony Davis, Arizona Daily Star \(Tucson, Ariz.\), Dec. 13, 2018](#)

## California’s worst wildfire, the Camp Fire

As California experienced increasing drought in the fall, the deadliest and most destructive fire in the Golden State’s history, the wind-driven Camp Fire, swept through the city of Paradise in a matter of hours, so quickly that many people were trapped by flames. The apocalyptic blaze burned 153,000 acres in Butte County; destroyed 13,972 residences, 528 commercial buildings, and 4,293 other buildings; and ended at least 86 lives since it began on Nov. 8.

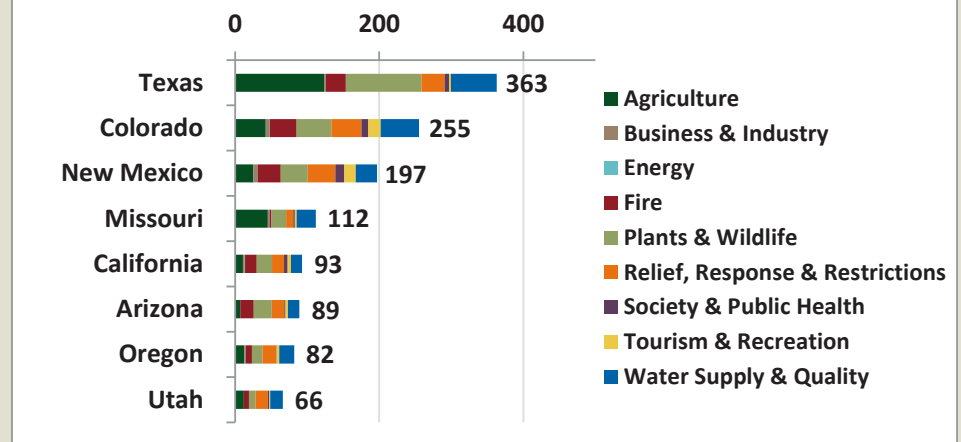
Prior to the Camp Fire burning much of Paradise, the area was parched, receiving just a tiny fraction of the 5 inches of precipitation normally received over the summer and early fall. Vegetation was tinder dry, and the region had a highly combustible fuel load because of past years of drought, among other factors contributing to the blaze.

[“The deadliest, most destructive wildfire in California’s history has finally been contained,” by Cleve R. Wootson Jr., The Washington Post \(DC\), Nov. 26, 2018](#)

[“As autumn rain in California vanishes amid global warming, fires worsen,” by Rong-Gong Lin II, Matt Hamilton and Joseph Serna, The Los Angeles Times, Nov. 13, 2018](#)

[Camp Fire \(2018\)](#)

### Impacts in the Drought Impact Reporter, 2018



National Drought Mitigation Center

## Relatively dry start to Oregon water year, low rivers

Since the start of the water year on Oct. 1, precipitation and snowpack were below normal in Oregon, while temperatures were above normal in the west and northeast parts of the state. Soil moisture, stream flows and mountain snowpack were all lower than usual, as drought persisted.

In southwest Oregon, low river flows and warm water temperatures in Douglas County caused a delay in coho spawning, as low water levels prevented fish from swimming upstream. Since coho can spawn until spring, there was still time for the spawn to occur. Also in extreme southwest Oregon, the Chetco River in Curry County was flowing too slowly at 89.7 cubic feet per second to allow salmon to swim upstream to spawn, leaving the fish congregating in deeper pools.

[“Oregon water year off to slow start,” by George Plavin, Capital Press – Agriculture Weekly \(Salem, Ore.\), Dec. 7, 2018](#)

[“Despite rain, county remains in drought,” by Saphara Harrell, The News-Review \(Roseburg, Ore.\), Nov. 26, 2018](#)

[“Drought Creates Great Rock Fishing and Bay Salmon Trolling,” by Larry Ellis, My Outdoor Buddy \(Ore.\), Nov. 10, 2018](#)

## Dry water year, drought emergency in Utah

On Oct. 15, Governor Gary Herbert declared a drought emergency for the

entire state of Utah as drought was at or nearing historic levels. Drought was most intense in San Juan County in the southeast corner of the state, and six counties declared drought disasters.

Utah, like Colorado, had an intensely dry year, with 2018 being the state’s driest water year in recorded history, going back 123 years. Sixteen of the state’s 49 major reservoirs monitored by the Utah Department of Natural Resources were below 20 percent, and eight reservoirs were below 5 percent. Gunnison and Piute reservoirs were essentially empty.

[“Gov. Herbert declares drought emergency for all of Utah,” by Brian Maffly, The Salt Lake Tribune, Oct. 15, 2018](#)

[“Utah just experienced its driest year since scientists have kept records,” by Brian Maffly, The Salt Lake Tribune, Oct. 10, 2018](#)

### DROUGHT IMPACT REPORTER



For more detailed reports, visit [droughtreporter.unl.edu](http://droughtreporter.unl.edu)



# Drought impact summary 2018

## By Denise Gutzmer

National Drought Mitigation Center  
Impacts Specialist

At the beginning of 2018, abnormally dry conditions and patches of drought covered much of the U.S. By mid-summer, drought was most intense in the southern Great Plains, the Southwest and western U.S., and by the end of the year, mainly affected the Southwest and West.

During 2018, the NDMC added 1,786 impacts to the Drought Impact Reporter. Most (362) of the impacts described damage to agriculture, plants and wildlife in Texas. There were 255 and 196 for Colorado and New Mexico, respectively, describing a range of impacts for both states.

Here are some of the more significant events from 2018:

## Texas agriculture damaged by drought

The drought areas of Texas shifted during spring and early summer, with the western regions affected early on, and parts of northern and eastern Texas experiencing drought as summer arrived. Livestock sales picked up in June because of poor rangeland and pasture conditions, and hay yields and supplies were low.

Heat and drought combined to cause considerable stress and damage to crops and pastures in July. In drought-affected areas, pasture and hay struggled and dried up. Farmers opted to bale grain crops for feed, as the plants were not able to make grain. By August, some Texas ranchers were culling cattle or even selling entire herds as drought dried up water sources and parched forage. By the end of summer, it was apparent that drought severely damaged cotton and other crops, as well.

Farmers in drought-affected areas were abandoning their grain crops and were baling them for cattle feed. It was suggested that even weeds, such as crabgrass, foxtail, barnyard grass and goose grass, might be valuable forage for baling, if there was nothing else.

[“Texas Crop and Weather Report – June 5, 2018,” by Adam Russell, The Bryan-College Station Eagle \(Texas\), June 5, 2018](#)

[“Texas Crop and Weather Report,” Texas A&M AgriLife \(College Station, Texas\), June 26, 2018](#)

[“As drought lingers, Texas ranchers opt to reduce their herds,” by David Warren, The Associated Press, Aug. 14, 2018](#)

[“Dry weather affecting cotton harvest in the Big Country,” by Jillian Grace, KTXS-TV 12 Abilene \(Texas\), Sept. 17, 2018](#)

[“Texas Farmers Baling Grain Crops Amidst Drought,” by Sonja Begemann, AG Professional \(Lenexa, Kan.\), July 24, 2018](#)

## Low river flows in Colorado

Poor snowpack from the 2017-18 winter reduced Colorado’s rivers to a fraction of normal, limiting rafting and recreational activities across the state through the summer. In the northwest, record heat warmed the waters of the Yampa and White rivers, stressing fish. Fishing restrictions remained in place for nearly a half dozen rivers toward late summer. Several rivers in west central Colorado ran at near-record lows, some as low as 30 percent of average, worrying anglers and ecologists about harm to trout. By the end of August, Colorado’s reservoirs were at roughly half of capacity, compared to an average of 82 percent. In the end, 2018 was one of Colorado’s driest water years on record.

[“Low Water Is Trouble For Trout,” by Zoe Rom, Aspen Public Radio \(Colorado\), Aug. 29, 2018](#)

[“Record Summer Heat Leaves Outfitters And Fish On The Yampa River In Hot Water,” by Grace Hood, Colorado Public Radio \(Centennial, Colo.\), Aug. 21, 2018](#)

[“SW Colorado’s Basins, Reservoirs Are Parched; Blue Mesa Nears Historic Low,” by Hayley Sanchez, Colorado Public Radio \(Centennial, Colorado\), Sept. 7, 2018](#)

[“Colorado’s 2018 water year closes as one of driest on record,” by Heather Sackett, The Aspen Times \(Colo.\), Oct. 2, 2018](#)

[“Animas River appears to have hit all-time low,” by Jonathan Romeo, The Cortez Journal \(Colo.\), Oct. 3, 2018](#)

## Low flows in the Colorado River Basin

Lower than expected flows in the Colorado River basin over the

summer increased the odds of a water shortage in 2020. The U.S. Bureau of Reclamation put the chances of a shortage in Lake Mead at 57 percent, an increase from the 52 percent chance projected in May. A drought spanning nearly two decades, along with population growth, increased water demand in the region and reduced the amount of water stored in lakes Mead and Powell. If Lake Mead were to fall below 1,075 feet above sea level, water deliveries to Arizona, Nevada and Mexico would be reduced. In early September, Lake Mead was at about 38 percent of capacity, while Lake Powell was at 48 percent.

[“Odds of shortage increase for vital river in US Southwest,” by Dan Elliot, The Associated Press, Aug. 24, 2018](#)

## New Mexico

Northern New Mexico had an unusually dry 2017-18 winter, starting the state on a painful year of drought. Stretches of the Rio Grande River went dry through Albuquerque in July, prompting the Bureau of Reclamation to release water leased through the San Juan-Chama project to keep the riverbed wet in the Albuquerque area. By the end of September, the Elephant Butte Reservoir on the Rio Grande River fell to just 3 percent of capacity, the lowest level since the early 1970s.

[“Wait ensues for summer rains as drought blankets New Mexico,” by The Associated Press, Santa Fe New Mexican, July 5, 2018](#)

[“New Mexico farmers brace for meager water allocations,” by Susan Montoya Bryan, The Associated Press, Albuquerque Journal \(N.M.\), Dec. 20, 2018](#)

The remarkably dry winter also increased tree mortality significantly in New Mexico and eastern Arizona as insects, such as bark beetles, thrived and damaged the weakened trees. In New Mexico, trees on about 120,000 acres were affected, a quadrupling of land affected compared to the previous year, an uptick that the Forest Service attributed to drought. Trees on about 300,000 acres in eastern Arizona were affected for the largest increase in tree mortality since the early 2000s.

*Continued on page 9*

[“Aerial surveys show dead trees in Arizona, New Mexico,” by Felicia Fonseca, The Associated Press, SFGate.com \(San Francisco\), Dec. 25, 2018](#)

## Drought, fire danger led to forest closures in Southwest

To combat the increased fire danger in the arid Southwest, numerous state and federal forests were closed to visitors starting in May to reduce the likelihood of wildfires, given that many blazes are caused by people. In Arizona, officials feared that the perfect storm of an exceptionally dry winter, intense drought and plenty of dry fuels had primed the region for wildfires.

At the end of summer, authorities felt the decision to close forests was a success, having prevented untold acres from burning. In Arizona, forest closures and prevention messaging were credited with limiting the number of burned acres on state land to less than half of that which burned in 2017.

[“Santa Fe National Forest to close amid fire threat,” by Sami Edge, Santa Fe New Mexican, May 30, 2018](#)

[“Fire officials: Decision to close forests during the wildfire season paid off,” by Bree Burkitt, Arizona Republic, Oct. 4, 2018](#)

## Wild horses needed food, water in the Southwest

Numerous groups throughout the West hauled food and water to wild horses as drought threatened the animals’ survival in Arizona and Colorado. Federal land managers also undertook emergency roundups in desert regions of Utah and Nevada. The Bureau of Land Management said the problem was overpopulation, combined with severe drought, exacerbating resource issues. Critics disputed BLM’s capacity assessment.

[“Drought spurs extreme measures to protect West’s wild horses,” by Julian Hattem, The Associated Press, July 23, 2018](#)

## Crop damage, high hay prices in Missouri

Missouri crops, particularly in the northwest, were stunted during the

hot, dry summer, and farmers began feeding hay and hauling water in July. With pastures and hay fields parched, the cost of hay rose to heights beyond that seen during the 2012 drought. Drought conditions varied across the state, with impacts being worst in the north. Hay prices rose from the start of the year through late August to higher than during the 2012 drought.

[“2018 drought differs from 2012 in varied impact, says MU economist,” The Caldwell County News \(Hamilton, Mo.\), Aug. 28, 2018](#)

## California’s dry water year

Meaningful precipitation was scarce in California in early 2018, prompting worries that drought had not truly ended. March did not disappoint, however, and its storms significantly boosted snowpack in the Sierra Nevada. The April 1 statewide snowpack was 58 percent of average.

The 2018 water year, ending Sept. 30, amounted to below-average precipitation nearly statewide, but reservoirs were still near or above average storage, thanks to plentiful precipitation in 2017. A significant portion of Southern California ended up with half or less of average annual precipitation in 2018.

A more comprehensive report about California’s water year can be found at [Water Year 2018: Hot and Dry Conditions Return](#).

[“Late-winter storms slow California’s dive back into drought,” by Rich Pedroncelli and Ellen Knickmeyer, The Associated Press, April 2, 2018](#)

[“DWR: 2018 water year saw below-average precipitation,” by Western Farm Press \(Saint Charles, Ill.\), Oct. 2, 2018](#) □

## Reclamation accepting drought planning grant applications

**A** \$9 million federal program designed to help fund drought mitigation efforts is now accepting grant applications

The Bureau of Reclamation’s WaterSMART Drought Response Program provides matching federal funding to assist states, tribes, irrigation districts, water districts and other local entities with water or power delivery authority located in the 17 Western United States with reclamation or drought resiliency projects. The bureau is part of the U.S. Department of the Interior (DOI).

“This Funding Opportunity Announcement (FOA) supports Drought Resiliency Projects that will build long-term resilience to drought and reduce the need for emergency response actions,” according to a release from the DOI. “These projects are generally in the final design stage, environmental and cultural resources compliance has been initiated or already completed, and the non-Federal funding, necessary permits, and other required approvals have been secured.”

An estimated 10 to 15 grants will be awarded, according to the DOI. Applicants can request up to \$750K for projects that build long-term resilience to drought and reduce the need for emergency response actions. Proposed projects that are supported by an existing drought plan are prioritized.

Grant applications will be accepted until March 27 at 4 p.m. Mountain time. For more information, and to apply for grant funding, go to [www.grants.gov/web/grants/view-opportunity.html?opId=312255](http://www.grants.gov/web/grants/view-opportunity.html?opId=312255). □

# Five states began drought plan updates in 2018

**By Theresa Jedd**

NDMC Post-Doctoral Researcher

**and RaeAnna Hartsgrove**

NDMC Graduate Research Assistant

Detecting emerging drought occupies thousands of scientists around the world, but monitoring the physical environment is the easy part, or so says Mark Svoboda, NDMC director and one of the world’s leading experts on drought monitoring. He adds, “The hard part is knowing what you’re going to do about it.”

At least five U.S. states, an unusually high number, began drought

plan updates in 2018. “Last year was especially busy in assisting states with drought planning and hopefully the trend continues during 2019,” said Cody Knutson, the NDMC Drought Planning coordinator. Prompted by economic losses from recent prolonged droughts, combined with federal hazard planning requirements, Colorado, Minnesota, New Mexico, Oklahoma and Utah have all undertaken plan updates.

In the United States, authority for water and drought planning rests with state, tribal and local governments. The number of states with drought plans, or plans for coping with drought included in

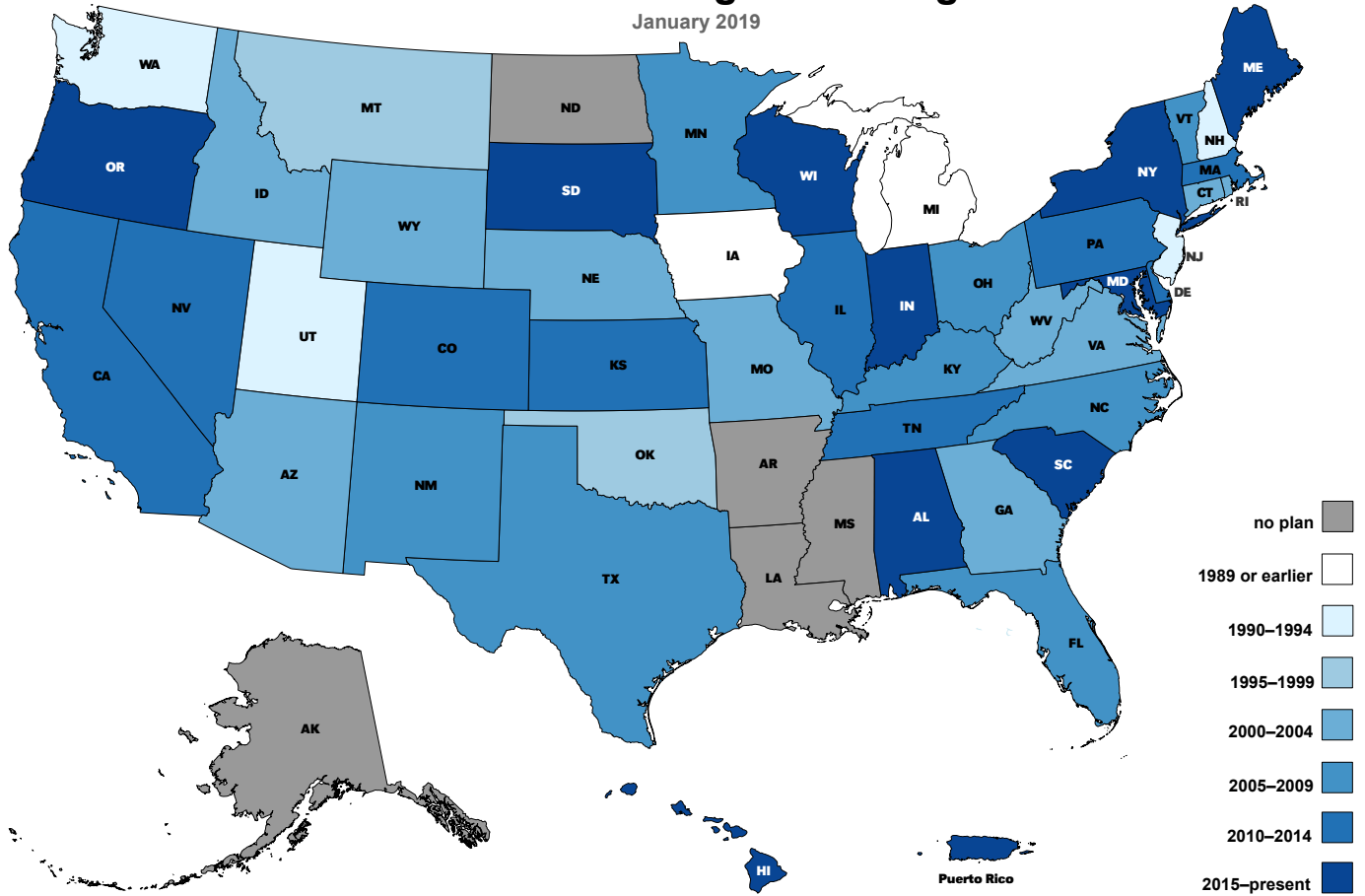
water, climate or hazard plans, has steadily increased since the drought center was established in 1995. But for the 45 states with drought plans in the drought center’s database, 25 plans are more than 10 years old, and may be starting to gather dust.

Ideally, planning documents would keep pace with the changing climate, said Taryn Finessey, senior climate change specialist with the Colorado Water Conservation Board. While seasonal and yearly changes may sometimes go unnoticed, shifts between decades are notable. The drought center also recommends that updates account for changes in water use and vulnerability.

*Continued on page 10*

## Status of Drought Planning

January 2019



**National Drought Mitigation Center**

Out of the 45 officially current state drought plans in the drought center’s database, 25 plans are more than 10 years old.

Planning can significantly reduce losses. Finessey underscored that drought is an ongoing management issue and that drought effects can linger, especially in the agricultural sector. For example, for livestock producers in a semiarid state, “drought doesn’t stop hurting just because we start to get rain or we start to get snow, it continues to hurt because people are losing genetics and it takes decades, if not generations, to rebuild stock, and so we can’t expect to bounce back immediately.”

Although agriculture is often one of the first sectors affected, it is far from being the only one. After joining the Minnesota Department of Natural Resources, Luigi Romolo, Minnesota’s state climatologist, took a close look at his state’s drought plan. He said what he found was unsettling: “I quickly recognized a need to update the plan since there wasn’t a lot of detail at all about the drought hazard in general, what it means for the state, or what the general impacts are.” Though the state is strong in water resources, he said the plan needs more information about how drought affects all sectors of the state’s economy. Though they’re just getting started, Romolo has taken the lead to move forward with a plan update before the next drought disaster strikes.

Mark Shafer, Associate State Climatologist at the Oklahoma Climatological Survey, emphasized the need to keep up with the latest in drought monitoring capacity. New monitoring capacity has been

***“When you only face drought every seven years, there can be a long gap between evaluating the impacts and how we address them, and that’s one of the things we want to achieve in our new plan. We are not waiting seven years to look at the plan. We’re meeting every year or twice a year, whether there’s a drought or not, so that it doesn’t catch us off guard.”***

***– Candice Hasenyager, Utah Division of Water Resources***

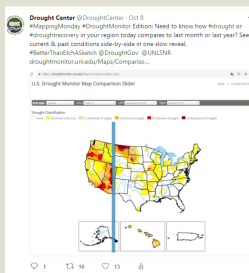
developed since his state’s drought plan was created in 1997. Shafer said, “The U.S. Drought Monitor did not exist at this time and will need to be incorporated into the new plan.” He added that expertise in drought policies or drought management is limited within the state, so he turns to regional and national planning initiatives such as the NOAA Regional Integrated Sciences and Assessments (RISA) program.

In some cases, the urgency of dealing with ongoing droughts can prompt a more rapid update process. In New Mexico, which has had some degree of drought nearly continuously for the past 20 years, the Office of the State Engineer’s Water Use and Conservation Bureau was directed to update the drought plan. “We were told to work on revising the drought plan in late August and we were asked to get it done by the end of the calendar year,” said Molly Magnuson, Water Use and Conservation Bureau Chief.

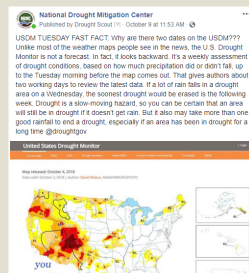
Utah and Colorado are conducting sector-based economic impact assessments for the 2018 droughts. In Utah, a multi-state workshop helped start the process. Candice Hasenyager oversaw the Utah Division of Water Resources’ Drought Response Plan Workshop in July 2018. She said, “When you only face drought every seven years, there can be a long gap between evaluating the impacts and how we address them, and that’s one of the things we want to achieve in our new plan. We are not waiting seven years to look at the plan. We’re meeting every year or twice a year, whether there’s a drought or not, so that it doesn’t catch us off guard.”

The NDMC has expanded its collection of drought planning documents to include water, hazard and climate plans. Visit the NDMC’s collection of state-level drought-related plans: <https://drought.unl.edu/droughtplanning/InfobyState.aspx>. □

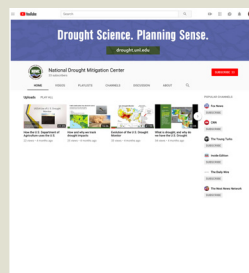
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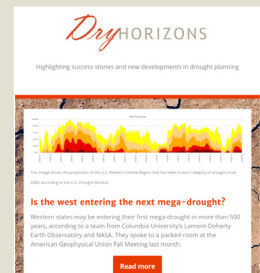
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# New web-based form makes submitting drought observations easier

By Cory Matteson

NDMC Communications Specialist

The National Drought Mitigation Center (NDMC) in January 2019 switched to a streamlined method for reporting local drought conditions, and is working with state agencies and other partners across the country, notably the National Integrated Drought Information System, to promote use of the new form.

"This new form works really well on mobile devices, including photo uploads, which is one of the features that people have been requesting," said Kelly Helm Smith, NDMC drought impact researcher. "It also builds on the condition-monitoring scale developed by CoCoRaHS, which people also really seem to like."

Researchers across the country, including CoCoRaHS (the Community Collaborative Rain Hail and Snow Network), the Carolinas Integrated Sciences Assessment, the Southern Climate Impacts Planning Program, and the drought center, are developing tools for "condition monitoring," focusing on collecting ongoing reports, wet or dry, rather than crisis-driven reports.

"We want people to tell us what they are seeing and experiencing whether it is wet or dry," Smith said. "That way, we can see the difference between wet, normal, and drought conditions, which actually varies from place to place."

In addition to working on appealing ways to get people to submit their drought-related observations, researchers are working with decision-makers such as state drought coordinators to learn what type of condition or impact information would be helpful to collect from observers. The launch of the test form in 2018 coincided with emerging drought in Missouri, so Missouri state climatologist Pat Guinan, extension agents, agencies and ag interest groups all publicized it, resulting in a bumper crop of observations from that state.

Looking back on the experience, Guinan said observations such as one from a city official with a photo, saying the town's reservoir had never before been so low, were particularly helpful. The Missouri Department of Natural

Resources also re-posted all of the photos that observers collected to its website.

Since 2005, the center has offered the Drought Impact Reporter, a first-of-its-kind resource that provides a nationwide database of information from a variety of sources, including media and volunteer observers. Those responses are collected and mapped, offering revealing, information-rich updates on how drought is (or isn't) affecting different regions of the U.S., down to the county. This information sometimes helps U.S. Drought Monitor authors ground-truth physical indicators of drought. The U.S. Drought Monitor is a trigger for federal agricultural relief programs and other decisions.

After testing in 2018, the NDMC replaced its old form for collecting observations from people. The new form, which is available at [droughtreporter.unl.edu/submitreport](http://droughtreporter.unl.edu/submitreport), asks users to rank conditions on a seven-point scale, from severely dry to severely wet. Observers can then provide additional information on how conditions affected an array of local concerns, from crop and livestock production to tourism and fire threats.

Under each category, users can select specific events that have been associated with the drought at the time of their report. Did the local golf course require more irrigation than usual? Was a mandatory water conservation policy implemented? Did farmers see a decrease in the weight of their livestock? With a few clicks, observers can contribute to a detailed look at local conditions.

The form lets observers upload a photo that illustrates drought conditions they are seeing, along with caption information that details what the photo shows. Combined, the form, photo and captions will tell the stories of how drought is affecting the country. A pilot test of the new form in 2018 yielded valuable information, such as this submission from a survey respondent in October 2018:

"We are in Owyhee County in Idaho," the respondent wrote. "No water for crops or cattle, very limited feed and reduced weight on cattle with lower pregnancy rates for cattle. We probably had half of the precipitation of a normal year. Driest year we have had since the drought in the '90s."

*Continued on page 13*



Milda Vaitkus (left), with the Center for Applied Land Management and Information Technology, which is co-located with the drought center at UNL's School of Natural Resources, mapped the observations from 2018. "We had no idea that we'd have such a tremendous response from Missouri," Smith said. "Milda did an amazing job of mapping real-time data that we hadn't seen yet." Claire Shield (right), NDMC climatologist, is the map-maker for 2019.



The photo above and the following text came in via the new form in 2018: “Please enlarge and realize this is a picture of the overflow of the Hamilton reservoir. This was taken June 10, 2018 with no rain since then. The dry land and weed patch should have more than five feet of water covering it. The water level is falling almost 3 inches per week and without installation of an emergency intake, there will be no drinking water available to the City of Hamilton or Caldwell Co. PWSD 2 in 15 weeks.”

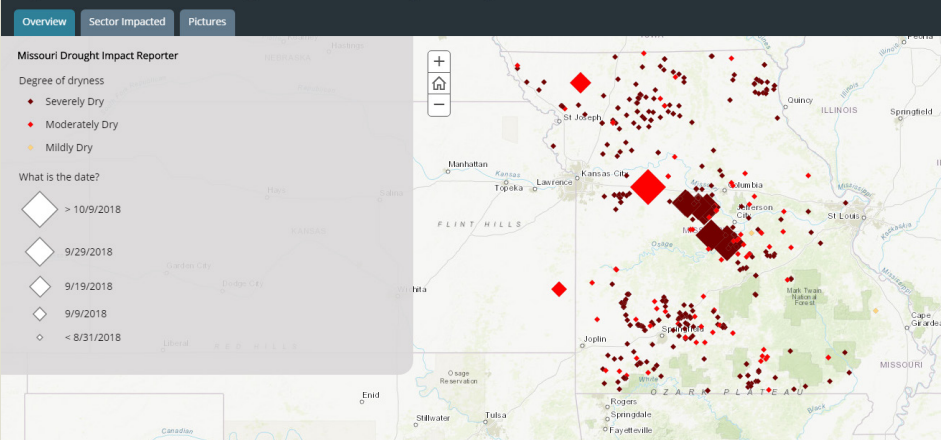
observations about impact sectors and specific impacts within those sectors, and the location of observations that include photos. The mapped archive of observations from 2018 is currently accessible via the DIR Submit a Report page and will continue to be accessible via the DIR.

The Drought Impact Reporter was developed with funding from the National Oceanic and Atmospheric Administration and from the U.S. Department of Agriculture’s Risk Management Agency. The new form for collecting observations is supported by NOAA’s Sectoral Applications Research Program and the National Integrated Drought Information System, and in collaboration with NIDIS Drought Early Warning System regions and with USDA Climate Hubs.

## Guidelines for drought condition-monitoring and impact reporting

- Go to <https://droughtreporter.unl.edu/submitreport> and click on the link to the current survey.
- Report at regular intervals, wet or dry.
- Use the form to pinpoint your location, or to let us know what county you are in, as well as the date of your observation or photo.
- A photo of the same spot submitted once a season or once a month would help build up a consistent set of observations, so that we can contrast drought with normal or wet conditions.
- How dry or wet is it? Pick from seven levels, ranging from severely dry to severely wet.
- What if any impacts of drought are you experiencing? Click on any sectors that are relevant to you to see a list of potential impacts, and check those that apply.
- Upload a photo (optional). By uploading the photo, you agree that it may be used and shared for educational and management purposes.
- Provide any additional description or caption information.
- Provide contact information (optional), which will not appear on the web: Your name, organization and email.

### Experimental Missouri Drought Conditions & Impacts Map



Missouri observers were particularly active in 2018, submitting a total of nearly 1,400 reports. Larger icons represent more recent reports. Color indicates observed dryness category. See archived reports via <https://droughtreporter.unl.edu/submitreport>.

Data from the updated form, created with Survey123 for ArcGIS, is presented on an accompanying map of the U.S., accessible from the DIR Submit a Report page. Users of the 2019 map will be able to filter mapped observations to find specific types of events, such as dry wells or reduced

crop yields. Survey responses will show up immediately on the map. Uploaded photos will be processed and viewable on the map in batches and available soon after they are submitted.

Different tabs on the map show how dry or wet observers said it was at each point, the location of

# FEMA risk assessment process tailored for drought

For the first time, emergency managers and community planners have guidance on how to use the federal Threat and Hazard Identification and Risk Assessment process to prepare for drought. The multi-media Drought THIRA Toolkit is now online and available for free to those with an interest in planning for drought.

Policymakers, planners, natural resource and emergency managers and others interested in the Drought THIRA Toolkit and webinar can view the information at [droughtthira.unl.edu](http://droughtthira.unl.edu).

The Federal Emergency Management Agency recommends that communities go through a THIRA process to understand what hazards might affect them, how they would be affected, and how they can prepare. A team led by Denise Bulling, disaster and behavioral health expert with the University of Nebraska Public Policy Center, worked with emergency managers and planners in the Platte River Basin as a pilot region to customize the THIRA process for the drought hazard. The National Drought Mitigation Center and the High Plains Regional Climate Center, also based at Nebraska, provided detailed data on the extent and effects of drought in the basin.

“The virtual toolkit resulting from this project creates a bridge between emergency management and water resource planning,” Bulling said. “We featured the THIRA planning process because it is a shared, flexible planning process involving participants from all sectors in the community. We think this webinar will be of particular interest to planners responsible for facility or jurisdictional emergency planning anywhere drought is a possibility.”

**Preparing for the Health Effects of Drought: A Workshop for Public Health Professionals and Partners**, Feb. 4, Sacramento and online, Public health practitioners can learn about preparing for drought in a workshop/webinar Feb. 4. The in-person event will be in Sacramento, Calif., 10-4 Pacific time. Local health department staff and



**Drought THIRA Toolkit**

**National Drought Mitigation Center**

The toolkit provides guidance and examples for designing and using a THIRA in any community that experiences drought.

*“We worked with emergency managers and decision-makers to make sure that the information we’re presenting makes sense to them. The scenarios we created helped everyone picture effects of drought they hadn’t thought of before.”*

*– Deborah Bathke, drought center climatologist and education coordinator*

The toolkit provides guidance and examples for designing and using a THIRA in any community that experiences drought.

“We worked with emergency managers and decision-makers to make sure that the information we’re presenting makes sense to them,” said Deborah Bathke, drought

center climatologist and education coordinator, and co-investigator on the project. “The scenarios we created helped everyone picture effects of drought they hadn’t thought of before.”

Funding for the two-year project was through the National Oceanic and Atmospheric Administration’s Sectoral Applications Research Program (SARP). □

## Upcoming events

partners are particularly encouraged to attend in person, to hear tips and lessons learned from California health departments that have responded to severe drought. This workshop is hosted by the California Department of Public Health as part of the California Climate Action Team Public Health Workgroup meeting series. The

morning session will be on the health impacts of drought, and drought projections, with a focus on California. The afternoon session will help people understand and use the new Centers for Disease Control resource guide,

*Continued on page 15*

“Preparing for the Health Effects of Drought: A Resource Guide for Public Health Professionals.”

Register for the workshop: <https://cpaess.ucar.edu/forms/preparing-health-effects-drought-california-2019>

Register for the webinar: <http://bit.ly/2RSrASH>.

**2019 California Rangeland Climate and Drought Workshops**, Feb. 6–7, 12–13, a collection of regional workshops on climate and drought resources to support short- and long-term rangeland drought planning. The workshops are hosted by UC Cooperative Extension in partnership with the National Drought Mitigation Center, the USDA California Climate Hub, and the National Integrated Drought Information System. Topics include a behind-the-scenes look at the U.S. Drought Monitor, weather monitoring and forecast products, overviews of drought programs and assistance and drought early warning systems.

For information and to register for the Feb. 6 conference in Solvang, California: [ceventura.ucanr.edu/live/stock-range-programs/workshops/](http://ceventura.ucanr.edu/live/stock-range-programs/workshops/)

Feb. 7 in Tulare: [cekern.ucanr.edu](http://cekern.ucanr.edu)  
Feb. 12 in Loomis: [ucanr.edu/loomisdroughtworkshop](http://ucanr.edu/loomisdroughtworkshop)

Feb. 13 in Susanville: [ucanr.edu/survey/survey.cfm?surveynumber=26446](http://ucanr.edu/survey/survey.cfm?surveynumber=26446)

**Society for Range Management Annual Meeting**, Feb. 10–14, Minneapolis, Minnesota, featuring three drought-related symposiums among the many presentations and events centered on the study, conservation, management and sustainability of the world’s rangelands.

Register at [annualmeeting.rangelands.org/registration/](http://annualmeeting.rangelands.org/registration/).

**Drought Information Needs of Iowa Specialty Crop Growers**, Feb. 18, Ankeny, Iowa, a research project intended to improve drought early warning information and provide a seasonal drought outlook for specialty crop growers. Participants in the project will receive \$100 for attending the full discussion and are asked to provide feedback on how new drought information could help prepare for drought.

Register by Feb. 11. To register, contact Diana Cochran in the Iowa

State University Department of Horticulture at [dianac@iastate.edu](mailto:dianac@iastate.edu) or 515-294-0035. Questions about the research can be directed to Tonya Haigh with the National Drought Mitigation Center at [thaigh2@unl.edu](mailto:thaigh2@unl.edu) or 402-472-6781.

**Northern Great Plains Drought Planning Workshop**, Feb. 21, Minot, North Dakota, an event to help ranchers prepare for drought. North Dakota State University Extension, in collaboration with the National Drought Mitigation Center, will provide participants with the tools and skills needed to develop a drought plan for their individual ranch. During this one-day workshop, participants will learn about the impacts of drought, tools available for drought planning, how to develop a plan and how to implement a plan. Ranchers Jim Faulstich of Highmore, South Dakota, and Lynn Myers of Lewellen, Nebraska, will share the drought plans for their ranches.

To register and learn more, visit: <https://goo.gl/forms/qsIfVIHx5VtZi5qC3>.

**Drought Information Needs of Missouri Specialty Crop Growers**, Feb. 27, Columbia, Missouri, a research project intended to improve drought early warning information and provide a seasonal drought outlook for specialty crop growers. Participants in the project will receive \$100 for attending the full discussion and are asked to provide feedback on how new drought information could help prepare for drought.

Register by Feb. 27. To register, contact Tim Baker of University of Missouri Extension at [BakerT@missouri.edu](mailto:BakerT@missouri.edu) or 660-663-3232. Questions about the research can be directed to Tonya Haigh with the National Drought Mitigation Center at [thaigh2@unl.edu](mailto:thaigh2@unl.edu) or 402-472-6781.

**Monitoring and Reporting Drought in Arizona**, March 6, Scottsdale, Arizona, a conference held to learn about the U.S. Drought Monitor, drought tools and resources, increasing coverage of ground-measured precipitation data in Arizona and additional opportunities and technologies for drought impact reporting. Experts from the National Drought Mitigation Center, the Arizona Drought Monitoring Technical

Committee, NOAA and the USDA will be at the one-day workshop.

Register and learn more at: [bit.ly/2Fwbrfj](http://bit.ly/2Fwbrfj).

**Drought Information Needs of Wisconsin Specialty Crop Growers**, March 6, Hancock, Wisconsin, a research project intended to improve drought early warning information and provide a seasonal drought outlook for specialty crop growers. Participants in the project will receive \$100 for attending the full discussion and are asked to provide feedback on how new drought information could help prepare for drought.

Register by Feb. 11. To register, contact Ken Schroeder, Portage County University of Wisconsin Extension, at [ken.schroeder@uwex.edu](mailto:ken.schroeder@uwex.edu) or 715-346-1316. Questions about the research can be directed to Tonya Haigh with the National Drought Mitigation Center at [thaigh2@unl.edu](mailto:thaigh2@unl.edu) or 402-472-6781.

**U.S. Drought Monitor Forum**, March 19–21, Bowling Green, Kentucky, a conference held every two years to review inputs and processes contributing to the U.S. Drought Monitor map.

Registration by March 1. If the federal government shutdown continues beyond January 31, the USDM Forum will be postponed. Please don’t book any travel until a decision has been made.

Register and learn more: <https://drought.unl.edu/eventinfo.aspx?id=963>

**Planning for Drought and Cascading Hazards**, April 14, San Francisco, a session at the American Planning Association’s national conference.

Cody Knutson, social scientist and NDMC Drought Planning coordinator, will co-present a session reporting on a drought-related survey of planners, a drought planning summit, and on drought and cascading hazards such as wildfire and mudslides. This is part of an APA-led project funded by the Federal Emergency Management Agency.

Learn more: <https://www.planning.org/events/activity/9165478/>. □