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February 19, 2014

Mr. John Heiser
California Energy Commission
1516 Ninth Street, MS-40
Sacramento, CA 95814-5512
john.heiser@energy.ca.gov

Re: Articles re California Drought and U.S. Drought Monitor (08-AFC-8A)

Dear Mr. Heiser,

Please find attached four articles regarding the California drought and the most recent U.S. Drought Monitor (dated February 11, 2014) in the above-referenced docket. Though we are certain the Commissioners are well aware of the current situation, Sierra Club would like to submit these pieces into the record.

Governor Brown declared a State of Emergency on January 17, 2014, and most of the Central Valley, including Kern County, is now designated as experiencing exceptional drought (D4) conditions. Possible impacts associated with D4 drought classification include exceptional and widespread crop/pasture losses and shortages of water in reservoirs, streams, and wells, leading to water emergencies. Sierra Club asks the Commissioners to consider the substantial water demands of the HECA project for cooling purposes in light of California's struggle with the impacts of one of the state's worst droughts in over 100 years.

These documents have been e-filed with the Commission and served on parties via the Commission's e-filing system. Please let me know if you have any questions. Thank you.

Sincerely,

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The New York Times | http://nyti.ms/1gyHEBk

U.S.

Parched, California Cuts Off Tap to Agencies

By IAN LOVETT JAN. 31, 2014

LOS ANGELES — Responding to one of the worst droughts in California's history, state officials announced on Friday that they would cut off the water to local agencies serving 25 million residents and about 750,000 acres of farmland.

With no end in sight for the dry spell and reservoirs at historic lows, Mark Cowin, director of the California Department of Water Resources, said his agency needed to preserve what little water remained so it could be used "as wisely as possible."

It is the first time in the 54-year history of the State Water Project that water allocations to all of the public water agencies it serves have been cut to zero. That decision will force 29 local agencies to look elsewhere for water. Most have other sources they can draw from, such as groundwater and local reservoirs.

But the drought has already taken a toll on those supplies, and some cities, particularly in the eastern San Francisco Bay Area, rely almost exclusively on the State Water Project, Mr. Cowin said.

"We'll always keep basic human health and safety as highest priority," he said. "We'll try to meet those needs as best we can."

The Metropolitan Water District, which serves much of Southern California, gets about 30 percent of its water from the State Water Project.

Most of the farmers served are in Kern County, at the southern end of the Central Valley. Kern County is a major producer of carrots.

"Our action is intended to keep as much of the remaining water supplies upstream in reservoirs," Mr. Cowin said, "so we have it available for the warm period in the summer and fall."

Last year was the driest on record in California, and January, usually one of the wettest months of year, has brought almost no precipitation.

In January, Gov. Jerry Brown declared a drought emergency for California. And despite some moisture in some parts of the state this week, the news has only gotten worse in the two weeks since his proclamation.

State reservoir levels are lower than they were at this time in 1977, the last time the state endured a drought this severe. The snow pack sits at only 12 percent of normal for this time of year. And 17 rural communities are in danger of running out of water within a few months.

"Today's action is a stark reminder that California's drought is real," Mr. Brown said in a statement. "We're taking every possible step to prepare the state for the continuing dry conditions we face."

Mr. Brown has urged Californians to reduce their water consumption by 20 percent. In addition, a growing list of mandatory restrictions has been put in place.

The California Department of Fish and Wildlife has limited fishing in certain places because of low water levels. Outdoor fires have been restricted because of dry conditions that have prolonged the danger of wildfires in the state far past the usual end of fire season. The Department of Forestry and Fire Protection has hired 125 more firefighters this week.

The announcement about water allotment was made Friday in part to help farmers determine what, if anything, they should plant this year.

Many ranchers, forced to buy hay to feed their cows, have sold off much of their herds, while farmers in a number of Western states have been mulling whether to let their fields lie fallow this year.

"Farmers, fish and people are all going to get less water immediately," Mr. Cowin said. "But we think these actions will help protect our water sources in the long run."

A version of this article appears in print on February 1, 2014, on page A12 of the New York edition

with the headline: Parched, California Cuts Off Tap to Agencies.

The New York Times | http://nyti.ms/1biyNPu

U.S.

Severe Drought Has U.S. West Fearing Worst

By ADAM NAGOURNEY and IAN LOVETT FEB. 1, 2014

LOS ANGELES — The punishing drought that has swept California is now threatening the state's drinking water supply.

With no sign of rain, 17 rural communities providing water to 40,000 people are in danger of running out within 60 to 120 days. State officials said that the number was likely to rise in the months ahead after the State Water Project, the main municipal water distribution system, announced on Friday that it did not have enough water to supplement the dwindling supplies of local agencies that provide water to an additional 25 million people. It is first time the project has turned off its spigot in its 54-year history.

State officials said they were moving to put emergency plans in place. In the worst case, they said drinking water would have to be brought by truck into parched communities and additional wells would have to be drilled to draw on groundwater. The deteriorating situation would likely mean imposing mandatory water conservation measures on homeowners and businesses, who have already been asked to voluntarily reduce their water use by 20 percent.

"Every day this drought goes on we are going to have to tighten the screws on what people are doing" said Gov. Jerry Brown, who was governor during the last major drought here, in 1976-77.

This latest development has underscored the urgency of a drought that has already produced parched fields, starving livestock, and pockets

of smog.

"We are on track for having the worst drought in 500 years," said B. Lynn Ingram, a professor of earth and planetary sciences at the University of California, Berkeley.

Already the drought, technically in its third year, is forcing big shifts in behavior. Farmers in Nevada said they had given up on even planting, while ranchers in Northern California and New Mexico said they were being forced to sell off cattle as fields that should be four feet high with grass are a blanket of brown and stunted stalks.

Fishing and camping in much of California has been outlawed, to protect endangered salmon and guard against fires. Many people said they had already begun to cut back drastically on taking showers, washing their car and watering their lawns.

Rain and snow showers brought relief in parts of the state at the week's end — people emerging from a movie theater in West Hollywood on Thursday evening broke into applause upon seeing rain splattering on the sidewalk — but they were nowhere near enough to make up for record-long dry stretches, officials said.

"I have experienced a really long career in this area, and my worry meter has never been this high," said Tim Quinn, executive director of the Association of California Water Agencies, a statewide coalition. "We are talking historical drought conditions, no supplies of water in many parts of the state. My industry's job is to try to make sure that these kind of things never happen. And they are happening."

Officials are girding for the kind of geographical, cultural and economic battles that have long plagued a part of the country that is defined by a lack of water: between farmers and environmentalists, urban and rural users, and the northern and southern regions of this state.

"We do have a politics of finger-pointing and blame whenever there is a problem," said Mr. Brown. "And we have a problem, so there is going to be a tendency to blame people." President Obama called him last week to check on the drought situation and express his concern.

Tom Vilsack, secretary of the federal Agriculture Department, said in an interview that his agency's ability to help farmers absorb the shock, with subsidies to buy food for cattle, had been undercut by the long deadlock in Congress over extending the farm bill, which finally seemed to be resolved last week.

Mr. Vilsack called the drought in California a "deep concern," and a warning sign of trouble ahead for much of the West.

"That's why it's important for us to take climate change seriously," he said. "If we don't do the research, if we don't have the financial assistance, if we don't have the conservation resources, there's very little we can do to help these farmers."

The crisis is unfolding in ways expected and unexpected. Near Sacramento, the low level of streams has brought out prospectors, sifting for flecks of gold in slow-running waters. To the west, the heavy water demand of growers of medical marijuana — six gallons per plant per day during a 150-day period — is drawing down streams where salmon and other endangered fish species spawn.

"Every pickup truck has a water tank in the back," said Scott Bauer, a coho salmon recovery coordinator with the California Department of Fish and Wildlife. "There is a potential to lose whole runs of fish."

Without rain to scrub the air, pollution in the Los Angeles basin, which has declined over the past decade, has returned to dangerous levels, as evident from the brown-tinged air. Homeowners have been instructed to stop burning wood in their fireplaces.

In the San Joaquin Valley, federal limits for particulate matter were breached for most of December and January. Schools used flags to signal when children should play indoors.

"One of the concerns is that as concentrations get higher, it affects not only the people who are most susceptible, but healthy people as well," said Karen Magliano, assistant chief of the air quality planning division of the state's Air Resources Board.

The impact has been particularly severe on farmers and ranchers. "I

have friends with the ground torn out, all ready to go," said Darrell Pursel, who farms just south of Yerington, Nev. "But what are you going to plant? At this moment, it looks like we're not going to have any water. Unless we get a lot of rain, I know I won't be planting anything."

The University of California Cooperative Extension held a drought survival session last week in Browns Valley, about 60 miles north of Sacramento, drawing hundreds of ranchers in person and online. "We have people coming from six or seven hours away," said Jeffrey James, who ran the session.

Dan Macon, 46, a rancher in Auburn, Calif., said the situation was "as bad as I have ever experienced. Most of our range lands are essentially out of feed."

With each parched sunrise, a sense of alarm is rising amid signs that this is a drought that comes along only every few centuries. Sacramento had gone 52 days without water, and Albuquerque had gone 42 days without rain or snow as of Saturday.

The snowpack in the Sierra Nevada, which supplies much of California with water during the dry season, was at just 12 percent of normal last week, reflecting the lack of rain or snow in December and January.

"When we don't have rainfall in our biggest two months, you really are starting off bad," said Dar Mims, a meteorologist with the Air Resources Board.

Even as officials move into action, people who have lived through droughts before — albeit none as severe as this — said they were doing triage in their gardens (water the oak tree, not the lawn) and taking classic "stop-start-stop-start" shower.

Jacob Battersby, a producer in Oakland, said he began cutting back even before the voluntary restrictions were announced.

"My wife and I both enjoy gardening," he wrote in an email. " 'Sorry, plants. You will be getting none to drink this winter.' "

A version of this article appears in print on February 2, 2014, on page A1 of the New York edition

with the headline: Severe Drought Has U.S. West Fearing Worst.

The New York Times | http://nyti.ms/1exlc3T

U.S.

California Seeing Brown Where Green Used to Be

By JENNIFER MEDINA FEB. 13, 2014

SELMA, Calif. — Fields that in any other year would be filled with broccoli, melons and onions are instead dusty patches of dirt. Farmers are calculating losses that add up with each arid day. Thousands of farm workers who rely on paychecks for tending the fields are expected to go unemployed this year.

"It's as worse as I've ever seen it, I'll tell you that right now," said Bill Chandler, who runs a nearly 500-acre farm, growing raisin grapes, peaches and almonds.

For more than a century, Mr. Chandler's family has watered crops from a canal near his ranch, which holds rainwater and runoff from the nearby Sierra mountain range. Last summer — and the summer before that — it was dry. This year, Mr. Chandler does not even expect to see a trickle of water through the cracked dirt. "People would like to think a few storms will solve our problems, but that's not even going to get us close," he said.

With California facing its worst drought in modern history, President Obama will visit Fresno on Friday with the state's two senators, Dianne Feinstein and Barbara Boxer, who are promoting legislation that would offer $300 million in aid. The bill would also simplify the process of buying water from other areas and allow changes to try to divert more water from the Sacramento-San Joaquin River Delta to farmers.

But with Republicans in the House pushing instead for an overhaul of environmental protections of the delta, there are few immediate solutions in sight for the Central Valley, a massive stretch of land in the middle of the state that provides nearly half of the nation's produce. State officials have already said that they will not be able to offer any water to the farmers through California's vast network of canals. And federal officials are expected to announce that their web of reservoirs will not provide any water this year either, leaving thousands of farmers to rely exclusively on private wells.

"This is a real idling of land, and there is nothing positive about it," said Daniel A. Sumner, an agriculture economist and the director of the Agricultural Issues Center at the University of California, Davis. "It's not fallowing — that implies a choice. This is not like North Dakota, where we know it's going to get better. We're talking either spending huge sums on bringing water in or thousands of acres lost."

It is still too early to know whether the drought will create widespread food shortages or price increases, as farmers are still deciding what they will plant this spring. But by any measure, the outlook is grim.

Less than a month ago, Mr. Sumner and other experts estimated that 300,000 acres of rich farmland in the region would go unplanted. Now, he has nearly doubled that estimate.

"I haven't learned anything yet that tells me it is less severe than we might have hoped," he said.

The drought could translate into an $11 billion loss in annual state revenue from agriculture, according to the California Farm Water Coalition, an industry advocacy group. And in the Central Valley, where

farming and food processing provide nearly 40 percent of all jobs, the most acute pain is most likely to be felt among low-level employees, who scrape by with seasonal work.

The immense flatland west of the Sierra Nevada is maintained through extraordinary engineering efforts that send billions of gallons of water from the north to irrigate some three million acres of farmland. Here, farmers are insistent that jobs are tied directly to water, and they routinely protest environmental restrictions that limit their supply from the Sacramento delta. Signs like “Food grows where water flows” and “No water = no jobs,” dot the highways. These days, electric billboards usually reserved for traffic information flash this message: “Serious drought. Help save water.”

In previous droughts, unemployment in some towns climbed as high as 45 percent, a number many expect to see this year, according to the Westlands Water District, the largest federally controlled provider in the state.

“Even if we’re able to make it work, which is really still a question, there are going to be many people who really suffer tremendously and simply cannot put food on their tables,” said Sarah Clark Woolf, who helps run her family’s farming operation, Clark Brothers, in Five Points, southwest of Fresno. The farm is keeping about half of its 1,200 acres empty this year, which means fewer temporary workers and a smaller profit margin.

Switching crops would have little impact, farmers say, because anything they plant would need water. Many farmers have traded vegetable row crops for trees growing almonds and pistachios, which are more profitable but require water year-round.

Like many farms here, Clark Brothers abandoned traditional flooding several years ago in favor of drip irrigation, which delivers a smaller and more concentrated amount of water to the crops. This year, Ms. Woolf’s farm will be forced to rely entirely on the ground wells it owns, pumping what they need to keep the existing crops healthy. But there is no way to

know how much water is available underground — and with neighboring farmers doing the same, it is only a matter of time before the wells run dry.

"It's like a bank account that is going to run out, and you don't know when," Ms. Woolf said, standing near her fields of garlic, where workers were laying rubber irrigation tubes under the murky cloudless skies. "With no rain, we're not recharging what we're taking. Nobody wants to do it this way, but you make the decision where to plant just based on where you can get the water to for as long as it lasts."

Digging a new well can cost hundreds of thousands of dollars, and these days, even finding someone to do it can be impossible. With so many so constituencies desperate for water, companies that dig wells have yearlong waiting lists. And in some places, the water quality has already deteriorated so drastically that irrigating with well water would only hurt the crops.

When thousands of farmers gathered at the World Ag Expo in nearby Tulare this week, booths selling sophisticated products meant to measure every drop of water were crowded with would-be buyers. High-tech systems that once might have been dismissed as too costly were being examined by even some of the smallest operations.

"We have trees coming in that we already paid for, and we don't know how to water them," said Cameron Kaplan, who manages his grandfather's citrus trees in Visalia, Calif. "I'm looking for anything I can find."

But the most ubiquitous proposed solution was far simpler, emblazoned on T-shirts and used as a greeting: "Pray for rain."

Correction: February 17, 2014

An earlier version of a picture caption with this article referred incorrectly to farms in the area. They are unplanted, not abandoned.

A version of this article appears in print on February 14, 2014, on page A14 of the New York edition with the headline: California Seeing Brown Where Green Used to Be.

California drought: Past dry periods have lasted more than 200 years, scientists say

By Paul Rogers progers@mercurynews.com San Jose Mercury News
Posted:

MercuryNews.com

California's current drought is being billed as the driest period in the state's recorded rainfall history. But scientists who study the West's long-term climate patterns say the state has been parched for much longer stretches before that 163-year historical period began.

And they worry that the "megadroughts" typical of California's earlier history could come again.

Through studies of tree rings, sediment and other natural evidence, researchers have documented multiple droughts in California that lasted 10 or 20 years in a row during the past 1,000 years -- compared to the mere three-year duration of the current dry spell. The two most severe megadroughts make the Dust Bowl of the 1930s look tame: a 240-year-long drought that started in 850 and, 50 years after the conclusion of that one, another that stretched at least 180 years.

"We continue to run California as if the longest drought we are ever going to encounter is about seven years," said Scott Stine, a professor of geography and environmental studies at Cal State East Bay. "We're living in a dream world."

California in 2013 received less rain than in any year since it became a state in 1850. And at least one Bay Area scientist says that based on tree ring data, the current rainfall season is on pace to be the driest since 1580 -- more than 150 years before George Washington was born. The question is: How much longer will it last?

A megadrought today would have catastrophic effects.

California, the nation's most populous state with 38 million residents, has built a massive economy, Silicon Valley, Hollywood and millions of acres of farmland, all in a semiarid area. The state's dams, canals and reservoirs have never been tested by the kind of prolonged drought that experts say will almost certainly occur again.

Stine, who has spent decades studying tree stumps in Mono Lake, Tenaya Lake, the Walker River and other parts of the Sierra Nevada, said that the past century has been among the wettest of the last 7,000 years.

Looking back, the long-term record also shows some staggeringly wet periods. The decades between the two medieval megadroughts, for example, delivered years of above-normal rainfall -- the kind that would cause devastating floods today.

The longest droughts of the 20th century, what Californians think of as severe, occurred from 1987 to 1992 and from 1928 to 1934. Both, Stine said, are minor compared to the ancient droughts of 850 to 1090 and 1140 to 1320.

Modern megadrought

What would happen if the current drought continued for another 10 years or more?

Without question, longtime water experts say, farmers would bear the brunt. Cities would suffer but adapt.

The reason: Although many Californians think that population growth is the main driver of water demand statewide, it actually is agriculture. In an average year, farmers use 80 percent of the water consumed by people and businesses -- 34 million of 43 million acre-feet diverted from rivers, lakes and groundwater, according to the state Department of Water Resources.

"Cities would be inconvenienced greatly and suffer some. Smaller cities would get it worse, but farmers would take the biggest hit," said Maurice Roos, the department's chief hydrologist. "Cities can always afford to spend a lot of money to buy what water is left."

Roos, who has worked at the department since 1957, said the prospect of megadroughts is another reason to build more storage -- both underground and in reservoirs -- to catch rain in wet years.

In a megadrought, there would be much less water in the Delta to pump. Farmers' allotments would shrink to nothing. Large reservoirs like Shasta, Oroville and San Luis would eventually go dry after five or more years of little or no rain.

Farmers would fallow millions of acres, letting row crops die first. They'd pump massive amounts of groundwater to keep orchards alive, but eventually those wells would go dry. And although deeper wells could be dug, the costs could exceed the value of their crops. Banks would refuse to loan the farmers money.

The federal government would almost certainly provide billions of dollars in emergency aid to farm communities.

"Some small towns in the Central Valley would really suffer. They would basically go away," said Jay Lund, a professor of civil and environmental engineering at UC Davis.

"But agriculture is only 3 percent of California's economy today," Lund said. "In the main urban economy, most people would learn to live with less water. It would be expensive and inconvenient, but we'd do it."

Farmers with senior water rights would make a huge profit, he noted, selling water at sky-high prices to cities. Food costs would rise, but there wouldn't be shortages, Lund said, because Californians already buy lots of food from other states and countries and would buy even more from them.

Fallback plans

In urban areas, most cities would eventually see water rationing at 50 percent of current levels. Golf courses would shut down. Cities would pass laws banning watering or installing lawns, which use half of most homes' water. Across the state, rivers and streams would dry up, wiping out salmon runs. Cities would race to build new water supply projects, similar to the $50 million wastewater recycling plant that the Santa Clara Valley Water District is now constructing in Alviso.

If a drought lasted decades, the state could always build dozens of desalination plants, which would cost billions of dollars, said law professor Barton "Buzz" Thompson, co-director of Stanford University's Woods

Institute for the Environment.

Saudi Arabia, Israel and other Middle Eastern countries depend on desalination, but water from desal plants costs roughly five times more than urban Californians pay for water now. Thompson said that makes desal projects unfeasible for most of the state now, especially when other options like recycled wastewater and conservation can provide more water at a much lower cost.

But in an emergency, price becomes no object.

"In theory, cities cannot run out of water," Thompson said. "All we can do is run out of cheap water, or not have as much water as we need when we really want it."

Over the past 10 years, he noted, Australia has been coping with a severe drought. Urban residents there cut their water demand massively, built new supply projects and survived.

"I don't think we'll ever get to a point here where you turn on the tap and air comes out," he said.

Megadrought now

Some scientists believe we are already in a megadrought, although that view is not universally accepted.

Bill Patzert, a research scientist and oceanographer at NASA's Jet Propulsion Laboratory in Pasadena, says that the West is in a 20-year drought that began in 2000. He cites the fact that a phenomenon known as a "negative Pacific decadal oscillation" is underway -- and that historically has been linked to extreme high-pressure ridges that block storms.

Such events, which cause pools of warm water in the North Pacific Ocean and cool water along the California coast, are not the result of global warming, Patzert said. But climate change caused by the burning of fossil fuels has been linked to longer heat waves. That wild card wasn't around years ago.

"Long before the Industrial Revolution, we were vulnerable to long extended periods of drought. And now we have another experiment with all this CO2 in the atmosphere where there are potentially even more wild swings in there," said Graham Kent, a University of Nevada geophysicist who has studied submerged ancient trees in Fallen Leaf Lake near Lake Tahoe.

Already, the 2013-14 rainfall season is shaping up to be the driest in 434 years, based on tree ring data, according to Lynn Ingram, a paleoclimatologist at UC Berkeley.

"It's important to be aware of what the climate is capable of," she said, "so that we can prepare for it."

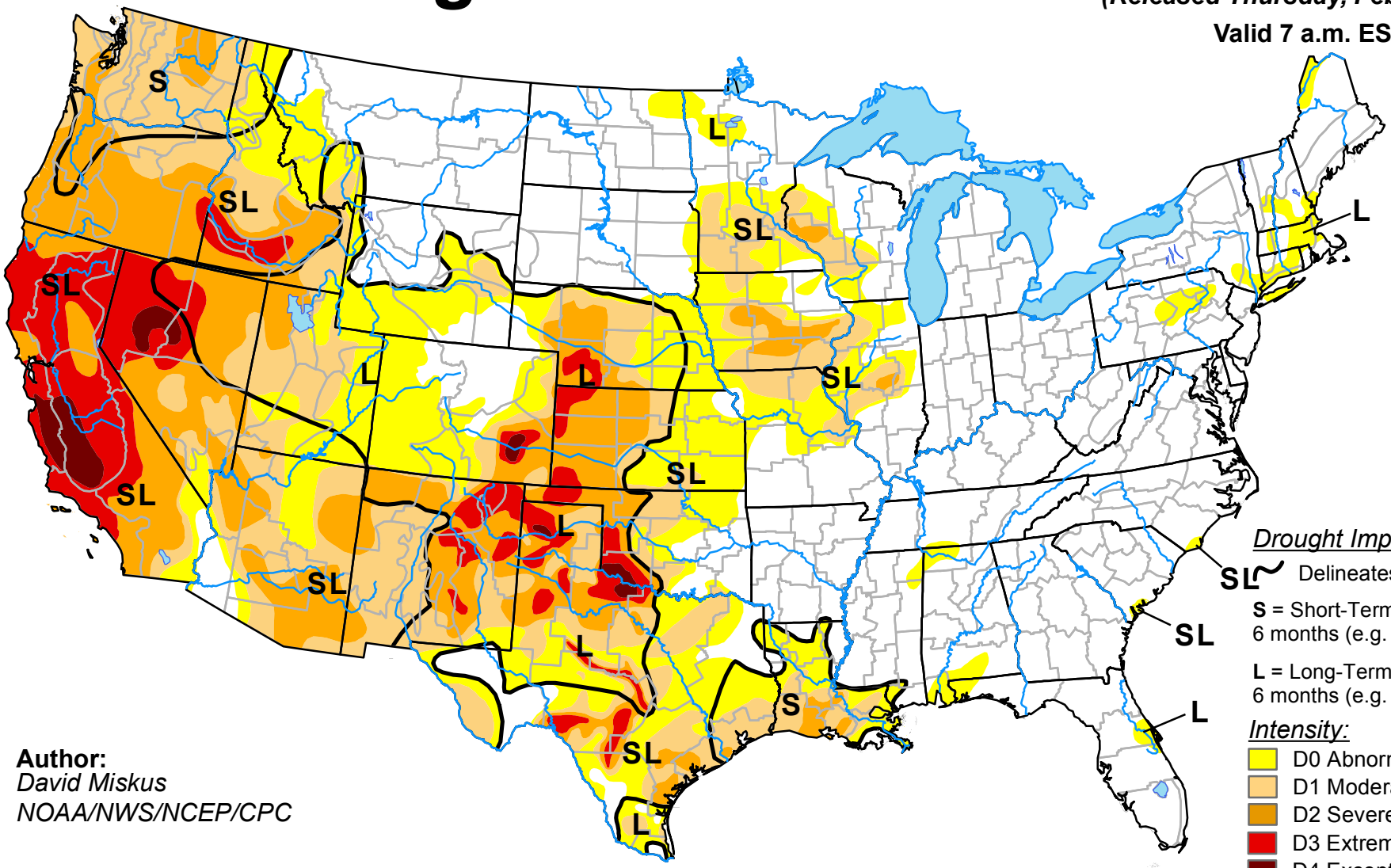
Paul Rogers covers resources and environmental issues. Contact him at 408-920-5045. Follow him at Twitter.com/PaulRogersSJMN.

U.S. Drought Monitor

February 11, 2014

(Released Thursday, Feb. 13, 2014)

Valid 7 a.m. EST



Author:
David Miskus
NOAA/NWS/NCEP/CPC

Drought Impact Types:

SL Delineates dominant impacts

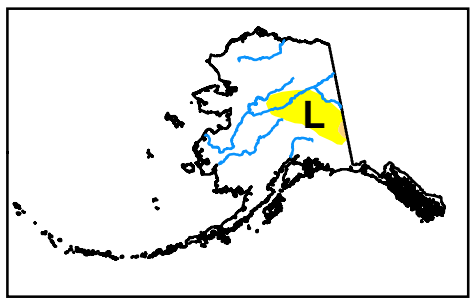
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

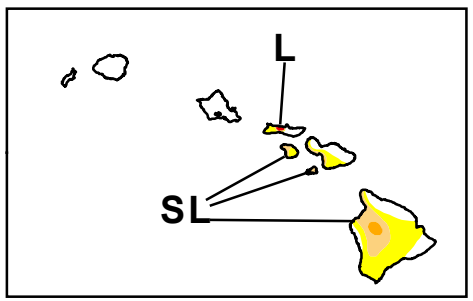
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

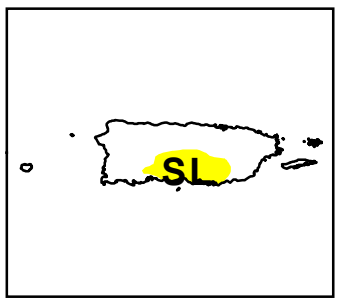
Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.





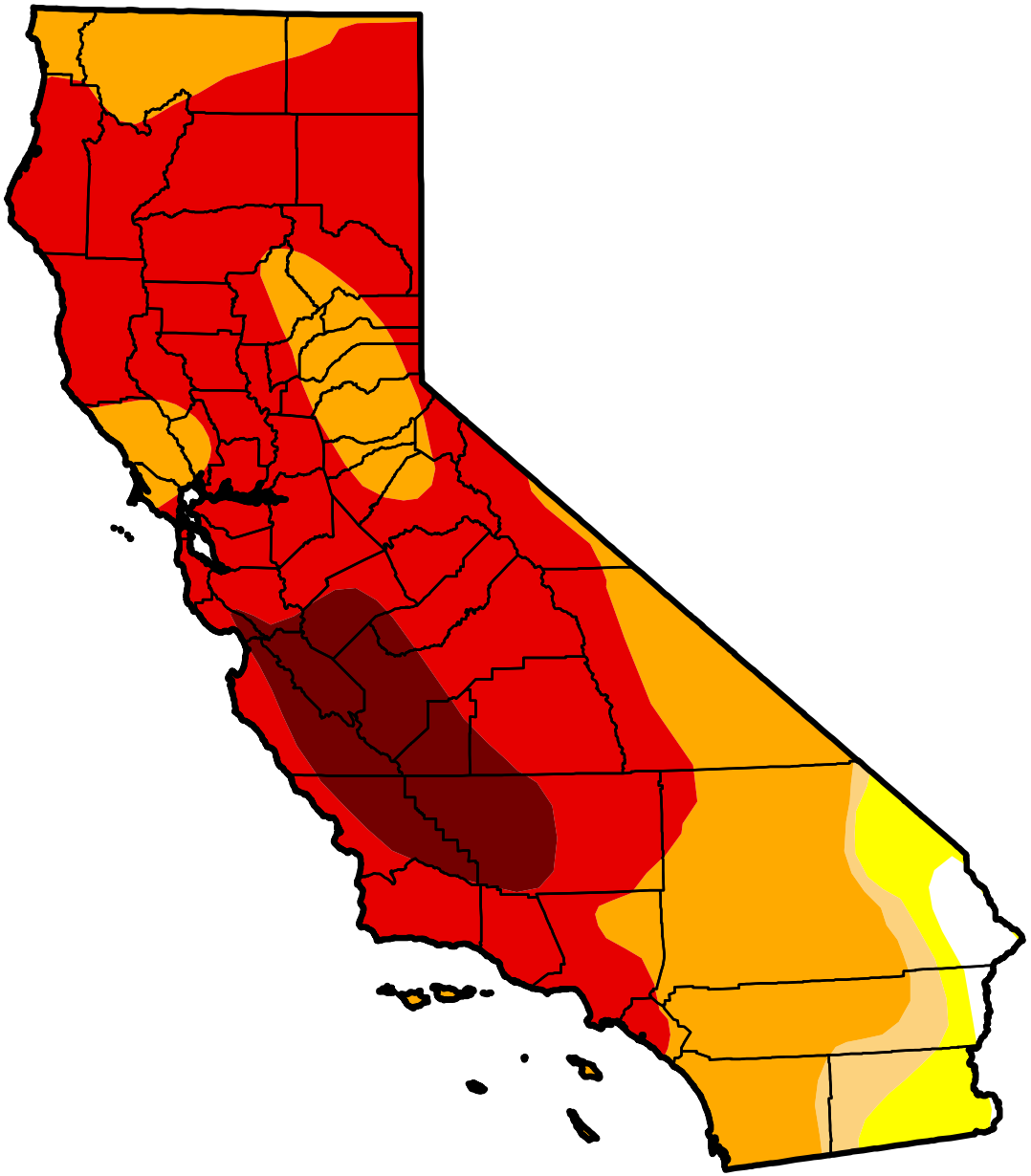


USDA National Drought Mitigation Center

http://droughtmonitor.unl.edu/

U.S. Drought Monitor

California



February 11, 2014

(Released Thursday, Feb. 13, 2014)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	1.43	98.57	94.54	91.59	60.94	9.81
Last Week *2/4/2014*	1.43	98.57	94.18	89.91	67.13	9.81
3 Months Ago *11/12/2013*	2.61	97.39	96.00	84.12	11.36	0.00
Start of Calendar Year *12/31/2013*	2.61	97.39	94.25	87.53	27.59	0.00
Start of Water Year *10/1/2013*	2.63	97.37	95.95	84.12	11.36	0.00
One Year Ago *2/12/2013*	34.53	65.47	47.18	23.72	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Miskus
NOAA/NWS/NCEP/CPC

http://droughtmonitor.unl.edu/

U.S. Drought Monitor Classification Scheme

Update: The U.S Drought Monitor Website has undergone a webpage re-organization to make the site easier to navigate. **This page** will provide updated URLs to update any pages you may have bookmarked. If you have questions about the new website, please visit our **New Website FAQ**.

Update: The FSA Eligibility Tool website has moved. The new location is **http://droughtmonitor.unl.edu/fsa/**

What You See

D0-D4: The Drought Monitor summary map identifies general drought areas, labelling droughts by intensity, with D1 being the least intense and D4 being the most intense. D0, drought watch areas, are either drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels.

S and L: Since "drought" means a moisture deficit bad enough to have social, environmental or economic effects, we generally include a description of what the primary physical effects are:

> *S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)*
> *L = Long-Term, typically more than 6 months (e.g. hydrology, ecology)*

The Thinking Behind the Map

Drought intensity categories are based on five key indicators, numerous supplementary indicators including drought impacts, and local reports from more than 350 expert observers around the country. The accompanying drought severity classification table shows the ranges for each indicator for each dryness level. Because the ranges of the various indicators often don't coincide, the final drought category tends to be based on what the majority of the indicators show and on local observations. The analysts producing the map also weigh the indices according to how well they perform in various parts of the country and at different times of the year. Additional indicators are often needed in the West, where winter snowfall in the mountains has a strong bearing on water supplies. It is this combination of the best available data, local observations and experts' best judgment that makes the U.S. Drought Monitor more versatile than other drought indicators.

Drought Severity Classification

			Ranges				
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Short-term drought indicator blends focus on 1-3 month precipitation. Long-term blends focus on 6-60 months. Additional indices used, mainly during the growing season, include the USDA/NASS Topsoil Moisture, Keetch-Byram Drought Index (KBDI), and NOAA/NESDIS satellite Vegetation Health Indices. Indices used primarily during the snow season and in the West include snow water content, river basin precipitation, and the Surface Water Supply Index (SWSI). Other indicators include groundwater levels, reservoir storage, and pasture/range conditions.

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