

# Is California headed to 'megadrought'?

*Even after a three-year dry spell, the West could face decades more without enough water*

**Deborah Sullivan Brennan, San Diego Union Tribune, 10-10-14**

For three years now, Californians have fixed leaks, ripped out lawns and shortened showers, adjusting to what officials call the most severe drought in memory.

Imagine what changes might come next if the drought continues for the rest of our lifetime.

Megadroughts — dry periods that last decades or even centuries — are very much a reality in the Golden State. They have occurred several times during the past millennium, and researchers said there's a high chance that California is about to enter another super-long dry spell. Some climate experts actually believe the state is already in the realm of a megadrought.

Extended drought could lead to new ordinances that force residents and businesses to sharply curtail their water consumption — while paying more money for the water that's available. It could mean the end of lawns and widespread use of new technologies for saving water. It could reshape California's farms and forests.

During the past three years, California has endured not only meager precipitation and small snowpacks, but also high temperatures in regions like San Diego County. In fact, the state has experienced low rainfall most of the time since 1999.

Reservoirs are currently about a third of capacity — roughly half their normal level.

“Right now, we're looking at the worst drought we've seen in modern records,” said Alexander Tardy, a meteorologist with the National Weather Service in San Diego.

Scientists warn the worst may still be to come, based on past cycles of megadrought that they've pieced together by analyzing tree rings, paleological records, computer modeling and other evidence.

In a study published this month, Cornell University researcher Toby Ault and some of his colleagues calculated the risk of a megadrought happening this century. Ault is a professor in the Department of Earth and Atmospheric Sciences at Cornell University.

He and the other researchers concluded that natural circumstances and climate change combine to put the likelihood of a decade-long drought in the Southwest at 50 percent to 80 percent. And they estimate that the chance of a megadrought, which they define as a 35-year dry period, is 10 percent to 50 percent by the end of this century.

There's a small, but real chance that drought could last half a century or longer, said Ault, a professor in the Department of Earth and Atmospheric Sciences at Cornell University.

In 2010, a report by the UC Davis Center for Watershed Sciences found that a seven-decade drought would be ecologically and financially devastating to certain parts of California — but that the state as a whole could survive if regulators relied on water trading and reallocation in smart ways.

“As an adaptable and clever species, we can manage the risks of megadroughts,” Ault said.

### **Capturing water**

If the current drought extends for years, San Diegans would need to change habits and expectations about water. While no one predicts that drinking water would dry up, other uses — from backyard irrigation to agriculture — could be altered significantly.

“If we get to the point where we’re rationing, everything needs a hard look. That means lawns in Rancho Santa Fe and La Jolla, and almonds in the Central Valley,” said Bill Patzert, a climate scientist at NASA’s Jet Propulsion Laboratory in Pasadena.

In Frank Herbert’s series “Dune,” inhabitants of the desert planet Arrakis collect water in windtraps and wear stillsuits that recycle moisture from their breath and body waste. Are Californians headed in that direction?

Not exactly, experts said, but capturing practically all usable water will be crucial to surviving the ongoing drought and future ones.

“What’s going to be important is that we’re consistent and tireless in our efforts ... to conserve water, to recycle water and to treat water as the precious resource that it is,” said Emily Young, senior director of environment for the San Diego Foundation.

The county’s residents used 20 percent less water in fiscal 2014 than they did in fiscal 2007, and lowered their water use in August by 6 percent compared with the same month last year. These savings came despite a hot, dry summer.

But if the drought continues, San Diegans would have to move quickly from the current per capita consumption level of 161 gallons per day to about half of that, said architect Robert Thiele, vice president of the San Diego Green Building Council.

“That’s going to affect everybody’s life,” he said. Then he added: “It’s not going to put them in jeopardy.”

Some water experts said it would take vast public-works investments — and not just residents’ individual conservation efforts — to achieve such a major reduction.

“I am not a proponent of the idea that we can conserve our way out of those policy problems,” said John Minan, a law professor at the University of San Diego and a former chairman of the California Regional Water Quality Control Board. “Clearly, additional conservation is necessary. But you reach a point where conservation simply doesn’t produce additional water resources. So the struggle and challenge will be to find additional water resources.”

### **Future waterworks**

Some of the infrastructure projects are in the works.

For example, the city of San Diego plans to build a water purification plant that will treat wastewater to the quality of distilled water. Public Works officials envision it producing 83 million gallons of drinking water per day by 2035.

In Carlsbad, a desalination plant is slated to open next year. That facility is expected to generate about 7 percent of the county's drinking water by filtering 100 million gallons from the ocean each day.

"If we were to continue more than five years (with drought), you would see desalination plants going up" elsewhere for the region, said Tardy at the National Weather Service. "There's going to have to be more (water) infrastructure, storage and transportation."

On-site water recycling, now an experimental process, could become a standard plumbing feature of large facilities and campuses, Thiele said. Catching and cleaning storm water is another possibility. Other technologies could even capture water from the air, Thiele said.

UC San Diego has discussed the possibility of on-site water reuse, and it already wrings more than 15,000 gallons per day from air-conditioning systems on humid days, said John Dilliot, associate director of energy and utilities for the university.

"If we can start to think of our water system as a closed loop or natural system, we reuse water again and again," Thiele said.

One such example is the "Living Machine," a treatment system that enables staff at Marine Corps Recruit Depot in San Diego to recycle sewage in the central courtyard.

The system, which looks like a planter blooming with hibiscus and wetland plants, filters sewage from the boot camp's barracks into a series of gravel-filled chambers infused with purification microbes.

"It treats up to 10,000 gallons per day of mined sewer water," said Lt. Cmdr. Raymond Fletcher.

After additional steps involving ultraviolet light and chlorination, the treated water is pumped underground to maintain the bright green lawn on which Marine recruits pose during graduation ceremonies.

The depot has cut its water use by about 40 percent since 2007, and it considers the "Living Machine" a pilot project that's part of the Marine Corps' efforts to improve environmental sustainability across its operations in the United States and abroad.

"Across the (Department of Defense), you're going to see more of this kind of system of water capture and reuse," Marine Lt. Col. Mike Rohlfs said.

## **Orchards and orchids**

In a state famous for citrus orchards, suburban lawns and striking scenery, extended shortages of water would alter the panorama of farms, homes and wildlands.

During the Pleistocene period — from about 2.6 million to 11,700 years ago — California's landscape shifted with swings of climate, said Jon Rebman, curator of botany for the San Diego Natural History Museum.

Water-loving plants expanded during wet spells and contracted into pockets during droughts, replaced by desert-dwelling species. That ebb and flow of vegetation helped generate the diverse flora we see today.

In the event of a long-lasting modern drought that includes San Diego, "what you would see are things like trees and shrubs moving up higher and higher in elevations, and dying down below," Rebman said.

“Only things that are more desert- or arid-adapted would be moving in behind them.”

Junipers in Anza-Borrego are already dying off, he said. Sycamores and willows that grow in urban canyons also would become scarcer, as San Diegans turn off the tap on runoff water — a crucial source of life for such vegetation. Plants found only at the top of mountains, including certain orchids and high-elevation wetland plants, could perish.

In neighborhoods, lush lawns could become a relic of the past, many water experts said. Incentive programs to help homeowners remove turf are a voluntary option today, but they could become mandatory in the future.

If not outlawed entirely, lawns could become victim to stringent water rationing and steep price hikes for water.

“If you have to decide whether to use water for hygiene and drinking versus watering your lawn, that’s a pretty obvious choice,” said Lynn Ingram, a professor of earth and planetary science at UC Berkeley who has examined historical climate patterns in California and the West.

Richard Carson, a professor of economics at UC San Diego, said price increases are the most effective way to compel people to slash water use. But allowing those who can afford it to maintain verdant landscaping at premium prices could help subsidize conservation, he added.

“Those are exactly the people economists say you need, because you need that money to reduce the prices for people who conserve lots of water,” Carson said.

Farms are another hot topic, because they use more than three-quarters of the state’s water supply. They hold some of the oldest and most deeply entrenched water rights, yet they’re still subject to state authority concerning drought-induced water conservation.

“The California Constitution contains a reasonable use clause, and there’s a lot of power within that clause,” said Minan, the USD law professor. “The problem is that the politicians would prefer not wrestle with agriculture.”

Under that clause, he said, regulators could limit the kinds of crops farmers grow, restricting high-water products such as rice, alfalfa and cotton. They could eliminate water subsidies, which allow growers to irrigate at reduced rates.

During a prolonged drought, growers could be encouraged or even compelled to sell some of their water rights to urban users.

“Water purchase agreements happened in the Old West, but they’re also happening right now in the new frontier of San Diego,” Thiele said.

Amid the uncertainties and calls for changes, water managers said they’re taking steps in the right direction.

“California is already on the pathway for long-term climate change adaptation, and managing for drought is really in the same vein,” said Jeanine Jones, deputy drought manager for the state Department of Water Resources.

Ault, the Cornell University co-author of the new drought study, said drought is a potent force that shapes

the West.

“I think of megadrought as yet another natural hazard, like earthquakes or floods,” he said. “It’s just a natural disaster in slow motion, but that doesn’t mean we can’t cope with that type of hazard.”