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Press Clippings

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Vox

California's deadly floods won't break the megadrought

Atmospheric rivers are dumping rain on California. That's not a good thing.

By Neel Dhanesha | @neel_dhan | neel.dhanesha@vox.com | Jan 6, 2023, 11:40am EST

A pedestrian crosses the street in San Francisco, California, on January 4, 2023. A series of atmospheric rivers has hit the state in the last two weeks, bringing torrential rain, winds, and flooding. | Liu Guanguan/China News Service/VCG via Getty Images

Neel Dhanesha is a reporter covering science and climate change at Vox. Prior to Vox, Neel was an editorial fellow at Audubon magazine and an assistant producer at Radiolab.

A "river" **more than 100 miles wide** is gushing through the air high above California, bringing with it heavy rain, winds, and snow. It's the third in a **series** of weather systems known as **atmospheric rivers** — long, heavy columns of water vapor in the sky — to hit the state in the last two weeks.

It's already proven deadly: Two people have died as a result of the storms, including a toddler; roads have flooded or been hit by mudslides, forcing evacuations; and more than 180,000 Californians lost power. On Wednesday, California Gov. Gavin Newsom declared a state of emergency ahead of the storm's arrival, and the city of San Francisco **ran out of sandbags** for the second day in a row as residents rushed to protect their homes from the possibility of flooding.

Once the storm passes, there will be little respite: Another atmospheric river is forecast to hit the state this coming weekend and next week, bringing **even more flooding**.

California is looking drenched at the moment, but for the past two decades, it's been suffering through a **megadrought** of the kind that hasn't been seen in more than 1,000 years. The drought threatens the region's agricultural industry and ordinary citizens alike, putting livelihoods at risk and raising concerns about what the future of life in the West might look like.

Which might, understandably, raise a simple question: Can all this rain, despite the suffering it brings, help alleviate the drought?

The simple answer: Unfortunately not. A flood during a time of drought is a double disaster.

Reason 1: Too much water all at once

As we wrote last August, **droughts and floods are something of a vicious cycle**. It takes time for water to soak into soil, and having multiple storms hit in quick succession is something like overwatering a potted plant: The soil simply can't take any more water. Eventually the rain turns into floods, which further erode the soil and bring the risk of downed trees, which can take out power lines and damage buildings; a 2-year-old child was killed this week when a redwood fell on a mobile home in Sonoma County.

"We are in the middle of a flood emergency and also in the middle of a drought emergency," **said** California Department of Water Resources (DWR) Director Karla Nemeth in a media briefing on Wednesday. "This is an extreme weather event and we're moving from extreme drought to extreme flood. What that means is a lot of our trees are stressed, after three years of intensive drought, the ground is saturated and there is significant chance of downed trees that will create significant problems."

In non-drought conditions, tree roots act a bit like sponges, soaking up water from the soil. But droughts make tree roots less sponge-like, which means they can't soak up as much water right away. That also makes the roots weaker and the trees more susceptible to falling during extreme flooding.

If the rain had been spaced out over a series of months, it might have helped with the drought by filling reservoirs over time, said **Noah Diffenbaugh**, a climate scientist at Stanford University's Water in the West program. The soil would also be less saturated, allowing for more water to soak in more slowly, replenishing groundwater wells and reducing the chance of flooding.

Instead of collecting in reservoirs or soaking into the ground, the water has nowhere productive to go. So it floods.

Reason 2: Too little water altogether

Expecting these extreme rain events to alleviate the drought is a bit like racking up thousands of dollars in debt over the course of months and only receiving one or two paychecks at the end of the year.

"Most people wouldn't say the problem's been solved because of one normal monthly paycheck," Diffenbaugh said. "A normal year of rainfall would not break the drought. In fact, even one wet year wouldn't necessarily break the drought."

California's "megadrought" designation is a recognition that the state has been through a series of drought years with relatively few wet seasons.

Breaking the drought **would require multiple years** of above-average rain and snowfall.

As things stand, the atmospheric rivers hitting the state have filled smaller reservoirs to capacity, while **major reservoirs still sit mostly empty**.

The smaller reservoirs filling to capacity isn't exactly good news: Those reservoirs are used for flood control as well as storage, which means the risk of flooding increases since there's nowhere else for the water to go. The water can't be diverted to the large reservoirs, either, since the system that's used to move water around the state isn't designed for quick, heavy events like these atmospheric rivers, and building out a system that can do so will take massive investments of time and money.

Reason 3: Climate change is making snowpack melt earlier

The reservoirs are also only part of the water puzzle in California. Just as important is snowpack, or the accumulated snow on mountains, which acts like a natural water-storage system and provides about 30 percent of the state's water.

The atmospheric rivers are bringing snow to the Sierra Nevada mountains, but the snow line is **moving higher and higher** as climate change intensifies, meaning there's less snow overall, and the snow doesn't last as long as it used to.

A snow survey conducted by the DWR earlier in the week showed the storms that hit California in December **brought a significant amount of snow with them**, but the question is whether that snow will last through the year. A 2022 January snow survey came back with the seventh-highest measurements on record for that location, but by April 1, much of that snow

had disappeared, leading to the third-lowest measurements on record for the same spot. Losing that snow early means it won't be available during the summer months, when the water is most needed.

Atmospheric rivers like the ones hitting California this winter are **going to keep hitting the state**. As climate change continues to transform the water realities of the West, Diffenbaugh said, the state will likely have to retool its infrastructure to capture more stormwater from those events and reduce its reliance on the steadily disappearing snowpack.

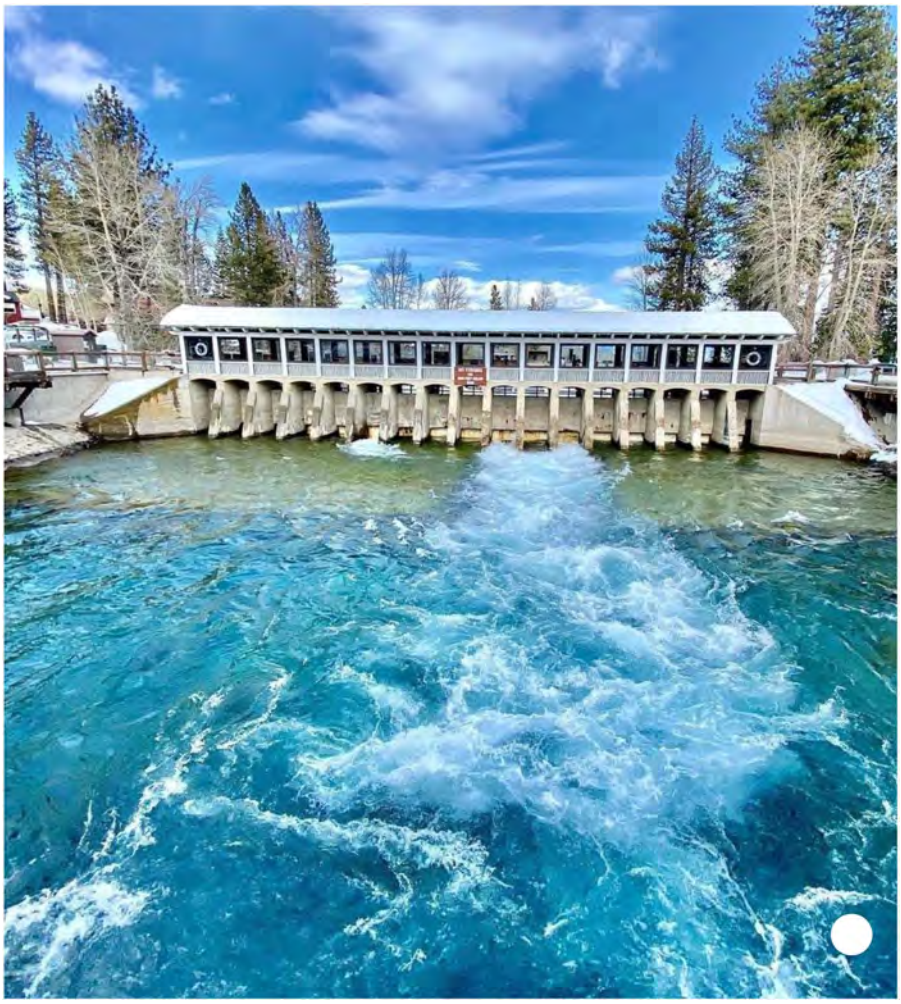
"We have a lot of water infrastructure systems that are really sophisticated," said Diffenbaugh. "Part of the challenge is updating those really well-developed systems to be resilient to and prepared for the challenges that this new climate provides."

Tahoe Daily Tribune action

Above the rim: Ongoing winter storms lead to rapid rise for Lake Tahoe

News FOLLOW NEWS | Jan 15, 2023

Madison Schultz FOLLOW
mschultz@tahoedailytribune.com



The dam in Tahoe City receives a rapid influx of water from the ongoing storms. *Provided/Tahoe City Downtown Association*

SOUTH LAKE TAHOE, Calif. — California has been getting pounded with consistent winter storms for the past several v plenty more precipitation on the way, Lake Tahoe's ski resorts aren't the only spot in the basin reaping the benefits of t snowfall.

Only 30 days ago, Lake Tahoe's lake level was at 6,222.56 feet. About a month later, the lake is now at 6,224.02 feet, and rising. This rapid rise in lake level is credited to the ongoing winter storms, bringing Tahoe above its natural rim.

According to the U.S. Water Master's Office, Lake Tahoe rang in the new year strong, receiving a 0.43-foot rise on Jan. 1 seventh overall in record for single-day lake level rise. When analyzing Tahoe's low point just 30 days ago and compari conditions, the influx of water is substantial.

"From the rise of the 6,222.56 feet to the measured level of 6,224.02 feet, this is a rise from the low point to the high of Chief Deputy Water Manager for the U.S. Water Master's Office Dave Wathen. "This is the equivalent of approximately 1 feet added to the lake."

Lake Tahoe has seen a rapid rise in lake level in the last 30 days.
Provided / U.S. Geological Survey

This rise in lake level provides for a more full Lake Tahoe for the seasons ahead, but analyzing the bigger picture, also t success to what has more recently been a dry California and Nevada.

“We need water for recreation in Tahoe, but more importantly our partners downstream need water for drinking and a Amy Berry, CEO of the Tahoe Fund, said. “The top six feet of Tahoe is a federal reservoir that feeds lots of agencies and downstream.”

With Lake Tahoe’s lake level increase serving other nearby areas, the benefits are also big for this influx of precipitatio overall environment.

“Higher water levels also mean cooler waters near the shoreline, which should reduce algal growth that we see typicall warmer waters,” Berry said.

While the precipitation is filling Lake Tahoe, these storms are ongoing, and there is a potential threat for flooding in ne

“These storms can cause flooding within the Tahoe Basin and dangerously all along the Truckee River, including downt Berry said. “We don’t have to worry too much about Tahoe itself flooding until it reaches 6,229 feet or higher.”

Fanny Bridge in Tahoe City in the fall season 2022, before the rapid lake level rise. *Provided / Tahoe City Downtown Association*

In 2017, the lake was filled to the maximum limit after years of ongoing drought. According to U.S. Geological Survey da something that is possible again for 2023, which can bring potential threats to Tahoe's landscape.

"If the lake goes much higher than 6,229 feet, it threatens the shoreline and creates erosion issues, this is something tc the early summer months," Berry said. "Flooding and rain also bring lots of sediment that is in the river and stream bed lake. We have 63 tributaries into Lake Tahoe, and they are likely all carrying fine sediment into the lake that will impact clarity right now."

Berry said that while the water is great for the forests that are dying due to drought and beetle infestation, this water a underbrush will flourish in the summer months, increasing fire danger overall.

Given the tremendous amount of precipitation received over the last 30 days, it can be assumed that California and Ne expecting to be out of the ongoing drought period, however, that isn't official as of yet.

"We are technically still in a drought," Wathen said. "We will make the formal designation whether we are in a drought typically. It's important to acknowledge that we still have a lot of winter to come. We've seen winters like this in the pas though we're having a big month now, it can also shut off and go back to being dry. We're in great shape now and Tahoe which is great, but it can always turn around quickly."

The dam in Tahoe City receiving a rapid influx of water from the ongoing storms. Photo taken from Fanny Bridge. *Provided / Tahoe City Downtown Association*

While in the midst of the winter season and with seemingly no end to the stormy weather, there are proactive ways tha community members can better manage and prepare for the winter storms ahead to make for a successful lake in the s come.

"The best thing we can do to prepare for big, wet storms from an environmental perspective is erosion control and sto management," Berry said. "At the big scale, this means major watershed restoration projects, stream restoration projec stormwater infrastructure. This is mostly funded from local, state, and federal budgets, so supporting water bonds at t encouraging local government support of these projects, and writing to your congresspeople and senators is importan

For more information and statistics on Lake Tahoe's lake level increase, visit: https://www.usgs.gov/.

Correction: A photo caption in the story has been updated. A photo was taken of the dam in Tahoe City from Fanny Bridge.

Second wettest water year on record reported for Reno already

by News 4 & Fox 11 Digital Staff
Sunday, January 15th 2023

Snow covers the Truckee River in downtown Reno on Saturday, Dec. 31, 2022 (Courtesy: Ben Margiott/KRNV)

RENO, Nev. (News 4 & Fox 11) — Just three and a half months into the water year, Reno has seen the second wettest on record.

Since October 1, Reno has seen 7.4 inches of liquid which surpasses the annual average of 7.35 inches.

The best year on record was 2017 when 8.35 inches of precipitation fell in the Biggest Little City.

California's concrete shell is making its flooding much worse

The "atmospheric river" that has dropped weeks of rain on California is showcasing how much of the state is paved over.

Jan. 18, 2023, 3:00 AM PST

By Hayes Brown, MSNBC Opinion Columnist

California has spent the first weeks of the year dealing with a "parade of storms" that has left the Golden State distinctly waterlogged. Over the weekend, more precipitation slammed into the state, causing snow closures up in the mountains, flooding down in San Diego and a mudslide near Oakland. The state has had rainfall totals of 400% to 600% above average since Christmas, an amount that would likely overwhelm almost any region, especially one so parched after years of drought. But the severity of the flooding in California's cities shouldn't come as a surprise given how few places the deluge can go once it has fallen from the sky.

Over the last century, the world has been increasingly covered with impermeable pavements like asphalt, tarmac and concrete to handle the rise of motor traffic. As of 2004, the total area of paved surfaces in the U.S. alone covered an area nearly the size of Ohio, a figure that has surely only increased since then.

This growing shell over the planet is both contributing to climate change and exacerbating its effects, as we're seeing now in California.

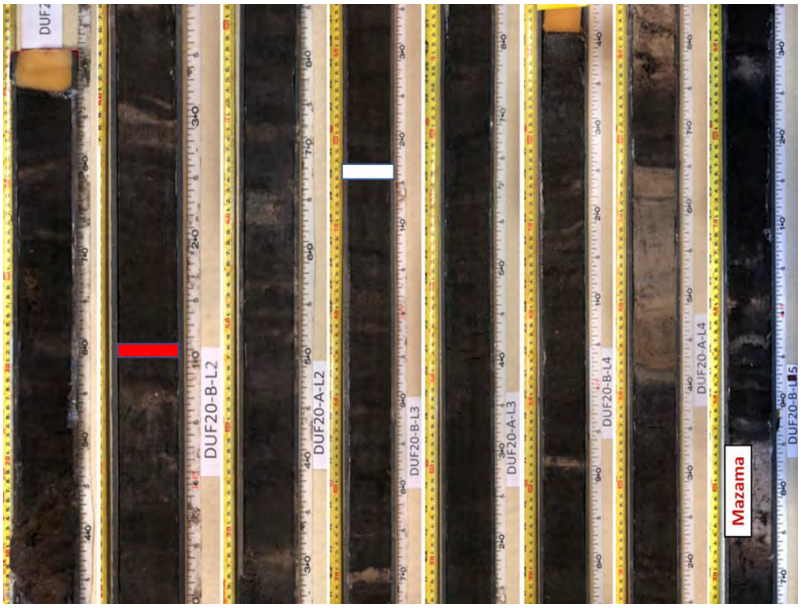
At this point, the problem isn't a lack of science about the matter – it's decades of poor planning. The Center for Watershed Protection has said that "as much as 65% of the total impervious cover in the landscape can be classified as 'habitat for cars'" –which includes roads, parking lots, driveways and garages. Meanwhile, a group of researchers in 2020 estimated that for "every percentage point increase in roads, parking lots and other impervious surfaces that prevent water from flowing into the ground, annual floods increase on average by 3.3%." And a 2013 study showed that Los Angeles was 61%covered with impervious surfaces at the time; San Francisco, which has been dealing with flooding for weeks now, was 54% paved over.

The problem isn't a lack of science about the matter — it's decades of poor planning.

Even before the record precipitation in California, we already knew what happens when development overtakes the planet's ability to absorb the brunt of extreme weather. When Hurricane Harvey struck Houston in 2017, the floodwaters from the storm killed dozens and displaced tens of thousands of people. Harvey was the perfect kind of storm to devastate the country's fourth-largest city – massive and slow-moving, dumping 60 inches of rain over four days – and an example of the storms to come as climate change accelerates.

More from MSNBC Daily

Must reads from Today's list



Core samples from wet meadows sites across Nevada showed a consistent period where no new sediment was laid down, indicating significant and lasting drought across the region.

Centuries-long drought in the Great Basin shown to be a recurring pattern

A multi-centennial drought termed the Late Holocene Dry Period could serve as a map for future climate projections, Indigenous human responses a model for resilience and adaptability

January 19, 2023

Jennifer Theresa Kent (https://www.unr.edu/nevada-today/about/authors/jennifer-kent)

Nevada has a history of periodically locking into centuries-long droughts, new research shows. In the culmination of nearly a decade of research involving biogeographers, paleoecologists, climatologists, archaeologists and anthropologists, the presence of a multi-centennial drought termed the Late Holocene Dry Period was confirmed to have occurred between 3,100 and 1,800 ago. While what caused the climate to dry up continues to be explored, the research shows that whatever combination of oceanic and atmospheric conditions that led to drought occurred persistently and repeatedly throughout the region's history. Should such a pattern lock into place today, a megadrought as severe as the Late Holocene Dry Period has the potential to reappear and endure in the American Southwest – something Emeritus Foundation Professor of Geography and the publication's first author Scott Mensing believes should be planned for.

> **"The take home message would appear to be that in order to adapt, we must be sufficiently resilient in order to move and take advantage of new resources. We can't just keep doing the same thing in the same place."**

"We don't know exactly what sets this pattern up, but I think it's useful to know that such a pattern can persist for centuries thus leading to very long droughts here in central Nevada, and by extension over into California," Mensing, who is also the Fred D. Gibson Endowed Professor Emeritus, said. "The amount of water we are getting now is high compared to what could be expected. Everything that is being done now to accommodate for drought should be magnified."

Associate Professor of Geography Adam Csank found that temperatures during the Late Holocene Dry Period were notably cooler than what is being recorded across Nevada today. The warming climate further complicates the possibility of severe drought in the American West.

“Hot droughts are a lot worse than just dry droughts,” Csank said. “If the Pacific Ocean ever sets up again in a way that locks in a long period of drought like we see in these paleo records, and you add a warming climate on top of that, it would be a concern. That makes me worry about water resources in the West.”

By comparing the drought records to indicators of human occupation – remnants of fire hearths, house floors, bits of basketry or pieces of food material – in dirt samples from previously excavated archaeology sites across the Great Basin, the researchers were also able to show how the Indigenous communities responded with resilience and adaptability to the drought by abandoning the dry lower elevations and moving to higher and wetter elevations.

With the foresight of a potential megadrought in the West, the question is, what will human adaptability look like today?

“People are pretty resilient. They can work in a landscape in a variety of ways and a number of different scenarios,” Dave Rhode, research professor of archaeology at the Desert Research Institute, said. Rhode and David Hurst Thomas of the American Museum of Natural History in New York City along with other anthropologists collaborated with Mensing on the anthropological aspects of the research. “It shouldn’t surprise us that there are going to be long periods of strong drought where people are going to be forced to move or adapt in one way or another. This is something that has happened many times in the past and raises the question of where they are going to go and how do we negotiate amongst ourselves on making that not contentious. Human responses are going to be really dynamic in the face of significant climactic change.”

Climate models moving forward show a drier southwest and Mensing points out that the pattern of drought seen 3,000 years ago is more likely than not in our future.

“The take home message would appear to be that in order to adapt, we must be sufficiently resilient in order to move and take advantage of new resources,” Mensing said. “We can’t just keep doing the same thing in the same place.”

When the absence of evidence is the evidence

> **"Just by random chance you could get time periods where there are 100-year-long droughts in the West. There is no one mechanism, it just happens because the right combination of ocean and atmospheric conditions come together, and we get a drought"**

Mensing initially published some evidence of the Late Holocene Dry Period in 2013, but recent funding from the National Science Foundation to pursue a more accurate dating of the hypothesized drought in the Great Basin allowed Mensing and his team to pursue a novel radiocarbon dating technique. Mud core samples were taken from wet meadows at four sites across southern, central and northern Nevada. By meticulously separating and dating each centimeter of the sample, they were able to record the changes in pollen and sediment being laid down in the meadows over time which would inform how wet or dry the year was. The technique is rare if unheard of in the field of paleoecology, and what they found surprised them.

“We’re working with mud, right?” Mensing quips. “Usually, you find pieces of organic material at some places in a sample and you interpret everything in between. But we really needed to know when things started and stopped. We dated continuous samples and that’s the only way we found this period when all the meadows completely dried up.”

Site after site showed a jump from 1,500 years ago to around 2,200 years ago where there was no sediment to date in the core samples. Had the data appeared this way at just one site, it may have been mistaken as an error. However, the absence of sediment was consistent at all sites during the same time period.

Mensing and a research colleague collect core samples at a wet meadow site in Nevada. Photo courtesy of Mensing.

“One of the coolest things about this study is that the absence of evidence is the evidence,” Csank said. “We continued to accumulate records where there was this huge gap in the data with no record of sediment being laid down.”

The researchers looked at highly accurate tree ring records collected by Adjunct Professor of Geography Connie Millar, which showed that the period from 2,000 to 1,800 years ago was the driest within the last 4,000 years, and compared them to their core sample dates. The period where no sediment was found fell within that same date range, allowing the researchers to interpret the absence of sediment as the likely result of the wet meadows drying out completely during the drought.

Dating the entirety of the Late Holocene Dry Period showed that there were three phases to the drought: an initial 900-year dry period followed by 200 years of wetter climate and then another 200 years of extreme drought. Attempts to determine what caused the climate to slip into these long periods of severe drought were nuanced. The likely culprit is a combination of warmer arctic temperatures, variability between the tropical Pacific trade winds during El Niño and La Niña and warmer sea surface temperatures off the coast of the Pacific Ocean.

“Just by random chance you could get time periods where there are 100-year-long droughts in the West,” Csank said. “There is no one mechanism, it just happens because the right combination of ocean and atmospheric conditions come together, and we get a drought.”

When the archaeologists began to find gaps in their own records showing an absence of human occupation at different sites across Nevada during the same time periods when the meadows went dry, a bigger story began to take shape. Even the more consistently inhabited northernmost sites where the climate was generally less impacted by the drought were eventually abandoned toward the end of the first phase of the drought, reoccupied during the 200-year reprieve and abandoned once again during the following 700-year period of extreme drought. In contrast, the most intensive occupation of Alta Toquima in the central Nevada alpine zone took place during the long dry phase of the Late Holocene Dry Period.

“To see a region-wide sediment depositional hiatus as well as the hiatus seen at some of the archaeological sites all tied together really tells you there was something major going on environmentally,” Rhode said.

The research focused on the Great Basin in Nevada, but the drought likely extended into California and Utah. Further research and higher resolution records using many-thousand-year-old bristlecone pine tree rings could reveal just how far the drought extended in the American Southwest and for precisely how long.

Thomas and Rhode are looking beyond the nomadic behaviors of the Indigenous communities to see if they can identify any other patterns of cooperation or advances in technology in response to the drought. Mensing also encourages climate modelers to continue to look at the dynamics that set off the Late Holocene Dry Period and incorporate the predictions into future climate models.

Having studied these wet meadow sites for over a decade, often during periods of drought, Mensing has never seen them dry. The Late Holocene Dry Period is thought to be the longest and most extreme drought within the last 3,000 years. "All we can do now is inform those that are in the areas of potential drought – places where we assume there's water at the surface and forage for cattle – that those resources could disappear more years than not. Is that 6 years out of 10? Is that 14 years out of 20? This is unknowable in our data going back," Mensing said. "The human record is one of resilience and mobility in response to reoccurring drought across the Great Basin. We should plan and make assumptions based on less amounts of water today to prepare for the potential of tomorrow."

The research was a collaboration between biogeographers, paleoecologists, climatologists, anthropologists and archaeologists from seven institutions including the University of Nevada, Reno; the Desert Research Institute; the American Museum of Natural History and UC Santa Barbara.

January 19, 2023

Jennifer Theresa Kent (https://www.unr.edu/nevada-today/about/authors/jennifer-kent)

Stanford News (http://news.stanford.edu/)

JANUARY 19, 2023

New Stanford research shows droughts can make water unaffordable for low-income households

According to a recent study, when providers act to curtail water use or invest in new infrastructure because of a drought, bills can rise for low-income households and drop for high-income households.

BY LAURA CASTAÑÓN

Access to safe, affordable water is a necessity for human health and well-being. But when droughts strike areas that are already water-stressed, water providers are forced to enact measures to curtail water usage or invest in supplies from more expensive sources, which can increase costs for consumers. According to a recent study from the **Fletcher Lab (https://fletcherlab.science/)** at Stanford University, **published (https://www.nature.com/articles/s44221-022-00009-w)** in *Nature Water*, these measures can disproportionately affect water bills for low-income households, making water more costly for the most vulnerable people.

(https://news.stanford.edu/wp-content/uploads/2023/01/shutt

Researchers examined how di erent types of drought, various resilience strategies, and household behavior can a ect the a ordability of water. *(Image credit: Shutterstock/Piyaset)*

“A low-income household often has a different response to curtailment measures and surcharges because of how much water they used before the drought,” said Benjamin Rachunok, who conducted the work as a postdoctoral researcher at Stanford and is now an assistant professor at North Carolina State University. “This can lead to different affordability outcomes for low- and high-income people, even if the same processes and policies are being applied to everyone.”

The researchers found that in some cases, low-income households end up seeing bills rise during droughts, while high-income households see their bills drop. Their work illuminates the interconnected mechanisms that affect affordability and may be able to help water planners and policymakers better understand the potential impacts of long-and short-term drought responses.

Modeling drought response

Drawing on public data from the 2011 to 2017 drought in California, the researchers built a model to examine how different combinations of drought length and severity, various resilience strategies, and household behavior can affect the affordability of water.

“The standard way of thinking about the connection between water scarcity and affordability has been to look at the cost of supplying water and how that cost is passed on to users through rate design,” said **Sarah Fletcher (https://profiles.stanford.edu/sarah-fletcher)**, senior author of the paper and an assistant professor of civil and environmental engineering in Stanford Engineering and the Stanford Doerr School of Sustainability. “But in order to fully understand the impacts of drought on water affordability, we have to include people’s behavioral responses to how the drought is unfolding and the restrictions that are put in place.”

When there is a water shortage, providers often ask consumers to cut back on their water usage, while applying a drought surcharge to bills to make up for lost revenue. Fletcher and Rachunok found that high-income households can cut back significantly, lowering their average water bill even with the addition of a surcharge. Lower-income households, however, tend to have less flexibility in their water usage. Even when they are able to curtail their water use, the drop does not make up for the additional cost of the surcharge.

Water utilities may also invest in infrastructure, such as desalination or water-recycling plants, to increase their water supply. The model showed that in all drought scenarios, these projects increase costs and reduce affordability for low-income households.

“Affordability is a key part of water access,” Fletcher said. “If we think about water security as including affordability for low-income populations, then some of the expensive technological measures that we often consider might actually harm water security by making water unaffordable for a larger number of people.”

An affordable future

Water is typically considered affordable when it does not exceed between 2% and 4% of a household’s income. While the cost of supplying water is the primary driver of water bills, even a small bill increase during droughts could make it difficult for some households to afford the water they need.

By providing insight into the mechanisms that affect affordability, Fletcher and Rachunok hope to help cities evaluate different approaches for long-term water supply planning. They are continuing to investigate how rate structures and other drought management techniques affect people's behavior and are working to develop a generalized approach to help regulators make the best decisions for an uncertain future.

"We have a changing climate and changing water needs," Fletcher said. "We have to develop approaches that allow us to adapt in robust ways so that we can still have water systems that are reliable, cost effective, and provide all the services that we need. And we should really be centering the needs of vulnerable communities as we do that adaptation."

Fletcher is the Lee and Kitty Price center fellow at the **Stanford Woods Institute for the Environment (http://woods.stanford.edu/cgi-bin/index.php)**.

This work was funded by the Stanford Impact Labs and the UPS Endowment Fund at Stanford University.

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LOCAL NEWS & EVENTS

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TMWA to explore new contract for board legal counsel

By: **Mark Hernandez** January 19, 2023

Downtown Truckee River photo by Ty O'Neil / This Is Reno.

During a board of directors meeting for the Truckee Meadows Water Authority on Wednesday, the future of the board's legal representation was questioned.

The McDonald Carano law firm has been contracted as the board meeting legal representation for TMWA since 2001 and hasn't had to rebid for the contract. There are other a orneys who are employed by TMWA, but they work in other areas such as litigation.

"That's a long time to have a government contract that doesn't go up for review or reconsideration," TMWA board member Jenny Brekhus said. "And in that time, as best I can tell, the point person for this very large, statewide law firm – we're now on our third person."

If the contract was put to bid, McDonald Carano could still secure the contract, but it would give other law firms an equal chance to legally represent TMWA in all their meetings.

"I think you just can't let big government contracts lie forever," said Brekhus. "We're going on our third decade with them, and it's time. It's time for us to put to paper what [TMWA's] needs are legally. It is time to see who's out there."

One reason this has been brought up now, she said, is to avoid any conflicts of interest there might be between TMWA contracting with McDonald Carano and the same firm being retained by adverse parties.

For example, the current board meeting legal representation from McDonald Carano is Lucas Fole a who has also represented organizations such as the Nevada Housing Alliance and the Nevada State Apartment Association.

TMWA General Manager John Zimmerman outlined three options going forward: sticking with the status quo of McDonald Carano, using TMWA staff legal representation or opening up a contract bidding process and seeing what options would come from that.

Staff counsel Stephanie Morris said during the meeting that there are practices in place to avoid overlapping conflicts of interest between legal counsel and other law firms.

The use of outside counsel is to monitor meetings as per open meeting requirements as well as other legal services. TMWA has two staff a orneys, so the added help of outside counsel gives them access to more specialized lawyers.

Board member Devon Reese said he agreed that the role of outside counsel needed to be be er defined in a new contract but didn't agree with the idea of conflict as stated by Brekhus.

"She's wrong for a couple of reasons — one because unfortunately she's chosen to weaponize this question of conflicts, and I don't think that's necessary to have this discussion," he said. "We can have a discussion about what is important about the board's policies without saying that any particular person has commi ed an ethics violation, so McDonald Carano as a law firm is above reproach."

The board decided to have Zimmerman draw up a new possible bid for outside general counsel and also to look at the structure of what legal representation is used as well as the cost. The next time this comes up at a board meeting is when a final decision is made.

ENVIRONMENT

Magnetic solution removes toxic "forever chemicals" from water in seconds

By Michael Irving
January 22, 2023

A sample of contaminated water being treated using the new technique, with the PFAS chemicals being attracted to the side with the magnet University of Queensland

Scientists in Australia have developed an intriguing new technique for removing toxic “forever chemicals” from water. Adding a solution to contaminated water coats the pollutants and makes them magnetic, so they can easily be attracted and isolated.

Per- and polyfluoroalkyl substances (PFAS) are a group of chemicals that have been in wide use around the world since the 1950s, thanks to their water- and oil-repelling properties. However, more recently PFAS chemicals have been linked to a concerning number of health problems, including increased risks of diabetes and liver cancer. Worse still, a recent study has found that their levels in rainwater almost everywhere on Earth exceed the

EPA's guidelines, and to cap it all off, these stable molecules are very hard to break down, earning them the nickname "forever chemicals."

Now, researchers at the University of Queensland have developed a technique that could help remove PFAS chemicals from water. The team designed a solution called a magnetic fluorinated polymer sorbent which, when added to contaminated water, coats the PFAS molecules. This makes them magnetic, so then it's a relatively simple process to use a magnet to attract the pollutants and separate them from the water.

In tests with small samples of PFAS-laden water, the team found that the technique could remove over 95% of most PFAS molecules, including over 99% of GenX – a particularly problematic chemical – within 30 seconds.

Plenty of teams have investigated ways to break down PFAS, usually involving catalysts triggered by UV light or heat. Others have made use of hydrogen or supercritical water.

But the researchers on the new study say their magnetic solution has a few advantages over existing PFAS removal techniques. The solution itself can be reused up to 10 times, it can work much faster than others, and doesn't require any extra energy to trigger the reaction.

"Our method shows it is possible to remove more of these chemicals in a way that is faster, cheaper, cleaner, and very simple," said Dr. Cheng Zhang, co-author of the study. "Because our process does not need electricity, it can be used in remote and off-grid communities. Our team will now scale up

the testing and we hope to have a commercially available product ready in the next three years."

The research was published in the journal *Angewandte Chemie*. The team describes the work in the video below.

Michael Irving

Michael has always been fascinated by space, technology, dinosaurs, and the weirder mysteries of the universe. With a Bachelor of Arts in Professional Writing and several years experience under his belt, he joined New Atlas as a staff writer in 2016.

Tesla announces $3.6 billion investment in electric semi-truck manufacturing in Northern Nevada

Gabby Birenbaum

January 24th, 2023 at 1:00 PM

Economy Energy

Read this story in Spanish

Tesla intends to invest $3.6 billion in

A project manager for the Tahoe Regional Industrial Center presents a site map on Wednesday, Sept. 12, 2018. (David Calvert/The Nevada Independent)

battery and electric semi-truck manufacturing in Northern Nevada, expanding the company's presence and the clean energy industry in the state, the White House said Tuesday.

Tesla's investment will grow the existing Gigafactory facility by 4 million square feet in Storey County and add two new factories – a cell factory to produce 2 million light-duty vehicle batteries per year, and the company's first high-volume factory to produce the Tesla Semi, a Class 8 semi-truck entirely powered by electricity. CEO Elon Musk set a goal on its Q3 earnings call in October of producing 50,000 semis annually by 2024.

Gov. Joe Lombardo (R-NV) and White House infrastructure chief Mitch Landrieu lauded the announcement as evidence of their respective administrations' strengths. Landrieu called Tesla's investment part of a "manufacturing boom of President Biden's first two years" that will bring more than 3,000 jobs to the Reno-Sparks area.

"This announcement is the latest in more than $300 billion in private sector investment in clean energy and semiconductor manufacturing announced since the President took office," Landrieu said in a statement. "It will create more than 3,000 good-paying jobs in Nevada helping America lead in clean energy manufacturing, strengthening our energy security, and ultimately lowering costs for families."

The Tesla investment would be the second in the region. In 2014, then-Gov. Brian Sandoval brought the electric vehicle giant to Northern Nevada through tax incentives estimated to be worth **$1.25 billion over 20 years.** The result – Storey County's Tesla Gigafactory – is one of just five such Tesla facilities in the world.

According to a 2022 report from the Nevada Governor's Office of Economic Development (GOED), the Gigafactory has employed more than 18,000 Nevadans in construction jobs and battery production.

Tesla has not applied for tax incentives for its new project, according to GOED. Nevada law automatically provides tax credits and abatements for qualified projects in which

capital investment is greater than $3.5 billion over 10 years, as long as 50 percent of the employees are Nevadans and the company meets certain wage and health insurance requirements.

The size of the new investment would seem to qualify.

Lombardo touted the Tesla announcement – which he referred to as a new facility – in his **State of the State address** on Monday as evidence of his administration's pro-business stance.

"Whether it's closing the lithium loop, unlocking innovation and investment in logistics, entertainment, science and technology, or embracing entrepreneurship, the message is that Nevada is ready to partner," Lombardo said.

Lombardo **attended** the announcement as well. His office said they could not yet specify what tax abatements the company will receive.

Landrieu, meanwhile, cast Tesla's investment as a win for the Biden administration's clean energy pursuits, particularly in funding vehicle electrification and

manufacturing through the bipartisan infrastructure law. The legislation appropriated $2.8 billion for battery materials processing and manufacturing – nearly $120 million has already gone to Nevada companies – and $7.5 billion to build out a network of electric vehicle charging stations.

Tesla CEO Elon Musk appeared in Nevada in December to present the all-electric semi-truck that his company will build, delivering it to client PepsiCo and announcing Tesla's use of the vehicles between Nevada and its facility in Fremont, Calif.

This story was updated at 3:45 p.m. to include details about Tesla's Gigafactory expansion and at 4:30 p.m. to omit reference to Sparks. It was updated again at 8 p.m. with comment from Gov. Joe Lombardo's office.

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- Brian Sandoval - $1,565

Lake Tahoe Nevada State Park in Incline Village on Friday, Jan. 20, 2023. (David Calvert/The Nevada Independent)

Indy Environment: Heavy snow and rain fell across Nevada this month. Are we still in a drought?

Good morning, and welcome to the Indy Environment newsletter.

As always, we want to hear from readers. Let us know what you're seeing on the ground and how policies are affecting you. Email me with any tips at daniel@thenvindy.com

Over the past few weeks, storm after storm has rolled through the Sierra Nevada mountains and the Great Basin, dropping much-needed rain and heavy snow from Reno to Elko. But despite all the welcome precipitation, the state still faces drought conditions after back-to-back dry years.

As with much of California and the West, the entire state of Nevada faced moderate to extreme drought, according to a U.S. Drought Monitor analysis released Thursday. **Still, conditions have improved since Oct. 1, the start of what hydrologists refer to as the "water year."**

So, where do things stand?

During a drought update on Tuesday, regional climate experts summarized the impacts of the past month's storms — nine "atmospheric rivers" that carried significant amounts of water through California and Nevada, boosting snowpack to far above average for this time of the year. **These storms, blasting through in short succession, were so powerful in certain areas that they brought the bulk of precipitation forecasters might expect to see in an entire water year.**

“The recent set of storms have substantially mitigated many of the drought impacts,” climate researcher Julie Kalansky said. “But it’s too soon to tell the full impact of the ongoing drought.”

Kalansky, who works with the Scripps Institution of Oceanography and the California/Nevada Drought Early Warning System, said there are still unanswered questions, a major one being whether there will be more precipitation in the coming weeks. But other factors play into making a determination about drought. Despite high snowpack levels, it’s unclear how much water will make it into rivers as the snow melts.

When looking at the past three decades, snowpack in the mountains that feed the Carson River, which cuts through Carson City and ends at the Lahontan Reservoir near Fallon, is at about 241 percent of the median for this time of year. On the other side of the state, in the eastern Nevada mountains along the Humboldt River parallel to I-80, that snowpack number is near 188 percent.

For both areas of the state, the precipitation boost could bring a measure of relief to irrigators as key storage reservoirs on the Carson and Humboldt rivers started the water year close to empty.

Looking at the drought conditions emerging in late 2019, Nevada State Climatologist Stephanie McAfee said the recent storms have helped close precipitation deficits in northern parts of the state, including Reno and Elko. But Southern Nevada still faces a precipitation deficit from the start of the back-to-back drought years: Las Vegas, she said, is behind in overall precipitation.

Outside of Las Vegas, much of the state’s water supply hinges on what happens in the eastern Sierra mountains and the mountains of the Great Basin, where small rivers and streams drain into the Humboldt River. But Las Vegas depends on the Colorado River,

which is fed by snow that falls far upstream in the Rocky Mountains. **In the Colorado River Basin, recent winter storms have helped increase snowpack, but climate scientists said it’s too early to tell what kind of impact it will have for spring runoff,** as *KUNC*’s Alex Hager recently reported.

“Everybody is so eager to make an early call on this,” climate scientist Brad Udall told *KUNC*, noting that several years of high precipitation are needed to fill the river’s reservoirs. “Invariably, you'll get caught with your pants down if you think you know what's going to happen.”

It’s a point that McAfee echoed during the drought briefing on Tuesday. **She noted that there are “some long-term deficits and some structural challenges that even one great winter won’t entirely fix.”** The Colorado River is the most notable example, where continual overuse and decades of drought, amplified by climate change, has led to critically low reservoir levels.

Other river systems and groundwater basins across the West have faced similar issues, where even in good years, there are more legal rights to use water than there is water to go around.

“So when we start thinking about: Are we back to normal yet? Are we out of drought? In some ways, we are on a good path toward being out of drought and in some ways we have many other significant changes to make to be more resilient to drought,” McAfee said.

More reporting on the drought, snowpack and water:

- *The Nevada Current*'s Jeniffer Solis wrote about a Desert Research Institute report that **looked at how extreme spring heat can influence how snowpack melts into rivers.**
- UNLV professor Kristen Averyt **is serving as the drought and Western resilience director at the White House's Council on Environmental Quality,** per Politico.
- California writer Mark Arax published a thoughtful *New York Times* op-ed reflecting on the drought and flood cycles **that characterize the state's relationship to water.**

Albemarle Lithium Operations in Silver Peak, Nev. on Oct. 6, 2022. (David Calvert/The Nevada Independent)

Protecting wildland communities

Forest Service works hard to reduce hazardous fuels, wildfire threats to communities Andrew Avitt

Pacific Southwest Region

January 26, 2023

For those who love the outdoors, the occasional weekend trip will not do. Instead, many have chosen to live as close to nature as possible, on the edge of forests. One in three homes in the U.S. is now located in a wildland community, areas often referred to as the wildland-urban interface, where developed and undeveloped land meet.

The benefits to this lifestyle choice are many: recreation opportunities abound, quality drinking water, and clean air. There is also a dangerous drawback that 70,000 urban and wildland communities across the country face every year—the threat of wildfire.

A picture of a treated stand after the completion of the Montreal project around neighborhoods in South Lake Tahoe. (*Photo courtesy of Amy Jirka, The Great Basin Institute*)

Wildfires at the Wildland-Urban Interface

Increased development of wildland communities, climate change, and drought contributed to a four-fold increase in the number of residential and commercial structures destroyed by wildfire between 2014 and 2020.

“Hazardous fuels treatments in forests around communities and neighborhoods has never been more important,” said Victor Lyon, a Forest Service vegetation management staff officer on the Lake Tahoe Basin Management Unit. “And when we treat the land, we not only reduce wildfire threat to those communities but improve forest health and support wildlife habitat.”

As a long-time wildlife biologist and vegetation manager, Lyon knows the risk of wildfire threat to

wildland communities. Wildfire also affected Lyon personally, when the Angora Fire in 2007 destroyed a house he planned to buy in California.

Since the Angora Fire in 2007, the Forest Service treated about 35,000 acres surrounding communities and plan to treat 5,000 more acres per year. Though types of hazardous fuel treatments vary, mechanical thinning, prescribed fire, and pile burning all aim at a common outcome -- reducing the amount of fuel available to burn.

These treated areas can slow or even stop extreme wildfire behavior. Treated areas cause the fire to move from treetops to the forest floor, which enables firefighters to better contain the blaze. This was the case in another California wildfire near South Lake Tahoe when the Caldor Fire entered an area that had been treated and firefighters saved the Christmas Valley community.

Call in the Experts

A chipper turns excess vegetation into chips to accelerate decomposition and reduce fire risk (*Photo courtesy of Amy Jirka, The Great Basin Institute*)

Forest Service fuel treatment projects start with two simple yet very complicated, questions: What wildfire protections do the land and surrounding communities need? What fuel treatments will have the best outcome?

The answers require expertise and input from scientists and land managers. Specialists in silviculture, forest planning and engineering, heritage resources, fisheries, and trails, among others, all contribute to the design of a project. Their different perspectives lend a more holistic project design, when leads to a more balanced plan with better results.

“Basically, when we manage the forest, we are trying to reach a desired condition that's appropriate for that stand,” said Rita Mustatia, a Forest Service silviculturist. “In most cases means making the stand resilient, not just to fire but also to invasive species and disease.”

Mustatia has over 25 years' experience as a professional silviculturist, or tree scientist, for the Forest Service. She collects information and conducts analysis on tree stands, information that project managers use to determine overall forest health and what types of treatments may be needed.

For example, a Jefferey pine stand on the South Lake Tahoe Basin had trees spaced 15 to 20 feet apart.

The stand was suffering more than Mustatia initially realized. “There was evidence that the trees were not doing well, from disease, and in some areas from bark beetles.”

Years of fire suppression allowed vegetation in non-fire areas to build up, and forests grew denser. It’s a common misconception: more trees equate to a healthier, more vibrant forest. But more trees mean more competition for water.

“It's like a glass of water with 100 straws,” said Mustatia. “The trees are all consuming water at the same time and during times of drought with a shortage of water the effects are only compounded.”

The dense, dry tree stand posed a serious fire threat to the nearby communities of Montreal, Cold Creek, High Meadows, Golden Bear, Susquehana, Washoan, Hekpa and Mandan - home to about 5,000 people.

Mustatia and her Forest Service Team planned and implemented the Monteal Project, which thinned 465 acres of the forest until the trees were 30 to 50 feet apart. Now the forest is healthier and the nearby communities safer from the threat of wildfire.

Overstocked, dense forests, drought stricken, and susceptible to disease are not just conditions unique to the South Lake Tahoe Basin, they persist across many western forests, and are critical to treat to mitigate extreme wildfire behavior, the kind that threatens communities in the wildland-urban interface.

It Takes a Community

Landscapes needing treatment are often large and encompass many different land ownerships.

The Forest Service works closely with other federal agencies, Tribes, private landowners and organizations. The Montreal project was done together in partnership with the California Tahoe Conservancy, local industry, and the Great Basin Institute.

“The successful completion of the Montreal Whole Tree Project is an important milestone toward accomplishing the South Tahoe Fuels Treatment Project, a treatment area of 3,737 acres in the Wildland Urban Interface,” said Jerry Keir, co-founder and chief executive director of the Great Basin Institute.

The Great Basin Institute, a regional environmental nonprofit based in Reno, Nevada, is a long-time partner in the Tahoe Basin, supporting similar projects across 11 national forests in California.

“Our partnership with The Lake Tahoe Basin Management Unit spans over almost a quarter of a century, and we are grateful for, and inspired by, the ongoing accomplishments to improve forest health and advance applied science for the adaptive management of our forest resources,” said Kier.

The Institute has raised significant matching funds for conservation efforts, having signed more than$165 million dollars in grants and agreements on behalf of public lands in the Western U.S. In California, the organization provided more than $9 million dollars in non-federal funds for national forests and parks in California.

These fiscal contributions further the organization’s ability to offer additional services, including analysis required by the National Environmental Protection Act and resource surveys that evaluate the potential effects of forestry projects on land, river systems, air quality, and wildlife. Funds also provide supplemental resources for the implementation phases of reforestation, salvage operations, and habitat improvement projects, while deploying more than 120 foresters, archeologists, wildlife biologists, and hydrologists this season alone.

“Partners are filling a vital role in supporting critical post-fire recovery efforts,” added Keir.

The Institute, with the support of partners and subcontractors, provide environmental assessments on the effects of fire for the Windy, French, Caldor and Dixie fires in the coming year, expediting permitting while raising funds and adding staff to accelerate treatments across several large landscapes.

Achieving the desired pace and scale of land treatments requires the support of states, Tribes, local, non-government organizations, and private contractors. No one organization can work alone to change the severe fire conditions we are experiencing. We must work together to shift the future for our forests.

Wildfire Crisis Strategy

America's forests are in a state of fire emergency, as nearly a quarter of the contiguous United States remains at moderate to very high risk of severe wildfires. In response, the Forest Service established a Wildfire Crisis Strategy for dramatically increasing fuels and forest health treatments by up to four times current treatment levels in the West, which bears the brunt of the risk.

Wildfire mitigation treatments – whether controlled burns, logging, or mechanical thinning – are a vital part of the Forest Service's commitment to sustain

the health, diversity, and productivity of all of America's forests.

Resources:

For more information on the Montreal project please visit (Website), and for more information on the larger Forest Service strategy to reduce wildfire threats to communities please visit Confronting the Wildfire Crisis: Protecting Communities and Improving Resilience in America's Forests.

Additional resource: *Wildland Urban Interface: A Look at Issues and Resolutions.*

Tahoe National Forest lake tahoe, wildland urban interface, wildfire, wildfire prevention, safety, fuel reduction, prescribed fire, controlled burn, mechanical thinning, fire adapted communities, rural communities

NEWS

In the West, pressure to count water lost to evaporation

SUMAN NAISHADHAM, Associated Press

Updated: Jan. 30, 2023 1:04 p.m.

1 of 9

FILE - Water flows down the Colorado River downriver from Hoover Dam in northwest Arizona, on Aug. 14, 2022, near the Lake Mead National Recreation Area. More than 10% of the water carried by the Colorado River evaporates, leaks or spills as the 1,450-mile powerhouse river of the West flows through the region's dams, reservoirs and open-air canals.

John Locher/AP

WASHINGTON (AP) — Exposed to the beating sun and hot dry air, more than 10% of the water carried by the Colorado River evaporates, leaks or spills as the 1,450-mile (2,334-kilometer) powerhouse of the West flows through the region's dams, reservoirs and open-air canals.

For decades, key stewards of the river have ignored the massive water loss, instead allocating Arizona, California, Nevada and Mexico their share of the river without subtracting what's evaporated.

But the 10% can no longer be ignored, hydrologists, state officials and other western water experts say.

The West's multi-decade drought has sent water levels in key reservoirs along the river to unprecedented lows. Officials from Nevada and Arizona say that they, together with California, now need to account for how much water is actually in the river.

The challenge is in finding a method that California also agrees to.

“It’s very hard to get consensus,” said Sarah Porter, director of the Kyl Center for Water Policy at Arizona State University. She thinks it's unlikely that states will reach an agreement on their own, without federal intervention.

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Unlike Arizona, California, Nevada and Mexico, the upriver or Upper Basin states — Colorado, New Mexico, Utah, and Wyoming — already take into account evaporation losses.

Now with a looming federal deadline for Colorado River basin states to say how they'll use at least 15% less water from the river, there's renewed urgency for Arizona, California and Nevada to factor in what's lost to evaporation.

One proposal comes from Nevada: States at the end of the river would see their Colorado River portion shrink based on the distance it travels

to reach users. The farther south the river travels, the more water is lost as temperatures rise and water is exposed to the elements for longer.

The Southern Nevada Water Authority estimates that roughly 1.5 million acre-feet of water are lost to evaporation, transportation and inefficiencies each year in Arizona, Nevada and California. That's 50% more than Utah uses in a whole year.

Nevada and Arizona could be on board with this plan.

Nevada stands to lose the least under this plan since Lake Mead — the man-made reservoir from which Arizona, Nevada, California and Mexico draw water — sits in its backyard.

Tom Buschatzke, director of Arizona's Department of Water Resources, called Nevada's proposal fair.

"Calculating the losses as Nevada has proposed is probably the most equitable and matches the real, physical world," Buschatzke said. "The further you are, the more the losses are."

But crucially, California disagrees. Officials there have said Nevada's plan would likely run afoul of western water law. California has rights to the largest share of Colorado River water. Just as important, in times of shortage, water cuts come later than for other users, based

on the so-called Law of the River, a series of overlapping agreements, court decisions and contracts that determine how the river is shared. Its senior water rights mean it has been spared from cuts so far.

California water managers have said evaporation and system losses should be accounted for based on this existing system. In a December letter to federal officials, Christopher Harris, executive director of the Colorado River Board of California, said any other approach could "face considerable legal and technical challenges."

For Arizona, that could mean shouldering losses so significant that some experts say the drinking water supply for Phoenix could be threatened due to diminished deliveries to the the Central Arizona Project, the 336-mile (541-kilometer) aqueduct system that delivers Colorado River water to that metro area and Tucson.

Under Nevada's plan, California would pay a steep price. In addition to using more water from the river than any other state, its water travels some of the longest distances. California's Imperial Irrigation District, the single largest of all users of Colorado River water, would lose about 19% of its share. The region grows many of the nation's winter vegetables and alfalfa, and Imperial has said it disagrees with issuing water cuts according to evaporative losses at all.

Tina Shields, water manager for Imperial Irrigation District, said Arizona and Nevada — whose water rights are more junior than

California's — were advocating for the Southern Nevada Water Authority's plan because it would benefit them to share the losses.

“When you have a junior, right, that’s what you do,” Shields said. “You try to share the problem with other users.”

According to John Fleck, a researcher at the University of New Mexico’s Water Resources Program, Lower Basin states have avoided recognizing these losses for so long in part because there was no need to in decades past. Water was plentiful and some states didn't take all the water to which they were legally entitled.

Shared Destiny. Shared Responsibility.

Sustainability > Climate Change

Why California, other western states face growing pressure to reduce water consumption

"We have to be rethinking the way we manage water in the West. We can't let a good winter stop that important work."

By Gianna Melillo | Jan. 30, 2023

The major storms that hit California earlier this winter dumped more than 32 trillion gallons of water on the state, helped boost some of the region's reservoirs and increased snowpack in key mountains throughout the West.

But despite this temporary reprieve, the region will need to work on water conservation and reducing demand given climate change.

Global warming has worsened aridification in the West. Coupled with growing demand from a rising population, it is depleting the Colorado River, which supplies water to seven states and helps feed the nation's two largest reservoirs, Lake Powell and Lake Mead.

"If we want to have a stable Colorado River system going forward, we have to reduce consumptive use, there's no way around it," said Eric Balken, executive director of the Glen Canyon Institute.

"We can't increase the supply and so the only part we have control over is the demand part of the equation. And it's a tall order."

Climate change brings warmer and unpredictable weather that is a threat to the once reliable supply of snowpack melting into rivers. Warmer temperatures increase evaporation from reservoirs and compound a host of other factors that jeopardize the west's water supply.

Reducing demand is the "big knob that we have on the system and ultimately, we may put ourselves in a position where we don't have a choice," said Adrian Harpold, an associate professor of mountain ecohydrology at the University of Nevada, Reno.

The seven states that draw water from the Colorado River are working to reach an agreement by the end of the month to conserve 2 million acre-feet or more of Colorado River water in 2023.

That's in addition to cuts that already took effect in Arizona this month, first announced last August by the Bureau of Reclamation. The cuts reduced Arizona's supply by 21 percent, Nevada's by 8 percent, and Mexico's by 7 percent.

Should the states fail to come up with an agreement by Jan. 31, the federal government will step in.

"There's been an overallocation of water from the Colorado River for certainly the last 30 years, if not longer," said Jay Lund, co-director of the Center for Watershed Sciences and professor of civil and environmental engineering at the University of California, Davis.

Decades ago, some states were not using their full allocations. But demands and allocations have been higher than inflows over the last 20 to 40 years, Lund explained.

"Unless we get an unexpected deluge, we're going to have to actually reduce water use in the Lower Colorado River Basin by a substantial amount, probably by 20 or maybe even 30 percent," Lund said.
"Reducing water use is the only way to get our way out of this."

To meet the growing water crisis in the West, some proposed partial solutions include increasing desalination efforts, but the process is costly and requires lots of energy.

Increasing managed aquifer recharge projects, or helping surface water

seep into aqueducts more efficiently, is also an option for some regions.

But the main problem for the Lower Colorado River Basin is that there's no water to recharge, Lund said.

The Role of Agriculture

Around 80 percent of the Colorado River's water goes toward agriculture. Over the years, a number of farmers have already adjusted to the growing shortages.

Some have switched to growing less water intensive crops, while others have implemented new irrigation techniques to cut down on water waste.

Still, more is needed.

"When we talk about conservation, urban conservation is good, it's fine. But even if you just dried up all the cities and made everybody move away, you would still not have reduced water enough to avoid the shortfall," said Lund, pointing to the importance of agricultural cuts.

Going forward, land fallowing, or setting aside arable land for one or more years before it's cultivated again, would conserve a significant amount of water, although some growers would prefer to avoid this option.

Choosing to grow different crops and singling out the best areas suited for agriculture can also help the sector conserve water.

However, any future cuts will ultimately need to weigh the demands of rural agricultural areas and those in more urban regions.

"We really need to think about the economic impacts of these decisions in a way that really considers people's socioeconomic standing and vulnerable populations," said Harpold.

For those hit the hardest, turning to alternative economic bases could be an option. If cuts are imposed at the federal level, the government could allocate some money to communities to help them transition.

The Inflation Reduction Act passed last year includes $4 billion in funding for water management and conservation efforts in the Colorado River Basin and other areas facing similar drought levels.

Overall, "we have to be rethinking the way we manage water in the West," said Balken. "We can't let a good winter stop that important work."

Will Reclamation and the States Make the Grade on a Colorado River Deal

By **Kyle Roerink** - January 30, 2023

Colorado River - image: Sylvi, cc 2.0

One out of nine Americans depends on the Colorado River, meaning that the public has vested much faith in water managers. In most Colorado River Basin States, the public has little opportunity to grade how federal, state and local water officials manage the resource that serves 40 million people, wildlife, food production and recreation. With multiple deadlines looming in the coming weeks,

it's important to consider how the public can assess the quality of management in a system that is crashing before our eyes.

Tomorrow marks the January 31 deadline put forth by federal officials to strike a grand bargain between the seven Colorado River Basin (CRB) states. A groundbreaking, watershed deal among the states is unlikely to be announced tomorrow. But the water managers' PR machines will certainly churn out news to feed the beast and assure everyone that all is well — despite the past 15 years of failure.

When you consider whatever news comes out of the latest negotiations, do not forget what the nation's top scientists warn: We need millions of acre-feet of new cuts to stabilize the system. This is just the beginning of a drier era on the Colorado River.

Below we've outlined a basic table accompanied by a grade and synopsis. The smaller the cut, the worse the grade.

“This latest exercise in curtailment will be futile if we’re not cutting at least an additional 3 million acre-feet annually,” said John Weisheit, conservation director of Living Rivers. “Water managers have ignored the structural deficit, climate change, and over-use for decades, pushing us to this current precipice. They are failing the public, ecosystems, and future generations.”

Any effort to tackle the problem with 2-4 million acre-feet worth of new cuts is a mere bandage for a gunshot wound. Stabilizing the Colorado River System of today doesn’t fully prepare us for the system of tomorrow. Mother Nature is bringing more cuts whether water managers like it or not. How we prepare now matters for future generations.

GRADE	QUANTITY OF CUTS	SYNOPSIS
A	Usage cut by an additional 5 million or more acre feet	Will stabilize system and provide a buffer in addition to existing curtailments.
B	Usage cut by an additional 3-4 million acre feet	Will stabilize current system by addressing Structural Deficit and 21st century hydrology in addition to existing curtailments.
C	Usage cut by an additional 2-3 million acre feet	Will begin to address Structural Deficit and 21st Century declines in addition to existing curtailments.
D	Usage cut by an additional 1-1.5 million acre feet	Will not stabilize system in addition to existing curtailments.
F	Usage cut by an additional 1 million acre feet	Will not stabilize system in addition to existing curtailments.

The above table is predicated upon simple math. With climate change, we've lost about 3 million acre-feet from the 20th Century average in addition to the annual 1.2 million acre-feet from the Lower Basin's structural deficit i.e. over-use, evaporation, and system losses. While we cannot predict what each subsequent water year will bring in the coming decades, we can plan to expect that we will see a system with less and less water.

What We Know So Far

Right now, the only certainty we have are the cuts outlined in the 2007 Interim Guidelines, the Drought Contingency Plan, and the Minute 323 Mexican treaty, which total 1.01 million acre-feet of heretofore enacted curtailments. This is a baseline for what we already have on the table, but it will not stabilize the system.

Despite congressional appropriations in the Bipartisan Infrastructure Law and the Inflation Reduction Act that will likely lead to compensated reductions for water users, the public cannot yet account for how those funds have reduced demand. Nor do we have clear data from parties

who signed a Memorandum of Understanding for proposed agreements such as the 500-plus plan. We can not yet account for promises by states like California to cut an additional 400,000 acre-feet or potential System Conservation Pilot Program participants. Nor do we account for the past, present and future Drought Response Operations Agreement (DROA) releases from Flaming Gorge Dam, which are not de facto curtailments in consumptive use.

What Will Management Have to Consider in the Future

The Colorado River System has lost about 20 percent of its average from the last century. That figure will likely double by the end of the 21st Century. Research released last summer suggested that Lower Basin water users had to reduce use –– in addition to current cuts –– by at least 2 million acre-feet annually to stabilize the system in the coming years. In the study, the efficacy of those reductions depended on the rate of future Upper Basin development. The Upper Colorado River Commission estimates that exclusive of evaporation, Upper Basin states could plan to

consume an additional 1.7 million acre-feet annually by 2060.

By some estimates, however, all Upper Basin states except Wyoming are already over-using their allocation under the Colorado River Compact's Upper Basin Amendments — which divvy the share via a percentage of water rather than fixed allocations as in the Lower Basin.

All of these factors lead us to believe that if both basins aren't significantly cutting, the nation can expect to be whipsawed by the Colorado River System for decades to come. We advocate for a new management regime at Glen Canyon Dam, a moratorium on new Upper Basin dams/diversions, robust curtailment in the Upper and Lower Basin, and better accounting for evaporation, system losses, and gauge readings throughout the Colorado River Basin.

Kyle Roerink writes columns on natural resource issues throughout Nevada and the West. Kyle is the executive director of the Great Basin Water Network. He lives in Reno. Support his writing.

The opinions expressed above are not necessarily those of the Sierra Nevada Ally. Our newsroom remains entirely independent of our opinion page. Published opinions further public conversation to fulfill our civic responsibility to challenge authority, act independently of corporate or political influence, and invite dissent.

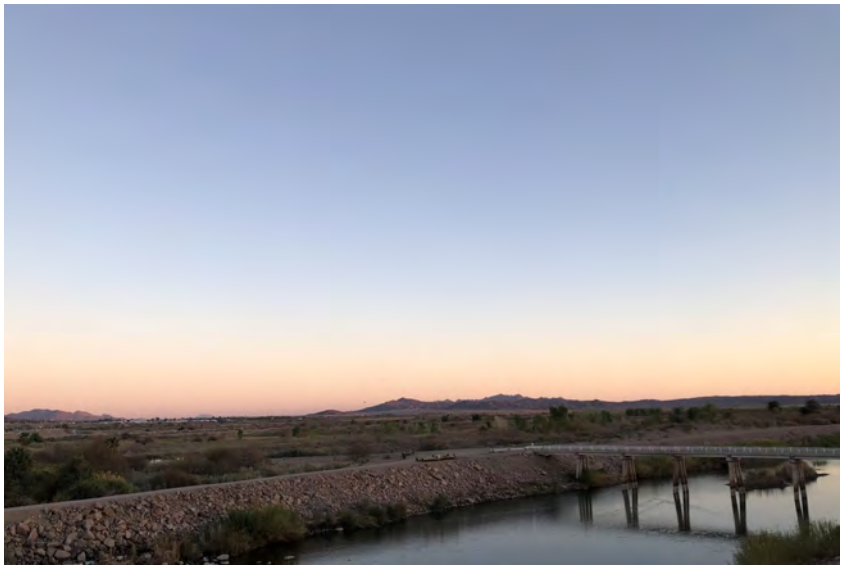
Founded in 2020, the Sierra Nevada Ally is a self-reliant 501c3 nonprofit publication with no paywall, a member of the Institute for Nonprofit News, offering unique, differentiated reporting, factual news, and explanatory journalism on the environment, conservation, and public policy, while giving voice to writers, filmmakers, visual artists, and performers. We rely on the generosity of our readers and aligned partners.

The NEVADA INDEPENDENT

Desalination and conservation are the answer to drought

Ron Aryel February 1st, 2023 at 2:00 AM

Opinion



Colorado River water o the Imperial Diversion Dam, which is used to send water to the Imperial Valley.

The Colorado River is in a state of crisis— which means the seven states and Mexico that rely on its water are in trouble, as well. Last summer, a lack of precipitation and meager snowpacks in the Rocky Mountains led to a Tier II shortage being declared for the river: The water level at Lake Mead, America's largest reservoir, had dropped to 1,042 feet, or just 28 percent full.

After 20 dry years, Lake Powell was also at the lowest level it had ever been (just 24 percent full) with an elevation of 3,523 feet, just below its buffer elevation of 3,525 feet. And while 4.1 million acre-feet of water are predicted to arrive this spring and summer, users of that water need 7 million acre-feet, resulting in a deficit.

The potential consequences include not only water shortages, but also a reduction in renewable energy. If the water level drops any lower, the Grand Canyon Dam's electric generating plant may not be able to generate power. Not only that, but downstream at Lake Mead, the drop in water level has already reduced the electric power available from the dam's turbogenerators to 1,362 megawatts, a reduction of 36 percent from its design

output. Should the water level drop to 1,000 feet, Hoover Dam will stop generating electricity ("dead pool"), and fossil-fired generating plants will have to replace it.

The Southern Nevada Water Authority (SNWA) has recently switched on the Low Lake Level Pump for the first time. The Tier II shortage means that the federal government could demand cuts. Arizona, Nevada and Mexico will surely see reductions to their water supplies.(Arizona alone stands to lose 21 percent of its allotment, or 592,000 acre-feet; meanwhile, the state's population is at 7.2 million residents and growing.) All in all, the prospect of severe water rationing **is looming**.

The federal government has directed the river compact states to cut their water use; the states had until the end of January to come to a consensus and submit a proposal. As of this writing, **six states have created a plan**; California declined to join them.

The first line of defense against drought, then, and the most conservative one, is water conservation.

Conservation efforts

Southern California's Metropolitan Water District has told residents to reduce watering of their yards and lawns to once a week beginning in June. The district pulls water from the Colorado River and the California State Water Project. The East Bay Municipal Utility District has instituted a 10 percent reduction in water use. It serves 1.4 million customers in Contra Costa and Alameda counties.

In 2014, California passed **the California Sustainable Groundwater Management Act**. More than 500 water management entities had to submit plans to the state detailing how they would manage groundwater. The goal was to reduce the pumping of groundwater, to help maintain its quality — and to not to run out of it.

The Truckee Meadows Water Authority (TMWA) and Southern Nevada Water Authority (SNWA) advocate for such measures as the reuse of wastewater from industry for irrigation and xeriscaping. TMWA has told the Northern Nevada public that water conservation, recycling and xeriscaping, as well as water directed into reservoirs, will be sufficient to supply us for the next two decades despite an increase in population. As for SNWA, it

has long term plans to reduce each resident's use of water to less than 100 gallons per day.

One conservation measure is the direct recycling of wastewater into drinking water by purifying the output from wastewater treatment plants. Direct Potable Reuse (DPR), also known colloquially as "toilet to tap," is legal in Texas, and Arizona allows it on a case by case basis. Science supports adopting this method, but political acceptance requires getting the public to focus on the safety of the water coming from the tap more than whence it comes.

Unfortunately, the consensus of climate scientists is that rain will predominate in place of snow in the coming decades, and given that snowpacks themselves constitute a major reservoir, this new pattern will exacerbate water shortages even as our population increases and our need to grow food and use water to extract minerals increase.(This leads one to the conclusion that TMWA's projections are probably too rosy for comfort.)

We are facing a brutal reality. No matter how much we try to conserve, our growing population requires more fresh

water while climate change is reducing the supply.

Desalination

If conservation alone can't help us, there is another solution that, in combination with conservation, can make a difference: The construction of large-scale desalination plants along the Pacific coast are inevitable if we are to avert disaster.

There are already 14 small-scale desalination plants on the west coast, but their production is far too little to make a meaningful contribution to potable water supply. The largest one is Poseidon's Carlsbad plant, which produces 56,000 acre-feet of potable water per year, enough to supply about 10 percent of San Diego's needs.

Many countries get drinking water from seawater this way. The Israelis get 80 percent of their potable water needs from desalination plants, and Saudi Arabia has desalinated seawater for many years. U.S. Navy ships and submarines supply sailors with water for drinking and bathing from "stills" installed on-board.

There are two ways to utilize desalination to help Nevada, and they are not mutually exclusive. The first is for our state government to help finance the construction of desalination plants in California and Mexico. In return for Nevada's investment, both California and Mexico would surrender Colorado River water rights to Nevada.

The second way is for Nevada to co-finance desalination plants and pipelines that would bring potable water here. This option is far more expensive but offers the advantage of a more reliable supply, as our own population growth, along with increasing agricultural and mining demand, may well outstrip the Colorado River's capacity, while climate change reduces the snowpack — and therefore, the water available from the Truckee River.

It is important to recognize that desalination is not entirely benign. A desalination plant requires large amounts of electricity to make potable water, and if fossil-powered generators make that electricity, they will contribute to pollution and climate change. If a desalination plant utilizes reverse osmosis, then the plant will make a gallon of potable water from two gallons of seawater, and must dispose of a gallon of concentrated

brine. Simply discharging the brine into the ocean without careful planning can harm marine life, and the intake pipe's screens can kill fish. Hence, desalination projects must show a favorable cost/benefit ratio: In return for a risk that is acceptable, potable water is produced that can save lives.

There is also a political problem: Coastal residents living near a proposed site for a desalination facility may fiercely oppose it, accepting gross exaggerations of the risks as gospel — especially if the plant, either directly or indirectly, serves what they perceive to be an urgent need in another state or even another neighborhood with which said coastal residents do not identify. An example of this latter objection would be an affluent and largely white community being reluctant to host a desalination plant in order to assist minority communities further inland.

If, on the other hand, the desalination is of the thermal type, which boils seawater and captures the condensate, brine is not a problem — but disposal of the salts left behind becomes an issue. However, these are a source of commercially useful chemicals, the sale of which can help pay to operate the plant. Thermal plants that utilize mirrors to focus sunlight to boil the water have been successfully demonstrated.

(A new reverse osmosis desalination plant can be designed to make its own sodium hydroxide, which is used to pretreat seawater entering the plant. Enough sodium hydroxide can be made to not only serve a plant's needs, but also to sell to other users. A new plant can also make hydrochloric acid for various industrial uses.

Currently, at least in our region, desalinated water is more expensive than river water. The water from the Carlsbad desalination plant supplying San Diego, representing 10 percent of potable water supplies as of 2019, costs $2,200 per acre-foot in 2018, whereas water from the Colorado River costs $1,200 per acre-foot. (It is important to note, however, that desalination costs have seen a significant drop compared with a decade ago.)

Brackish water

There is yet another option available locally in Nevada. Brackish water sources exist in Nevada, according to the U.S. Geologic Survey. Seawater has roughly 35 grams of

dissolved solids per liter of water; brackish groundwater generally has between one and 10 grams of dissolved solids per liter. Brackish water is unsuitable for drinking, but it requires less energy to desalinate than seawater and produces less brine requiring disposal. Hence, it is likely to be feasible to desalinate brackish groundwater in Nevada to supply potable water at lower expense than to pay California or Mexico to desalinate seawater. A variant of this approach would be to use brackish water for industrial and agricultural uses (cooling, irrigation, livestock watering), reserving potable water for drinking.

As there are environmental consequences to all options, it would be prudent to examine combinations of investments in all three, picking a mix that offers the best package of reliable, safe potable water at a reasonable cost and with manageable environmental impacts.

It is vitally important to remember that desalination is not a magical cure for drought and should not replace water conservation measures. Rather, it is an effective way to close the gap between what the efficient use of river and groundwater produce, and what we need.

Dr. Ron Aryel, a resident of Reno, is a pediatrician who also founded a real estate investment business in 2014 which owns both apartment buildings and single-family homes. He ran an award-winning pediatric practice for 11 years and served on the City of Reno's COVID Task Force. He and his wife Stacey, a retired pediatric neurologist, run the Albee Aryel Foundation, which supports students from disadvantaged backgrounds through university education.

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

Second Snow Survey Reflects Boost from Atmospheric Rivers

Published: Feb 01, 2023

SACRAMENTO, Calif. – The Department of Water Resources (DWR) today conducted the second snow survey of the season at Phillips Station. The manual survey recorded 85.5 inches of snow depth and a snow water equivalent of 33.5 inches, which is 193 percent of average for this location on February 1. The snow water equivalent measures the amount of water contained in the snowpack and is a key component of DWR's water supply forecast. Statewide, the snowpack is 205 percent of average for this date. Two months remain until April 1, when the state snowpack usually peaks.

The snowpack received a significant boost from one of the wettest three-week periods on record in California, following the driest three-year period on record. California also experienced above average precipitation in December just months after one of the hottest heatwaves in state history in September.

"California has always experienced some degree of swings between wet and dry, but the past few months have demonstrated how much more extreme those swings are becoming," said DWR Director Karla Nemeth. "California is preparing for more intense and dangerous climate swings by bolstering both drought and flood preparation. While today's results are good news for water supplies, we know from experience how quickly snowpack can disappear if dry conditions return in the months ahead."

DWR's electronic readings from 130 snow sensors placed throughout the state indicate the statewide snowpack's snow water equivalent is 33.7 inches, or 205 percent of average for this date. While those results are currently outpacing the record 1982-83 season, two months still remain. Every day it does not rain or snow, the conditions are drying. If California returns to dry conditions and the next two months lack additional precipitation, like what the state experienced last season, a significant snowpack early in the winter can quickly disappear. Periodic rain and snow over the next several months will be key to get the biggest water supply benefit from the state's snowpack without posing additional flood risks.

"Large snow totals like today are a welcome sight but also present new challenges for water managers as they walk the fine line between water supply and flood control," said DWR's Snow Surveys and Water Supply Forecasting Unit Manager Sean de Guzman. "As we move into the snowmelt season in the spring, water managers will work to manage flood risk and optimize the snowpack's water supply benefits during peak demands in the summer."

On average, the Sierra snowpack supplies about 30 percent of California's water needs and is an important factor in determining how DWR manages the state's water resources. Its natural ability to store water is why the Sierra snowpack is o en referred to as California's "frozen reservoir."

DWR is currently conducting Airborne Snow Observatory (ASO) survey flights to collect more information on the snowpack accumulated by these powerful storms. Data from these flights, which use LiDAR and spectrometer technology to measure snowpack across broad swaths of key watersheds, will be used by DWR to get an accurate account of California's snowpack and its water content and will increase the accuracy of water supply runoff forecasts. Since the storms California experienced in January saw variable snow elevations, this data, combined with snow course and snow sensor data, will help DWR understand how snow has been distributed across the Sierra Nevada.

These new data tools align with Governor Newsom's "California's Water Supply Strategy: Adapting to a Hotter, Drier Future" which calls for modernizing how the state manages water. The tools will also help inform flood management decisions, which will be increasingly important as California swings between extreme drought and flood. The recently adopted 2022 Update to the Central Valley Flood Protection Plan emphasizes the importance of flood management and the need to adapt California's flood infrastructure to a rapidly changing climate.

As the state prepares for a hotter, drier future, Californians should continue to use water wisely so that we can have both a thriving economy, community, and environment. DWR encourages Californians to visit SaveOurWater.com for water saving tips and information. As more swings between wet and dry conditions continue in the future, the public education campaign promotes making water conservation a way of life year-round.

DWR conducts five media-oriented snow surveys at Phillips Station each winter near the first of each month, January through April and, if necessary, May. The next survey is tentatively scheduled for March 1.

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Water system experts from across Nevada gather in Reno

Josh Meny
Feb 1, 2023

The state of Nevada is fragmented when it comes to water systems across the state and this week, stakeholders from different water systems are meeting to come together and see the bigger picture.

The Nevada Water Resource Association (NWRA) is holding its annual conference in Reno this week.

In the headlines, Nevada was one of the six western basin states to sign a consensus model for reducing water use from the drought-stricken Colorado River with California - the largest water user - being the lone hold-out.

Northern Nevada and rural parts of the state have different dynamics than southern Nevada.

"As you grow, where is all that water going to come from? And if you're not prepared for it, it could be a huge impact," said Nevada Water Resource Association Board Member Edwin James.

James says often times, the water systems stay in their own bubbles.

"You have urban areas that are now growing, they need water, so they look at water resources. All the water is allocated, so if you're trying to take water

you're going to have to take it from another source, and agriculture is always at risk," said James.

Truckee Meadow Water Authority Supply Supervisor Bill Hauck says even when levels are low in Lake Tahoe or the Truckee River, the water system still supplies adequate levels to users.

"We've got water coming from three sources. We have ground water production wells. We have water rights from the Truckee River system. Plus we have upstream drought reserves stored in federally owned and privately owned reservoirs upstream," explained Hauck.

Hauck says those three sources used collectively and managed integrated create a reliable source, and with this winter's above average snowpack, northern Nevada is in good shape.

"All the reservoirs on the Truckee River system are expected to make a significant if not full recovery this year," said Hauck.

Southern Nevada Water Authority takes 90% of its water from the Colorado River, and it is in active talks with six of the seven states across the Colorado River Basin. 60% of the water goes toward outdoor use, and 40% goes toward indoor use.

All indoor water is treated and returned back to the Colorado River, which extends their water supply credits. "I think because of the infrastructure investment that we have placed in southern Nevada, we've spent over 1.5 billion dollars on a third intake and low level pumping station, which gives us access to Lake Mead at all operation levels," explained Southern Nevada Water Authority Director of Water Resources Zane Marshall.

The federal government is looking for more reductions from Southern Nevada.

"The Bureau of Reclamation is looking for reductions of 2 to 4 million acre feet across the basin. There is certainly more that needs to be done to identify ways that we can reduce overall demand," said Marshall.

Water system representatives, technicians, research institutes, academics, and tribal governments attend the NWRA conference.

The Desert Research Institute and the University of Nevada Reno presented updates on their creation of an online water resource network. The project will collect data and share information between all water systems.

It should allow for broader collaboration and information-sharing with the public and elected officials.

FEBRUARY 1, 2023

Wildfires are increasingly burning California snowy landscapes, colliding with winter droughts to shrink snowpack

by Desert Research Institute

Snow under burned trees from the Caldor fire. The new study shows that snow melted more rapidly drought conditions within the footprints of wildfires. Credit: Anne Heggli, DRI

The early pandemic years overlapped with some of California's worst wildfires on re haunting, orange-tinted skies and wide swaths of burned landscape. Some of the im fires are well known, including drastic declines in air quality, and now a new study sh wildfires combined with midwinter drought conditions to accelerate snowmelt.

In a study published Jan. 20 in *Geophysical Research Letters*, a Desert Research In led research team examined what happens to mountain snowpacks when sunny, m spells occur in forests impacted by severe wildfire.

The researchers found a substantial increase in wildfires burning in California's snow throughout 2020 and 2021, when large blazes like the Dixie, Caldor, and Creek fires in snow zones. Using a 2013 midwinter dry spell as comparison, they found that sim the winter of 2021-2022 led to 50% less snow cover. The compounding impacts of w melt include an increase in sun exposure due to loss of forest canopy, and a reducti snow's ability to reflect sunlight.

"It's already established that wildfires are accelerating spring snow melt, but we wan what happens when you add a long winter dry spell on top of that," said Arielle Kosh student now at the Colorado School of Mines who co-led the study as part of her ma at DRI and the University of Nevada, Reno. "The Caldor fire burned in our backyard close to where we live and work. So, the following winter, we wanted to investigate w like."

Satellite data showed that compared to the 2001-2019 average, 2020 and 2021 saw fold increase in wildfires burning in California's seasonal snow zones. "What that im there's this increasing overlap between the fire and snow and there's all these casca compounding impacts on the system and especially the hydrology," said Ben Hatche climatologist at DRI who co-led the study with Koshkin. "This huge increase of fire a California snowy regions is exactly what we expect to see more of going forward."

A strong winter drought followed during the winter of 2021-2022, when Tahoe City e 46-day long midwinter dry spell (the second-longest since reliable records began in term median is 22 days without precipitation). A comparable midwinter drought follow to the winter occurred in 2013, giving the researchers the ability to compare and con impacts under more typical conditions with those that occurred in a severely burnt la

"In 2013 and 2022, we had very similar weather patterns, but we didn't see notable And in 2022, we also did not see melt in unburned areas," Hatchett said. "So that gi evidence suggesting that it's the fire and not the meteorology that's driving this."

Forests where severe wildfires have burnt the tree canopy have more exposed snow enhances the melting caused by sunny days and warm nights (another recent DRI s the snowmelt impacts of spring heatwaves). Snowmelt is further exacerbated by the snowpack's albedo, or the natural power of white snow to reflect, rather than absorb radiation. Particularly in the winters immediately following a wildfire, snow is dusted carbon of burnt vegetation, which can accelerate snowmelt rates by up to 57%.

The enhanced snowmelt was so pronounced within the perimeter of the Caldor fire researchers found a total of 50 fewer days with snow cover in the winter of 2021-20 number of snow cover days on record.

Following a wildfire, "there are two timescales of interest: right after the fire, the loss really dominates," said Hatchett. "But impacts from the loss of canopy last for decad longer if the forest does not recover."

The enhanced snowmelt of midwinter creates challenges for forecasting water avail natural snowpack reservoir. During the winter months, water managers need to leav reservoirs to prevent flooding; this means that earlier snowmelt may not be captured the dry season. Studies like this provide water managers with the tools to make mor predictions of the timing and magnitude of snowmelt.

"The fires have made major landscape disturbance that we're not taking into accoun forecasting abilities," Koshkin said. "I think this study is showing that wildfire impacts we need to implement this into our ability to understand how water runs off the lands of our world and it's increasing and it's going to affect more snowy places. So, it's im make sure that we understand the outcomes in our models and management plans Koshkin plans to expand on this research for her Ph.D. studies by examining region fire impacts on snow. She notes that how wildfire impacts snowmelt in the Sierra Ne different in Colorado or Idaho, due to different weather and snowpack conditions.

The researchers emphasize that the wildfire impacts seen in this study are the resul severity wildfires, and not lower-severity burns like prescribed fires. "This study real importance of bringing fire back onto our landscape in the sense that we need fire—answer to our wildfire problem," Hatchett says. "Bringing a more natural regime of fi prescribed and cultural fire, back onto our landscape will help reduce the likelihood fire."

"We can recognize that this could be our new normal," Koshkin said, "but we also ha to adapt and manage and mitigate as much as possible."

More information: Benjamin J. Hatchett et al, Midwinter Dry Spells Amplify Post-Fire Snowpack *Geophysical Research Letters* (2023). DOI: 10.1029/2022GL101235

Journal information: Geophysical Research Letters

Provided by Desert Research Institute

Reno sees coldest winter in 15 years, surpasses average precipitation for water year

by Audrey Mayer

Monday, February 6th 2023

snow.PNG

Reno, Nev. (KRNV) — We are not even halfway through the start of the water year, and Reno has already surpassed the average amount of precipitation and average seasonal snowfall. Since October 1, the start of the water year, Reno has received more than eight inches of precipitation (8.08") and almost twenty six inches of snowfall (25.8").

The water year starts over every year on October 1 and lasts through September

58° 47° 48°

30. T
received over the first weekend of February.

Precipitation totals aren't the only eye-catching numbers from this winter season. Chris Smallcomb, Meteorologist in Charge for the Reno National Weather Service, says The Biggest Little City is having the coldest winter since 2008.

"A lot of that started with that cold front we had in late October...ever since then, it's actually been a lot colder than normal," he said.

The Tahoe City weather station is also on track to have the coldest average winter since 1973.

Freezing temperatures plus heavy snowpack means good news for skiers and snowboarders and bad news if you enjoy running or hiking outdoors.

"But when that snowpack does melt, it's great news for the water supply. It will help fill up the creeks and rivers and the lakes and reservoirs will help our drought situation a little bit," said Smallcomb.

Reno can also anticipate some flooding concerns this summer, depending on how fast we warm up in the spring and summer months.

Email reporter Audrey Mayer at aumayer@sbgtv.com. Follow @AudsMayer on Twitter and Audrey Mayer KRNV on Facebook.

Loading ...

YALE Climate Connections

HEALTH

A double whammy: Wild re debris pollutes drinking water

Wildfires, which have intensified with climate change, litter the ground with debris that can contaminate drinking water supplies after a heavy rain.

by **ALEX URQUHART** and **TANYA PETACH**
FEBRUARY 3, 2023

(Photo credit: U.S. Department of Agriculture / CC BY 2.0)

The largest wildfire in New Mexico's state history burned over 300,000 acres in the summer of 2022 and came within a mile of the town of Las Vegas. The flames ultimately spared the town of 13,000, but months later, ash and soot left by the Calf Canyon/Hermits Peak wildfire fouled drinking water there when monsoon rains blanketed the region, paradoxically slamming Las Vegas with both **flooding and a municipal water shortage**.

Four people drowned in flash floods, and residents were forced to erect sandbag barriers to protect their houses. Meanwhile, the inundation overwhelmed the town's water filtration system with ash contamination, forcing mandatory restrictions to cut water consumption by about two thirds. Swimming pools went empty, and restaurants resorted to disposable dishes and utensils to cut back on dishwashing.

In September, New Mexico spent $2 million to rapidly install a temporary pre-treatment system. It is still propping up the overstrained filtration system while the town applies for federal funds for a permanent water treatment facility that the mayor **estimates** could cost as much as $100–200 million.

Climate change is worsening wild res

Around the world, more extreme wildfires have become a shocking signal that the effects of climate change are here. Wildfires are now more **common** and more **destructive**, making their damage more **expensive**.

Climate models have predicted this worsening trend for years and suggest it will continue as long spells of hot and dry weather become more common. In California, 12 of the 20 largest fires since 1932 occurred **in the last five years**. In the Mediterranean, the frequency of so-called "fire weather"—hot and dry weather that leads to large wildfires—is projected to increase by up to 30% **by the end of the century**.

Toxic runoff dirties drinking water

Although the dramatic violence of wildfires attracts intense media coverage, long-term impacts on water quality have gone largely unreported. The problem is alarming in the U.S. West, which has wrestled with regional water shortages for years. Researchers are **finding** that heavy rains in areas affected by wildfires can contaminate watersheds and overwhelm municipal drinking water systems. Municipalities must often pay astronomical costs to augment, repair, or replace entire water distribution systems. With risks growing, researchers say at-risk areas must plan ahead to act

quickly and communicate clearly about water issues to fire-hit residents.

Wildfires lead to increased flooding and sediment erosion into rivers because a healthy forest is no longer there to slow stormwater runoff and increase water absorption. During storms, ash from the wildfire will be carried unchecked directly into streams, where it can easily flow to a municipal water intake and overwhelm treatment plants, leading to water shortages or even total failure of municipal water systems.

Following the Rocky and Wragg fires in California, **researchers** studying the affected watersheds recorded drastic increases in dissolved organic carbon, dissolved organic nitrogen and ammonium. It took over a year for these levels to return to normal.

When fires burn through developed areas, toxic runoff is created from the destruction of building materials, electronics, appliances, and vehicles. Rain transports these dangerous chemicals into groundwater,

contaminating private wells and municipal systems. This can force months of boil water advisories, or even **do not drink/do not boil orders**, where drinking water must be brought in from other areas.

Even the water distribution system itself can become a source of contamination. Following the Tubbs Fire and the Camp Fire in California, both of which burned through developed areas, researchers found that municipal drinking water exceeded exposure limits for volatile organic compounds such as benzene. **The source of this contamination** may have been fire damage to plastic pipes and other synthetic components of the distribution system. With so many potential sources and causes of contamination, it is challenging for public officials to define an appropriate response. This has led to conflicting or variable recommendations in the aftermath of a fire, damaging public trust in official guidance.

Can we build re-resilient water systems?

As wildfires worsen globally, water quality problems will affect millions of people who live in threatened watersheds. In addition to cutting planet-heating emissions, specific solutions are needed to protect public health and safety from the inevitable fires to come.

Researchers who studied the aftermath of the Tubbs and Camp Fire have called for standardized and streamlined water quality monitoring following wildfires. They recommend a “do not use” order following any wildfire that burns through developed areas. Other recommendations include updated building codes to limit the spread of contaminated water within damaged distribution systems.

Clear health and safety guidance in the aftermath of a fire is crucial. In the months following the Camp Fire, **surveys of 233 households** within the affected community showed 54% had some level of anxiety about water contamination, and 85% were seeking alternative

water sources. The public needed clear recommendations about drinking water safety, including how to conduct at-home testing. Following a fire, clear and regular communication may be required for months or years, depending on the scope of contamination.

Municipalities may also identify standard operating procedures and fire response policies before disaster strikes. A **new study** examining the 2021 Marshall fire in Colorado outlined potential mitigation procedures that municipalities could implement, from emergency planning to post-fire flushing protocols.

“There are very simple straightforward actions that municipalities can take today to prevent wide-scale water distribution system contamination,” said Andrew Whelton, a lead author of the study. For example:
“isolating your water distribution center into zones so that if one part of the system is damaged it doesn’t spread to the other parts of the system.”

Having a plan in place will reduce confusion and increase trust and efficiency in the wildfire response, recent research suggests. One vital consideration is the level of water contamination that constitutes acceptable or unacceptable health risks.

“There are certain conditions that would indicate that your water is lightly contaminated and you should not use it,” Whelton said. “The Marshall Fire case study identifies those conditions, and another study identifies conditions of contamination in private wells. Your water can be chemically contaminated after a fire, and you have to do testing to determine if it is safe or not.”

Understanding these thresholds will lend clarity and speed to post-fire decision-making. And with climate change accelerating, the need for standardized practices that will educate the public about water safety and ensure access to clean water will only grow.

Alex Urquhart is the research and modeling manager at Energy Innovation Policy and Technology LLC® and Tanya Petach is the Climate Science Fellow at the Aspen Global Change Institute. Both organizations are Yale Climate Connections content-sharing partners.

*This post was updated Feb. 3, 2023, to reflect the correct spelling of Andrew Whelton’s name.

LAS VEGAS SUN

Despite separate plans for Colorado River cuts, stakeholders continue to talk

By Grace Da Rocha (contact)

Sunday, Feb. 5, 2023 | 2 a.m.

One proposal would bring cuts of 2 million acre-feet of water for users pulling from the drought-choked Colorado River system, mostly affecting California, Nevada and Arizona, in an attempt to conserve the region's most valuable commodity: water.

When looking at the plan released Monday by six of the seven states that rely on the Colorado River for their water supplies —and fiercely try to protect what they believe is their fair share —one water expert came to a harsh conclusion.

"It's a bandage for a gunshot wound," said Kyle Roerink, the executive director at the Great Basin Water Network.

The proposal, Roerink says, falls short because it puts the burden mostly on the three southwestern states — the so-called Lower Basin states.

"I think any time we see a proposal put forth that is going to limit consumptive uses, that's helpful," Roerink said. "It's promising, but when you look at who's giving up what, it just begs the question: Why does the Upper Basin get off scot-free?"

The Colorado River and its tributaries pass through seven states and into Mexico, serving 40 million people and a $5 billion-a-year agricultural industry. Some of the largest cities in the country, including Los Angeles, Phoenix, Denver and Las Vegas, two Mexican states, Native American tribes and others depend on the river that's been severely stressed by drought, demand and overuse.

The 1,450-mile river also generates hydroelectric power for regional markets and irrigates nearly 6 million acres of farmland.

States missed a mid-August deadline to heed the U.S. Bureau of Reclamation's call to propose ways to conserve 2 million to 4 million acre-feet of water. They regrouped to reach consensus last week to fold into a larger proposal the Bureau of Reclamation has in the works.

Arizona, Nevada, New Mexico, Colorado, Utah and Wyoming sent a letter Monday to the Bureau of Reclamation, which operates the major dams in the river system, to outline an alternative that builds on existing guidelines, deepens water cuts and factors in water that's lost through evaporation and transportation.

Those states propose raising the levels where water reductions would be triggered at Lake Mead and Lake Powell, which are barometers of the river's health. The model creates more of a protective buffer for both reservoirs — the largest built in the U.S. It also seeks to fix water accounting and ensure that any water the Lower Basin states intentionally stored in Lake Mead is available for future use.

The modeling would result in about 2 million acre-feet of cuts in the Lower Basin, with smaller reductions in the Upper Basin. Mexico and California are factored into the equations, but neither signed on to Monday's letter.

California on Tuesday submitted its own proposal, which details how states could conserve between 1 million and nearly 2 million acre-feet of water through new cuts based on the elevation of Lake Mead.

But, unlike the plan released by the states, California's attempt did not account for roughly 1.5 million acre-feet of Colorado River water lost to evaporation and transportation — a move sought by the other states that would mean big cuts for California.

Instead, California proposes reducing water taken out of Lake Mead by 1 million acre-feet, with 400,000 acre-feet coming from its own users. The state previously outlined that level of cuts in October.

Arizona would bear the brunt of bigger cuts — 560,000-acre feet— while Nevada would make up the rest. Those numbers are based on discussions from prior negotiations, California's letter said.

The proposals, of both the six states and the separate one by California, are only a short-term solution for next three to five years before the seven states will meet again for negotiations in 2026, said John Entsminger, general manager at the Southern Nevada Water Authority. He said all seven states had been negotiating in good faith.

"I don't view not having unanimity at one step in that process to be a failure," he said. "I think all seven states are still committed to working together."

Patricia Mulroy, CEO of Sustainable Strategies Consulting and former CEO of the Southern Nevada Water Authority, said the plan proposed by the six other states is "a great first step."

Aside from meeting the conservation goals requested by the Bureau of Reclamation, Mulroy thinks the cuts would finally force California to release its priority position in water rights. This would "represent a major shift and would make the river community nimbler," she said.

On the other hand, Roerink isn't concerned about California so much as he is the Upper Basin states of New Mexico, Colorado, Utah and Wyoming. In a social media post, Roerink wrote that "the Upper Basin states must have signed that letter with an ear-to-ear grin" because there are no cuts above the compact line.

"When you look at this proposal, it doesn't mean that much to me— the fact that you got the Upper Basin states to sign on because they get everything they want (and) there's no sacrifice for them," Roerink said in an interview.

With no proposed cuts for the four states, Roerink believes they could continue to develop new dams, diversions and pipelines that would bring all other water conservation efforts to naught.

Entsminger doesn't necessarily agree with his water colleagues about the Upper Basin states.

Despite a lack of proposed cuts for the Upper Basin states, Entsminger said that they will still be making contributions, especially through the Drought Response Operations agreements that have moved water downstream from the Flaming Gorge Dam on the Green River near the Utah-Wyoming border, along with future conservation programs.

"The majority of cuts have to come in the Lower Basin (because) that's where the vast majority of the water is used," Entsminger said. "With the Upper Basin … they're having curtailments under their state laws on a pretty regular basis. … So it really is almost a year-to-year effort in the Upper Basin."

Mulroy even said she was pleased to see the Upper Basin states' contributions, especially since they don't use their full entitlement of water compared to California, Nevada and Arizona.

One point on which Roerink, Entsminger and Mulroy agree is that the need for "shared sacrifice and … some element of equity" from the farmers to the city developers and state actors who depend on the Colorado.

"I've never been a big fan of finding a villain and blaming a villain, (but) if you want to find a villain, that spreads across every single user group," Mulroy said.

Farmers, many of which hail from California, need the water for their crops and use roughly 70% of the water allocated to the Lower Basin states, according to Mulroy. Roerink has also accused places like Las Vegas of continuing to develop housing and expand despite water's scarcity.

And while Entsminger admitted that Las Vegans need to be realistic about the arid climate, which would inevitably make water scarce, he believes every user in each sector of the basin needs to use less water.

"It's so critical to spread out the pain," Entsminger said. "If you can come up with a system where every water user is taking a 5-10% reduction and you can balance the system that way, then it'll be painful but not catastrophic to any one user."

The Bureau of Reclamation will consider the separate proposals as part of a larger proposal to revise how it operates Glen Canyon and Hoover Dams — behemoth power producers on the Colorado River. The reservoirs behind the dams — Lake Powell and Lake Mead — have reached historic lows amid a more than two-decade-long drought and climate change.

The bureau plans to put out a draft of that proposal by early March, with a goal of finalizing it by mid-August when the agency typically announces the amount of water available for the following year. Bureau of Reclamation officials have said they will do what's needed to ensure the dams can continue producing hydropower and deliver water.

The Associated Press contributed to this report.

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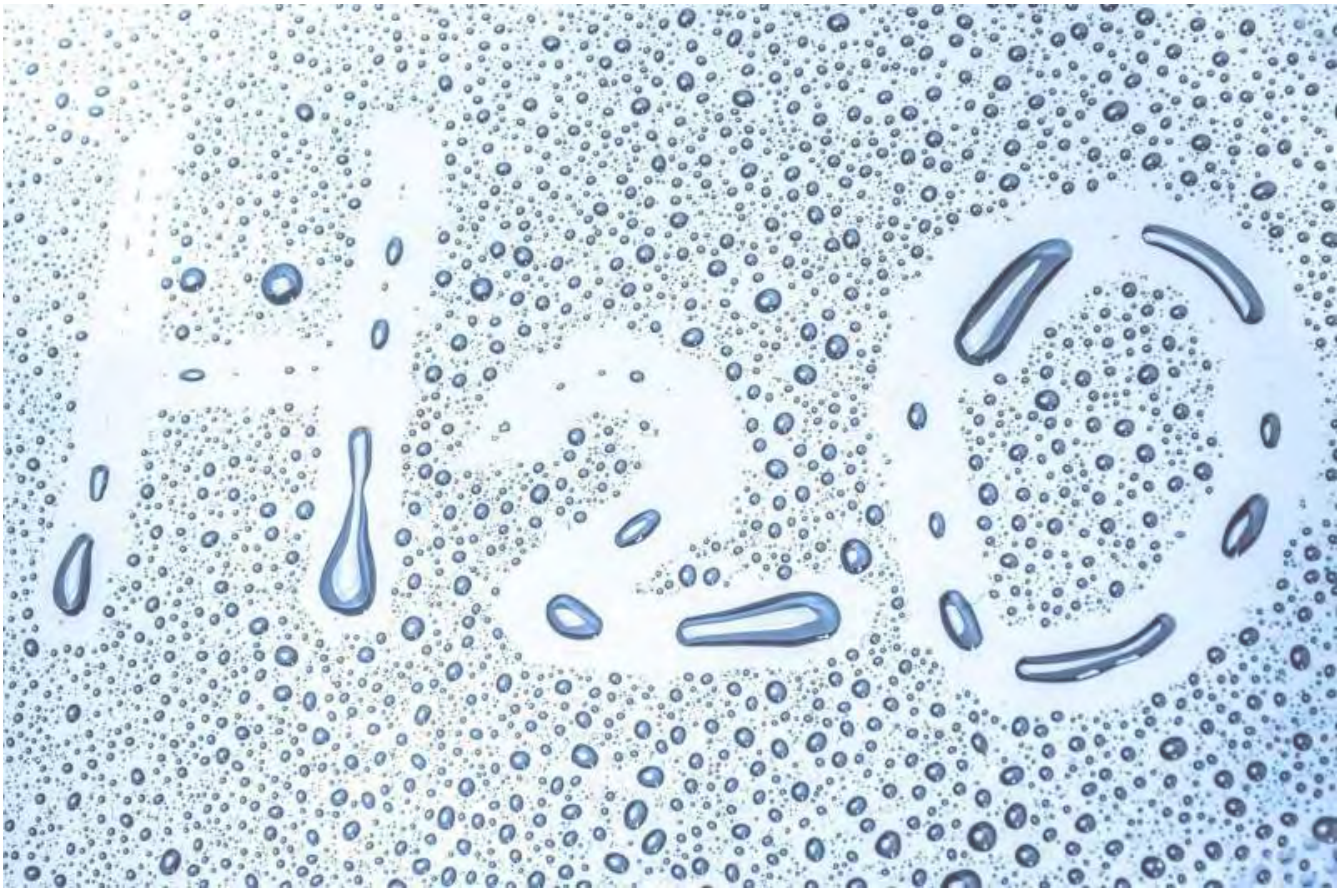
Want people to use less water? Tell them it going to cost more

by Carly Wanna, Bloomberg News



Credit: CC0 Public Domain

When people hear that their water is going to cost more, they start to use less of it.

That seemingly obvious finding comes from a new study led by researchers at the N University of Singapore and published this week in *Nature*. But the researchers also across an interesting nuance: The announcement of a water price hike, more than t itself, can have a bigger impact on consumption. The conclusion points to the need policy communication when it comes to water-conservation efforts.

"People do respond to the price change, and people also respond to the information says Mingxuan Fan, a co-author of the report and a visiting assistant professor at th University of Singapore Business School. "You can actually use pricing as part of yo conservation tool. It is effective, and it will be even more effective if you communicat

To reach their conclusion, researchers monitored monthly water consumption for 2 m Singapore from January 2011 to December 2019, looking for impacts from two diffe the price of water, and (2) the impact of expanded government subsidies in 2012 an consumers, and in particular low-income households, foot their water bills.

In 2017, Singapore announced a 30% increase in the price of water to reflect rising Following that announcement, researchers found that the monthly water consumptio households dropped by 5.8% relative to private apartments.

But 3.7% of that decline—nearly two thirds of the total impact—came after the policy announcement but before any actual price change. The study also notes that consu water usage responded more to the announcement of a price hike than those with h usage, who responded more to the hike itself.

"Consumers don't pay a lot of attention to water prices and need clear messaging in prices to effectively encourage conservation," says Daniel Brent, an assistant profes environmental economics at Pennsylvania State University who was not involved wi "Hopefully, utilities will embrace randomizing different messaging around water price the most effective way to communicate water prices to their customers."

As droughts become more frequent, governments all over the world are looking at w water supply and demand, including by raising prices. Critics argue that these price negatively impact low-income individuals who might be unable to afford sufficient wa logic prompted Singapore and other governments to offer subsidies based on house

Too generous a subsidy could, in theory, negate the effect of a price hike by enablin level of water consumption—but the Singapore study found no such effect. Instead, households that had access to the subsidy decreased their water consumption at le those households that did not have that assistance.

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