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Let's talk about
the weather



A study from the University of California, Riverside, has found that after a drought-stricken California lifted a year of mandatory water-use cuts, urban water use crept back up somewhat, but the overall lasting effect was a more waterwise Golden State. Published in the journal *Water Resources Research*, the UCR study found that water use by 2019 was still lower than it was in 2013, thanks in large part to water use changes by larger water users. We sat down with Dr. Mehdi Nemati, the study's lead author, to talk about the study and what its results mean for the residents, governing bodies, and municipal organizations in California.

Dr. Nemati is an Assistant Professor of Environmental Economics and Policy at the School of Public Policy, University of California, Riverside. With a strong focus on applied econometric methods and big data analysis, Dr. Nemati's policy-oriented research centers on economic issues associated with water management.

Q: WHEN THERE'S A DROUGHT, WHO MAKES THE JUDGEMENT CALL THAT A CONSERVATION MANDATE SHOULD BE IMPLEMENTED?

A: In California, that falls to the Office of the Governor, the State Water Resources Control Board, and the Department of Water Resources. Together they make the decision to do one of two things. The first is a voluntary reduction, and the other is a mandatory reduction. When the Office of the Governor issues a drought emergency, this releases funding for the water agencies to invest in conservation and other sustainability projects. It also gives the State Water Resources Control Board the authority to require water agencies to report their water use levels and so on.

Q: CAN YOU EXPLAIN WHAT YOU MEAN BY REBOUND EFFECT?

A: During a serious drought, there are big pushes for a reduction in water use, but when the drought appears to be over, then people think that it's fine to use water again. For example, in 2013/2014, when there was a conservation mandate, we saw a 25% reduction in water use, but then in 2017/2018, water use levels started to creep back up again. Not to the same pre-drought levels, but it does start to rebound.

Q: DESCRIBE THE DATA THAT YOUR TEAM USED FOR THIS ANALYSIS.

A: We studied data from a midsize water utility in Northern California that serves about 20,000 households. We focused on single-family residential because that's the majority of the water used by that water agency. Fortunately, they monitor hourly water consumption in addition to the monthly meter, and they have advanced metering infrastructure as well. So they produce millions of data points to see not only if the reduction happened but what was the rebound effect. If there is a behavioral change, we can also observe that from the data.

Q: SPEAKING ABOUT AVERAGE HOURLY WATER CONSUMPTION, HOW DID THAT CHANGE POST-MANDATE?

A: First of all, we did see that there is there's a rebound effect, so we see reductions during the mandate, and then it starts to come back up. But we also see a shift in the hours of consumption. The utility that we were studying was educating residents to water earlier in the day rather than later. This resulted in a reduction of water use, but also a shift in the distribution to the earlier hours. We see a lot of watering happening and all the outdoor watering early in the morning rather than later. 8:00 or 9:00 in the in the morning was the norm pre-mandate, which shifted to 4:00-5:00 am during and after the mandate, which is better because you're not losing water to the evaporation. (Most agencies now recommend watering in the evening.) This

reduction could be a product of the agency's messaging or could be that there were restrictions on watering during certain hours.



Q: WHAT DO THESE FINDINGS MEAN FOR WATER UTILITIES? HOW CAN THEY APPLY THIS TO HOW THEY OPERATE AROUND DROUGHTS?

A: Based on what we're seeing, what that means for the water agencies is that next time there is a drought and there's a call for reductions, there may not be much low-hanging fruit left. People already got efficient appliances, maybe installed a smart sprinkler, or made some behavioral changes, but it's going to be harder and harder to make additional reductions as we move forward. So we have to think about innovations on their part. The second takeaway is that their messaging is working, at least with regard to watering at better times of the day. That's great. There are also certainly financial implications because all of the utilities in California Public Utilities must recover their costs. If there are fewer sales, even after the drought is over, that's something they will have to prepare for. So you have to think about what this means financially and make investments in the future, like better infrastructure, for example.

Q: THE FINDINGS SUGGESTED THAT PEOPLE WHO USED THE MOST WATER BEFORE A WATER MANDATE SHOWED A SLOWER REBOUND EFFECT THAN THOSE WHO WERE ALREADY USING LESS WATER. CAN YOU EXPLAIN THAT?

A: This relates to factors like income status, the type of house and acreage, etc. It seems that residents who use more water are typically more affluent and tend to have higher education. So they're adopting technology when there is a call for reduction and are continuing to use that after mandates have been lifted, minimizing any rebound effect. This is what we call efficiency gains. Efficiency means that there's not going to be a rebound; it's not short-term. But for those that used less water to begin with, when a conservation mandate is issued, they often let their yards go brown, then once the mandate is over, we see a larger rebound effect to try to recover their yards and greenery.

Q: FOR RESIDENTIAL USERS, WHAT'S THE BIGGEST DRAIN OF WATER?

A: Indoor water use has been largely cut through rebates for water-wise appliances, like low-flow toilets and high-efficiency washing machines. However, **residential outdoor water use in the U.S. accounts for nearly 8 billion gallons** of water each day, mainly for landscape irrigation.

It's getting harder to conserve, but there are still so many opportunities outdoors replacing traditional lawns with drought-tolerant native plants or using weather-based irrigation. However, that brings up a disparity when it comes to the effects of water conservation in more affluent areas vs low-income areas. In low-income areas, single-family homes with yards often let their lawn go brown, while higher-income areas adapted through technology, using smart sprinkler controllers triggered by weather data to only water at night or skip watering during or after rain events. These are some of the unintended consequences of conservation mandates, especially in disadvantaged communities or these communities that cannot afford to adopt new technology.

Q: WHAT WAS THE MOST INTERESTING OR SURPRISING FINDING TO YOU?

A: To see the shift in watering times was pretty impressive since it was essentially across the board. People had changed their behaviors. Again, that could be because of the educational material they sent out or it could be that people were trying to follow the watering restrictions in their district. The other surprise was this rebound effect in lower income versus higher income water users because, again, that speaks to the role of technology and if you're able to afford to adopt these innovative new technologies.

Read the full research article from Water Resources Research **here**.

- OTHER WEATHER NEWS -

JULY 2023 HOTTEST ON RECORD

July ended not only as one of the hottest months in the past few years or even decades, but global scientists are reporting that it may have been the hottest month on record in the last 120,000 years. Earlier in the month, on July 6th, the global average temperature rose to 17.08 degrees Celsius, becoming the new hottest day in recorded history. Some warming can be attributed to the El Nino pattern settling in. However, climate scientists and global environmental organizations are also warning that temperatures will continue to rise unless more efforts are made to decrease **human-caused climate change**.

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INSURANCE COMPANIES ARE DROPPING STATES WITH HIGH CLIMATE STAKES



In Florida, Farmers Insurance stopped offering new auto, home, and umbrella policies later last month and said coverage for existing policyholders would not be renewed upon expiration. The move will affect about 100,000 existing policies and represents the latest retreat by insurance companies reluctant to cover Americans living in areas prone to extreme weather events. As more natural catastrophes become billion-dollar disasters and construction costs soar, some insurers have begun limiting coverage or suspending new policies in states including Florida, California, and Louisiana.

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COOLING PAVEMENT IS LOWERING TEMPERATURES IN PHOENIX

As much of the western United States baked under extreme heat last month (and the month before that), the city of Phoenix is using cooling technology on some city streets, parking lots, and even rooftops to lower temperatures. City officials are hoping that by using the technology more throughout the city, they can one day fully offset **urban heat island effects** that turn up the city temperatures. The technology is being used alongside other city-wide cooling efforts like planting more trees and adding more shade structures to public spaces.

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WHAT TO PLANT IN YOUR GARDEN THIS AUGUST

Normally by August, most gardeners are busy harvesting, weeding, and watering the edibles and ornamentals planted earlier in the season. But even in the late summer, there's still time to plant delicious, short-season crops and dress up beds and borders with gorgeous cool-season flowers. The trick is knowing what and when to plant in your late summer garden so that you can have a beautiful and bountiful harvest going into the fall.

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