

Researchers urge closing outdated water rule to aid Colorado River crisis

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The Colorado River's Horseshoe Bend. Credit: University of Virginia

Researchers investigating the historic stresses of the American West's water supply have identified a simple solution that could put parts of the Colorado River Basin on a more sustainable path.

In a new paper, a consortium of scientists and water experts including Julianne Quinn, an assistant professor in the University of Virginia

Department of Civil and Environmental Engineering, and UVA Darden School of Business professor Peter Debaere conclude that closing Colorado's "free river conditions" loophole should be a key first step to reducing water stress in the region.

The study is [published](#) in the journal *Water Resources Research*.

In Colorado, when the river carries enough water to meet everyone's needs, the "free river condition" allows anyone—regardless of whether they own [water rights](#)—to take as much as they want from the river. The provision is a relic of water-sharing agreements among the seven states, 25 Native American tribes and parts of Mexico—some 40 million people—for whom the Colorado is a lifeline.

"Closing this loophole in Colorado's water rights system could save millions of cubic meters of water and be the state's modest contribution to solving [water stress](#) in the Colorado River Basin," said Debaere, an expert in water economics and markets.

A region thirsting for solutions

Quinn leads the National Science Foundation project under which the analysis was conducted. She specializes in optimizing water resources management through mathematical modeling to help water managers balance competing objectives.

"Our project goal is to integrate supply-side water management through reservoir operations with demand-side management through fallowing programs in which farmers are paid for not irrigating their land," Quinn said.

The 1,450-mile Colorado irrigates some of the country's most productive farmland and generates hydropower used across the Upper and Lower

Basin states, comprised of Colorado, Wyoming, Utah and New Mexico and Arizona, Nevada and California respectively.

But the river's water volume is shrinking as rising temperatures increase evaporation and reduce the snowpack that feeds the river. At the same time, demand from farms and cities has been rising.

In mid-2022, water levels in the river's two major reservoirs, Lake Powell and Lake Mead, dropped so low the intake of water for hydropower was threatened, prompting a federal "shortage" declaration and the Biden administration's call for reduced usage. After the West experienced historic "atmospheric river" storms in 2023 and early 2024, the lakes have recovered to 37% of capacity. In 2000, they were nearly full.

The costs of 'free river conditions'

While trying to determine appropriate payments for a fallowing program, the team discovered the free river loophole, Quinn explained.

"It threatens the success of any payment program," she said. "If the water 'saved' by paying farmers not to irrigate results in more frequent free river conditions, someone else can then legally divert that saved water in excess of their right, defeating the purpose."

For example, during free river conditions in 2017—despite a decade and a half of drought—Quinn's team's analysis estimated 108 million cubic meters of water were diverted that could have been reserved in Lake Powell.

Moreover, Lower Basin states have the right to issue a "compact call" should the Upper Basin states exceed their sharing obligations under the century-old Colorado River Compact. That could trigger sudden usage

cuts, putting these states, which include Colorado, in a bind they could have avoided.

With some existing sharing agreements expiring at the end of 2025, the seven states are again negotiating their rights to the Colorado River.

Debaere said closing the loophole is a small step, but one that opens doors to future reforms.

"This is not a technological solution," Quinn added, "but a pragmatic end to a legal loophole in the management of water in the system."

The paper's co-authors include T. Li (International Business School Suzhou, Xi'an Jiaotong-Liverpool University, Suzhou, China); S. Fox and K. Bennett (B3 Insight, Denver); P. Block and K. Hietpas (Department of Civil and Environmental Engineering, University of Wisconsin-Madison); M. Mekonnen and S. Sharma (Department of Civil, Construction and Environmental Engineering, University of Alabama, Tuscaloosa, AL); B. Richter (Sustainable Waters, Crozet, VA; and S. Singh (Department of Systems and Information Engineering, UVA).

More information: P. Debaere et al, Closing Loopholes in Water Rights Systems to Save Water: The Colorado River Basin, *Water Resources Research* (2024). [DOI: 10.1029/2023WR036667](https://doi.org/10.1029/2023WR036667)

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