

Changing Water Conservation Attitudes Positively Impacts Water Availability, Study Finds

by Pennsylvania State University

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The increased demand for clean water and its limited supply have made water management one of the most pressing challenges facing society today. Changing attitudes about water conservation could significantly impact water consumption and help address this issue, according to research led by Renee Obringer, assistant professor of energy and mineral engineering at Penn State.

Many factors, including population growth, agricultural needs, and land use change, all contribute to an increased demand for water, especially in urban areas, Obringer said. Climate change and drought may also reduce the availability of water in some areas.

Water managers have primarily looked to solve increasing water needs by expanding or developing new water sources and supplies, such as enlarging reservoirs or extracting groundwater, but such solutions don't address the root of the issue.

According to Obringer, a socio-hydrology approach that accounts for how people influence water systems through their own consumption patterns is needed to understand the best way to manage stresses to the water system.

"It's important that we acknowledge the fact that humans play a role in our hydrological system," Obringer said. "Even in the farthest corners of the planet, things are changing because of us and how we use water. We wanted to see if an individual's decisions or water conservation attitude could impact the community's water availability and see what emerges if those attitudes are changed."

Obringer notes, "That encouraging participatory, collective action can make an impact and hopefully lead to happier, healthier communities." This is something that the CRWP also recognizes and strives to provide our community with the information, tools, and resources to make a difference. For more information and how to take advantage of our conservation resources, hover over the Conservation Tab at the top of our [home page](#).

To read this article in its entirety and the results of Obringer's findings, click [here](#).

The CRWP implements a Public Outreach and Education Program as well as a Conservation Rebate Program on behalf of its members to encourage efficient water use and meet WMCP requirements. These programs have a number of individual programs or components that provide awareness, information, motivation, and action for efficient indoor and outdoor water use practices.

Water conservation is an important tool in meeting the water supply needs of our communities and can help us reduce the cost of developing new water supplies. It also allows us to leave more water in the rivers for fish and recreation.

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Previous socio-hydrology research assessed how socioeconomic status and end-use intentions influenced consumption, but consumer attitudes and social norms were excluded, as they confused predictive models, resulting in overpredictions or misrepresentations of the water system, Obringer said.

"In periods of drought, cities often encourage, possibly even mandate, reduced water consumption to help conserve the water supply," Obringer said. "However, without changing the underlying values, beliefs and attitudes associated with water conservation, it is unlikely that these initiatives will be successful, particularly in the long term."

With the understanding that attitudes influence behavior, Obringer and her collaborator—Dave White, director of the Global Institute of Sustainability and Innovation at Arizona State University—developed an agent-based model (ABM) to investigate the impact of water conservation attitudes on overall water availability in Phoenix. ABMs are computer models used to simulate real-world systems that are made up of individual units, like people, and their interactions with each other and their environment.

"The primary entities in our model are the agents, which represent households in the city of Phoenix," Obringer said. "Using results from a previous household survey conducted across three metropolitan areas in the Colorado River Basin, we considered the Phoenix households to belong in one of seven archetypal groups that have different attitudes toward water conservation and participation in conservation programs."

"Since the region is experiencing a decades-long megadrought, Phoenix residents were familiar with water conservation policies and drought situations."

The seven archetypes used to classify Phoenix households were: neutral, individualist, would-be-participant, concerned, participant, confident denier and disengaged. Participant and would-be-participant are similar archetypes in that they both recognize the need for conservation programs, but the "would-be-participants" stated that they did not know how to get involved. And, the researchers said, while their work was limited to Phoenix, the archetypes and model could be applied to other areas, provided the data was available.

"The power of dynamic ABMs is they can account for the changing relationships that occur between water systems, climate and consumption to capture the nuances in a modern society," Obringer said, noting that the agents' water conservation attitudes can drive changes in

consumption and ultimately the system's behavior. "The static models used in the past work primarily as a snapshot in time and assumed that the relationships are stationary."

The team conducted more than 100 model runs to validate the model's accuracy before applying it to five hypothetical scenarios, which ranged from converting partial participants to full participants and "disengaged" to "concerned." They then conducted an additional 100 model runs for each scenario.

The researchers found the biggest effect on overall water availability occurred when the "would-be-participants" archetype converted into "participants." In one scenario, when half of the "would-be-participants" converted, there was a 4.5% increase in water supply—a significant amount according to the researchers.

The researchers suggested that a rebate program or educational campaign targeting renters could help encourage such conversion in the real world.

"Our results indicated that the best course of action was to focus intervention efforts on a subset of residents that recognize the problem but are unsure how to help," Obringer said. "These residents, the 'would-be participants,' are not only willing to participate in water conservation programs but are also among the most prevalent archetypes in Phoenix."

"This indicates that even getting a fraction of the households to shift archetypes can benefit the water system through increased supply."

Targeted campaigns have a high chance of success and are more likely to make a significant difference in the water availability, according to the researchers.

"The model doesn't show what policy or program would successfully persuade any specific group," Obringer said. "However, the ability to test scenarios and see what sort of groups or ideas are most worthy of targeting is invaluable in places where they're accounting for every gallon of water."

Obringer said she plans to build on the model, with the next step focused on incorporating predicted climate models to see how different scenarios might play out in the future due to climate change. The goal is to eventually test demand management policies or additional variables such as predicted population growth.

"I think one of the critical things that we were see in these results is that, while individuals might not think that they can make any difference, all you need is a critical mass—and it doesn't necessarily mean a lot of people—working towards the same goal to change the outcome," Obringer said.

"That encouraging participatory, collective action can make an impact and hopefully lead to happier, healthier communities."

More information: Renee Obringer et al, Simulating socio-hydrological responses to climatic conditions in Phoenix, Arizona, JAWRA Journal of the American Water Resources Association (2024). [DOI: 10.1111/1752-1688.13191](https://doi.org/10.1111/1752-1688.13191)