

2023

YEAR IN REVIEW





Table of contents

Arizona Water Innovation Initiative

Vision: Water security for a thriving Arizona

Mission: To drive a thriving water future through discovery, innovation and action for the benefit of all of Arizona

The 2020 Gallup Arizona Survey asked Arizonans to select the issues they consider to be most important for improving Arizona's future. **A secure water supply was among the top five priorities.**

Center for the Future of Arizona
"The Arizona We Want: The Decade Ahead"

Arizona's water resources are the foundation for our environment, economy and way of life. The state of Arizona is pleased to partner with ASU through the Arizona Water Innovation Initiative to enhance management of Arizona's water resources. Innovation in water treatment technology, drought response measures, water supply planning and technology solutions will ensure that Arizona continues to lead the way on water sustainability."

Patrick J. Adams, Water Policy Advisor,
Arizona Governor's Office of Resiliency

- 4 Introduction
- 6 Impact at a glance

Strategic priorities



Improving water efficiency and quality with technology

- 7 Purifying water to boost Phoenix supply
- Innovating water treatment practices for the semiconductor industry



Revolutionizing water measurement, modeling and prediction

- 8 Improving forest health and water resilience through science-based management
- Adapting to climate change impacts on water supply
- 9 ASU water visualization tool recognized for sustainable impact



Measurably advancing water security in Arizona's most water-insecure households

- 10 Bringing together communities, organizations and advocates: creating the Arizona Water for All Network
- Deploying proven water security solutions
- 11 ASU water expert Amber Wutich named a 2023 MacArthur Fellow



Catalyzing community understanding, engagement and capacity

- 12 Using the power of storytelling to drive societal change
- Planning for agricultural and community resiliency
- 13 Collaborative solutions for sustainable water management



Building consensus on sound water stewardship

- 15 Linking policy decisions and water stewardship
- Understanding water affordability in Northern Arizona communities



Convening conversations on evidence-based water solutions

- 16 ASU Flow 2023: A water year event for researchers and practitioners
- 17 Sea of Cortez water importation: Technical, economic and environmental considerations
- 18 Water narratives: A multimedia storytelling experience

- 19 Mapping our water reserves for the future
- 21 Water sustainability at center of new mixed-reality game
- 23 Looking forward



Arizona has arrived at an innovation moment

Our state needs new technologies and policies to drive transformative adaptation and a thriving future in the face of complex water challenges.

In response, the Arizona Water Innovation Initiative (AWII), led by Arizona State University's Julie Ann Wrigley Global Futures Laboratory™ and the Ira A. Fulton Schools of Engineering, officially launched in April 2023. The initiative is bringing the unmatched power of ASU's innovative approach to research and action to one of the most critical issues facing Arizona.

In the first year of this multiyear, \$40 million investment by the state of Arizona – alongside a \$5 million gift from the Virginia G. Piper Charitable Trust – AWII is strengthening Arizona's water resilience through technological developments, applied research, partnerships and community engagement. As a result of long-term drought and aridification there is significantly less renewable surface water available, and higher temperatures are creating a "hot megadrought" in the Colorado River Basin.



“Arizona Water Innovation Initiative is strengthening Arizona's water resilience through technological developments, applied research, partnerships and community engagement.”

Climate impacts include higher average temperatures, more extreme heat, further reductions in surface water supplies and more unpredictable precipitation.

In basins throughout Arizona, especially rural areas, non-renewable groundwater is used to support growth for communities and large agricultural operations, but progress on policy solutions is difficult. Lack of certainty about current and future water supplies undermines public confidence, threatens economic development, impacts budgets and finance and hampers effective decision-making about investments in water.

To address these challenges with innovative technologies and approaches that support sustainable economic development, improve human health and enhance environmental quality, AWII is made up of five pillars, or strategic priority areas, that leverage support across the campus and state.

The initiative also includes a growing list of partners. ASU officials work with industrial, municipal, agricultural, tribal and international partners to collectively develop water solutions. These solution areas include developing new approaches and technology for water conservation, augmentation, desalination, efficiency, infrastructure and reuse.

Through meaningful partnerships and inclusive engagement, including convenings across a broad range of water topics, our team is linking knowledge with action to inform decision-making and enhance societal outcomes by leveraging expertise, research and networks at ASU.

We at AWII invite you to discover, innovate and act with us to drive a thriving water future for all of Arizona.

Dave White

Principal Investigator,
Arizona Water Innovation Initiative
Julie Ann Wrigley Global Futures Laboratory™



Impact at a glance

Stood up dozens of innovative water resilience projects across the state

on crucial issues including water security, technology solutions and agricultural community resilience.

Launched two water technology testbeds

to advance Arizona's high-tech economy.

Offered neutral ground

to evaluate innovative water solutions including atmospheric water harvesting and desalination.

Registered four new patents

for advanced water treatment applications.

Developed powerful new tools

to monitor Arizona's groundwater resources from space.

Equipped leaders to adapt

to climate change impacts on the Colorado River with key data and tools.

Generated more than \$20M

in additional investments for Arizona water resilience research and development.

Recognized for Environmental Excellence

and sustainability impact with Arizona Forward's Governor's Award.

Developed an AI-powered water communication tool

to enhance public education on Arizona water issues.

Established a statewide water equity network

to support water-insecure communities.

Strategic priorities



Improving water efficiency and quality with technology

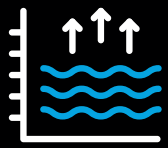


Purifying water to boost Phoenix supply

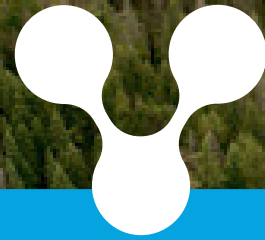
AWII is providing policy support and technical assistance to the state of Arizona, Arizona Department of Environmental Quality, and the city of Phoenix and its partners as it moves forward with plans for advanced water purification and direct potable reuse. The Phoenix plan will provide up to an additional 60 million gallons of water per day to Phoenix residents. This will reduce reliance on the Colorado River, which opens up new supplies that are resilient to drought.

Innovating water treatment practices for the semiconductor industry

The semiconductor – water reuse demonstration and research facility is addressing water-related challenges with practical and innovative treatment practices, particularly for the semiconductor industry. The focus is on transforming wastewater into tap water to minimize overall demand for freshwater or municipally treated water. This will ensure that the longer-term operation of semiconductor industries leads to sustainable growth in Arizona.



Revolutionizing water measurement, modeling and prediction



Improving forest health and water resilience

Strategic forest thinning efforts help reduce the threat of catastrophic wildfire and could be a possible solution to protecting our water supplies. ASU and Salt River Project are working together to understand the effects of forest thinning on the hydrologic cycle. Innovative hydrological modeling techniques enable accurate forecasting of site-specific water benefits resulting from reductions in forest cover. These insights are pivotal for decision-makers dealing with multifaceted challenges like wildfire control and improving ecosystem resilience and water supply.

Adapting to climate change impacts on water supply

In collaboration with the Central Arizona Project and 14 regional water management agencies, ASU's team of researchers developed the Colorado River Basin-Scenario-Explorer tool. The Scenario Explorer is an interactive online dashboard that can model scenarios like droughts and forest disturbances, enabling users to understand the impact of climate change in the Colorado River Basin. This tool uses satellite observations and hydrologic modeling to improve water resource decisions and management, enhance situational awareness of water resources and empower stakeholders with actionable insights.



ASU water visualization tool recognized for sustainable impact

An ASU research team has been developing solutions to help decision-makers manage water in the Colorado River Basin, a resource essential to seven states including Arizona. In 2019, the NASA's Earth Science division awarded ASU a \$1 million grant for its Long-Range Scenario Modeling of the Colorado River Basin project.

In collaboration with the Central Arizona Project, or CAP, and 14 other water management agencies, ASU's team of researchers developed an online visualization tool, CRB-Scenario-Explorer, which can simulate scenarios such as droughts and forest disturbances.

"Agencies who have a stake in the Colorado River Basin are not necessarily in agreement about changes in policy," says Enrique Vivoni, Senior Global Futures Scientist and a faculty member in the School of Sustainable Engineering and the Built Environment and director of the Center for Hydrologic Innovations. "As a result, decision-makers are seeking unbiased information, data and models from universities and other research organizations that can help them in the difficult tasks that lie ahead. Our challenge is to provide outcomes that are clear, actionable and communicate the uncertainties involved."

For this reason, Vivoni says it was important for the team to collaborate with various organizations across states to ensure the project's outcomes and models accurately represent the diverse perspectives of the basin. He emphasizes the importance of recognizing the collective effort behind this project and that its success was achieved through the collaboration of researchers, students and stakeholders.



The research team from the Center for Hydrologic Innovations at Arizona State University accept the Governor's Award for Arizona's Future from the sustainability nonprofit organization Arizona Forward. Photo courtesy Enrique Vivoni

Recently, the project received the Governor's Award for Arizona's Future from the environmental organization Arizona Forward, a recognition given to projects with significant sustainability impacts. Vivoni, who also serves as the lead for the Advanced Water Observatory and Decision Support System, one of the pillars of the Arizona Water Innovation Initiative, says the award is a testament to the project's ability to provide policymakers with valuable insights to guide water resource management.

"The future will be more challenging," Vivoni says. "There will likely be less water due to warming temperatures and the loss of snow cover. This use-inspired research comes from a real need for Western states to rethink how they use water now and in the future. We also must think about equity. Equity comes in all shapes and forms. It's not only about water for the most important economic output – it's about water fairness as well."



Measurably advancing water security in Arizona's most water-insecure households



The AW4A team attends the One Water Summit to meet with state water leaders

Bringing together communities, organizations and advocates: Creating the Arizona Water for All Network

The Arizona Water for All (AW4A) team met and collaborated with diverse communities statewide to find new ways to leverage our resources and have the biggest impact on Arizona water security.

The AW4A network is now a growing group of more than 100 community organizations; academics from Northern Arizona University, University of Arizona and ASU; policymakers and industrial changemakers across the Southwest equipped to shift Arizona water infrastructure.

Deploying proven water security solutions

Our dedicated team of engineers is working to improve water quality in communities across the state by designing and implementing water technology solutions. We are deploying modular, adaptive and decentralized (MAD) water solutions – bringing together engineered and social infrastructure – to improve community resilience in a fast-changing desert climate with hard-to-predict water access needs. We are working with communities to develop self-contained, transportable and low-maintenance water mechanisms, which are deeply embedded in community-level social infrastructure, to improve water sustainability.



Point-of-use water filtration system designed and installed by AW4A engineers in Florence, Arizona



ASU water expert Amber Wutich named a 2023 MacArthur Fellow



“My work has been relentlessly focused on ensuring that people who are cut off from the predominant ways of distributing water can get enough water to survive.”

Photo courtesy of the MacArthur Foundation

At nine in the morning on what she would describe as an “otherwise very normal” day, Amber Wutich sat down at her desk for a day of writing. When a call came in to her cellphone, she answered right away – she always answers the phone when her children are out of the house. Wutich, a water expert with two decades of research experience under her belt, was informed that she had been selected as a 2023 MacArthur Fellow by the MacArthur Foundation.

The highly coveted fellowship, sometimes referred to as a “genius grant,” is awarded to talented individuals who have shown exceptional originality in and dedication to their creative pursuits. The purpose of the fellowship, according to the MacArthur Foundation, is to enable recipients to exercise their own creative instincts for the benefit of human society.

Wutich’s creative instincts have led to major discoveries and groundbreaking work in her field. She, along with the teams she has engaged with, has been awarded \$80 million in research funds, published more than 150 peer-reviewed articles and achieved the titles of President’s Professor and Senior Global Futures Scientist at ASU.

“My work has been relentlessly focused on ensuring that people who are cut off from the predominant ways of distributing water can get enough water to survive,” Wutich says.

Wutich also serves as the lead for Arizona Water for All, one of the pillars of the Arizona Water Innovation Initiative, which aims to use engineering and social infrastructure

to improve water security for vulnerable households and ensure communities that are politically excluded from water access and decision-making can participate in future-focused discussions that impact them most.

Empowering and allowing people to shape their own water futures is crucial, Wutich says, and collaboration is key to creating more sustainable outcomes. She added that water insecurity can be found anywhere, including Arizona, and must be addressed through investments, new water policy and innovations.

Raised in Miami and exposed to hurricanes, Wutich saw firsthand how water disruptions could shape environments, distress and survival. She officially started working in the water insecurity field in Bolivia just after the Bolivian Water War. Local communities she worked with guided her to study the connections between water insecurity and mental health, and she listened. She has been listening – and working to empower those faced with water inequities – since.

“My work really is dedicated to understanding some of the darkest parts of the human experience,” Wutich says. “I’m hopeful that if we really do invest in social infrastructure, which is what gives rise to human innovation and ingenuity, that great things could happen for humanity.”



Catalyzing community understanding, engagement and capacity



Using the power of storytelling to drive societal change

The new Water Narratives and Societal Change courses explored impactful water narratives and storytelling, equipping students with essential skills in narrative writing. Students gained in-depth knowledge of key water issues and mastered successful approaches to effectively express complex water-related topics.

Planning for agricultural and community resiliency

We are engaging agricultural communities in the Colorado River Basin to address unique issues related to uncertain water supplies and demands. We introduce concepts of anticipatory governance, including exploratory scenario planning, as tools for decision-making under high uncertainty. These innovative approaches allow communities to drive their own future planning efforts.

Planning for agricultural and community resiliency workshop participants noted:

“It was great to see the various sectors working together, solidifying our identity and connections to agriculture.”

“Loved collaborating with people from all different backgrounds! Considering perspectives and making inclusive solutions.”



Gbemileke Anthony, a graduate student in media, arts and science at ASU, talks about the decreasing water level in Lake Mead, Photo by Charlie Leight/ASU News



Collaborative solutions for sustainable water management

Like many rural regions in Arizona, Sulphur Springs Valley in Cochise County faces groundwater declines while attempting to balance a multitude of community needs, including protecting its agricultural heritage and economy and supporting quality of life for residents.

In response to water challenges, Sulphur Springs Valley community members engaged in a scenario planning workshop to review possible futures and outcomes for agriculture and groundwater in the valley. Exploratory scenario planning delves into the root drivers of possible futures, providing stakeholders with insights for adaptation, resource alignment and flexible policy creation.

The Exploratory Scenario Planning (XSP) for Water Resilient Agriculture project is led by a team from two units of the Lincoln Institute of Land Policy, its Babbitt Center for Land

and Water Policy and Consortium for Scenario Planning, and Arizona State University's Arizona Water Innovation Initiative. The Sulphur Springs Valley XSP workshop team also included professional facilitation support from Southwest Decision Resources, Cochise College, Cochise County, the University of Arizona's Arizona Institute for Resilience and The Nature Conservancy.

The project was initiated by forming a steering committee composed of local stakeholders with diverse perspectives. This committee provided oversight, guidance and rallied the community for workshop participation.

In September 2023, the project team and the local steering committee hosted a two-day XSP workshop, bringing together participants representing different sectors, including multigenerational and newer agricultural interests, homesteaders and residents, city and county representatives, and other business and community leaders.



Building consensus on sound water stewardship

Facilitators guided discussions on large-scale forces driving community change, helping analyze and prioritize strategies across different future conditions. An immediate post-workshop outcome was the formation of the Sulphur Springs Water Alliance, a collaborative watershed group dedicated to effective management and conservation of the region's water resources.

A few key elements contributed to the success of the workshop:

- **Community-led collaboration:** The Sulphur Springs Valley XSP project was driven by the community, with a diverse local steering committee actively shaping the workshop. Their leadership not only enhanced credibility but also fostered trust and communication among individuals with diverse views.
- **Local expertise and empowerment:** Workshop discussions were guided by local expertise, empowering participants to prioritize ideas. While outside experts were available, the emphasis was on cross-disciplinary local knowledge.

- **Futures thinking and strategic discussions:** Discussions focused on understanding trends across possible futures, allowing proactive anticipation of changes and connections with stakeholders in the region. Intentional questions and activities maintained structured, inclusive, and productive conversations, ensuring all voices were heard.

The results of this XSP workshop in rural Cochise County demonstrate that rural communities are not only rich with committed, passionate residents but also have diverse perspectives who value working shoulder to shoulder on cooperative priorities and solutions that support regional water management efforts.

While each region has differing biophysical, economic and social contexts, the planning approaches used in this workshop can be more widely applied to other arid and semi-arid communities across Arizona and the West to help more rural areas collaboratively explore uncertain trends and forces at play in their regions.



Linking policy decisions and water stewardship

The Kyl Center for Water Policy at ASU has developed a variety of water information resources intended to support sound water policy decisions. For example, the Arizona Water Blueprint is a data-rich, interactive and evergreen hub of information about Arizona water resources and policy. It provides data visualizations and in-depth multimedia content on critical water-policy topics. In addition, the Colorado River Visualization Enterprise (the "CuRVE Project") models the Arizona impacts of Colorado River climate, hydrologic and management scenarios on individual community water systems, agricultural districts, tribal communities and industries across multiple decades.

Understanding water affordability in northern Arizona communities

Access to safe, reliable, affordable drinking water is the foundation of public health, economic opportunity and quality of life in any community. Yet, significant challenges associated with providing and maintaining this access exist across Arizona, perhaps most acutely on Native American reservations and in small, physically isolated rural communities across the state. Northern Arizona in particular is known for its isolated, rural areas and for the challenges faced by the Navajo Nation, Hopi Tribe and other tribal and rural communities in developing and maintaining access to safe, reliable drinking water. This study is contributing to better understanding water affordability in this area.

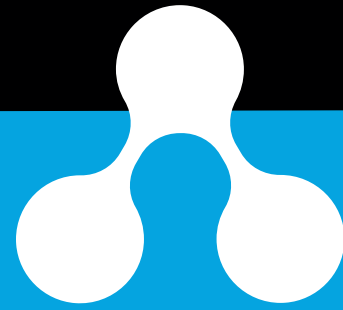
“The work we are doing at the Global Futures Laboratory **needs people of different backgrounds and disciplines** to work in a fashion that transcends disciplinary approaches so that they can provide novel options or solutions to the world's complex problems.”

Peter Schlosser,
vice president and vice provost
of Global Futures Laboratory





Convening power



ASU Flow 2023: A water year event for researchers and practitioners

One of the main goals of the ASU Flow Event, co-organized by Center for Hydrologic Innovations and Arizona Hydrological Society (AHS) Phoenix Chapter and held in November 2023 at the Rob and Melanie Walton Center for Planetary Health, was to bring together scientists and practitioners to develop innovative ideas and create long-lasting partnerships.

During the event, ASU students and researchers had the opportunity to meet practitioners from the private sector and government agencies. The Director of the Center for Hydrologic Innovations and Fulton Professor of Hydrosystems Engineering, Enrique Vivoni, and Mike Hulst, President of AHS, Phoenix Chapter, welcomed participants during an opening speech that was accompanied by the pitter-patter of light rainfall. A poster session, followed by five nicely executed lighting talks, informed around 80 participants from over 20 companies and agencies about AWII projects and other efforts addressing water resilience and cutting-edge research.

Through AWII, the state has entrusted ASU researchers to step up and set aside the normal way of doing things to create innovative and practical solutions to secure a water resilient future for Arizona. As an important contributor to the AWII, Center for Hydrologic Innovations is bringing practitioners and scientists together in new ways. Indeed, the ASU Flow Event is here to stay, and the Arizona Hydrological Society, Phoenix Chapter and Center for Hydrologic Innovations look forward to working with partners for our 2024 event.



Sea of Cortez water importation: Technical, economic and environmental considerations

The proposed importation of water from the Sea of Cortez to address water security in Arizona by augmenting water supplies raises a complex set of technical, economic and environmental considerations.

The Global Center for Water Technology, one of the pillars of the Arizona Water Innovation Initiative, held a panel discussion in October 2023 to address questions related particularly to the technical feasibility of water desalination and importation from the Sea of Cortez to Arizona. The purpose of the panel was to bring together experts from various technical fields and initiate conversations. The discussion was held in a public venue as a follow up to a technical roadmap completed by the GCWT in August 2023.

The panel was kicked off by Paul Westerhoff, Distinguished Global Futures Scientist, who provided a framing of water importation options being considered across Arizona. The panel was moderated by Wellington "Duke"

Reiter, executive director of the University City Exchange and founder and executive director of Ten Across. Panelists included Chelsea McGuire of Water Infrastructure Finance Authority of Arizona, Glenn Williamson of the Canada Arizona Business Council, Kerri Hickenbottom of the University of Arizona and John Tate of Stantec.

The group focused on the technological feasibility of importing desalinated water from the Sea of Cortez to Arizona. While complex, from a solely technical perspective, the project is feasible, noted Westerhoff. Future discussions on the project are expected to address a wide range of issues, including economic impacts, environmental effects and social considerations.

Only through a comprehensive analysis and open dialogue can informed decisions be made regarding this potentially transformative, yet potentially risky, undertaking.



Mapping our water reserves for the future



Water narratives: A multimedia storytelling experience

The Narrative Storytelling Initiative at the Julie Ann Wrigley Global Futures Laboratory presented a dynamic water narratives experience in October 2023 with 100 registered attendees. While addressing critical water challenges Arizona is currently facing, this multimedia experience featured a variety of narrative approaches that inspired and created a positive impact. The Water Narratives event created a powerful convergence of science, art and advocacy for a more sustainable water future.

In depth, Water Narratives highlighted exceptional works created by students in consultation with faculty who explored water issues and compelling ways to express them. It drew on a unique format that brought together six Arizona State University courses from both the College of Global Futures and the Herberger Institute for Design and the Arts to gain knowledge and apply creative craft. Faculty and students also participated in a short panel discussion, allowing guests to interact and collaborate with artists and researchers.

The event presented a selection of participants best works in a variety of artistic formats, including a student instrumental performance of a monsoon, a performative dance presented as 'Water Seekers' and insightful interviews with students who produced digital sound, photo art and creative writing projects, narrating their unique water perspectives. Following the main show, attendees engaged with water experts, faculty, student creators and the projects themselves through multimedia stations, encouraging guests to share, watch, listen and truly feel the passion in these projects.



Tired of reading how Arizona might one day run out of water and become the 21st century version of the Dust Bowl?

This story is for you.

It offers hope, innovation and common-sense measures – but mostly it reveals how one Arizona State University professor is helping to monitor groundwater storage changes across the state, find new groundwater and maintain it at a level that will ensure longevity, and fend off overexploitation.

For more than a quarter-century, ASU Professor Jay Famiglietti and his research team have been working on a satellite system that he says can track groundwater supply changes and depletion from space via the NASA GRACE mission.

Famiglietti, the science director for the Arizona Water Innovation Initiative and Global Futures Professor in the School of Sustainability, part of the College of Global Futures, and Senior Global Futures Scientist, says these satellites can map out regions of the world that are gaining or losing water. Closer to home, Famiglietti says this can help the Grand Canyon State protect and identify vital groundwater supply and divulge how to better utilize it for future generations.

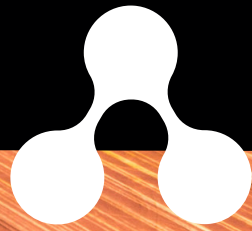
Here, Famiglietti discusses his work, research and what Arizona must do to protect its most precious resource.

Question: How do these satellites work and how long have you been working on this project?

Answer: I've been working with the NASA GRACE (Gravity Recovery and Climate Experiment) satellites since about 1997, which was five years before they launched in 2002. That gave me and my students a lot of time to prepare for the launch and to think about what to expect from the data and how we might use it to track water from space. We are still at it, now working with the GRACE Follow-On mission over 25 years later.

Arizona and the southwestern U.S. are in the throes of a megadrought and are literally losing water mass each month. The loss of water mass on the ground means that the region exerts slightly less of a gravitational tug on the satellites as they fly by, allowing them to float slightly higher in their orbits. The opposite happens, for example, when there is a large snowstorm in the mountains – the region has gained water mass, and the satellites are pulled a tiny bit closer to the Earth in response to the greater gravitational tug on the satellites.

By keeping track of the ups and downs of the GRACE satellites, which is done with incredible accuracy, we are able to map out the regions of the world that are gaining or losing water on a monthly basis.



Water sustainability at center of new mixed-reality game



Q: How has groundwater in Arizona been used or misused in the past?

A: Arizona gets about 40% of its water supply from groundwater. That water is used in both municipal and rural water supplies. Outside of cities, much of that groundwater is used for irrigated agriculture. Like many states in the United States, and many regions around the world, water management has historically focused on surface water in our rivers, lakes and reservoirs. The need to manage groundwater has lagged behind by decades.

It may surprise people to know that, by area, less than 25% of the state of Arizona is subject to groundwater management. In the rest of the state if you own the land and you have drilled a well, there are virtually no limits to how much groundwater you can pump.

This is problematic and can lead to several negative environmental consequences, like causing rivers to run dry, driving a loss of biodiversity or causing the ground to sink. Importantly, overpumping in one region often leads to lowering groundwater levels beyond that region.

Q: Why are you optimistic about your technology now?

A: We are having a moment here in Arizona in which I feel like the stars and planets are aligned so that we can make great progress toward water sustainability in our state. Most importantly, we have in Arizona Gov. Katie Hobbs someone who has made water a priority from day one of her administration.

We are also fortunate to have a core of dedicated researchers across the state, including our team at ASU, that received \$40 million from the state of Arizona to lead the state's Arizona Water Innovation Initiative. The initiative provides the funding base so that we engage deeply with state agencies to co-develop a research agenda to find those critical pathways to a sustainable water future for Arizona.

Finally, it is worth noting that Arizona's government water agencies are welcoming the opportunity to work together with us at ASU.

Q: What can we do to improve the situation in Arizona?

A: One of the most important things that we can do in Arizona, across the entire state, is to understand how much water we have, how much we use and how these are changing over time. If we don't know these things, it will be impossible to manage our water sustainably with future generations in mind.

We need to assess how much surface and groundwater we have, how much is available to us and how much of that is renewable versus nonrenewable. Once we understand that gap across the state's watersheds, groundwater basins, irrigation or water management districts, then we can look at how to manage it moving forward.

As an outcome of the Arizona Water Innovation Initiative, along with our partners, we hope to identify a range of potential options for decision-makers and water managers – like tools in a toolkit. For example, these can include conservation, new technological advances in water monitoring and water-use efficiency and production, managed aquifer recharge, sewage recycling, desalination, policy interventions and more.



With no end in sight for Arizona's megadrought, many researchers at Arizona State University are developing innovations to mitigate the drought's effects on residents, agriculture and industry, and promote water resilience and security.

Claire Lauer, a professor of technical communication in the School of Applied Professional Studies, part of the College of Integrative Sciences and Arts at ASU's Polytechnic campus, and Senior Global Futures Scientist, is applying her knowledge of user experience, or UX, and Arizona's water landscape to educate the public about the intricacies of water usage because "there's a lot of misinformation about water out there," she says. "Educating the public on water management will help communities make informed decisions, which can have a huge effect on Arizona's water policies and conservation efforts."

Lauer is collaborating with ASU faculty across disciplines to develop an engaging mixed-reality game and accompanying museum installation designed to convey the complexities of water allocation across Arizona.



The team is also coordinating efforts with the Smithsonian Museum on Main Street in Washington, D.C., the Arizona Science Center in Phoenix, and eight tribal and rural museum sites across Arizona to make the mixed-reality game informative, relevant and entertaining. The innovation, known as WaterSIMmersive, has been awarded a \$2 million, four-year grant from the National Science Foundation to further develop the project.

The project grew out of the WaterSIM America computer simulation platform led by Dave White, associate vice president of ASU Knowledge Enterprise and director of ASU's Global Institute of Sustainability and Innovation. Lauer, who is also a Senior Global Futures Scientist in ASU's Julie Ann Wrigley Global Futures Laboratory, became interested in improving the simulation's visual design, content and gameflow, and incorporating the general public's lived experiences with water for a more memorable interaction.

Researching public perceptions about water and gathering a team of subject-matter experts in education, psychology, technology and tribal water policy were Lauer's initial priorities.

"Ninety percent of the water used indoors in the Phoenix area is treated and recycled, yet many Phoenix residents we've spoken to think that taking shorter showers and conserving water indoors will help. The majority of a home's water is, in fact, lost through outdoor landscaping," says Lauer, who also serves as the chief UX architect for the Arizona Water Innovation Initiative.

In Arizona, 22% of water is used by cities and households, 6% is used by industry, and 72% is used for agriculture. Lauer said that the amount of water used for farming is cause for

concern because "large parts of rural Arizona are dependent on nonrenewing groundwater and have no laws about the amount of water that can be pumped, so they are vulnerable when new agricultural operations move in and water demand rises unsustainably."

Beyond offering critical information about Arizona's water landscape, the exhibit intends to share the megadrought's impact on water in tribal communities, including tribal "adjudication," or the negotiation of legal rights to water.

To ensure that the project's collaborations with tribal communities are inclusive, credible and sensitive to their needs, Lauer connected with Michelle Hale in ASU's American Indian Studies program, who works to build bridges between disciplines to enable shared conversations about issues like these.

"It's about making sure Indigenous communities are at the table when discussing water," Hale says. "This work gives tribal cultural centers and libraries a chance to work with people on the grassroots level to facilitate input on important state-level water issues."

WaterSIMmersive will educate users on the ramifications of water allocation. Initial gameplay concepts will give players the opportunity to virtually learn about water circumstances in five different communities along the Colorado River, interacting with characters who are farmers, engineers, Indigenous leaders and other stakeholders who live and work there. Each character will offer their perspectives about how they use water and why water is important to them.

"We are trying to thread the needle between something that's engaging, but also educational and memorable," Lauer says.

Looking forward

During our first-year innovation sprint, the Arizona Water Innovation Initiative laid a solid foundation for long-term impact on Arizona's water. AWII is dedicated to addressing Arizona's water challenges and securing a sustainable water future through diverse initiatives and partnerships.

In 2024, we are prioritizing research, technology transfer, policy development and community engagement. We look forward to continuing our support of water resilience projects in key areas such as adapting to current and future conditions, engaging Arizona residents in water resilient activities and demonstrating new technologies like advanced water purification. These efforts will equip our state to improve and adjust to changing needs.

Successfully applying new technologies to real-world scenarios is crucial for improving Arizona's water security. Expanding water engagement program delivery and partnerships will increase the initiative's impact on public awareness and water management practices. Researching and integrating social and engineered infrastructure will enhance water security in underserved

communities. Updating information tools will guide water management decisions at various levels that support long-term sustainability. Expanding partnerships and collaborations with other universities, research institutions and communities will lead to more comprehensive and impactful solutions.

AWII is already shaping Arizona's water future for the better. By focusing on key water challenges and collaborating with diverse communities, the initiative will continue to make significant contributions to the state's water security and sustainability.

To stay up to date with AWII activities and find water information you can trust, visit our website at azwaterinnovation.asu.edu, subscribe to our blog or attend one of our events. We look forward to working with you to secure a thriving future for Arizona.



Hey. The future is here. We need to get serious.

—Earth

Our planet is talking to us.

The Global Futures Laboratory is listening and working to build a healthier relationship with it. With a holistic, life-systems approach to solving critical resource challenges, we're driving toward a future in which all living things thrive. Join us.

globalfutures.asu.edu/join



**Julie Ann Wrigley
Global Futures
Laboratory™**

**Arizona State
University**

**Reshaping our
relationship
with our world**