



DECEMBER 2025 NEWSLETTER

Welcome to this edition of our newsletter

We highlight groundbreaking research, global collaborations, and upcoming opportunities to connect with colleagues across the region. At Mizzou, our faculty, students, and alumni continue to push the boundaries of knowledge and innovation. From investigating emerging contaminants in drinking water and soil to advancing global conservation efforts, their work demonstrates the power of research to protect public health, strengthen communities, and address pressing environmental challenges.

In this month's newsletter

You'll read about:

- **Co-Director Baolin Deng and MWC Research Scientist Pan Ni received a \$2.8 million grant** from the U.S. Department of Energy and their work towards the development of breakthrough extraction technology.
- **Mizzou Engineering Faculty - including some of the Center's staff - are among the top 2% of world scientists**, according to a list compiled by Stanford University
- Faculty achievements, including **Dr. Rebecca North's appearance in a STLPR story.**
- The **2025 Great Plains Water Conference: Securing Water Resources for Tomorrow** at the University of Nebraska Omaha and a compilation of photos from the conference.
- Key seminars

Together, these stories showcase how Mizzou's researchers and students are not only advancing science but also making meaningful contributions locally, regionally, and globally.



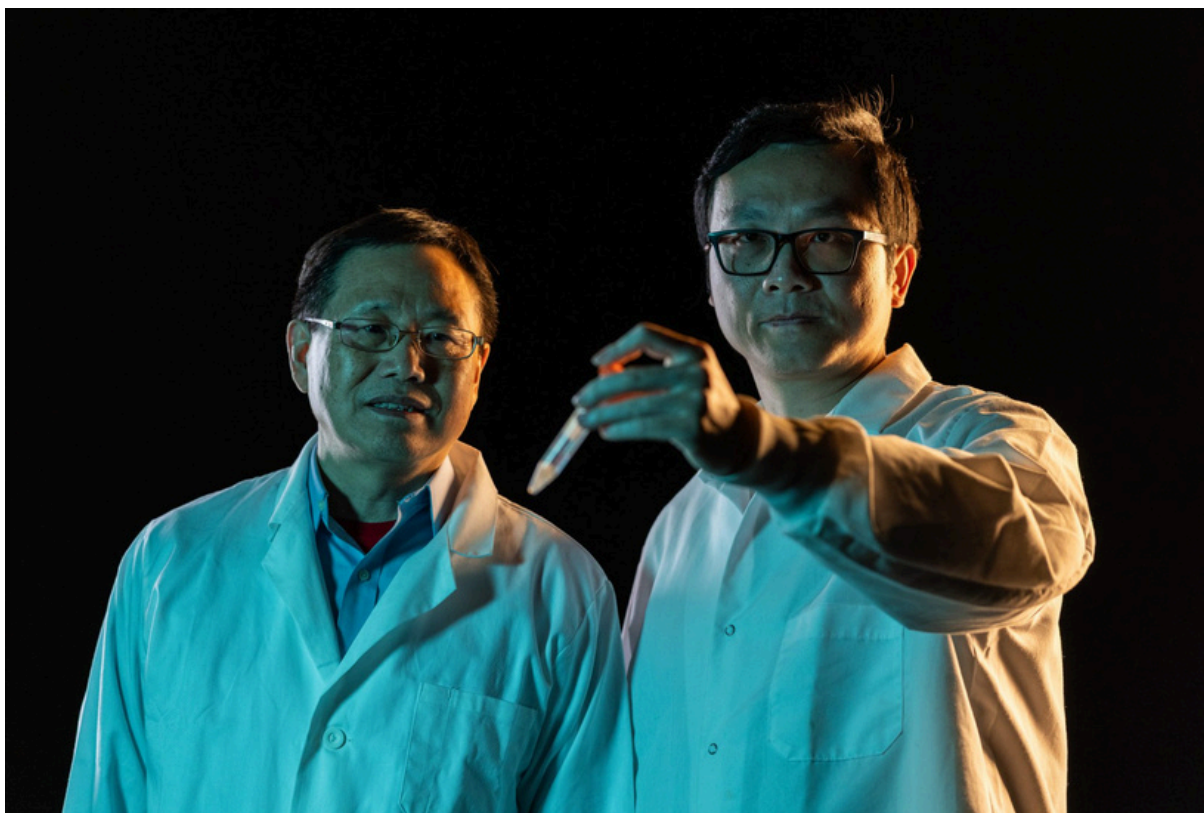
News & Research

Here we highlight several key research moments within the College of Engineering and College of Agriculture, Food and Natural Resources.



Turning waste into wealth: Mizzou researchers target Missouri mines for critical materials

A \$2.8 million U.S. Department of Energy award is powering the development of breakthrough extraction technology.



Dec. 16, 2025

Written by: [ShowMe Mizzou](#)

Photos by: Abbie Lankitus



DECEMBER 2025 NEWSLETTER

Baolin Deng, Curators' Distinguished Professor of Civil and Environmental Engineering and co-director of the Missouri Water Center, and Pan Ni, a research scientist with the center, showcase the polymers that help filter for rare earth elements from mining waste.

University of Missouri researchers are developing a process to transform abandoned mining waste into an untapped treasure chest of rare earth elements.

Baolin Deng, Curators' Distinguished Professor of Civil and Environmental Engineering and co-director of the Missouri Water Center, and **Pan Ni**, a research scientist with the center, have secured a \$2.8 million grant from the Department of Energy for the work.

Other collaborators include Mizzou College of Engineering faculty Jian Lin, Jaewon Lee and Caixia "Ellen" Wan, as well as Quasar Energy Group and the University of Colorado.

Rare earth elements, also known as critical materials, are the magnetic, fluorescent and catalytic powerhouses behind technologies such as electronics, vehicles, national defense systems and more. While not geologically rare, their dispersed nature makes them expensive and difficult to extract. That's one reason the U.S. currently relies heavily on foreign imports of critical materials.

Deng and his team want to change that by extracting rare elements from existing waste found in retention ponds and nearby wastewater at old mining sites across the state.

"If Missouri were to become a leading supplier of these elements, it would be a game changer," Deng said. "It could place the state at the center of the nation's technological future."



The ion-imprinted polymers, made from byproducts that come from seafood processing, grab specific elements.

Precision engineering

Unlike other methods that take a “catch-all” approach to extracting rare earth elements, Deng’s team is crafting technology that targets individual elements at the molecular level.

“There are plenty of materials that can strip contaminants from wastewater, but the key here is selectivity,” Deng said. “With 17 rare earth elements that share strikingly similar properties, the ability to separate them individually is transformative.”

Their cutting-edge solution: ion-imprinted polymers made from byproducts that come from seafood processing. These special materials are molded to latch onto specific rare earth elements when placed into mining wastewater. They grab the specific elements and filter out everything else.

To elevate the process further, the team is deploying artificial intelligence to continuously improve polymer performance and sharpen element-specific targeting.

“These elements are like twin brothers when it comes to telling them apart,” Ni said. “Maybe one weighs just a little more than the other. It’s incredibly challenging to differentiate them, but Professor Deng and our research team have proven it’s possible. Now, AI will further enhance the selectivity of our material.”

The team will spend the first part of the project perfecting polymer precision while also evaluating which waste streams and other sources contain the most valuable concentrations of elements. They will begin field testing at Missouri mining sites in the next few years.

The technology not only unlocks a domestic supply of critical materials, but it also turns environmental liabilities into economic opportunities, making cleanup of old mining sites profitable.

“In the past, cleanup was only a significant cost,” Deng said. “By pairing waste management with valuable material extraction, we can make remediation economically viable.”

The potential of the research doesn't end at state borders. Mizzou's collaboration with the University of Colorado allows researchers to apply the approach to mineral-rich natural runoff from the Rocky Mountains, further demonstrating national scalability and impact.

"The team is eager to advance this into a truly deployable technology that strengthens the U.S. supply chain," Deng said. "As researchers, we're laying the foundation. Ultimately, we'll want to work with industry to scale it into full-production reality."

Mizzou Engineering faculty among top 2% of world scientists

Twenty-three researchers were included in a prestigious list that ranks the millions of working scientists around the globe.



October 27, 2025

Written by: *[Mizzou Engineering](#)*

Mizzou Engineering has a rich tradition of academic excellence. Our researchers constantly challenge themselves and one another to pioneer breakthroughs. The results speak volumes. Twenty-three Mizzou Engineering faculty members are on a new, prestigious list of the highest scientific achievers in the world.

The list, compiled by Stanford University, draws on various metrics and citations to systematically rank the millions of working scientists around the globe.

“The faculty of Mizzou Engineering are truly world-class,” said Prasad Calyam, interim associate dean for research. **“Not only are they recognized internationally for their research, but they also provide our students with a reliable foundation for growth innovation and consistently deliver practical solutions to real-world issues facing communities everywhere.”**

The Stanford ranking system is based upon scientific citation data going back to the year 1788. It encompasses standardized data on citations, h-index, and a wide range of bibliometric indicators. Researchers are classified into 22 scientific fields and 174 sub-fields, drawing from Scopus data provided by Elsevier through ICSR Lab.

Mizzou Engineering faculty among the top 2% of world scientists

- Professor [Zhen Chen](#), Department of Civil and Environmental Engineering
- Curators’ Distinguished Professor [Jianlin Cheng](#), Department of Electrical Engineering and Computer Science
- Curators’ Distinguished Professor [Baolin Deng](#), Department of Civil and Environmental Engineering
- Professor [Curt Davis](#), Department of Electrical Engineering and Computer Science
- Professor [Dongsheng Duan](#), Department of Chemical and Biomedical Engineering – courtesy
- Professor [Dominic K.C. Ho](#), Department of Electrical Engineering and Computer Science

- Curators' Distinguished Professor [Zhiqiang Hu](#), Department of Civil and Environmental Engineering
- Assistant Professor [Qingyun Huang](#), Department of Electrical Engineering and Computer Science
- Curators' Distinguished Professor Emeritus [Jim Keller](#), Department of Electrical Engineering and Computer Science
- Associate Professor [Taesic Kim](#), Department of Electrical Engineering and Computer Science
- Associate Professor [Jian Lin](#), Department of Mechanical and Aerospace Engineering
- Professor [Xiaohua Liu](#), Department of Chemical and Biomedical Engineering
- Professor Emeritus [Frank Pai](#), Department of Mechanical and Aerospace Engineering
- Associate Professor [Suchi Rajendran](#), Department of Industrial and Systems Engineering
- Professor [Yi Shang](#), Department of Electrical Engineering and Computer Science
- Adjunct Professor [David Singh](#), Department of Mechanical and Aerospace Engineering
- Associate Professor [Sharan Srinivas](#), Department of Industrial and Systems Engineering
- Associate Professor [Caixia "Ellen" Wan](#), Department of Chemical and Biomedical Engineering
- Associate Professor [Feng "Frank" Xiao](#), Department of Civil and Environmental Engineering
- Professor [Ming Xin](#), Department of Mechanical and Aerospace Engineering
- Curators' Distinguished Professor [Dong Xu](#), Department of Electrical Engineering and Computer Science
- Associate Professor [Zheng Yan](#), Department of Chemical and Biomedical Engineering, Department of Mechanical and Aerospace Engineering – adjunct
- Curators' Distinguished Professor [Yuwen Zhang](#), Department of Mechanical and Aerospace Engineering



Governor Kehoe proclaims Nov. 2-8 as Water and Wastewater Professionals Week in Missouri

JEFFERSON CITY, MO, OCT. 31, 2025 – Governor Mike Kehoe has signed a proclamation declaring Nov. 2-8, 2025, as Water and Wastewater Professionals Week in Missouri.

The Governor's proclamation recognizes the vital work that water and wastewater professionals do to keep Missourians healthy and our communities strong.

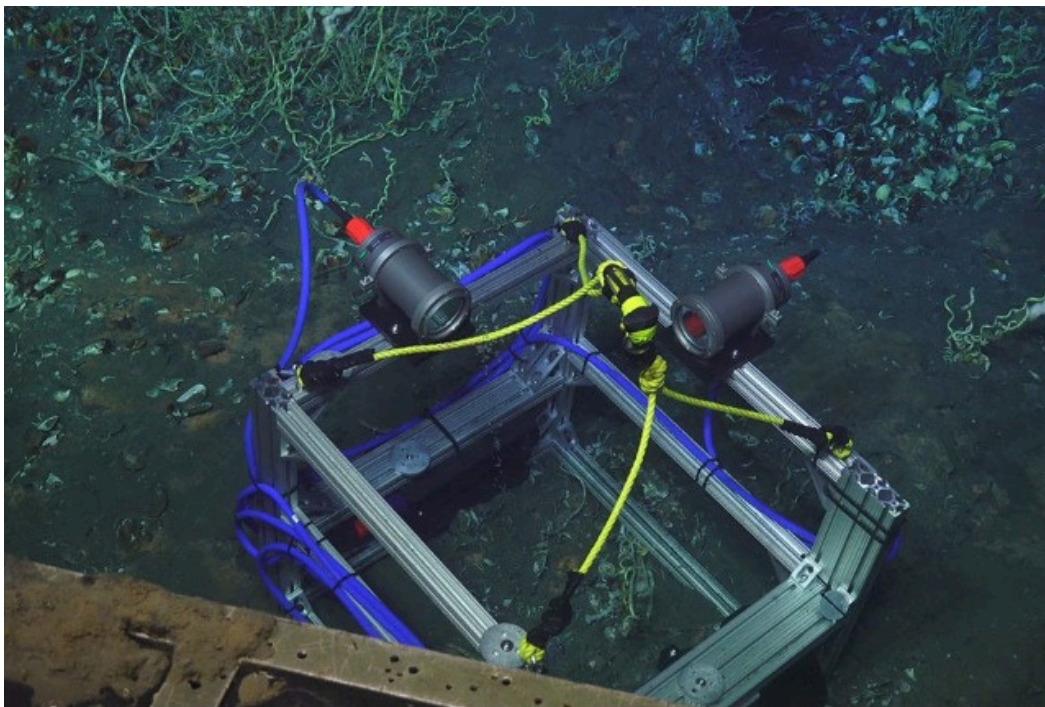
The proclamation highlights the important contributions made by water and wastewater professionals to protect the public health of Missouri citizens, and improve water quality for the state's streams, rivers and lakes. Water and Wastewater Professionals Week offers the perfect opportunity to recognize the vital role these professionals play in all of our lives.

For more information about the important work that water and wastewater professionals do, or how to become a certified operator, contact the Missouri Department of Natural Resources' Water Protection Program at **800-361-4827** or **573-751-1600**.

Written by: *Missouri Department of Natural Resources*

Snapshots of the deep shed light on hydrocarbon seeps

Mizzou engineers have developed a low-cost mobile technology to study naturally occurring gas leaks beneath the ocean's surface.



July 14, 2025

Written by: *Theo
Schwinke*

Unlike most conventional particle image velocimetry, RPiV can be submerged underwater and moved.

Natural hydrocarbon seeps — places where gases leak from the seafloor — occur all over the world. These seeps release streams of tiny gas bubbles into the ocean, feeding deep-sea microbes that rely on chemicals such as methane.

Binbin Wang, William Andrew Davidson Professor in the Department of Civil and Environmental Engineering, has spent years researching hydrocarbon seeps.

“Studying this phenomenon gives us better understanding of deep-sea ecosystems as well as how methane is transported in ocean waters,” he said.

To measure how much gas is leaking out and whether it reaches the ocean surface, Wang had to access one of the most hard-to-reach places on the planet: the ocean floor. Once there, he could observe those tiny gas bubbles, but he needed technology to do so.

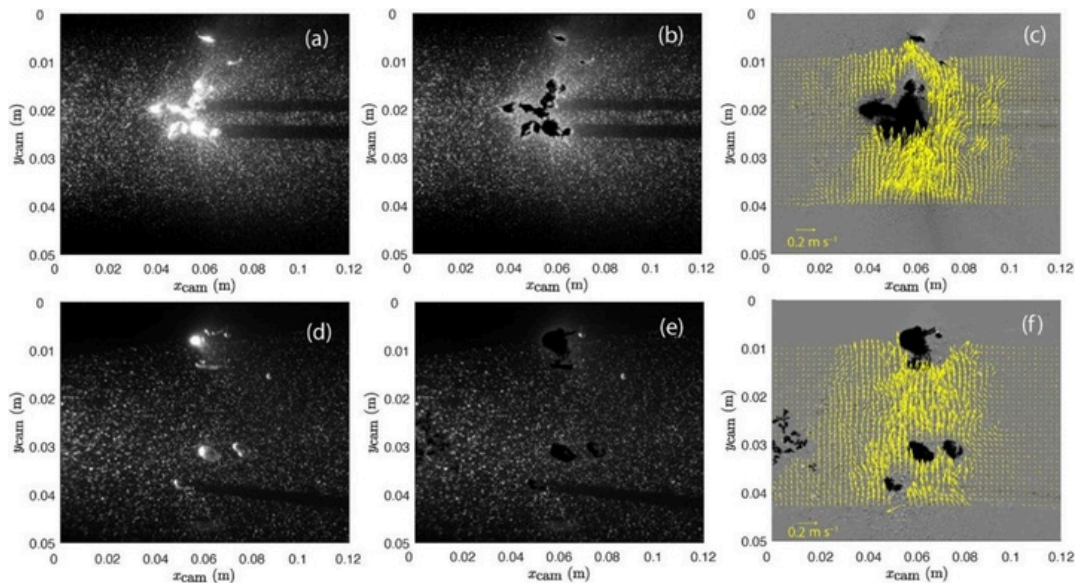
Up to now, researchers have been able to study small particles in water using particle image velocimetry (PIV): A laser lights up the particles, a camera takes a snapshot and software tracks how those particles move.

But PIV is typically not submerged. Wang needed to find a way to get this bulky, expensive technology to the ocean floor and back.

Wang and his team set out to create a new, underwater PIV system. Called RPiPIV, the system is powered by a Raspberry Pi — a low-cost computer about the size of a credit card. Unlike conventional PIV systems, RPiPIV can be tethered to a robot submarine for live monitoring or set up on the seafloor, making it easier to collect data on hydrocarbon seeps. Wang describes the system in an article published in *Limnology and Oceanography: Methods*.

“The key benefits of RPiPIV are its portability and underwater capability,” Wang said. “It’s also much cheaper than conventional PIV because it uses off-the-shelf parts like a consumer laser and camera and the Raspberry Pi,” Wang said.

Wang and his team tested RPiV in the laboratory before taking it on a research cruise in 2024 and deploying it at a depth of about 1,800 feet, becoming the first to study hydrocarbon seeps using an underwater PIV system.



Comparison between a conventional PIV system (top row) and RPiV (bottom row). Images (a) and (d) are raw photos of bubbles rising through the water. In (b) and (e), the bubbles are removed, leaving only the movement of the water. Images (c) and (f) show the direction and speed of the water (yellow arrows) moving around the rising bubbles (black spots). Longer arrows mean the water is moving faster.

The results were promising, if not perfect, and Wang is encouraged.

“There’s room for improvement,” Wang said. “The laser isn’t as focused or powerful as professional ones, and the camera is slower. But RPiV can go places conventional PIV can’t.”



DECEMBER 2025 NEWSLETTER

The technology behind RPiPIV is currently under review for a provisional patent application. Wang is interested in pursuing a commercial patent and envisions researchers employing the low-cost, versatile technology to study flows in lakes and streams.

“Sometimes the simplest solutions are the best,” Wang said. “By taking a practical, DIY approach to a complex technological puzzle, we’re accelerating the pace of discovery at that bottom of the sea, which can have an impact on life all over the planet.”

Mizzou Engineers are exploring new possibilities in our innovative centers and labs. [Learn more about our research!](#)

Conferences

This section reflects on both past and upcoming conferences where the Center or its staff and students presented the latest in water research.



2025 Great Plains Water Conference: Securing Water Resources for Tomorrow

On Sept. 18 and 19, the Center's faculty, researchers and students gathered on the University of Nebraska at Omaha's campus to provide updates on water supply and water quality throughout the region.

Topics discussed were water smart communities and watersheds, water quality monitoring and treatment strategies, emerging contaminants, wellhead protection, education and outreach, basin management, and more.

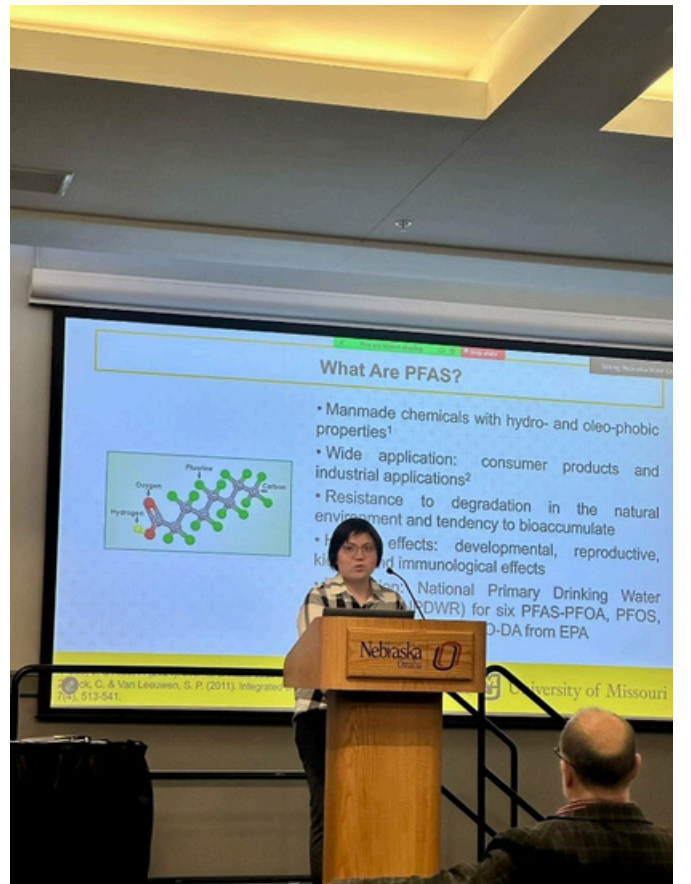
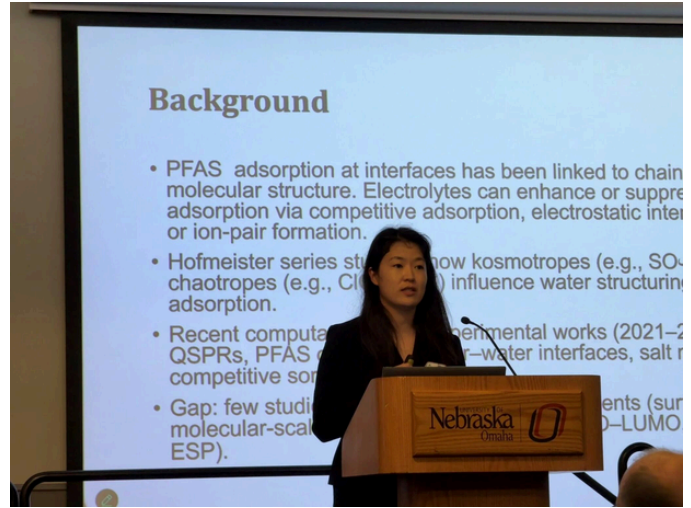
Researchers, governments, nonprofits, state agencies, and students from Nebraska, Kansas, Oklahoma, Iowa, Missouri, South Dakota, and North Dakota shared how communities across the Great Plains are planning for their future water resources.

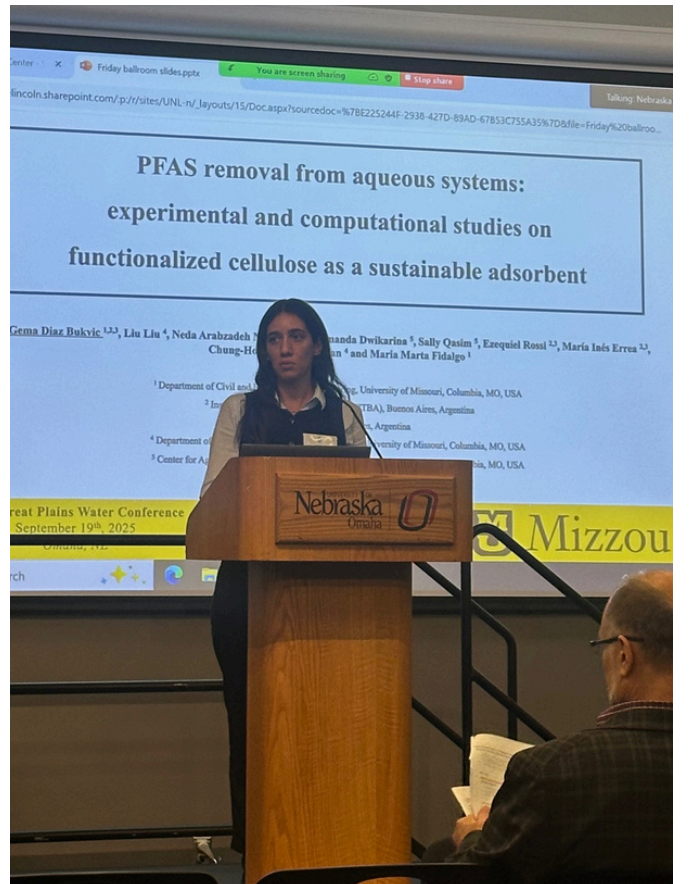
The event was sponsored by the Kansas Water Institute and the University of Nebraska – Lincoln's Institute of Agriculture and Natural Resources.

Dr. Katherine Nelson, Associate Professor Robin M. Rotman, doctoral student Xuejia Zhang, post-doc presenters [Pan Ni](#) and Jitae Do and other students spoke about different key topics in water research and management.

Here is a collage of images from our trip to Nebraska! See all of the amazing images of speakers, faculty and students.



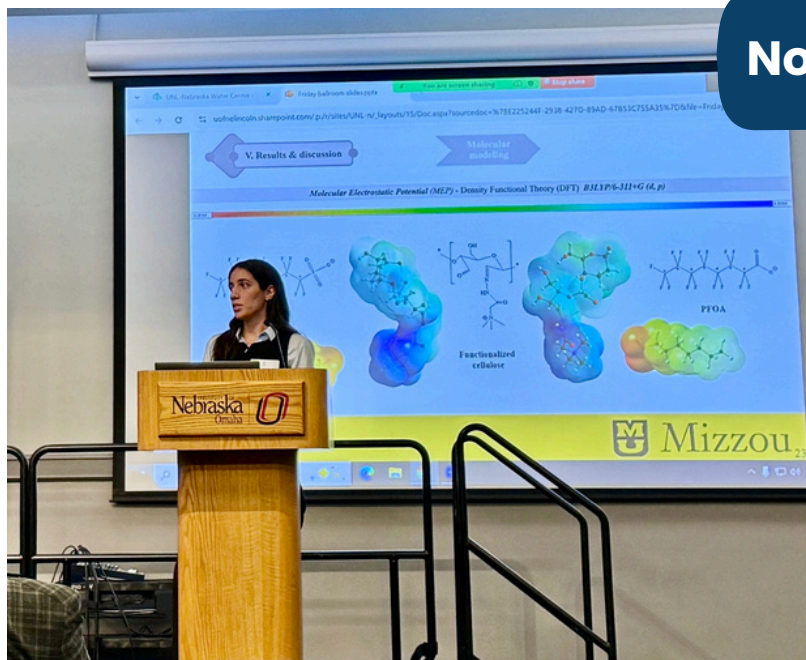






The Center thanks our students and faculty who spoke or supported our speakers.

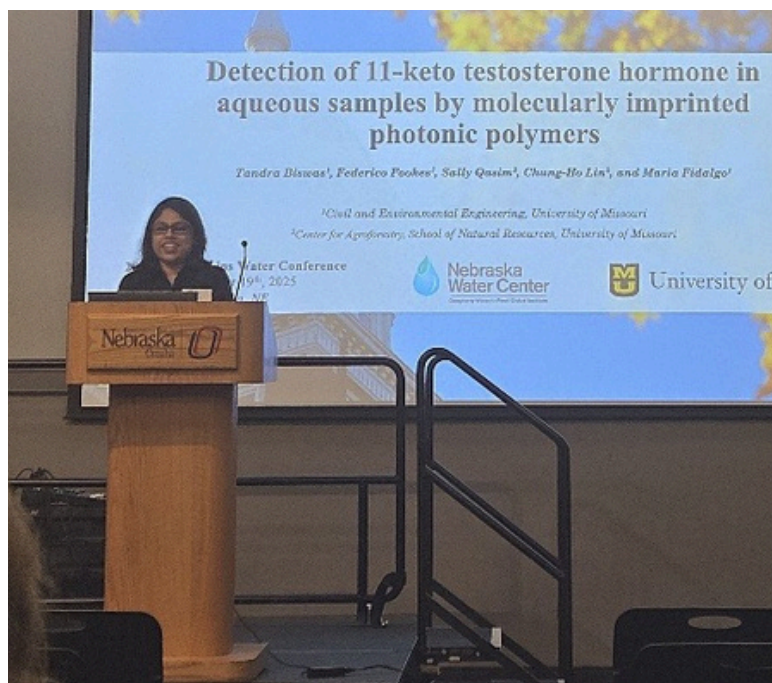
Notable student presentations



Pictured to the left is **Gema Diaz Bukvic**. The title of Bukvic's presentation was: *PFAS removal from aqueous systems: experimental and computational studies on functionalized cellulose as a sustainable adsorbent*

Pictured to the right is **Tandra Biswas**. The title of Bukvic's presentation was: *Detection of 11-keto testosterone hormone in aqueous samples by molecularly imprinted photonic polymers*

Biswas was also recently spotlighted on our social media accounts. To hear more about this research, take a look at our latest student spotlight post.



MWC Moments

This section is where we highlight notable moments and key faculty successes such as awards, grants or other forms of recognition.

Featured in STLPR



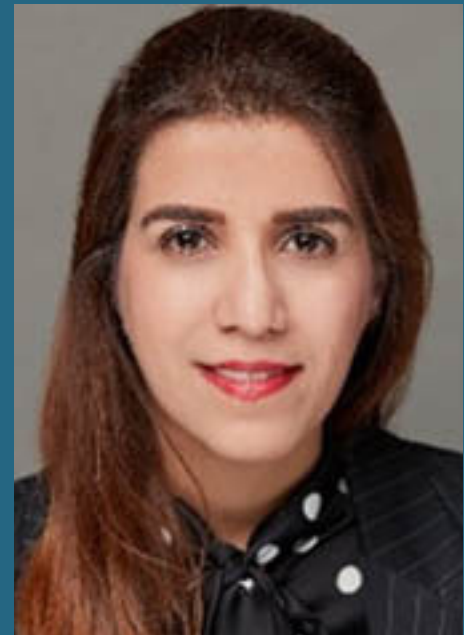
Dr. Rebecca North, associate professor at the School of Natural Resources at Mizzou and leader of the Limnology Lab, was featured in a story that aired on STLPR - St Louis's NPR affiliate.

The story is about Missouri's loss of programs testing lake water after funding cuts.

Read and listen to the [story here.](#)

Grant success!

Dr. Maryam Salehi, James C. Dowell Professor of Engineering and associate professor in the Department of Civil and Environmental Engineering at Mizzou, received \$100,000 in grant funding. This is related to her study on the influence of packaging materials on microplastics occurrence in drinking water.



Seminars

Here we highlight seminars from faculty from the past few months.

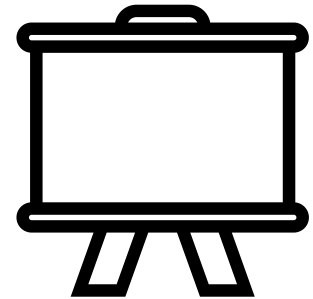
Theoretical and numerical simulation of air-water flows with varied approaches in environmental applications

Fabián A. Bombardelli, Editor in Chief of the Journal of Hydraulic Engineering, ASCE and RIBAGUA presented on Friday October 7, 2025.

Seminar Description: Despite major progress over the past forty years in understanding air-water flows, defining reliable simulation guidelines remains difficult. Unlike single-phase flows, multi-phase flows still demand extensive experimental and numerical research. Environmental and hydraulic flows involve high Reynolds numbers and a wide range of scales, requiring either fine-scale modeling or sub-grid approximations.

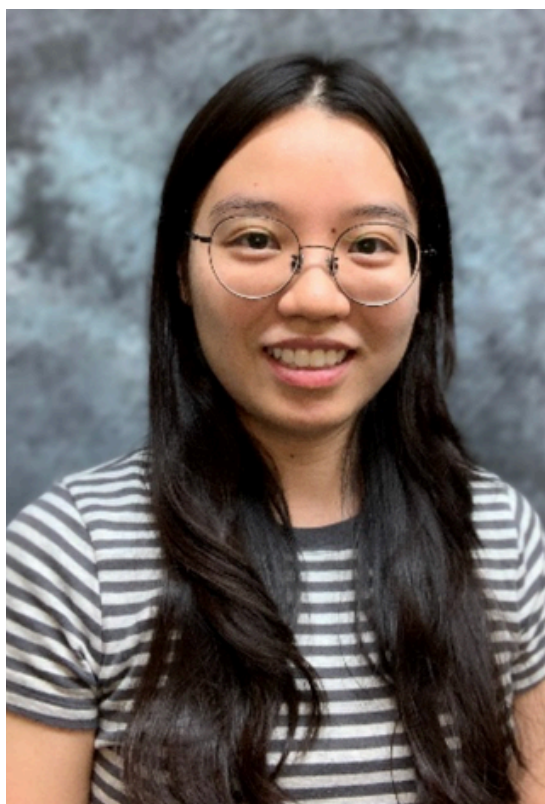
This work presents a multi-scale modeling framework for air entrainment. It first examines Scale-Resolving Simulations (SRS) based on the Spalart-Allmaras Detached Eddy Simulation model, then a Reynolds-Averaged Navier-Stokes (RANS) approach using a three-phase mixture formulation.

The RANS model provides information about air concentrations and correctly predicts the flow bulking in spillways, which causes notable numerical shortcomings in many other codes. Both methodologies show very good agreement with experimental data. Future lines of research for both types of models are discussed in the presentation.



Unexpected Retardation of PFAS in a Simulated Aquifer

Jiamin Mai, graduate research assistant in the Department of Civil and Environmental Engineering presented on Friday October 24, 2025.



Seminar Description: Per- and polyfluoroalkyl substances (PFAS) are a class of persistent contaminants frequently detected in groundwater worldwide. Their resistance to natural degradation and strong affinity for environmental interfaces make them a major concern for long-term water quality and human health.

While numerous laboratory studies have examined PFAS transport in either unsaturated or saturated zones, limited attention has been given to the transitional capillary fringe where diffusion and transient flow dominate. To address this knowledge gap, a tank-scale flow cell system was employed to simulate PFAS migration under hydrologic conditions that mimic natural aquifers, including intermittent flow, water table level changes and biochar amendment.

The results demonstrate that intermittent flow significantly enhances PFAS retardation compared to continuous flow, primarily due to redistribution and retention within the capillary fringe. Conventional equilibrium models based solely on solid-phase adsorption were found to overestimate retardation for short-chain PFAS and underestimate it for long-chain species.

Biochar amendment effectively increased PFAS retention and delayed breakthrough, particularly for longer-chain compounds, confirming its promise as an in-situ remediation material. Molecular dynamics simulations further revealed that PFAS adsorption onto quartz is energetically unfavorable, while adsorption onto biochar is spontaneous and exothermic. Together, these findings provide new mechanistic insights into PFAS fate in variably saturated systems and support the development of sustainable remediation strategies for contaminated groundwater.

Innovative approaches for improving the hydraulic disinfection efficiency of small drinking water systems

Dr. Karan Venayagamoorthy, the Fred and June Kummer Endowed Chair of Civil, Architectural and Environmental Engineering at Missouri University of Science and Technology, presented on Friday October 31, 2025.



Seminar Description: This talk will focus on highlighting the application of computational fluid dynamics (CFD) simulations to gain insights into the flow dynamics of disinfection contact tanks that are used for the treatment of drinking water.

The research that will be presented (funded by the Colorado Department of Public Health and Environment, CDPHE) was driven by increasing violations by small systems of the minimum EPA standards for drinking water quality.

Over a five-year period, different contact tanks configurations that are often used by small systems were tested to assess their residence time distributions using both tracer studies and computational fluid dynamics (CFD) simulations.

A variety of modifications and 'new' systems that were developed as part of this study will be presented to highlight how CFD simulations were employed to explore innovative scenarios for improving the hydraulic disinfection efficiency of such systems. A guidance document was developed from this study that CDPHE now uses to help small drinking water systems in Colorado.

Characterizing the submerged morphology of a tidewater glacier

Dr. Dr. Liz Weidner, acoustical oceanographer and assistant professor of Marine Sciences at the University of Connecticut, presented on Friday November 14, 2025.

Seminar Description: The submerged termini of tidewater glaciers are a critical, yet poorly characterized component of high latitude regions. While traditional oceanographic measurement techniques are limited by iceberg calving dangers, remote measurements made by active acoustic systems represent a useful, if underutilized, tool.

Here we will investigate the potential connections between ice face geometry, internal ice properties, and acoustic backscattering response of the ice face. Broadband (170–250kHz) split-beam echosounder observations were collected at Hans glacier in Svalbard. The ice face position and local slope were derived from split-aperture processing methods.



Spectral trends in backscattering over a frequency band of 80kHz were measured at grazing angles between 48 and 74 .

Overall, backscattering showed a weak frequency dependence across grazing angles and could be attributed to several scattering mechanisms associated with the ice–ocean interface (e.g., surface roughness, gas bubbles, thermohaline structure). Results will be discussed, along with the need for the collection of additional observational datasets, including in situ measurements of submerged termini properties.

Information about a Little-Known Career Path as Wildlife Biologists/Road Ecologists in the MoDOT Environmental Section

Taylor MacDonald, Senior Environmental Specialist for MoDOT, covering the Northeast and St. Louis regions of the state, and **Caleb Knerr**, Senior Environmental Specialist with the Missouri Department of Transportation (MoDOT), covering the Improve Interstate 70 program as the Environmental contact., presented on Friday November 21, 2025.





DECEMBER 2025 NEWSLETTER

Seminar Description: While working for a Department of Transportation (DOT) is not often thought of when determining a career path in wildlife biology, conservation, or ecology, it can be a great option to gain a wide range of experience. In MoDOT's Environmental Section, there are 7 biologists that evaluate transportation project's impacts to the environment.

This includes evaluating project areas for migratory birds in compliance with the Migratory Bird Treaty Act (MBTA), threatened and endangers species in compliance with the Endangered Species Act (ESA), and wetlands/streams in compliance with the Clean Water Act (CWA).

This presentation will go over what the job entails, along with some of the many different opportunities that are available as a DOT biologist and the valuable experience and knowledge available in these positions. Examples include mussel surveys; coordination/collaboration with the US Fish and Wildlife Service (USFWS), the US Army Corps of Engineers (USACE), the Missouri Department of Conservation (MDC), and other agencies; wetland delineations; bat surveys; and training opportunities.



DECEMBER 2025 NEWSLETTER

Thanks for reading this edition of our newsletter

Missouri Water Center Brief & Highlights is a publication of the Missouri Water Center. For more information about the Center, visit our Web site at water.missouri.edu.

Baolin Deng, Co-Director
Patrick Market, Co-Director
Kate Nelson, Associate Director
Karen Turner, Editor
Dominique Hodge, Newsletter Designer

This Newsletter is published with funds provided by the U.S. Geological Survey, Department of the Interior, as authorized by the Water Resources Act of 1964.

Sign up for our email list and check out our website for more newsletters and research updates.

Follow us on social media:



[@Missouri Water Center](#)



[@mowatercenter](#)



[@Missouri Water Center](#)

