the RESEARCHER

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Hannah Bloxham, ISU SARE student, setting up a sapflow sensor to measure plant water use. Photo Credit: Sarah Godsey (ISU)

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the RESEARCHER

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LETTER FROM THE DIRECTOR

Andy Kliskey

Welcome to our 2026 undergraduate research edition of The Researcher. Idaho's Established Program to Stimulate Competitive Research (EPSCoR) recently completed the second year of the Summer Authentic Research Experience (SARE) Program as part of an Idaho-wide National Science Foundation (NSF) funded program, Idaho Community-engaged Resilience for Energy Water Systems (I-CREWS) project.

SARE is our flagship undergraduate research program for the I-CREWS project that aims to address the consequences of meteorological, population, and technological change on energy-water (E-W) systems.

As the summer draws to a close, I am delighted to celebrate the undergraduate research capacity-building in I-CREWS that is represented by each SARE student and their SARE faculty mentor. SARE projects demonstrate the partnership between a faculty, who has devised the broad scope of a project, and the student, whose energy, time, and own ideas help to shape the project and see it to fruition.

The SARE projects this summer constitute a breadth of fieldwork, lab work, and computational work, which collectively generate important human capacity for Idaho and contributes to the economic development of the State of Idaho. SARE in 2026 highlights the engagement in undergraduate research and inquiry across Idaho's 2-and 4-year colleges and its universities. Thank you to each SARE student and each SARE faculty mentor for sharing your stories here.

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I-CREWS Research

Summer Authentic Research Experiences (SARE) Highlights

During year 2 of the SARE program, over 39 students participated in summer research in fields related to I-CREWS including geosciences, biological sciences, social sciences, resilience science, computational modeling, machine learning and artificial intelligence. Research experiences aimed to provide analytical outcomes to proactively address the impacts of meteorological, population, and technological change on energy-water (E-W) systems.

Of the students awarded SARE experiences, approximately 48% were from Idaho's 2-4 year colleges. Each student received hands-on, paid (up to $6,000) summer research experiences where they studied Science, Technology, Engineering, and Mathematics (STEM) topics broadly related to the I-CREWS project.

SARE students also participated in an orientation, Summer Research Community, and the Idaho Conference for Undergraduate Research (ICUR) in Boise, Idaho, on July 15-16 to showcase their research. For more information visit the SARE student profiles located on the Idaho EPSCoR website's Student Regional Map.

Student Regional Map found here:
www.idahoepscor.org/student-research-impacts

Can Plasma Break the "Unbreakable"? SARE Students Test Cold Plasma on Forever Chemicals

By Emily Elden

Boise State University chemist Jeneé Cyran and students Lauren Gold, a senior in Boise State's Accelerated Master of Science in Chemistry program, and Hal Scott, a College of Western Idaho computer science student, recently completed a Summer Authentic Research Experience (SARE) in which they investigated the ability of cold atmospheric plasma to break down forever chemicals.

What are forever chemicals?

Many have heard of forever chemicals, also known as perfluoroalkyl substances, or PFAS, but few realize how common they are in industrial goods. PFAS include thousands of molecule types designed to repel water or oil and can be found in everything from rain jackets and nonstick cookware to semiconductor chips in cellphones and firefighting foams.

Though useful in such applications, forever chemicals become problematic when they inevitably make their way into air, groundwater and wastewater. These pervasive substances are costly to detect and have been linked to multiple developmental delays and cancers. While recent breakthroughs have improved PFAS detection, one question remains: How do we break down substances designed to last forever? That's the question Cyran and her students set out to answer this summer.

Cyran is an assistant professor of chemistry at Boise State, where she directs the Cyran Lab which specializes in using spectroscopic techniques to examine photochemical processes and molecular level chemistry of emerging pollutants. This summer, she and the students worked in the Cyran Lab and Cornell Labs at Boise State University to test the structural integrity of a specific forever chemical called PFOA, or perfluorooctanoic acid. A common surfactant, PFOA forms single chemical layers at the water's surface, making it a prime candidate for study.

Research in action

The team made wet and dry samples of PFOA, then applied cold atmospheric plasma gas to break down the chemical. Gold and Scott then took the samples to the laser lab, using a frequency-generated spectroscopy technique — pairing a visible beam and an infrared beam at the same point on the surface — to get a surface-specific reading of the PFOA molecules.

"The first question we wanted to explore was, can this work at all? And so the good news is it does seem to change the [molecule] structure at the interface," Cyran said. "I think being able to expand this into other PFAS molecules or concentrations, to try to understand the limitations of plasma treatment, would be very beneficial. This could have applications for municipal and industrial water treatment facilities."

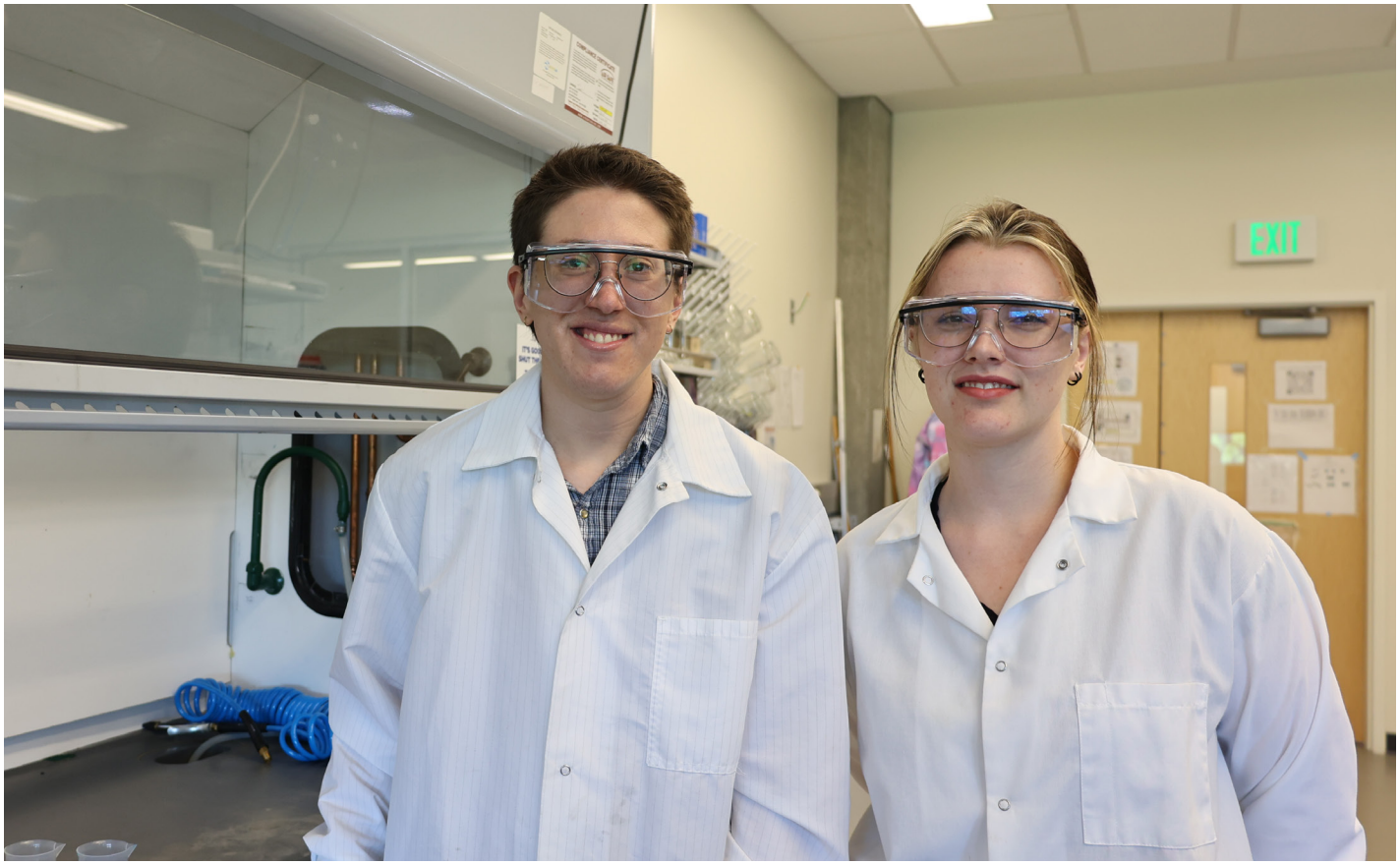
Scott, a returning student, credits the SARE experience with giving him a better understanding of what it's like to engage in real scientific inquiry.

"When I began this summer, I had little to no experience in chemistry or coding, and now I feel I have a basic understanding of both," Scott said. "I also learned what is involved in daily operations in a research lab and how to present research."

A collaborative experience

Cyran, Gold and Scott all pointed to the collaborative nature of the SARE experience as one of its greatest strengths. The cross-institutional, interdisciplinary student cohort and the chance to network at the Idaho Conference of Undergraduate Research made for an invaluable experience.

"It was a great opportunity to meet, learn and network with people, many of whom are experiencing their first research experience," Gold said. "It's not a common thing to be able to work with someone from another institution during undergraduate studies. It was really awesome to be able to teach and learn how exciting research can be."



College of Western Idaho (CWI) student, Hal Scott, and Boise State University (BSU) student, Lauren Gold, take part in Dr. Jenee' Cyran's lab at BSU. Photo Credit: Cynthia Miller (BSU)

SARE Students Work to Make Satellite Water Data More Usable

By Mary Everett, UI Research Scientist

Tebo (left) and Joseph (right) showcasing weather station dashboards that feature the water dynamic data the team was able to capture. Photo Credit: Tami Noble (Idaho EPSCoR)

Every day, satellites capture vast amounts of earth observations. This data can be used to measure temperature, land use, vegetation, and water characteristics – all highly useful to stakeholders in agriculture and environmental science fields. However, these measurements can be tricky to access, and even harder to combine with a more site-specific source of information like a weather station or soil moisture probe.

This summer, as part of their I-CREWS SARE program, North Idaho College students Tebo Shinetulga and Joseph Harris set out to bridge the gap between data access and use. To accomplish this, they focused on one specific remote sensing project: OpenET, an organizational consortium with partners including NASA, USGS, University of Idaho, and The Desert Research Institute. OpenET provides access to satellite-derived evapotranspiration, a crucial metric for water usage which is especially important for agricultural irrigation and environmental water sustainability.

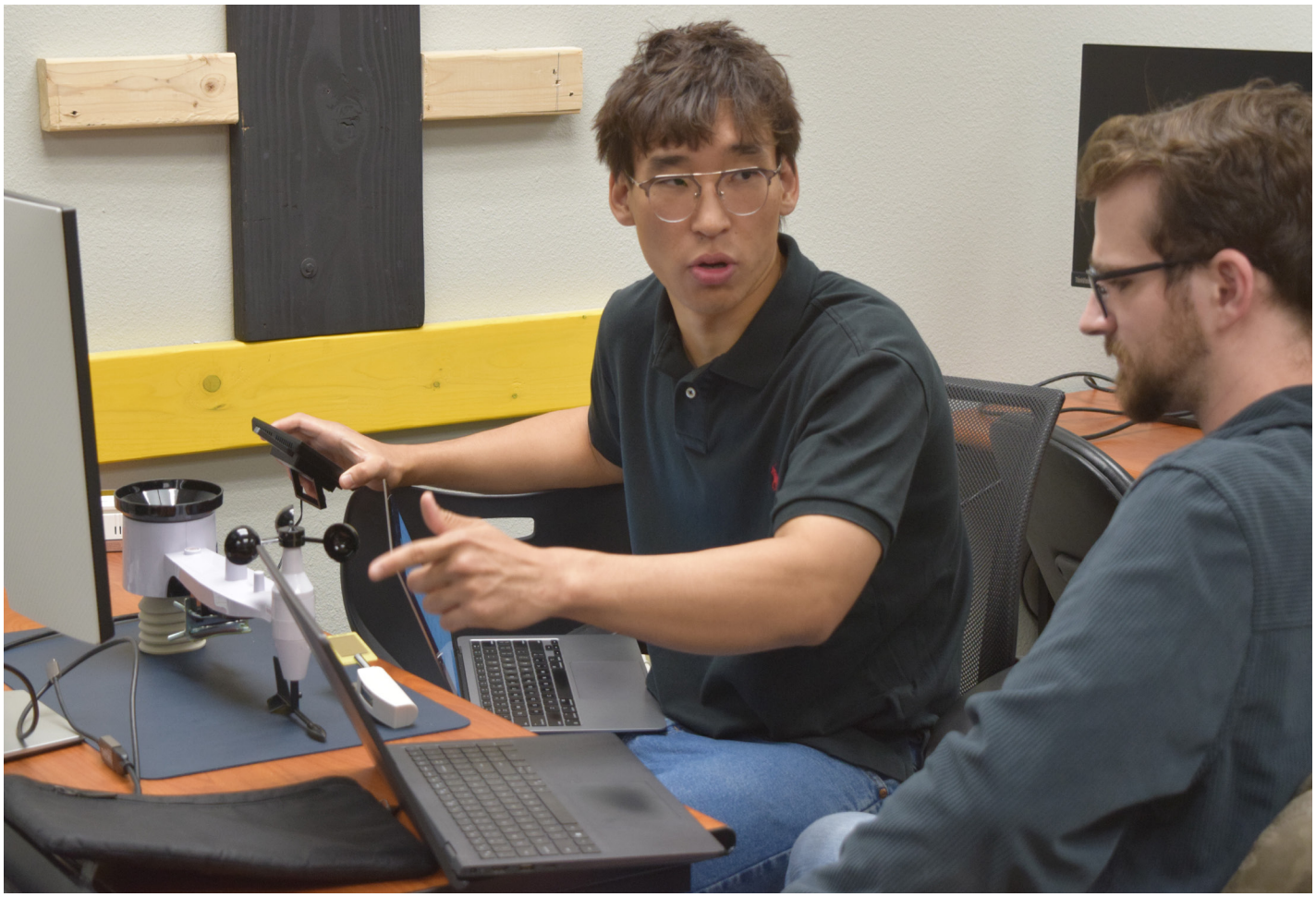
Joseph and Tebo developed a collect-store-visualize technology framework to pull evapotranspiration (ET) data, store it for a specific site, and allow it to be analyzed alongside location-specific measurement instruments already in place. This allowed for an extra dimension of research data at the two test locations: Sandpoint Organic Agriculture Center, and the Harbor Center on Lake Coeur d'Alene.

I-CREWS Research

The framework uses a python application programming interface (API) script to pull ET data for specific location coordinates. The data is stored in a free-tier cloud database (MongoDB), where it's queried by a front-end visualization and analytics suite called Grafana. Grafana allows the satellite to be combined with ground sensors, giving a more complete picture of water dynamics at broad and specific scales in each location. The entire technology stack is based on freely available tools, and Joseph and Tebo developed a detailed user guide during the project so anyone can reproduce the toolchain for a location of their choice.

"We hope that this project of our own funded and supported by SARE can be a free open source tool for local farmers and researchers," Tebo says of the project. Joseph adds: "I'm discovering that I really enjoy the data science and data analysis side of computer science, and it's just been great learning, and working through the challenges, and replacing what we don't know with what we do."

Joseph and Tebo both started research positions at the University of Idaho's Center for Intelligent Industrial Robotics via a Strategic Plan Initiation Grant prior to being awarded the summer fellowships. Both students have a passion for computer science and plan to continue their studies at UI after graduating NIC. They presented their work this July at the Idaho Conference on Undergraduate Research and hope to continue the research project into the Fall.



Tebo (left) and Joseph (right) working on the weather station dashboard. Photo Credit: Tami Noble (Idaho EPSCoR)

Broadening the Field: How Business Research Is Shaping Energy and Water Systems Analysis

By Ila Garrido

Tackling complex energy and water issues requires insights from many different disciplines. By applying economic analysis to resource management, Idaho State University (ISU) student Ashok Bahadur Deuba is demonstrating how business perspectives complement environmental and engineering research to address water resource challenges.

Working alongside associate professor Dr. Karl Geisler through the Summer Authentic Research Experience (SARE) program, Deuba focused his research on how regional industry makeup drives freshwater consumption across the country. To analyze these patterns, Deuba used spatial econometrics, combining water data from the U.S. Geological Survey with economic data from the U.S. Census Bureau. His sample covered 1,598 counties across the contiguous United States. The dataset highlighted sharp regional differences. Freshwater usage in the American West remains significantly higher than in other parts of the country, driven largely by agriculture. In fact, nine of the ten states with the highest irrigation withdrawals are located in the West.

However, Deuba's spatial models also revealed unexpected spillover effects across county lines. The study shows that increases in utilities, manufacturing, wholesale trade, transportation, real estate, management of companies, and administrative industries are associated with increased freshwater use in those counties, while also contributing to decreased water use in neighboring counties. It is a seemingly contradictory finding that the research team plans to investigate further. The project culminated in a presentation at the Idaho Conference on Undergraduate Research in Boise, where Deuba shared his work with students and faculty from across the state.

"I felt proud to showcase the work that Dr. Karl Geisler and I developed through the SARE program and represent opportunities available at Idaho State University," Deuba said. "This experience increased my confidence as a student researcher and helped me to gain valuable knowledge during the conference."

For Geisler, seeing an undergraduate economics student tackle complex spatial statistics made the project especially rewarding. "My undergraduate student undertook a project that would have been difficult for many graduate students, and he more than exceeded expectations," Geisler said. "It is truly an academic incubator where we can germinate new ideas which would not otherwise occur."

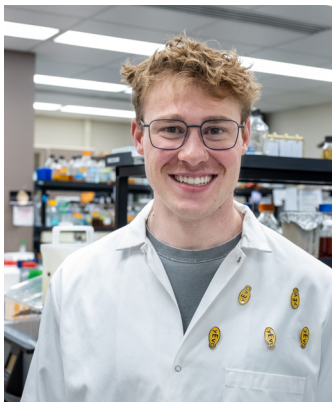
The collaboration established a framework for future research, with plans to publish a peer reviewed paper within the next year. As Deuba returns to his studies at ISU this fall, the analytical techniques and experience he gained will prepare him for graduate study and expand the perspective economics students bring to environmental issues.

SARE student, Ashok Bahadur Deuba

Biological Control of Fermentation Contamination to Improve Energy–Water Efficiency and Resilience in Brewing Systems

SARE Faculty Mentor: Paul Rowley, University of Idaho

Student: Dean Collins



Dean Collins, U of I SARE Student

This project evaluated antifungal "killer" yeasts as a biological strategy to prevent contamination by *Saccharomyces cerevisiae* var. *diastaticus* in fermentation systems, reducing reliance on energy- and water-intensive mitigation approaches such as pasteurization, filtration, and equipment sterilization.

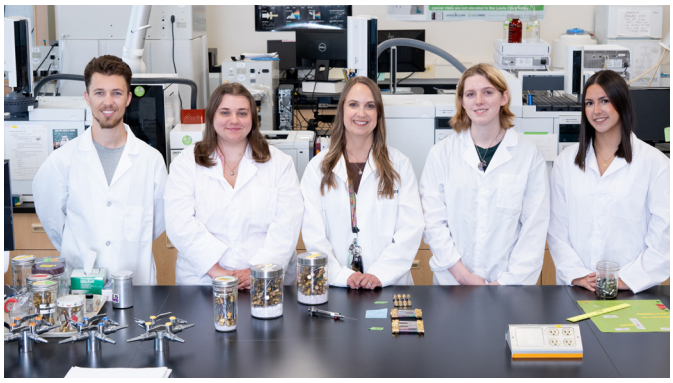
SARE student, Dean Collins, worked to investigate how biological antifungal strategies (killer toxins) can replace or reduce conventional contamination control methods that require significant energy (e.g., heat pasteurization) and water (e.g., cleaning and sterilization cycles). This work will contribute to building a more sustainable and resilient fermentation-based industry, saving both water and energy.

Assessing the Exposure Risk due to Wildfire Smoke in Idaho Communities

SARE Faculty Mentor: Nancy Johnston, Lewis-Clark State College

Students: Jadelyn Barrow, Kaitlynn Butler, Alba Carpena

Energy-water systems are under stress in Idaho due to warmer climates and drought in the summers, that may result in increased wildfires. Wildfire smoke can place communities at risk to air toxics and particulate matter. As part of the LCSC SARE Project, students were involved in community air sampling during background and wildfire seasons in Idaho to determine the exposure risk due to emitted air toxics. This project's outcomes will help communities plan and become resilient during these times of environmental change, aligning with I-CREWS's mission for Community-engaged Resilience for Energy-Water Systems.



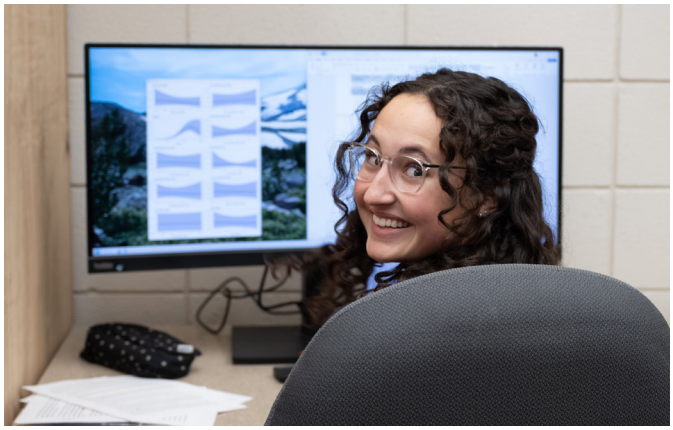
Nancy Johnston and research team work to determine exposure risk due to wildfire smoke. L-R: Jake Liapis (Idaho INBRE), Jadelyn Barrow, Nancy Johnston, Kaitlynn Butler, and Alba Carpena. Photo Credit: Leah Reitcheck (U of I)

Alba Carpena (left) and Nancy Johnston (right). Photo Credit: Leah Reitcheck (U of I)

Steelhead Survival

SARE Faculty Mentor: Matt Falcy, University of Idaho

Student: Tamsen Farris



SARE Student: Tamsen Farris. Photo Credit: Leah Reitcheck (U of I)

This SARE research project analyzed Idaho steelhead count data to determine ocean survival and statistically connect steelhead ocean survival to Columbia River hydropower operations (spill) and physical oceanic conditions like El Nino and sea surface temperature.

Tamsen Farris, SARE student, used statistical models to help combine intrinsic characteristics of the fish, such as fork length and outmigration timing, with fine-scale and broad-scale marine conditions, to determine which factors and periods of the first year of steelhead ocean residence are the most limiting on their survival.

According to Tamsen, "by helping to identify marine conditions and intrinsic factors that influence survival, we can help to inform conservation and management decisions moving forward."

SARE-Energization: an Educational Resource Management Game Focused on Energy Systems

SARE Faculty Mentor: Terry Soule, University of Idaho

Student: Devon Bryce

The goal of this project was to finish the development of *Energization*, an educational, resource management game focused on energy systems that was started last summer via a prior SARE award. Players represent different regional energy utilities and make decisions about resource development, sustainability, investment, system interconnection, competition, and cooperation in a contiguous game space comparable to the Western US in geography, energy intensity, water and other natural resources, and urban/rural mix.

Initially, this game is being deployed for educational purposes within the University of Idaho curricula such as Energy Literacy courses and the Energy Executives Course and hopefully will be used by STEM educators throughout the state.

Devon Bryce, SARE student, not only learned about energy systems, including their interplay with water and other natural resources, the economy, economic and population growth, etc. but was also able to develop his programming and related skills involved in developing educational video games. Devon stated, "currently, my help with programming and designing the game "Energization" will help teachers and students have a more engaging and dynamic way to study and test the kinds of decisions that go into energy utility systems."

U of I SARE Student, Devon Bryce, and Terry Soule (SARE faculty mentor). Photo Credit: Leah Reitcheck (U of I)

Linking Satellite Observations and Field Data to Improve Understanding of Reservoir Management Impacts on Lake Coeur d'Alene Water Quality

SARE Mentor: Meg Wolf, University of Idaho

Student: Munira Tabassum (Isaiah Preston-not pictured)

This project collected and analyzed long-term water quality data in partnership with the Baywatchers Citizen Science program to support restoration and management planning for Lake Coeur d'Alene in North Idaho. Coeur d'Alene Lake is a naturally occurring lake that is managed as a reservoir at its outflow to the Spokane River at the Post Falls Dam, a key regional hydroelectric power source. Current management maintains elevated lake levels late into the summer to support recreational beneficial use elevation targets and extend power generation. Elevated lake levels in late summer connect wetlands. that were historically disconnected from the main lake which alters nutrient cycling dynamics. These hydrologic changes may contribute to harmful algal blooms, which are closely linked to dissolved oxygen levels and have important impacts on the Coeur d'Alene Tribe and other local stakeholders. By examining the interactions between reservoir management, water quality, and algal bloom dynamics, this study helps illuminate the connections between water management and energy production in the region.

SARE student, Munira Tabassum, stated that "ultimately, this work supports more informed lake management decisions, helps us understand aquatic ecosystems and public health, and promotes the sustainable management of freshwater resources in North Idaho."

SARE student, Munira Tabassum. Photo Credit: Meg Wolf (U of I)

Closing the Loop: Developing Polymers to Recover Critical Minerals

SARE Faculty Mentor: Courtney Jenkins, Idaho State University

Student: Wyatt Black

This SARE project focused on developing sulfur-based polymers for targeted critical mineral recovery. Idaho relies heavily on hydropower and even wind, and the state's energy future relies on access to critical minerals. A vast, untapped critical material resource already exists within Idaho's stockpiled mine tailings, mineral processing waste, and e-waste.

An ISU research team has initiated collaborations with regional partners to take advantage of these waste streams. By developing low-cost, scalable polymers

ISU Faculty Mentor, Cori Jenkins and ISU SARE student, Wyatt Black. Photo Credit: Ila Garrido (ISU)

designed to selectively capture and refine high-value metals from these complex Idaho waste streams, the team aims to enhance recovery and strengthen environmental and economic performance.

In addition to providing students with hands on training in polymer synthesis and characterization and critical mineral extraction, students also increased their knowledge regarding the chemical importance, applications, and relevance of critical minerals in Idaho and across the world. SARE student, Wyatt Black, stated, "the research would help clean up the water supply for all of the people and ecosystems that use it in Idaho."

Orton Botanical Garden Community Demonstration on Local Water Resource Conservation

SARE Business Mentor: Deserae Orton, Orton Botanical Garden

Student: Alesia McLean

Orton Botanical Garden provided community demonstrations this summer, educating the public about native and drought tolerant plants, environmental health, and resource conservation. The Garden also provided demonstrations on high desert and native plants, teaching about their water wise and fire wise qualities. Outcomes included a greater understanding of the limited water resources and the use of high desert and native plant landscaping to conserve water, while promoting beauty, pollinator and bee habitats.

SARE student, Alesia McLean, stated "In Idaho, we are experiencing a severe drought. By educating the public about ways that they can make their gardens look nice without all the extra water usage, we can make Idaho a better place that is aware of the excessive amount of water needed for green lawns."

CSI SARE student, Alesia McLean, leads community demonstration at Orton Botanical Garden. Photo Credit: Ila Garrido (ISU)

Effects of a Record-Setting Warm Snow Drought on Water Supplies in Idaho's Headwaters

SARE Faculty Mentor: Sarah Godsey, Idaho State University

Student: Hannah Bloxham

This SARE project explored the record-setting low seasonal snowpack in southeastern Idaho by studying streamflow and plant water use in the local Gibson Jack watershed. This small watershed is representative of conditions experienced throughout the headwaters of much of Idaho this winter, and results from this case study can be transferred to other locations throughout the western US, which collectively influence agricultural water availability and hydropower production. SARE student, Hannah Bloxham, measured surface and groundwater as well as plant water use, and linked these field measurements with remote sensing of vegetation and moisture metrics.

According to Hannah, "Understanding the hydrological, vegetation, and rock material dynamics during an extreme snow drought in the Gibson Jack Watershed provides insight into conditions experienced throughout the headwaters in the majority of Idaho this winter. Results from the case study can be transferred to other locations throughout the western US. These areas in particular influence agricultural water availability and hydropower production."

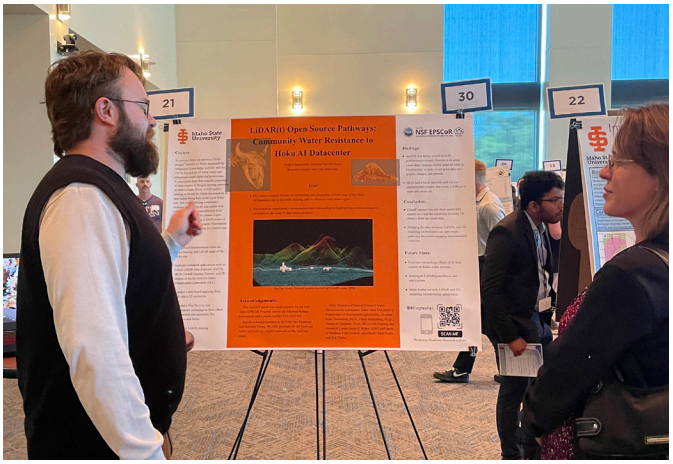
Hannah Bloxham, ISU SARE student, setting up a sapflow sensor to measure plant water use. Photo Credit: Sarah Godsey (ISU)

Co-Creating Resilient Water Futures: Open Source Pathways with LiDAR Databases Amidst AI Concerns

SARE Faculty Mentor: Jose Luis Benavides, Idaho State University

Student: Jonathon Van Der Horn

This SARE project investigated and utilized open source pathways for co-creation in creative workflows, toward the potential creation of a short video-art and experimental documentary. This project output engaged themes of water consumption, artificial intelligence, and environmentalism through creative modeling. Through an exploration of advanced 3D modeling and Blender tools, the team added on to ongoing knowledge-production about local-Idaho and Snake-River-Valley-to-regional concerns with AI water consumption, to visualize, model, and assess broader environmental concerns.



Jonathon Van Der Horn, ISU SARE student, presenting at the Idaho Conference for Undergraduate Research in Boise, ID. Photo Credit: Ila Garrido

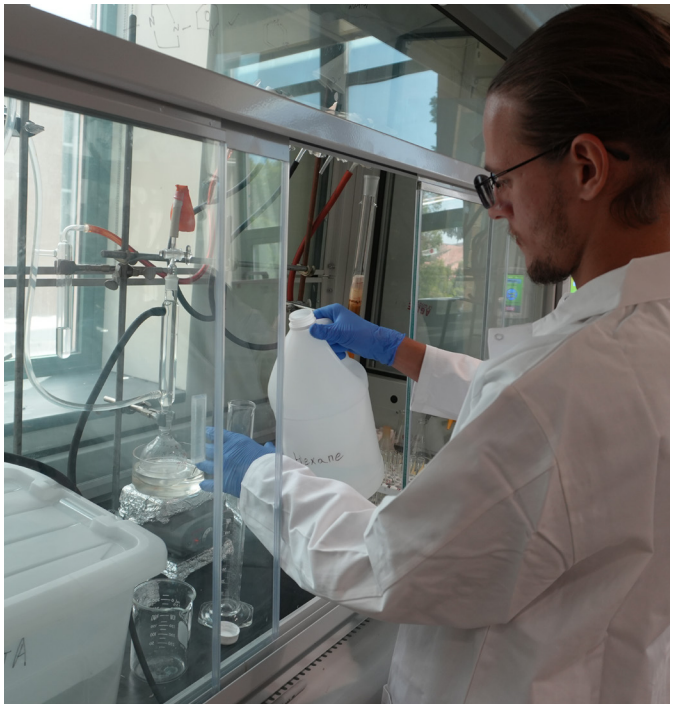
Bio-Inspired Polymers from Idaho Native Plants for Mineral Recovery from Mining Wastewater

SARE Faculty Mentor: Kativa Sharma, Idaho State University

Student: Angelo Mayer

This project sought to develop a sustainable method for recovering valuable critical metals from Idaho's mine tailings and wastewater using the state's abundant sagebrush plants. The ISU research team worked to turn natural compounds from sagebrush into special engineered polymers that can selectively capture important rare metals, while leaving others behind. These polymers have tiny "pockets" designed to fit the target metals, making the process highly efficient.

SARE students worked to extract and purify natural compounds from sagebrush, which serve as the building blocks for these polymers. The recovered metals are critical for many technologies, including green energy (electric vehicle motors, wind turbines), defense systems, consumer electronics, and medical imaging devices.



ISU SARE Student, Angelo Mayer. Photo Credit: Ila Garrido (ISU)

Applied Computational Models and Algorithmic Solutions to Common Optimization Problems In Energy-Water Systems

SARE Faculty Mentor: Paul Bodily, Idaho State University

Student: Michael Trosper

Many energy-water system challenges involve optimization problems where less effective solutions can produce substantial inefficiencies. Examples of such problems include: Optimal Water Flow (OWF), Optimal Pump Scheduling, Sensor Placement in Water Distribution Networks, Energy-Water Nexus Planning and Scheduling, and/or Infrastructure Design and Placement. Utilizing an existing interactive framework developed by an ISU research lab called Redux (for modeling and visualizing optimization problems), the SARE project worked to extend Redux to include these and similar problems/solutions, making them readily accessible to academic, industrial, and government stakeholders worldwide.

Michael Trosper, ISU SARE student, presents his research during the Idaho Conference for Undergraduate Research in Boise, Idaho in July. Photo Credit: Ila Garrido (ISU)

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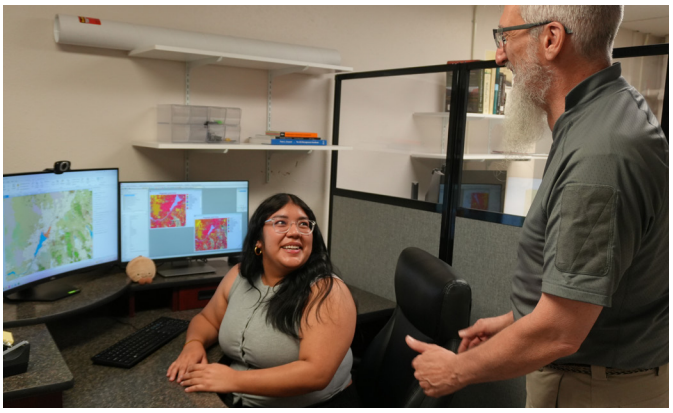
Land Change Modeler Application for I-CREWS Fort Hall Site

SARE Mentor: Keith Weber, Idaho State University

Student: Joselin Alvarado

This SARE project aimed to showcase how riparian vegetation could be impacted in the future by previous trends seen in the changes that occurred between 2016 and 2024, using land change modeling and remote sensing trend analysis to inform local land and water management decisions, particularly along the Snake River in the Fort Hall area. Riparian corridors along the Snake River are a vital support for water filtration, stream bank stabilization, and the maintaining of biodiversity, particularly in a region where Indigenous territory, water resources, and agricultural land intersect. One of the outcomes from the SARE project indicated that a substantial loss of riparian areas was projected to occur by 2032 for the Fort Hall site study area.

Joselin Alvarado, SARE student, states, “I want to use my understanding of geospatial modeling and background in statistics to better understand how the landscape around us is changing over time, especially in places where that change could impact both ecosystems and communities.”



ISU SARE student, Joselin Alvarado and Keith Weber, SARE Faculty Mentor. Photo Credit, Ila Garrido (ISU)