



# MONTANA NSF EPSCoR

## Spring 2022 Newsletter

The Spring 2022 Montana NSF EPSCoR newsletter is now available! Read about CREWS news and announcements, meet the Year 3 seed grant awardees, learn about education and outreach activities CREWS staff have recently facilitated, and more. You can find this newsletter and all other past Montana NSF EPSCoR newsletters online at <https://www.mtnsfepscor.org/resources/newsletters>.

### CREWS News

#### Two CREWS Undergraduate Research Students Awarded Prestigious Goldwater Scholarship

Two CREWS undergraduate research students, Shannon Hamp and Baylie Phillips, were recently announced as [Goldwater Scholars](#). This scholarship is the most prestigious award in the natural sciences, engineering, and mathematics in the United States and is given to sophomores and juniors who show exceptional promise to be the next generation of research leaders in their fields.



Shannon Hamp is a junior majoring in electrical and computer engineering at Montana State University. Hamp became involved with CREWS through a Research Experience for Undergraduates project in summer 2021 working in Dr. Joe Shaw's lab. She assisted with drone-based hyperspectral imaging of algae in the Judith River Basin and the Upper Clark Fork River, while also developing a low-cost multispectral imager for river algae detection. Baylie Phillips is a junior majoring in metallurgical and materials engineering at Montana Technological University. Phillips worked with Dr. Jerry Downey in fall 2021 as a CREWS undergraduate research intern, where she investigated selenium absorption and removal in Continuous Flow Metal Recovery systems. Phillips' research continues to encompass a broad array of disciplines but focuses mainly on exploring the life cycle of materials and ultimately removing materials from environmental systems.

[READ MORE](#)

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#### Montana Tech Awarded \$24M Grant to Develop Materials Technology for Rare Earth Element Processing Research Program

[Montana Technological University \(MTU\)](#) was recently awarded a five-year, \$24M research and development grant from the [Army Research Laboratory \(ARL\)](#) to develop a research program called "Materials Technology for Rare Earth Elements Processing." Dr. Jerry Downey, a CREWS research lead at MTU, will be the PI for the award, and Dr. Grant Wallace, a Research Associate in Dr. Downey's



research group, will act as co-PI. The program, developed in partnership with the [Montana Bureau of Mines and Geology \(MBMG\)](#), will build on the advances in the Continuous Flow Metal Recovery (CFMR) system developed during the current Track-1 CREWS project and will include analysis of large waste systems of the Butte-Anaconda mining complex and Montana coal mines. The goal of the program is to develop innovative, environmentally friendly, and industrially viable methods for recovering and separating rare earth elements (REE), and ultimately help lay the groundwork for economically and environmentally-sound utilization of REE sources in the United States. [READ MORE](#)

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## Bob Hall Receives ASLO Fellowship for Excellence in Aquatic Sciences

CREWS researcher Robert (Bob) Hall was recognized as an [ASLO \(Association for the Sciences of Limnology and Oceanography\)](#) fellow for the 2021 year for his sustained excellence in contributions to aquatic sciences. The Fellows program began in 2015 as a way for ASLO to acknowledge those members that consistently contribute to ASLO through their service to journals, conferences, and committees that advance the science of limnology and oceanography. Bob Hall is a professor of limnology at [Flathead Lake Biological Station](#) through the University of Montana, where he has worked since 2017. He has been interested in stream carbon cycling since attending graduate school at the University of Georgia. Hall's current work links geomorphology to stream metabolism and nitrogen cycling, time-series analyses of river metabolism, isotope tracers, and dissolved organic carbon (DOC) dynamics in streams. [READ MORE](#)




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## Researchers from CREWS Natural Resource Social Science and Judith River Watershed Teams Celebrate Publication of Two Articles



In the past year, members of the CREWS Natural Resource Social Science (NRSS) and Judith River Watershed (JRW) teams published two articles. The [first article](#), entitled "Social memory and infrastructure governance: A century in the life of a rural water drinking system" was published in *Environmental Research: Infrastructure and Sustainability*. The paper examines how shared social memories of water hardship impact water governance decision-making in the town of

Denton (Haggerty et al., 2021). The [second paper](#), "Beyond city limits: Infrastructural regionalism in rural Montana, USA," was published in *Territory, Politics, Governance*. It analyzes the political geography of the Central Montana Regional Water Authority and its proposed regional water pipeline system (Gansauer & Haggerty, 2021). The team is currently in the final stages of preparing a third publication for submission. This article will use region-wide interview data to articulate the community resilience dynamics associated with drinking water governance in the Judith region. [READ MORE](#)

# Project Highlights

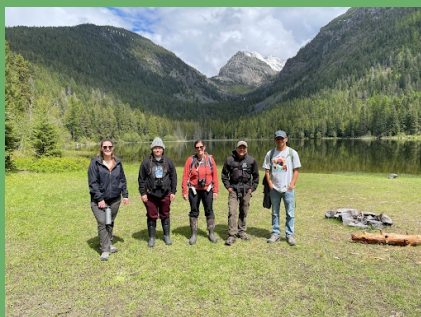
## Year 3 Workforce Development Seed Grant Awardees



### Ashley Beck, Carroll College

Dr. Ashley Beck, an Assistant Professor of Biology at Carroll College in Helena, was awarded a CREWS workforce development seed grant in Year 3 of the project. The objective of her seed grant project was to develop a Course-based Undergraduate Research Experience (CURE) for students at Carroll College. The focus of the project was to create a sequencing-based laboratory module that was integrated with the CREWS study

sites to collect data on environmental microbial taxa. [READ MORE](#)



### Georgia Smies, Salish Kootenai College

In Year 3 of the CREWS project, Georgia Smies, an instructor in the Fisheries and Wildlife Program at Salish Kootenai College (SKC), was awarded a CREWS workforce development seed grant to improve Category 1 wetland characterization using remote sensing tools and environmental DNA. During this

research, Smies and her students monitored select sites in the Flathead watershed in order to determine the aquatic species composition and animal activity at each site. [READ MORE](#)

## Education and Outreach

### Two CREWS Graduate Students Present at Diving into Data Workshop

The Diving into Data workshop, held in February, introduced teachers to a variety of methods to employ real-world data in their classrooms. The workshop, hosted by the [Science Math Resource Center \(SMRC\)](#) and supported by Montana NSF EPSCoR, included lightning talks from Riley Logan, a Ph.D. student at MSU, and Megan Moore, a Ph.D. student from UM, in addition to other researchers and staff. Some of the resources provided at the workshop included methods to collect data related to water quality, cloud cover, and ground temperature. Teachers who attended also received resources like water quality measurement kits and temperature sensors to engage in data collection in the classroom. [READ MORE](#)



**Science Math Resource Center  
Participates in MSU Family Science Day**





Staff from the [Science Math Resource Center \(SMRC\)](#) participated in the annual MSU Family Science Day in April. The event, hosted by [Academic Technology and Outreach](#), featured hands-on activities in science, technology, engineering, and mathematics. At the event SMRC staff, along with CREWS seed grant awardee Dr. Erika Espinosa-Ortiz and CREWS graduate student Caitlin Mitchell Mayernik, facilitated a CREWS Junior Researcher activity focused on water quality for over 150 fourth and fifth-grade students from schools around Bozeman.

## spectrUM Discovery Area Hosts Family Science Night in Anaconda

On April 27<sup>th</sup>-28<sup>th</sup>, the University of Montana [spectrUM Discovery Area](#) visited with students at Fred Moodry Intermediate School in Anaconda. Students participated in guided field trip programs in STEM and making and tinkering-related activities. Teachers participated in a professional development workshop to build their capacity to bring STEM experiences to their students, and spectrUM hosted a Family Science Night to engage the whole community. Megan Moore, a research assistant with the CREWS Upper Clark Fork River (UCFR) team and human geographer studying the Anaconda Company Smelter Superfund site, joined the Family Science Night with an interactive activity about the Smelter.



### CREWS Junior Researcher

Scientists and engineers from around Montana are studying Montana water systems and how our watersheds might be impacted by mining, agriculture and energy extraction.

**HERE'S A WATER ACTIVITY YOU CAN DO AT HOME!**

**How does acid mine drainage form?**

Acid mine drainage can form naturally due to the interaction of certain solid materials (like rocks) with water, air, and microbes. This process is called **weathering**, and it results in the release of acids, metals, and sulfates into water resources like rivers and creeks. Industrial activity like mining can increase the weathering process. The weathering process can result in the pollution and acidification (low pH) of water resources, which can affect the wildlife (animals, plants, microbes) living in or near the streams.

The goal of this experiment is to learn about a natural weathering process that can result in the formation of acidic streams. The pH is a measurement of how acidic or alkaline a substance is, and it ranges from 1 to 14. A pH of 7 is neutral (for example, milk), pH less than 7 is considered acidic (for example, lemon juice), and a pH greater than 7 is considered alkaline (for example, ammonia). The lower the pH value, the more acidic the substance, and the higher the pH value the more alkaline.

**YOU WILL NEED**

- Several types of solid natural materials like limestone, coal or charcoal, gravel, cement, or other types of rocks or metals like iron, aluminum, or magnesium.
- Several plastic water bottles (all the same size).
- pH strips.
- Tap water.

**GET STARTED!**

- Add water to the bottles and measure the pH with the pH strips (don't add any acid material yet).
- Empty one bottle with just water. This is called the **control**. Add the same type of acid material to each of the other water bottles (fill about 1/4 of the bottle with the solid material). Break apart the solid material into small pieces.
- Every day for four days, measure the pH of each bottle. Take note of the pH and write down if you observe any changes in coloration.

**ERIKA ESPINOSA-ORTIZ**  
Engineer  
Montana State University  
Center for Biofilm Engineering  
Montana NSF EPSCoR

**Hi! My name is Erika Espinosa-Ortiz, and I'm an engineer at Montana State University. I'm originally from Mexico City, a place with over 20 million people and serious issues due to water scarcity. This inspired me to become an environmental engineer and look for ways to preserve our water resources. My work focuses on developing technologies to clean up contaminated water using microbes. Besides working, I enjoy traveling around the world, and I have visited almost 100 different cities! My most exciting travel memory is of my riding a camel in the Sahara desert in Africa.**

**MY RESEARCH**

My teammates and I look for ways to clean water that has been contaminated by coal mining. Brown river mines can contain chemicals that are harmful to fish and plants. We know that fungi is a type of living organism, like a mushroom or mold, and bacteria (which people often assume are harmful) but can also be helpful! Some sometimes make these chemicals less harmful, so we are studying biofilms, which are giant communities of fungi and bacteria living together attached to a surface like a rock. Our team will compare biofilms that we grow in our lab to biofilms we find in streams and wells in the brown river basin and other places to see which fungi and bacteria might be most helpful for cleaning contaminated water.

The Consortium for Research on Environmental Water Systems (CREWS) is a National Science Foundation award partnership between the University of Montana, Montana State University, Montana Technological University, Idaho Technical College, and Upper Clark Fork River (UCFR) team. CREWS is a collaborative environmental water systems and aquatic water quality issues related to land use mining, intensive agriculture, and energy extraction. Research activities focus on three interconnected frontier water systems: land use mining, intensive agriculture, and energy extraction. Research activities focus on the Upper Clark Fork River.

**MONTANA STATE UNIVERSITY** **Montana Tech** **NSF EPSCoR** **spectrUM**

## Chief Joseph Middle School Students Learn about Water Quality through CREWS Junior Researcher Activity

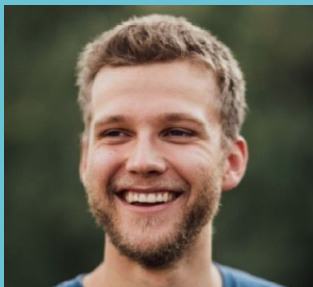
In late April, staff from the [Science Math Resource Center \(SMRC\)](#) at MSU conducted a CREWS education and outreach activity at Chief Joseph Middle School (CJMS) in Bozeman as part of their Earth Day celebrations. Over 100 sixth-grade students participated in the activity, which was a variation of the CREWS Junior Researcher acid mine drainage activity developed by Dr. Erika Espinosa-Ortiz, an Assistant Research Professor with the Center for Biofilm Engineering at MSU. CJMS students used pH strips to test different "contaminated" water samples, then built a filter using soda bottles, cotton balls, activated carbon, and other natural materials to filter the samples and examine how the water quality might have changed due to filtration.

## Shoutouts and Announcements

### Three CREWS Graduate Students Defend Ph.D. Dissertations in Spring 2022

**Congratulations to the following students who defended and**

graduated this spring! We wish you all the best as you embark on the next steps in your paths and careers



**Paul Hegedus, Ph.D.**  
**Dept. of Land Resources & Environmental Sciences, MSU**

**Advisors: Dr. Bruce Maxwell & Dr. Stephanie Ewing**

**Dissertation Title:**  
"Optimizing Site-Specific Nitrogen Fertilizer Management Based on Maximized Profit and Minimized Pollution"



**Katie Duncan, Ph.D.**  
**Dept. of Chemistry, MSU**  
**Advisor: Dr. Rob Walker**

**Dissertation Title:** "Solute Partitioning into Model Biological Membranes Studied with Time-Resolved Emission Spectroscopy and Calorimetry"



**Nida Shaikh, Ph.D.**  
**Dept. of Chemistry, MSU**  
**Advisor: Dr. Rob Walker**

**Dissertation Title:** "A Thermodynamic and Optical Assessment of Soluble Carbon Particulate Effects on Lipid Film Structure and Organization"



## **Dr. Ann Marie Reinhold to Join Montana State University's Gianforte School of Computing**

Dr. Ann Marie Reinhold, an Assistant Research Professor with the CREWS team since October of 2019, will be joining Montana State University's Gianforte School of Computing (GSoC) as an Assistant Professor in August of 2022. Hired as part of the GSoC's initiative to enrich their data science research and curriculum, Dr. Reinhold will be starting her own

lab, growing her environmental data science and simulation science research program, and developing and teaching new data science courses. She has a funded opening in her lab for a Ph.D. student whose research will operate at the intersection of simulation science, hydroecology, and biogeochemistry. Interested students can reach out to Dr. Reinhold at [reinhold@montana.edu](mailto:reinhold@montana.edu).

## **Upcoming Events**

### **CREWS Team Meeting**

**UCFWG Topic Discussion**  
Thursday, June 9 at 12 p.m.

**CREWS & BREWS**  
Friday, June 10 at 3:30 p.m.

**27th EPSCoR National Conference**  
**November 13 - 16, 2022**  
**Portland, Maine**

Join in person for the combined 27th NSF EPSCoR National Conference and 2022 EPSCoR PI Meeting, under the theme "Translating Stakeholder

**CREWS All-Hands Meeting**  
September 7 - 8, 2022  
Anaconda, MT

Needs into Impactful Research Outcomes." The combined conference has been designed to serve as a collaborative forum for interactive presentations and dialogue on rising trends in science, research, and broadening participation. [More information](#)

**View Events  
Calendar**

## Other Resources

### Have you heard about our workforce development resource, CREWS-U?

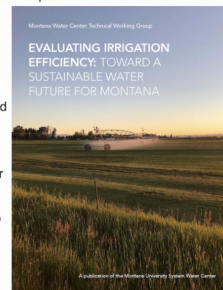
CREWS University, or "CREWS-U," is a resource for Montana professionals ranging from land resources managers and wastewater operators to K-12 teachers and informal educators who wish to obtain professional development and resources that relate to the research findings and broad concepts of the Montana NSF EPSCoR Track-1 project. The professional development resources we offer are guided by research data from stakeholder surveys and statewide needs assessments, and formats include self-paced online courses, in-person workshops, webinars, publications, and other tools. [LEARN MORE](#)

For questions about CREWS-U or to submit a suggestion for a new course or resource, please contact Suzi Taylor ([taylor@montana.edu](mailto:taylor@montana.edu)) or Madison Boone ([madison.boone@montana.edu](mailto:madison.boone@montana.edu)).

### For Workforce Development

#### Evaluating Irrigation Efficiency: Toward a Sustainable Water Future

The **Montana Water Center (MWC)** works with experts across the state and the Intermountain West to understand and synthesize issues of vital importance for Montana's water future. In light of this mission, and as a follow up to the 2018 Montana Water Summit, the MWC convened a technical working group in 2019-2020 to investigate the topic of irrigation efficiency and water conservation. In bringing together researchers, practitioners, managers, and policymakers, the goal of this project was to provide accurate, unbiased, and relevant information about the complex interplay between irrigation efficiency and water conservation at various scales.



A report from the MSU Science Math Resource Center - Fall 2021

#### Diversity, Equity and Inclusion in MSU Youth STEM Outreach

The framework presented here highlights exemplary practices for diversity, equity and inclusion (DEI) in science, technology, engineering and mathematics (STEM) outreach programs for youth in university programs hosted in an informal/out-of-school-time setting. Outlined in the framework are four primary domains: (a) organization fundamentals, (b) recruitment and registration, (c) outreach program personnel, and (d) outreach program design. For each topic within these domains, guiding questions and exemplary practices for DEI are presented. This framework is designed to allow those who host university STEM outreach programs for youth to evaluate and modify their practices to improve DEI. Section 2 calls specific attention to challenges faced by youth who are typically under-served or under-represented in STEM. The framework was developed through the analysis of both primary and secondary sources, including:

- Interviews with professionals from the MSU Office of Diversity & Inclusion and College of Education, Health & Human Development, Montana GEAR UP, and Montana Office of Public Instruction

- Interviews with K-12 educators and students
- Survey of Montana Science Olympiad coaches
- Community of practice meeting with MSU STEM outreach professionals and advocates
- Numerous MSU and national resources (see Appendices A and B) including Montana State University's Diversity and Inclusion Framework and the College of Education, Health & Human Development's Diversity and Inclusion Plan

This effort was also supported by SMRC's national partners, including Science Olympiad, National Science Foundation EPSCoR, NASA SciAct, NASA Astrobiology Institute and GLOBE, and the National Girls Collaborative Project as well as the Science Math Resource Center advisory board. Funding was provided by the Dean's Office of the College of Education, Health & Human Development. Please note that our findings and recommendations are not exhaustive and may change over time as new knowledge is acquired. For comments or questions on this publication, please contact the Science Math Resource Center at [smrc@montana.edu](mailto:smrc@montana.edu)



### New report from SMRC highlights diversity, equity, and inclusion framework for youth STEM outreach

The [Science Math Resource Center \(SMRC\)](#) at MSU has released a new report titled "Diversity, Equity, and Inclusion in MSU Youth STEM Outreach." The report highlights exemplary practices for diversity, equity, and inclusion (DEI) in science, technology, engineering, and mathematics (STEM) outreach programs for youth in university programs hosted in an informal or out-of-school-time setting. The framework outlines four primary domains, including

organization fundamentals, recruitment and registration, outreach program personnel, and outreach program design. It provides guiding questions to allow those who host university STEM programs for youth to evaluate and modify their practices to improve DEI. [LEARN MORE](#)

Do you have an idea, story, event, or opportunity that you would like included in a future Montana NSF EPSCoR newsletter? Please contact Madison Boone at [madison.boone@montana.edu](mailto:madison.boone@montana.edu)

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