The Current

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Idaho Water Resources Research Institute

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Mink Creek Water Quality

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Letter From The Director

Dear Readers,

As Director of the Idaho Water Institute, one of my greatest pleasures is to showcase the great work of our students. This issue of the Current is no exception, as it features the research activities of three students, all of whom are working on water resource issues within Idaho and the Northwest region. Not only does this newsletter provide them with a venue through which they can showcase their work, but it also provided an opportunity for a student from a very different background, English major, Ava Manning, to practice her craft and write the stories that we feature here.

In this interaction Ava interviewed two students and a faculty member, wrote a story on each of their projects, then returned it to them for editing and fact checking. This interaction provided a meaningful interaction for all of the students involved, and with any luck, allowed them to experience the interconnectedness between their respective trades. A true win/win!

Despite my involvement with these wonderful students, it remains devastating to witness the damage that the corona virus is exacting on Idaho communities. I particularly empathize with anyone in a mentor/protégé relationship, as it is very difficult to train students (or anyone else for that matter) under the current restrictions. Nevertheless, I marvel at the resourcefulness that I see within the Water Institute's staff and across the University of Idaho campus.

Stay safe and remember the words of Albert Camus, "In the midst of winter, I found there was, within me, an invincible summer."

Yours in Water,
Alan

Mink Creek Water Quality

AN E. COLI MYSTORY SOLVED WITH DNA

BY: MARIA ORTEGA, MARKETING AND COMMUNICATIONS MANAGER - BOISE

The Mink Creek watershed supports a wide variety of recreation uses with many quality trails and camping spots close to home in Pocatello. Much of the area also is grazed by cattle in the summer months. It's an area managed for multiple use. The West Fork of Mink Creek is part of the City of Pocatello's watershed, so it is closed to livestock grazing. "Any recreation you can think of happens in the Mink Creek watershed," said Robbert Mickelsen, Natural Resources and Planning Staff Officer for the Caribou-Targhee National Forest. "We have areas where people have summer homes. People pull up their camp trailer and camp next to streams. This is the recreational backyard for Pocatello.

"In recent times, water quality sampling on the East Fork and South Fork of Mink Creek showed that the streams were not supporting beneficial uses for recreation because of high levels of E. coli bacteria. The Idaho Department of Environmental Quality sampled seven locations on the East Fork and South Fork in 2017 and notified the Forest Service that water samples exceeded safe levels for primary and secondary contact for recreation.

"When they notified us of that, that was very much a concern for us on the Forest Service side, because providing clean water to the American people in this area is essential to our mission," Mickelsen said. "It's what we do. We take that mission very seriously."

To notify campers and recreationists, the Forest Service put up some warning signs about the water. But the big question was, where was the E.coli coming from? E. coli is a bacteria found in the intestines of warm-blooded animals. Was it cows? Careless campers? Dogs? Wildlife? That's where our detective story begins.

The DEQ report said that cattle were likely the primary cause of the high E. coli levels in Mink Creek. But Forest Service officials weren't sure.

"We started looking back at our rangeland monitoring and figuring out that we're meeting all of the best management practices for livestock grazing, that would protect water quality like stubble-height standards and utilization, and bank stability," Mickelsen said.

“We knew we didn’t have all the information to solve this problem. We reached out to the University of Idaho, and said Help!” UI cattle research specialist Jim Sprinkle and Eric Winford from the UI-Rangeland Center came to the next meeting with key stakeholders including the City of Pocatello, DEQ and local ranchers. “I raised the question, I think it’d be good for us to see who the major contributor is,” Sprinkle said. “So how do we do that? We do that with DNA.” UI cattle research specialist Jim Sprinkle and Eric Winford from the UI-Rangeland Center came to the next meeting with key stakeholders including the City of Pocatello, DEQ and local ranchers. “I raised the question, I think it’d be good for us to see who the major contributor is,” Sprinkle said. “So how do we do that? We do that with DNA.”

“Got a little bit of pushback on that from some of the people that it’d be even possible to do that, but Eric Winford assured everyone that U of I had that capability, and could do those tests.” Indeed, the notion of being able to identify the actual sources of E. coli through DNA testing is a fairly new thing. “Jim and I were really of the same mindset that we needed to find out what’s the source of this e-coli?” Winford said. “We shared papers, knew researchers had found dogs had contributed to e-coli before, geese had contributed to e-coli before, so we knew there were other possible suspects out there.”

To do the DNA research, the team needed $25,000 to cover costs. The Forest Service’s Region 4 Office in Ogden stepped up to fund the study. Eric Winford reached out to Alan Kolok, Director of the Idaho Water Research Institute at U of I. Kolok found a graduate student to help with water sampling and tapped Jane Lucas, a post-doc Ph.D. in the UI Department of Soils and Water Systems, to do the DNA analysis. “It was a very fortuitous series of events,” Kolok said. “When Eric got in touch with me, at the time, I had a grad student looking for a project. He wanted to do something environmental and cutting-edge molecular biological techniques. This project relative to source-tracking worked out perfectly for him.”

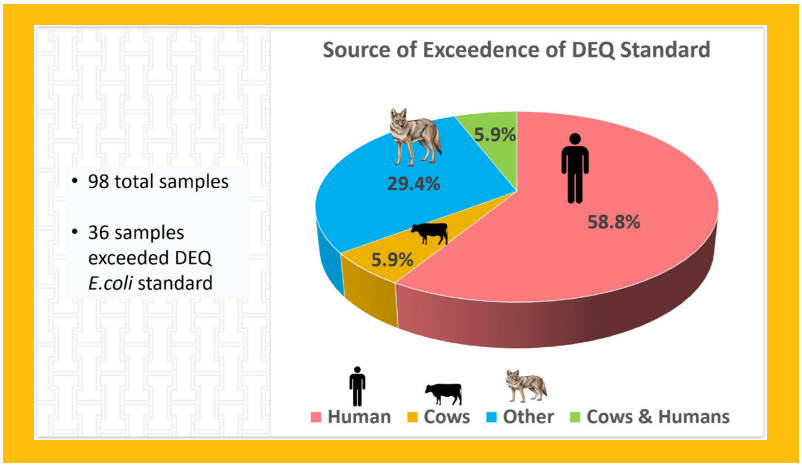
The U of I research crew ventured into the Mink Creek area in the summer of 2019 to collect more water samples. "In the study, we wanted to look at how livestock e-coli levels were in the stream prior to, during and following grazing,” Sprinkle said. “And we also did the same with humans, because there’s a lot of human recreation on the stream, and we wanted to check it before and after major holidays.” “It allows you to take a bunch of DNA and look for specific markers,” Lucas said. “We were looking for human markers. And cattle markers. And there are specific bacteria that live in the digestive tracts of humans and of cattle that are always present. That allows us to assign where that bacteria is coming from.

They re-sampled at the seven DEQ sites, and they added an additional seven sites to collect more data. Idaho State University provided lab space for the grad student, Nik Vishwanath, to do an initial analysis of the water data. The DNA samples had to be stored at 80 degrees-below-zero in a special freezer. Jane Lucus explains how they determine the source of E. coli through DNA testing.

"That's the same thing we'd do in a crime scene, we're looking for potential traces of a perpetrator, you sample the environment, look at the genetic bar code and hopefully you have a data base with that person." A $20,000 Quantative PCR machine evaluates the DNA data. It heats up the water samples – unzipping the vital DNA information – and provides a computer readout of the results. They evaluated 98 water samples, and went through them three times to confirm the source of E. coli.

The final results were as follows for the samples that exceeded safe standards:

- 59 percent came from humans.
- 6 percent from cattle
- 6 percent from humans and cattle
- 30 percent from other – dogs and wildlife



Now, Forest Service officials are evaluating the next steps. "So what I'd like to do is invite the partners back together at the table and work toward a solution that not only helps the community but protects the watershed resource," said Kim Obele, District Range, West Side Ranger District in Pocatello.

"The issue is very important to city of Pocatello and all of us. We need to work on that solution together." U of I officials were happy to play a positive role in the project. "It's been a great opportunity for us," Sprinkle said. "I'm in extension, and our mission in extension is to make science help answer questions and problems, and if we can do that, we can help provide some answers, then we feel we're doing our job." "I really have to hand it to the Forest Service, they handled it the right way," Sprinkle continued. "Instead of using a big regulatory hammer, they wanted to look for solutions and answers to questions. So that makes it pretty easy to find out answers when you have a willing partner like that." Plus, the whole field of environmental DNA shows promise, Lucas says. "We're learning the ability to extract DNA from our environment and understand where it comes from is growing into a huge deal," she said. "I've done a lot of this training with students, so that they see if they want to go into crime, medicine, environmental DNA work, wildlife conservation, wildlife biology, this is a technique that works for all of those fields, so I think that's really exciting it feels like we're training our generation to do a lot of great new science."

Jaz Ammon

GRADUATE STUDENT AFFILIATE

BY: AVA MANNING

Jaz Ammon, a first year masters student in the University of Idaho's Water Research Program, is currently working on a captivating research project that will aid in preparing for wildfires and in creating more resilient landscapes. Mr. Ammon received his Bachelor of Science from the College of Natural Resources in 2012 at the University of Idaho, and after working with the US Forestry Service and the National Park Service, he realized that he wanted to contribute more. He became interested more specifically in the connection between water resources and wildfire management, as throughout his career he had seen the significant rise in wildfires across the west.

"It is difficult to be a bystander when fires and subsequent threats to our fresh water supply are an almost constant topic in my field," says Ammon.

Jaz is currently working on a research project led by Dr. Erin Brooks in the Department of Soil and Water Systems that will help fire-prone communities track vegetation regrowth after wildfires. This project will use a computer-based model called the Water Erosion Prediction Project (or WEPP) to analyze decades of weather patterns and stream flow both before and after natural disasters, to study the ways that these events impact landscapes. WEPP is a program that allows you not only to look at past natural disasters, but it can also predict what will happen in the future as a certain area responds changes in climate over time. It does this through processing an immense amount of collected data on soil properties, rainfall and snowmelt, vegetation, and climate variables. This tool is widely applicable and will play a key part in Mr. Ammon's ongoing research project.

In September, Jaz applied for the Joint Fire Science Program' s Graduate Research Innovation Award, a grant that would fund an additional aspect of his research. Currently under review, this proposed research would detail how using satellite imagery and aerial photograph analysis could be used to expand on his current research project.

Hayley Schnae

MASTERS STUDENT

BY: AVA MANNING

Hayley Schnae is one of the newest additions to the Idaho Water Institute. Schnae first received her Bachelors degree in Ocean and Coastal Resources at Texas A&M University in Galveston, Texas. While completing her degree, she worked at Moody Gardens as an interpretive naturalist, during the summer of 2018, a position that required her to educate the public regarding ocean and rainforest conservation.

During her senior year, she worked on a wetland research project where scientists were doing bird counts and vegetation surveys throughout the Galveston Bay Bird Islands. She graduated in 2019 and then accepted a wildlife rehabilitation and education internship at the Northwoods Wildlife Center in Minoqua, Wisconsin.

After finishing her internship, she decided to go back to school to get her Master of Science in Water Resource - Science and Management. Schnae is working as a Research Assistant and will be playing a vital role in the upcoming Crayfish Mercury Project that the Idaho Water Institute is coordinating. She will graduate in December of 2022.

The Crayfish Mercury Project is funded for two years and will work with multiple community organizations, including IdaH2O, The River Mile, The Spokane River Keepers, and The Boise River Enhancement Network. The project will collect invasive crayfish from the Spokane and Boise rivers then test their tail muscles for total mercury content. The goal of this project is to get a clear picture of the extent of mercury pollution in the Spokane and Boise River basins.

What's in a Name?

BY: ALAN KOLOK

Names matter as they reflect societal fears, hopes and aspirations. Consider the changing of the name of the National Football League's, Washington Redskins to the Washington Football Team, or the National Basketball Association's Baltimore Bullets to the Washington Wizards. Those name changes speak volumes relative to changing societal norms and are, by no means, trivial.

Likewise, though less socially charged, consider the word wicked. Historically, one definition of the word was 'evil, morally wrong, or extremely unpleasant.' Recently, however the word has been used as a modifier of 'problem,' and has come to define a problem that cannot be solved but can only be mitigated. The concept of a wicked problem has been further amplified by adding the term 'super' in front of it, with the poster child for a super wicked problem being global climate change. Not only do super wicked problems have no simple solutions, but the solutions that would have worked in the past may no longer work in the future, and the individuals that could assuage the issue may actually be the ones that are often responsible for its continued expansion.

Water resource professionals have recently begun to use the term wicked in reference to water problems, and in fact there was a panel session on wicked water problems at the most recent American Water Resources Association annual meeting. Naming water problems in this way, points to the fact that these problems will share a number of features, including, incomplete or contradictory knowledge, a diversity in the opinions of community members involved, a large economic burden and the interconnected nature of the water problems with other social and economic problems. This is not just semantics, but rather provides a name that describes the changing paradigm in which water resource research operates.

A similar paradigm shift is also taking place at the interface between water resource research and public health. Take, for example, geohealth. Geohealth stands for global, environmental and occupational health and is the study of geography's effect on public health. This is not a new concept to water resource professionals, as the geographic separation of drinking water from wastewater has been a cornerstone of public health since the miasma theory of infectious disease was replaced by germ theory in the late 1800's. But today, Geohealth deals with so much more. Global satellite imagery, as well as national and internationally aggregated datasets on geographic information can be amalgamated with data regarding adverse human health outcomes collected by the Centers for Disease Control and Prevention (CDC). These analyses can produce results that were virtually impossible to amass just a few years ago. The medical community is beginning to recognize the value of environmental data, while water resource professionals are recognizing that their expertise may be essential if the medical community is to address wicked problems in environmental health.

What's in a name? Well, apparently plenty.

Lee Vierling

PRESIDENTIAL WATER SUSTAINABILITY INITIATIVE RECIPIENT

BY: AVA MANNING

Dr. Lee Vierling is currently a University Distinguished Professor at the University of Idaho, and has been working here for seventeen years. Vierling first received his Bachelor's Degree from Colorado College, and then went on to receive his PhD at the University of Colorado. He majored in Biology and Ecology, hoping to enhance the environment through research, and to empower the next generation of professionals through his teaching and mentorship. After graduating with his PhD, he worked for NASA researching a number of topics including: the history of Russian fires (as evaluated from satellite information), studying how the Arctic tundra ecosystems are changing, helping to design new satellite sensors, and developing new ways of measuring plant growth from space. In 2004, Vierling and his wife fell in love with the area of Moscow, Idaho, and relocated, residing here ever since.

Dr. Vierling is leading a group of scientists in the Sustaining Idaho's Needs in Environment and Water (SINEW), one of the projects recently funded by the Presidential Initiative on Water and Sustainability. The team will be spearheading research in three different water basins across the state. They will contact water leaders from the community to help gauge what issues each community has, and how they can help. SINEW's goal is simple: to bring community and scientific knowledge together to better the environmental future of each community. Approaching the community first will give the researchers at SINEW an idea of the community's history and the environmental issues they have been have been grappling with. Through these conversations, SINEW can create a solution that is finely tuned to each community's specific concerns. "Partnering with communities on areas of science and management is all about building trust and working together," Vierling says. "I am very lucky to have such a wonderful team of researchers, scientists, and community partners joining me for this project."

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