GREETINGS AND HAPPY 2019 FROM THE MONTANA WATER CENTER!

We are excited to be continuing our newsletter tradition in 2019, connecting you to water-related projects and research from across the Montana University System, and the state. As part of the National Institutes for Water Resources network, we will also connect you to national policy and research that affect our state’s water resources. Additional information about the Montana Water Center’s current projects, funded research, grant opportunities, and more can always be found at montanawatercenter.org. One of our goals is to stay in touch with water research and happenings in Montana, so reach out and let us know what is happening in your organization, lab, or watershed!

Wyatt Cross, Director, and Whitney Lonsdale, Assistant Director

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**2018 In Review**

- Co-organized and co-sponsored the Montana Water Summit, engaging nearly 300 water resource stakeholders in discussions about Montana’s water future

- Shared key findings of the Montana Climate Assessment in communities around Montana

- Co-sponsored the annual Fall Water School at MSU for wastewater operators from across the state

- Awarded three Faculty Seed Grants to faculty at MSU and Montana Tech

- Awarded six Graduate Student Fellowships to students at University of Montana, MSU and Montana Tech

- Shared Project Wet curriculum and training with a variety of educators and students in SW Montana

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**What’s New for 2019**

- Funded three new Faculty Seed Grants

- Granted seven new Graduate Research Fellowships

- Creation of Montana Water Consortium under new EPSCoR grant to foster increased communication and collaboration between the university system and state and federal agencies in Montana.

- Technical Working Group to investigate irrigation efficiency and water conservation at various scales
Robin Welling, a graduate student at the University of Montana, is investigating the relationship between large wood and sediment routing in low-order mountain streams.

MWC: Tell us about your research and some of your key results?
RW: My research looked at how the distribution of large wood relates to sediment storage and movement in a mixed bedrock-alluvial stream in the Bitterroot Mountains. Our research showed that the wood and sediment load in the mixed bedrock-alluvial subreach was substantially smaller than that of the alluvial subreach. These results suggest that even as wood may significantly alter local hydraulics and sediment transport, the geomorphic impact and influence of wood on sediment storage may vary substantially by channel type.

MWC: Describe the relevance and utility of your research for Montana.
RW: Our research suggests that mixed bedrock-alluvial channels effectively transport wood and sediment downstream. Hillslope disturbances including fire, beetle kills, and logging can increase the delivery of water, wood, and sediment to channels. Wood and sediment dynamics can determine the extent to which these disturbances propagate from headwater streams to low-lying areas where people live. The next step is to consider how changing wood and sediment supply might alter the transport efficiency of these channels.

MWC: Is your research part of a larger project or ongoing research at UM?
RW: The research on which my advisor, Andrew Wilcox, and I are working is part of a larger NSF-supported project exploring the morphologic and vegetative controls on sediment connectivity in mountain landscapes. Jean Dixon’s lab group at MSU is tackling questions about soil formation and movement on hillslopes while we are focusing on the transport of sediments once they have entered the channel network.

MWC: Were there any big challenges to overcome in the course of your research?
RW: Working in a relatively pristine and remote field setting presents some logistical challenges. As Lost Horse Creek is ungaged, it was hard to know when we should make a trip to collect measurements at a targeted streamflow. The weather often varies between the canyon mouth and the study site many miles up the drainage. My field assistant and I encountered over a foot of snow at the site following a snowstorm in mid-November 2017. We had no trouble driving there in sub-freezing temperatures, but we barely made it out after a day of heavy rain turned the snowpack into a slurry through which we crawled at 5 mph.
Yellowstone River Conservation District Council Seeking Input on Irrigation Project Opportunities

The idea that irrigation water management goes well beyond pivots and pipelines is something the Yellowstone River Conservation District Council knows well. After wrapping up a 15-year effort (the Cumulative Effects Analysis) to understand the science of human impacts on the Yellowstone River’s biology, hydrology and more, the Yellowstone River Conservation District Council – comprising one board supervisor from each of the 11 conservation districts along the Yellowstone River – is now shifting gears.

The Council is spurring conversation around the suite of science-based management recommendations they developed with the goal of linking the recommendations to projects that will improve the health of the Yellowstone River. The first of these “Yellowstone River Recommended Practices” the Council is championing is irrigation water management. Irrigation accounts for the largest amount of water use (95%) in the Yellowstone River Basin. Approximately 90% of the 100-year floodplain is used for either crop production or livestock grazing. With this vibrant agricultural heritage comes unavoidable impacts such as floodplain development, bank armoring, reduced river flows, sediment runoff and more.

To engage stakeholders on this issue and hear about on-the-ground project opportunities, the Council hit the road this fall, hosting four regional open houses in Big Timber, Huntley, Forsyth and Glendive during September and October. “It’s exciting to see progress being made linking the Cumulative Effects Analysis to real projects that will benefit the Yellowstone River and its people,” says Aaron Kolb, current Big Sky Watershed Corps member and soon-to-be employee with the Council. “The feedback we’ve received from local partners has been essential in charting a path forward.”

Over 70 individual irrigators, irrigation district managers, engineers, conservation district board members, conservation nonprofit representatives, elected officials and others attended. Discussions elicited familiar challenges such as aging irrigation infrastructure as well as new concerns focusing on how to engage the next generation of leaders, what to do about rising power costs and the need for long-range planning. Based on this robust local feedback, the Council identified approximately 50 specific project ideas that will form a priority plan to guide their irrigation water management work over the next several years. Projects range from infrastructure automation to soil health improvements for water retention and reducing runoff.

If you’d like to get involved, please contact Dan Rostad, Yellowstone River Conservation District Council Coordinator at 406-930-0594 and Dan.Rostad@mt.nacdnet.net. For more information on the Council and its work or to find scientific data related to the Yellowstone River, visit yellowstonerivercouncil.org.

MT Climate Office and Institute on Ecosystems Sponsor Soil Moisture Education Workshops

Workshops were held in October and November of 2018, in recognition of the need for soil moisture information for a broad range of uses: to monitor the effects of drought response as well as adaptations to changing climate; to improve success when producers seek insurance relief from weather-related losses; and to support statewide planning and budgeting. Instructors coordinated content integrated across concepts of fundamental soil physics, measurement technologies, and determination of plant available water for management applications. The state of local soil moisture measurement and interpretation was coupled with satellite measures of soil moisture to highlight current and potential statewide extrapolation. Theory and data practices were put in the context of the value of soil moisture data in forest management, evaluating water use efficiency, nutrient management, and precision agriculture.

Participants provided feedback on current use of soil moisture information, development needs, and suggested next steps in soil moisture education and monitoring in Montana. The majority of workshop participants reported that they currently used soil moisture information in their decision-making process, applied mostly to water management programs. Suggestions for monitoring improvement included easier access to data, need for more monitoring stations, and creation of relevant tools and strategies to use soil moisture information. Recommendations on next steps with soil moisture education emphasized more educational events, helping user base understand value of soil moisture data and applications, and outreach to producers and the general public.
Laurie Yung, a professor of Natural Resource Social Science at the University of Montana, received a Montana Water Center faculty seed grant to conduct research to improve climate information to enhance the drought preparedness of Montana’s agricultural producers.

MWC: Tell us about the research you conducted with the Montana Water Center faculty seed grant.
LY: We developed web and print-based climate information for Montana farmers and ranchers, and then field tested that information through focus groups with agricultural producers across the state.

MWC: Tell us what inspired or motivated you to take on this particular research topic.
LY: We’re interested in how Montana farmers and ranchers make decisions in the context of drought and water variability, and in particular how they utilize climate information in these decisions. More specifically, we want to understand what kind of climate information agricultural producers find useful (e.g. at what spatial scale) and what information they trust (e.g. from what source). Because seasonal forecasts and longer-term projections are somewhat uncertain, we’re also interested in how farmers and ranchers navigate that uncertainty as they utilize climate information.

MWC: Describe a few of your key results and how you hope this information will be used?
LY: In keeping with previous research on farm decision-making, climate information is just one of many factors that influence how producers make decisions in the context of drought or other water-related issues. In our focus groups, farmers and ranchers discussed the myriad, interacting factors that influence their decisions, from commodity prices and risk perceptions to knowledge of past droughts and innovations being piloted by their neighbors. Producers were cognizant of the uncertainty of the seasonal forecasts. They saw it as our responsibility as scientists to communicate clearly about the uncertainty of forecasts and their responsibility to determine how they want to act given that uncertainty. In other words, they want us to explain the uncertainty, but not to try to tell them what they should do in the context of that uncertainty. Perhaps not surprisingly, they trusted information from other farmers and ranchers more than other sources, especially with regard to new innovations that might work well in the face of drought.

MWC: Were there any results, insights or outcomes that were particularly surprising?
LY: Farmers and ranchers asked us to provide the climate information, but not to attempt to interpret what it would mean for them as producers or to suggest how they should respond. They argued that local conditions and the context of each farm operation differed enough to make broad recommendations unhelpful and that they were equipped to determine how to act on the forecasts. This was surprising because some previous research suggests that climate information is more useful if it is accompanied by suggestions regarding how to use it in decision-making.

Co-PIs on this research were Kelsey Jencso, Libby Metcalf, Nick Silverman, Brad Bauer, Michael Sweet. his research is part of the Montana Drought and Climate Project, a interdisciplinary research project of the Montana Climate Office. For more information, go to https://climate.umt.edu/mtdrought/default.php
WATER RESOURCES RESEARCH PROGRAM - 2019 AWARDS

The Water Resources Research Program helps fulfill an important part of the Montana Water Center’s mission by providing research funding for Montana University system faculty and students investigating issues of importance for Montana’s water resources. In 2019, the Water Center funded three new Faculty Seed Grants and seven new Graduate Research Fellowships, representing an exciting range of research topics and approaches. See below for research project descriptions.

FACULTY SEED GRANTS
Drs. Lisa Eby and Ben Colman, Department of Ecosystem and Conservation Sciences, University of Montana, Assessing the costs and benefits of beaver dam analogs to create resilience to climate change for aquatic ecosystems

Drs. Eric Sproles and Jordy Hendrikx, Montana State University, Department of Earth Sciences, Developing cloud-based tools to predict monthly streamflow in western Montana with SnowCloudHydro

Drs. Art Woods and Rachel Malison, University of Montana, Division of Biological Sciences, Effects of changing stream temperatures on Montana stonefly communities

GRADUATE STUDENT FELLOWSHIPS
Jackson Birrell, PhD student, Division of Biological Sciences, University of Montana, Variation in oxygen, temperature and flow in streams and how they influence the behavior of the giant salmonfly, Pteronarcys californica

Jesse Bunker, MS student, Department of Environmental Engineering, Montana Tech, Quantification of Groundwater Flux at a hydrothermal Feature in the Yellowstone River

Kimberly Bray, MS student, Division of Biological Sciences, University of Montana, Primary controls on nitrate use in lotic systems

Leah Joyce, MS student, Division of Biological Sciences, University of Montana, The influence of beavers on amphibian parasite dispersal in Glacier National Park

Luke Thompson, MS student, Department of Civil Engineering, Montana State University, Optimization of two-stage solids and nutrient removal wetland treatment system operating at a fish hatchery in a cold climate

Benjamin Tumolo, PhD student, Department of Ecology, Montana State University, Aquatic Insect Ecosystem Engineering Creates Resource Hot Spots in Montana Streams

Holly Nesbitt, PhD student, Forest and Conservation Sciences, University of Montana, Dynamics of changing water availability and water rights administration in the Upper Clark Fork River Basin, MT