

From Shore to Shore

A publication of the University of Minnesota Extension
Water Resources Team

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Welcome Megan Weber!

Meet the Water Resources Team's newest educator! Megan Weber joined the team in April to work on developing the new Aquatic Invasive Species Tracker Program.

Megan is a native Minnesotan who was born in Fergus Falls and graduated from Marshall Senior High School in Marshall, MN. Early on, she was interested in marine biology, so it was a natural transition for her to migrate to California for college. She attended the University of California – Santa Cruz and San Jose State University. After receiving her master's degree in environmental studies, she took a job with a water district and went to work monitoring for invasive mussels in freshwater systems. To her surprise, she found that she enjoyed working in the freshwater realm, so she returned to Minnesota, where she worked with Marrone Bio Innovations' program to test the use of the biopesticide Zequanox to control zebra mussels in lakes and infrastructure.

Although she was enjoying that work, Megan always felt that she would eventually work in the public sphere, and when she saw the job announcement with the University of Minnesota, she applied. She was attracted to the opportunities to work in education and outreach, to talk to people about invasive species, to work with the new Minnesota Aquatic Invasive Species Research Center, and to broaden her work beyond just invasive mussel species.



Megan is finding the development of the Aquatic Invasive Species Tracker Program to be challenging and enjoyable. The Tracker Program is a citizen science program that will enlist volunteers to collect data that will help resource managers and researchers determine which management tools work best to control aquatic invasive species. For example, if a lake is being treated to control Eurasian watermilfoil, volunteers from the Tracker program can collect data and enter it into a database so that researchers can begin to see which treatment options work best in specific situations.

Megan's office is in the Extension Regional Office in Andover. If you would like to contact her, call 763-767-3874 or email mmweber@umn.edu. Welcome Megan! ■



Calendar of Events

For the most current calendar items and more details, visit www.extension.umn.edu/environment/water/calendar/.

Environmental Statistics

Date: November 10

Location: Bunker Hills Activity Center

Contact: Shahram Missaghi, 952-221-1333, miss0035@umn.edu

Designing for Our Future – Sustainable Infrastructure and the Triple Bottom Line

Date: November 15

Location: St. Paul Student Center Theater

For more information: <http://freshwater.org/moos-family-lecture-series/>

"State of the River" Presentation

Date: November 15

Location: Hastings; Schaar's Bluff Gathering Center

For more information: <http://fmr.org/events/2016/11/15/state-river-presentation-hastings>

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Can Agriculture Residue Help Clean Water?

Reprinted with permission from Agricultural Utilization Research Institute, www.auri.org/2016/01/can-agriculture-residue-help-clean-water

Since the beginning of agriculture, farmers have prided themselves on leaving nothing to waste.

A research project funded by AURI, Minnesota Corn Research and Promotion Council and the U.S. Department of Agriculture's Agricultural Research Service (USDA-ARS) could lead to farmers making use of agricultural residue in a device called a denitrifying bioreactor, which reduces runoff of nitrate from farm fields.

Bioreactor technology has been developing for a few decades, using wood chips as a medium. The Minnesota research project tested materials even closer to hand for the average farmer. Initial results show materials like corn cobs can be even more effective than wood chips in reducing nitrate run-off.

The problem with nitrate comes when it escapes from farm fields. Scientists believe that high nitrogen levels in the surface waters of the Mississippi River Basin are a major contributing factor in the occurrence of a seasonal dead zone in the Gulf of Mexico, which harms marine life as well as the fishing and tourism industries that depend on it.

Since 2011, USDA-ARS agricultural engineer Gary Feyereisen has built a number of prototype bioreactors to test the denitrifying potential and flow characteristics of barley straw, corn stover and corn cobs, alongside the more conventional choice of wood chips.



"We found that these materials, corn cobs specifically, performed better than wood chips," said Feyereisen. "Ag residues offer carbon in a more labile form than wood chips, a form that's more easily broken down and provided to the denitrifying microbes. With wood chips, the carbon is tied up in lignins and longer molecular chains, which are harder to break down.

"Unfortunately, the ag residues are going to be used up quicker. We saw that particularly with barley straw and corn stover. Even after five months they were starting to be used up, and the rates of denitrification were dropping. The results suggest that if we could design a modular bioreactor—one that could easily be emptied of the exhausted medium and then refilled—we could achieve the kind of nitrate reduction we are hoping for."

Another finding of the research is that these agricultural residues perform better than wood chips in cold temperatures.

"We know that in the Upper Midwest, especially in Minnesota, much of the farm field drainage occurs during April and May when the ground temperatures are cold and the water is cold. In places south of here, they are not quite as cold,

and they do quite well with wood chip-filled bioreactors. We wanted to see if there is any advantage to using these agriculture residues under the cold temperature regime," explains Feyereisen.

Feyereisen and his graduate student assistants set up bioreactor columns in a room that could be chilled to 35 degrees Fahrenheit.

The reason temperature is a critical factor for bioreactor performance is that the chemical mechanism for denitrification is, as the name suggests, a biological one. Microbes establish colonies on the media inside the bioreactor. Water containing nitrate drains from the farm field and flows through the bioreactor where the microbes use the nitrate for respiration and convert it to gaseous nitrogen. This nitrogen gas is released harmlessly into the atmosphere, which is 78 percent nitrogen.

"The good news is that agricultural residue works better than wood chips under those cold weather conditions," says Alan Doering, senior associate scientist at AURI, who played a supporting role in Feyereisen's project—sourcing and preparing the ag residues so that they would match what a farmer would use.

Feyereisen's project now moves into a field testing phase. "We are hoping that by using a new modular design for bioreactors, they will be more user-friendly for the farmer," explains Becky Philipp, who serves as project manager for AURI. "Once the material has been depleted, it can be taken out and placed back on the land. We won't know how well that works until we conduct the field trials, but we're hopeful that the spent media will provide organic matter and additional fertility to the soil." Experts evaluating the adverse effect of nitrate runoff have set a goal of 45 percent reduction in nitrate loss from farm fields, Feyereisen notes. ■

The 4-H Aquatic Robotics Program

Brian McNeill, Extension Educator, Youth Development, 320-589-1711, mcnei006@umn.edu

The University of Minnesota's Extension Center for Youth Development offers the 4-H Aquatic Robotics program, which builds the capacity of young people to make a difference in their community. The program gives youth in 4-H clubs, camps and adventures opportunities to apply underwater robotic technology to real-world water issues through an inquiry-based approach. Through the program, youth engage with real-world issues using remotely operated vehicle (ROV) technology, thus building their identity as science learners. Using the underwater robotics program SeaPerch as a metaphorical "on ramp," Minnesota 4-H youth currently participate in robotics clubs, citizen science teams, and water quality monitoring efforts.

The SeaPerch program and its ROV were developed by MIT Sea Grant and the Society of Naval Architects and



Brian McNeill

Marine Engineers. Youth build, adapt, and then navigate the SeaPerch ROV through underwater challenges. They also use it in local watersheds, along with faculty, adult volunteers, and water resource partners as mentor guides, to explore and learn about Minnesota's waters.

SeaPerch offers a simple, interactive platform that allows students to learn about myriad subjects. By designing and building their own ROV, students learn about engineering. By conducting water sampling and observing habitat, they learn about biology. They learn about physics through buoyancy and electrical wiring, and they learn about history and so much more by studying the evolution of ocean exploration.

In addition, they learn scientific and mathematical concepts, strengthen their ability to think like scientists, develop skills using related language and tools, and gain positive attitudes about science and self. Through Minnesota 4-H Aquatic Robotics, youth have the opportunity to become more civically engaged and scientifically grounded.

The University of Minnesota Extension's 4-H Aquatic Robotics teams have been using the ROVs for addressing environmental issues in their communities, like:

- Lake clean up (one team collected 100 pop cans off the bottom of the lake)
- Watershed monitoring (creating partnerships, collecting and submitting data)
- Lake and river exploration (using the ROVs to identify invasive species)

The next area that the 4-H Aquatic Robotics program will tackle is invasive species education. The program is helping students learn early detection and monitoring methods for designated aquatic invasive species in selected waters. Then, with SeaPerch ROVs in hand, the youth will work to educate lake homeowners and citizens about the spread of invasive species such as invasive carp and zebra mussels.

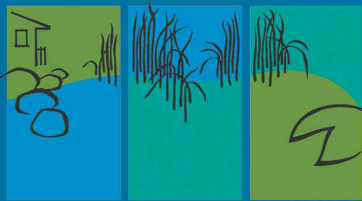
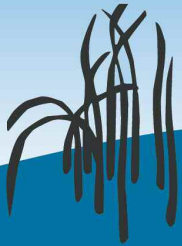
Facebook: www.facebook.com/MN4HAquaticRobotics ■



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From Shore to Shore

www.shorelandmanagement.org

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To subscribe or unsubscribe, please contact Heidi Olson-Manska at olsonh@umn.edu or 320-589-1711.

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Water Resources Team News and Events



Karen Terry

The next chapter for the *From Shore to Shore* newsletter

We are excited to announce that the *From Shore to Shore* newsletter is merging with the *Minnegram*, which is the University of Minnesota Water Resources Center's (WRC) quarterly newsletter of water news. The useful content you've relied on for years will be available in this merged newsletter along with articles focused primarily on water-related research from U of M with an emphasis on the work of researchers and graduate students from the WRC. The next issue of *From Shore to Shore* (Winter 2017) will be the last. Unless you unsubscribe, you will start receiving the *Minnegram* beginning with the Spring 2017 issue. As with the *From Shore to Shore* newsletter, you are welcome to unsubscribe at any time. Thanks for your continued interest in water issues in Minnesota!

To unsubscribe from the *Minnegram*, please send a message to Heidi Olson-Manska at olsonh@umn.edu.

Nominations for Minnesota Climate Adaptation Awards

Nominations are open for the Minnesota Climate Adaptation Awards. The awards recognize and celebrate exceptional achievements in leadership, education, research,

policies, and practices that improve resilience and develop, advance, or implement climate adaptation strategies. Award categories include individual, organization, institution, and business. The awards will be presented at the 2017 Climate Adaptation Partnership Conference on May 8, 2017 in St. Paul, MN. See the [nominations announcement](#) for details. The deadline to submit nominations is March 1, 2017.

Clean Water Summit – Green Infrastructure for Clean Water

The 2016 Clean Water Summit, "Green Infrastructure for Clean Water – Rethinking Redevelopment and Retrofits," was held September 22 at the Minnesota Landscape Arboretum in Chaska. This annual event drew about 200 attendees this year, and hosted two keynote speakers: Howard Neukrug, former commissioner and CEO, Philadelphia Water Services ("Driving Innovation in our Cities: New Trends for the Water Sector – Green Infrastructure and Beyond") and Dr. Robert Traver, Director and researcher, Villanova Urban Stormwater Partnership and the Villanova Center for the Advancement of Sustainability in Engineering ("Discoveries in Green Infrastructure: Uncovering the Unknown"). Many of the day's presentations are available online at www.arboretum.umn.edu/2016cleanwatersummit.aspx. ■