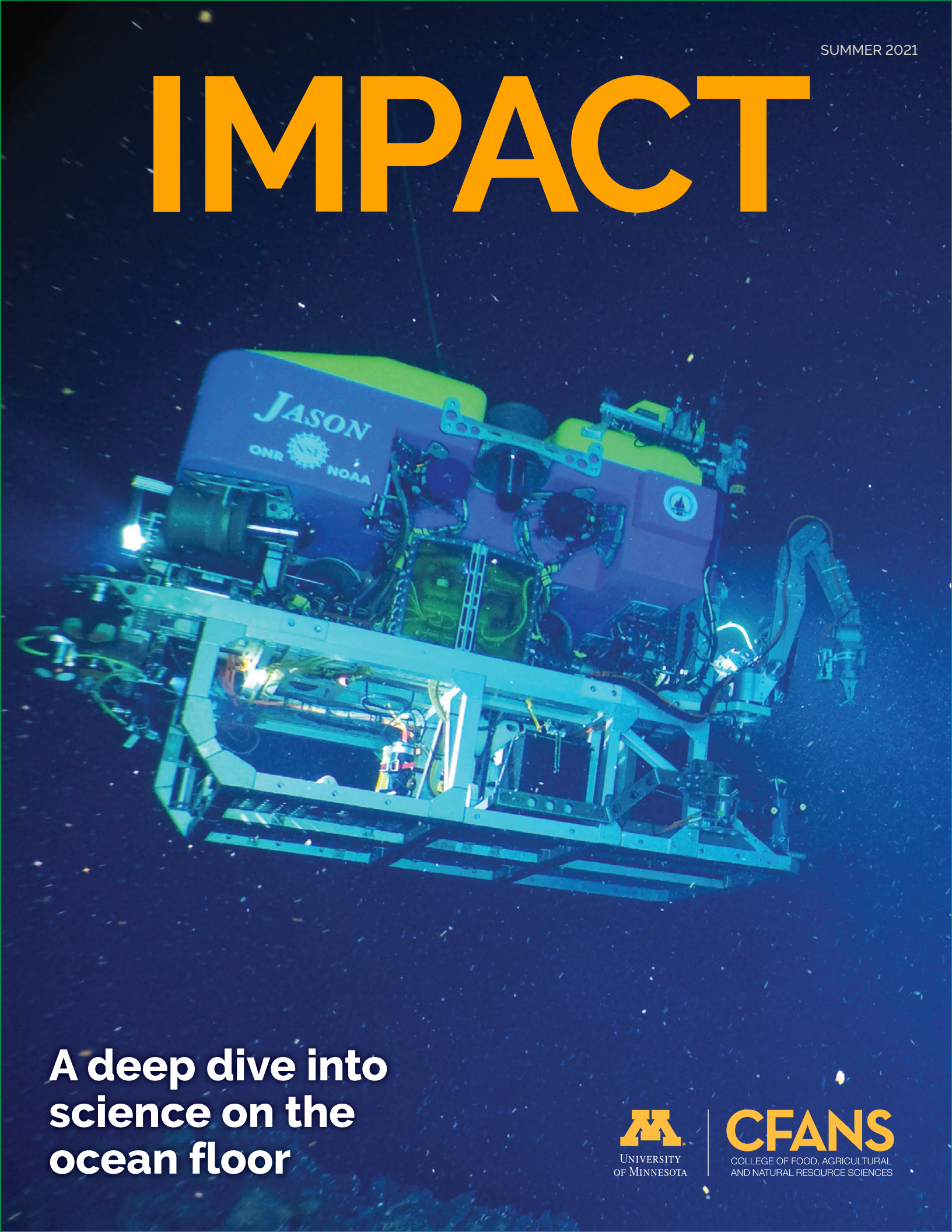
SUMMER 2021

IMPACT



A deep dive into science on the ocean floor

UNIVERSITY OF MINNESOTA
CFANS
COLLEGE OF FOOD, AGRICULTURAL AND NATURAL RESOURCE SCIENCES

A NOTE FROM **DEAN BUHR**

Best wishes to you from CFANS as the summer begins to wind down and we look with anticipation to being back on campus with our students this fall semester.

In this issue of *Impact*, we share stories of how your support and investment in CFANS are advancing our students, science, and solutions for a healthier, more sustainable Minnesota and world.

Dive into two compelling pieces about science and bodies of water — from the Pacific Ocean to the freshwater lakes of our great state. You'll meet researchers **Rose Jones** from the Department of Soil, Water and Climate, and **Gretchen Hansen** from the Department of Fisheries, Wildlife and Conservation Biology, to explore seafloor ecosystems and learn how climate change is impacting oxygen levels in lakes.

You'll also enjoy reading a personal reflection from one of our students, **Alina Smolskaya**, a senior in the plant science program. She shares perspectives on her rewarding experience in the CFANS Mentor Program with alumni **Tabare Abadie**. I'm inspired by their great partnership and hope their story moves you to consider becoming a mentor yourself. This program is just one of a variety of opportunities for alumni to interact directly with students to enrich their learning experience at CFANS and share career advice.

If you'll be in the Twin Cities between August 26 and September 6, be sure to come see us in the Agriculture Horticulture Building at the 2021 Minnesota State Fair. We're thrilled to be back at the Great Minnesota Get-Together in person to share CFANS research on climate adaptation and solutions and would love to have you visit.

Thank you for your continued support. Please take care and enjoy the beautiful days of summer transitioning to fall.

Sincerely,

Brian Buhr

Dean, College of Food, Agricultural and Natural Resource Sciences

GRETCHEN HANSEN CONDUCTS RESEARCH ON MINNESOTA'S BIG SANDY LAKE. READ ABOUT ONE OF HER FRESHWATER PROJECTS ON PAGE 7.

ON THE COVER: **ROSE JONES** AND TEAM WORKED WITH THE REMOTELY OPERATED VEHICLE (ROV), JASON, TO EXPLORE HYDROTHERMAL VENTS ON THE SEAFLOOR.

PHOTO COURTESY OF WOODS HOLE OCEANOGRAPHIC INSTITUTION.

FIGHTING HUNGER FOR A FOOD-SECURE FUTURE

Inspired by the 50th anniversary of U of M alumnus **Norman Borlaug**, PhD, receiving the Nobel Peace Prize for a lifetime of work to feed a hungry world, CFANS has honored 50 individuals or groups working to advance food security today.

The "50 CFANS Hunger Fighters" include scientists, educators, and leaders who build on Borlaug's vision for a well-fed and peaceful world — many of whom are CFANS students, faculty, staff, postdoctoral researchers, alumni and supporters who work in a variety of sectors worldwide. They were nominated in recognition of their outstanding efforts to fight hunger locally and globally. Their work ranges from finding policy solutions to end hunger and malnutrition, to helping smallholder farmers transition from subsistence agriculture, to income-generating farming, to eliminating food deserts in urban areas.

"At CFANS, we take immense pride in the many researchers, students and alumni working to alleviate food insecurity issues around the world," said **Dean Brian Buhr**. "That work includes creating pest and disease resistant crop varieties; enhancing climate resistance in crops; increasing nutrition in plant and animal foods; identifying ways to reduce environmental pollution; and much more."

To read about each honoree, visit **z.umn.edu/cfanshungerfighters**.

MENTORSHIP REFLECTIONS

Each year, the CFANS Mentor Program matches approximately 200 students and post-docs with alumni and industry professionals who share valuable career insights and guidance. **Alina Smolskaya**, originally from Belarus and currently a senior in the plant science program, shares thoughts on her partnership with mentor **Tabare Abadie**. Abadie, a native of Uruguay, is a senior research manager and laureate at Corteva Agrisciences in Iowa.

FROM LEFT: ALINA SMOLSKAYA, TABARE ABADIE

Smolskaya:

"I came to the U of M fairly recently, transferring to plant science from an entirely different field – business. Thankfully, I learned about the mentorship program and signed up right away. I couldn't have been paired with a better mentor!

I'd describe my experience with Tabare with a metaphor: I'm in a big building with all the lights out. This building is analogous to the field of plant science. I'm trying to piece together the layout of the building, but with only a small flashlight. Getting a mentor is like having a huge flashlight pointed at parts of the building I didn't even know existed!

Tabare helped me widen my vision and understanding of the field, and we quickly established a strong relationship. I'm thankful for his insight and dedication as he worked with me on graduate school planning and the search for an internship.

Besides furthering my knowledge of plants, I want to continue developing my networking, organizational and leadership skills. When I graduate, I hope to be a mentor and pay forward this life changing experience."

An ocean scientist in Minnesota

Rose Jones, PhD, is an ocean scientist in Minnesota, "which is a very logical place to be," she says with a bit of a laugh.

Her interest in microbes that live in extreme environments and survive without sunlight led to her postdoctoral position in Professor **Brandy Toner's** lab in the Department of Soil, Water, and Climate. The lab studies the geochemistry of low temperature environments, including the seafloor.

While nearly every food chain on Earth starts with energy from the sun being captured by photosynthesis, on the seafloor there are ecosystems that live in total darkness. The first link in these food chains is the chemical energy provided by hot fluids escaping from the spreading tectonic plates. Specialized microbes have the ability to harness energy directly from the rocks. The crabs, worms, and other unusual sea creatures that live near hydrothermal vents all depend on these microbes and their ability to convert the rock energy into biological energy. "There's an awful lot of life down there, all relying on these very small creatures," said Jones.

RESEARCHERS GUIDE ROV JASON'S ACTIVITIES FROM THE SHIP'S CONTROL ROOM.

To learn exactly how microbes obtain energy from the rocks, Jones needs to collect rock samples from the seafloor that she can analyze back in the lab. That was her objective during a month-long research expedition to the middle of the Pacific Ocean earlier this year.

Her ship spent seven days navigating the Pacific before arriving at its destination: a particular spot along the East Pacific Rise, the tectonic plate boundary that runs along the seafloor. The diverging tectonic plates release hot, chemically-rich fluid creating the hydrothermal vents Jones came to study.

Once the ship was on station, or directly over the sampling site, the round-the-clock work began. The team used a remotely operated vehicle (ROV) called Jason to explore their underwater surroundings. From a control room on the ship, Jason was able to navigate to specific locations, collect rock samples using its robotic arms, take photographs, and even live-stream on YouTube.

A typical day for Jones included a "Jason shift" from midnight to 4 a.m. and noon to 4 p.m. As the science lead for the shift, she was responsible for informing the pilots of the science objectives the team wanted the ROV to complete: picking up samples, measuring hydrothermal fluid temperature, making observations, and recording data.

ROV JASON HEADS FOR THE SEAFLOOR.

JONES SAILED ON ROGER REVELLE, A GLOBAL CLASS OCEANOGRAPHIC RESEARCH VESSEL.

"WHAT HAPPENS WHEN THE HEAT STOPS?"

HOT TO COLD

Hydrothermal vents were discovered about 40 years ago, and scientists are still asking questions about the complex and alien ecosystems they support. An experiment Jones is involved in, called Hot2Cold Vents, asks "what happens when the heat stops?"

Because the tectonic plates are constantly moving, a mound will eventually move off of its geothermal energy source. At the rate of a few inches per year, this can take decades to thousands of years. What will happen to the microbes and the rest of the ecosystem when the vent fluids are no longer supplying the rocks with chemical energy?

In 2019, on a previous research cruise, Jones and her collaborators set this process in motion on a faster timescale by removing rock samples from an active hot vent and letting them cool. They brought some samples to the surface to analyze, and left some rocks on the seafloor to cool gradually. This cruise was an opportunity to go back and collect those rocks, which have been detached from the vent for two years.

While exploring with ROV Jason, Jones was fortunate enough to discover some naturally deceased vents as well. These "old, dead sites" can shed light on the changes that active vents will eventually undergo.

ROSE JONES AND TONER LAB COLLEAGUE **ADRIAN WACKETT** CONDUCT LAB WORK ON THE SHIP.

BACK ON LAND

Back on land, Jones is preparing her seafloor samples to be run on a synchrotron, an instrument that uses X-rays to characterize the mineral composition of the rocks she's collected.

"We can use these X-ray techniques to get a microbe's-eye view of the world," she said. Because the seafloor microbes harness energy from the rocks, they leave behind chemical signatures of their presence. Those minute changes can be detected by the synchrotron.

Jones now has rock samples from active hydrothermal vents, her two-year-old cooled samples, and the naturally inactive sites she discovered. By looking at this array of rocks, she'll begin to understand the progression of these microbes through the chemical changes preserved inside.

GRADUATE STUDENTS **KAYLA LAW** (LEFT) AND **SANTIAGO ZABALA** (IN PEN), WORKED WITH **LEE JOHNSTON** (IN HAT) TO ENGAGE K–12 STUDENTS.

STUMP THE SCIENTIST

"Why do pigs snort?" ***"Is there a difference between organic and conventional milk?"*** *"Can pigs get coronavirus?"*

These questions, along with numerous others, were asked by curious K-12 students during "Stump the Scientist" virtual sessions at the West Central Research and Outreach Center (WCROC).

In a typical year, the WCROC in Morris, Minnesota, would welcome hundreds of students to the Center for field trips and farm tours. During the COVID-19 pandemic, however, they had to develop alternative yet engaging learning opportunities to provide outreach and education.

Using an iPad and Zoom, they logged in from their livestock facilities and connected with classrooms. Students got an up-close view of sows in a farrowing barn, cows with their newly born calves, and graduate students taking research samples. Students were charged with the task of asking questions of faculty and staff in order to "Stump the Scientist."

"The students really engaged in this challenge! Students asked questions related to pig production, pig behavior, and pork meat," said **Lee Johnston**, PhD, swine scientist at the WCROC. "It was interesting to see what aspects of pig production they were curious about."

The program's primary goal was to give students and teachers a behind-the-scenes look at research projects, their impact on food production, and how students might envision a career for themselves in agriculture.

"Students were excited to learn about dairy cows and see a calf after it was born. They were curious how we raise our calves, and what they eat and drink to become a milking cow in just two years," said **Brad Heins**, PhD, dairy scientist at the WCROC.

Funding for Stump the Scientist was supported by generous donations from WCROC's 2020 Give to the Max Day campaign.

Nurturing legacies

FRANK BUSTA AND JEAN KINSEY

CFANS Professors and Directors Emeriti **Jean Kinsey** and **Frank Busta** are one generous couple with two different giving priorities — yet they share a philosophy: Give back. Give to your passion, give to what you hope for — give to nurture a legacy.

"I had the best job in the world," said Kinsey, reflecting on her 34 years working with graduate students in the Department of Applied Economics and as Founder/Director of The Food Industry Center. "I had the opportunity to develop my passion at a place that was very good for me."

When she retired in 2010, it was harder to get funding for student research than it was earlier in her career. "I wanted to give back... to ensure this work continues," she said. She created the Jean Kinsey Graduate Fellowship to help students whose research focuses on the economics of consumer behavior, the food supply chain, marketing, and public policy impact on health and wellbeing.

Kinsey enjoys interacting with the fellowship recipients and learning about their passions and aspirations. She donates annually to the fund and includes it in her estate plan.

Busta, a long-time President's Club member, retired in 2014 after a 33-year career as professor and head in the Department of Food Science and Nutrition, and Advisor and Director for the National Center for Food Protection and Defense. After his first wife, Beverly, died, he created a memorial fund in the College of Education and Human Development to help her memory and passion live on, and he started thinking of his own legacy.

Food safety and defense is his passion, and knowing the lack of recognition for this critical area, he made plans in his estate to reward faculty working in food safety and defense — the Busta Faculty Award.

JOLEEN HADRICH IS ONE OF 31 AGREETT-FUNDED FACULTY MEMBERS.

MEET

AGREETT

Solving agricultural challenges, addressing critical issues

In 2015, Minnesota lawmakers approved legislation that created the Agricultural Research, Education and Extension Technology Transfer program (AGREETT). This includes a multi-year, $5 million state investment through the Minnesota Department of Agriculture in agricultural research, Extension, and teaching at the U of M. The AGREETT program benefits Minnesotans through work at CFANS, Extension, and the College of Veterinary Medicine.

In one CFANS example, AGREETT-funded **Joleen Hadrich,** PhD, associate professor and Extension specialist in the Department of Applied Economics, combines animal health, production and farm financial data to help dairy producers become more profitable and sustainable.

Hadrich's recent research has examined changes in wealth and income variation on U.S. dairy farms across time, and applied human health concepts to dairy cows to determine the economic cost of common animal diseases at a farm level. She works closely with livestock and crop producers to study the interaction between economic concepts and biological processes of the production system.

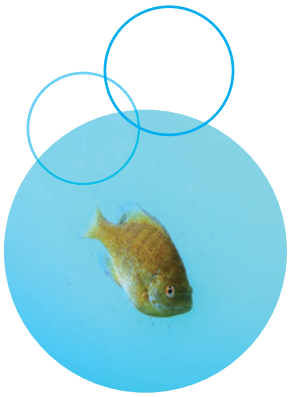
AGREETT funds also improve preparation for, and response to, crisis situations. In summer 2020, for example, Hadrich had a particular focus on rapid response work related to the impact of COVID-19 on the food system.

"The AGREETT investment in the University benefits all Minnesotans," said Hadrich. "It advances our state's food economy, communities and environment — making Minnesota healthier and more sustainable for its citizens."

Today, 31 AGREETT faculty and Extension educators have been hired to focus on issues that impact the state's health, including clean water; climate change; soil health; crop and livestock productivity; microbial science; agricultural technology; and pest resistance.

As Earth warms, lakes are losing oxygen

Oxygen levels in the world's temperate freshwater lakes are declining at rates faster than in oceans, according to research published in *Nature* and co-authored by **Gretchen Hansen**, PhD, assistant professor of fisheries ecology in the Department of Fisheries, Wildlife and Conservation Biology. It's a trend researchers found is largely driven by climate change and land use, threatening freshwater biodiversity and water quality.



The team discovered that:

- oxygen levels in lakes across the temperate zone (between the tropics and polar regions) have declined 5.5% in surface waters, and 18.6% in deep waters since 1980;
- in a large number of nutrient-polluted lakes (e.g., lakes with excess phosphorus), the falling oxygen levels are indicative of rising water temperatures and harmful algal blooms; and
- lakes are releasing increased amounts of methane into the atmosphere as a result of methane-producing bacteria thriving in oxygen-poor lakes.

Although lakes make up only about 3% of Earth's land surface, they contain a disproportionate concentration of the planet's biodiversity. "Previous research has documented global declines in oxygen of oceans, or focused on individual lakes, but this project is the first to document dramatic loss of oxygen in the deep waters of lakes around the world," said Hansen.

According to Hansen, Minnesota has been a leader in identifying the importance of coldwater, oxygenated habitat in lakes and working to restore and protect the watersheds of lakes to counteract these concerning trends. "This research highlights the importance of that ongoing work for adapting to climate change," she said.

As research continues, Hansen and collaborators, including **Lesley Knoll** with the U of M's Itasca Biological Station and Laboratories, recently received a grant to examine in-depth the drivers of oxygen loss in Minnesota lakes.

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It's time for the Great Minnesota Get-Together 2021!

Stop by and visit CFANS at the Minnesota State Fair, August 26–September 6

Agriculture Horticulture Building
1271 Underwood Street (by the Space Tower Ride)

New this year:

Learn how CFANS is putting climate adaptation into action for a more sustainable future and have fun with interactive science!

President Gabel (center) with CFANS friends at the 2019 State Fair.

MINNESOTA STATE FAIR