



UPSTREAM

News from Itasca Biological Station and Laboratories



PHOTO BY NICK MINOR

New research takes root

Three new projects look at changing forests, the impact of earthworms and the effects of microbes on lake nutrients.

For more than 100 years, faculty and students have made their way to northwest Minnesota to study the flora and fauna of the state through field research and coursework at the headwaters of the Mississippi River. Now, a new effort is underway to kick-start research and collaboration based at Itasca Biological Station and Laboratories for years to come.

This spring, the Station awarded Seed-to-Root grants to three University of Minnesota scientists in a push to expand research. The grants provide up to two years of funding.

“We decided to run this grants program to embed effort at Itasca — that explains the ‘Seed-to-Root’ title. Our hope is that the grants not only spark projects but also build collaboration and community focused on common ground at Itasca,” says Jonathan Schilling, Station director.

Each of the three recipients received up to \$75,000 in funding to pursue their research focused on the Itasca region. While expanding the research happening at the field station itself, Schilling also sees how these grants will play a broader role in Itasca’s work for the park, local community and state.

“All of the funded projects have aspects of engagement, capacity building and collaboration,” says Schilling. “The thing I most look forward to is how they mesh with each other and with ongoing efforts at the Station, strengthening a dynamic, science-focused community in the heart of Itasca’s wild spaces.”

The first cohort of Seed-to-Root recipients includes professors Peter Kennedy, Trinity Hamilton and Kyungsoo Yoo.

Boreal big picture

Scientists know climate change holds the potential for lasting impacts on the distribution of ecosystems around the world. In Minnesota, however, how quickly the composition of forest ecosystems change from one type to another is not yet clear. Examining around 35,000 trees, Kennedy hopes to find out.

“Despite excellent experimental work on the physiological responses of young trees, there has been little actual field-based quantification of the rate of change in tree composition occurring at the boreal-temperate forest ecotone,” he says. “We are establishing this 16-hectare long-term forest inventory plot near the University of Minnesota Itasca Biological Station and Laboratories to better understand this tree composition change within a global context.”

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DIRECTOR'S MESSAGE

Greetings from Itasca!

I hope this note from the North finds you well. We have plenty to share in this edition of *Upstream* — 2019 has been busy, with many new faces finding their glow around the fire pit.

Fall is here, and the chilly wind has taken with it the mosquitoes, finally. They had a good year, and we have data to prove it. Consistent rain was also a boon to amphibians and a profusion of mushrooms, conks and corals kept my eyes to the ground. Aurora made an appearance, back-lighting dense stands of wild rice. The back country is just as you left it, unspoiled.

The Station, however, has seen new action that is still resonating. We piloted two new field biology course offerings, launched an artist-exchange program, collaborated with park naturalists to create a standing seminar series and watched new grants and scholarship efforts begin to bear research fruit. We even had a polka band play in the top of a white pine on the day the kitchen staff released their cookbook.

New action stacked atop old, and we took it in stride. But we all know that this is the “royal we.” I look toward the horizon, but my staff is at the controls. One of my favorite metaphors for making progress is that a steering wheel is easier to turn when the vehicle is moving. The staff keep Itasca moving, they have shaped my sense of direction, and they weathered my “pedal down” moments. For that, my hat is off to you. I’m lucky. Thank you.

Jonathan Schilling, Director
Itasca Biological Station and Laboratories

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Kennedy and his collaborators plan to identify and map the trees across the plot and use the data collaboratively with fellow researchers around the globe through an international network of similar research plots.

Warming by worming

In the spring, when gardeners put their shovels in the ground to turn over the first bits of soil in their backyards, they are likely to encounter an earthworm or two. While now commonplace, European earthworms greatly changed the makeup of soils in North America after native earthworms mostly died off during the Ice Age. With large populations across the state and country, Kyungsoo Yoo wants to know what impacts they have on soil temperature as they move through leaf litter and soil.

“We are hypothesizing that invasive earthworms substantially affect heat exchanges between the atmosphere and the soils,” says Yoo. “The expansion of earthworm populations resulted in removing or thinning the organic litter layer that insulates the underlying mineral soils from the hot summer or cold winter temperatures. We thus expect to see that forest soils infested with invasive earthworms experience more extreme temperatures. Worming may significantly modify global warming.”

Think globally, sequence locally

Trinity Hamilton launched a project using DNA sequencing technology to evaluate the microbes and fungi from tributaries into Lake Itasca. As lakes play a key role in carbon cycling, she plans to use a “MinION” DNA sequencing device to evaluate the varied sources of water to the lake, and what variations she may see in the microbes and fungi that may impact carbon and nitrogen levels.

“The MinION generates data in real time — which is ideal for quantifying seasonal changes as well as incorporating next-generation sequencing into research and courses at the Itasca Biological Station,” says Hamilton. —*Lance Janssen*

Fungal finding

The question: Dead fungal biomass, or “necromass,” stores lots of carbon in soils (Clemmensen et al. 2013 *Science* vol. 339), but for how long?

The setup: Postdoctoral researcher Francois Maillard and staff scientist Erin Andrews tested the decomposition rates of dead fungal biomass in soils near the Station. The research team wanted to find out how long this biomass stores carbon, so they distributed mesh bags of fungal biomass in several locations on Itasca’s new plots north of the Park boundaries, waited several weeks, then retrieved and tested the contents of the bags.

The takeaway: “We found significantly different fungal communities colonizing dead mycelia in soil versus wood logs,” says Maillard. “Despite this, the dead fungal biomass decomposition rates were similar (and extremely fast) in the two habitats. This indicates something we call ‘functional redundancy’ between two different microbial communities, and it may help us model carbon as it is released from this large pool of soil carbon.”

What goes on at the Station?

In addition to researchers, here is a timeline of what a typical year looks like, including group size, based on 2019 use.

<p>JANUARY</p> <p>FEBRUARY</p> <p>MARCH</p> <p>APRIL</p> <p>MAY</p>	<p>Lab/department retreats</p> <p>Outdoor recreation excursions (12)</p> <p>Concordia College course trip (25)</p> <p>University of Minnesota Crookston course trip (10)</p> <p>University of Minnesota student groups</p> <p>University of Minnesota faculty, staff and student recreation</p>
<p>MID-MAY</p> <p>JUNE</p>	<p>Conservation Corps training (25)</p> <p>Itasca field biology courses (25-40)</p> <p>Life Science Summer Undergraduate Research Program (90)</p> <p>College of Biological Sciences alumni event (40)</p> <p>Minnesota Department of Natural Resources meeting (35)</p> <p>Workshops (30)</p>
<p>JULY</p>	<p>Nature of Life undergraduate program (~700)</p>
<p>AUGUST</p> <p>SEPTEMBER</p> <p>OCTOBER</p>	<p>Minnesota Department of Natural Resources aquatic plant workshop (25)</p> <p>Graduate program orientations</p> <ul style="list-style-type: none"> • Neuroscience (20) • Molecular, Cellular and Structural Biology (35-70) • Plant and Microbial Biology (23) • Ecology, Evolution and Behavior (19) <p>Fisheries, Wildlife and Conservation Biology course (40)</p> <p>Landscape Architecture grad student workshop (20)</p> <p>Wild rice field trip (50)</p> <p>University of Minnesota Post-doc retreat (40)</p> <p>Biochemistry, Molecular Biology and Biophysics retreat (95)</p> <p>University of Minnesota Duluth courses (30)</p>
<p>OCTOBER</p> <p>NOVEMBER</p> <p>DECEMBER</p>	<p>Lab/department retreats</p> <p>University of Minnesota student groups</p> <p>University of Minnesota faculty, staff and student recreation</p>



NOTE: This doesn't include every program that comes to the Station, just most of our repeat users. If you want to bring your program or research to the Station, contact us at IBSL@umn.edu to check availability.



STATION NOTES

Plankton aplenty

Spend some time with me over the summer and you will likely go out on a boat to help collect some plankton from Lake Itasca. Phytoplankton are photosynthetic, they form the base of the lake food web, and they are often microscopic organisms. Zooplankton are tiny animals — usually best seen with a microscope — that are important in lake food webs in many ways, including serving as fish food. These tiny organisms feature prominently in many of my education, public engagement and research activities.

It's exciting to show others the wonders of what can be found in a drop of lake water, or what I sometimes call the "Miniature World of Lake Itasca." All ages respond to plankton. Sometimes folks are intensely curious, while other times they might think the zooplankton are sort of gross but cannot look away.

I find that it is always an opportunity to talk about water quality and the importance of healthy lakes and forests. I am also beginning to study how changing winter conditions and shorter ice cover may influence the balance of harmful and beneficial phytoplankton during the summer.

Speaking of winter ... the seasons are already turning at Itasca and so will the plankton until next summer when the cycle begins again.

Lesley Knoll, Station Biologist
Itasca Biological Station and Laboratories



Did you know?

The Mississippi River's watershed drains 41 percent of the continental United States.



Lesley Knoll's module on Lake Itasca aquatic ecology at Nature of Life — a four-day orientation for incoming College of Biological Sciences students — gives students a chance to use scientific equipment out on the pontoon. "We always grab some plankton to bring back to the lab to investigate under the microscope," says Knoll. In one student's own words about their most memorable part of their module experience: "I loved looking under the microscope and identifying a enormous organism that wouldn't stop moving!" Another student, Nha-Khoi Bui-Nguyen, created an illustration (above) of zooplankton during her module.

Meet Charlie Schmidgall

The Station's Resident Manager keeps things running.

Charlie Schmidgall has served as Itasca Biological Station and Laboratories' resident manager for nearly two decades. He shared a little about his work, what he likes most about his job and what keeps him busy when he's not at the Station.



What do you do at Itasca?

I wear many hats, but mainly I supervise a staff of nine (one full-time, year-round and eight seasonal) and oversee maintenance for buildings, grounds and dining at Itasca. I also work on building projects and upgrades to infrastructure such as roadways, pathways, Internet, electrical, water and sewer. I live on-site year-round as the facilities caretaker.

Describe something interesting or unusual about your work.

The most interesting thing is getting to interact with the people coming to the Station, and working and living in one of the most wonderful areas of the world.

What do you like to do in your free time?

In my free time, I love to do things with my wife and family like vacation and spending time with my grandkids. Outdoor sports and activities keep me busy, as well as the time I spend at church and doing volunteer work.



PHOTO BY STEPHANIE XENOS

Connecting both ends of the big river

Itasca partners with New Orleans artist residency to launch a scientist-artist exchange exploring our connection to — and impact on — the Mississippi.

A trip down the Mississippi River is a study in extremes. At its northern point, it is ensconced in the protected old-growth forest of a state park. Its southern shores are dotted with oil refineries and industrial infrastructure. The water itself becomes progressively more polluted with runoff from agricultural and urban areas.

“I have made several recent trips to the outlet of the Mississippi River near New Orleans, starting my travels at Itasca in the boreal forest and ending in Louisiana bottomland on the same river,” says Jonathan Schilling, director of Itasca Biological Station and Laboratories (IBSL). “At Itasca, the river is hardly more than a stream with a footbridge you can walk across. At the other end, near where it flows into the Gulf of Mexico, it’s wide and muddy with a heavily trafficked eight-lane bridge connecting one shore to the other,” says Schilling. “For all its contrasts, it remains shared water. There is a connection at a level deeper than words — it’s a cool thing — and it is worth exploring.”

IBSL is the first field station on the river. Schilling and colleagues at A Studio in the Woods, an artist residency in New Orleans and one site of the new Lower Coast Field Station, launched a collaboration this fall that pairs scientists and artists from both ends of the river to do just that.

“This exchange is about exploring the impact of human activities

upstream through a creative dialogue between scientists doing place-based research and artists rooted in these very specific environments,” says Schilling.

The collaboration took shape over the course of the last year with a hand from the Weisman Art Museum at the University of Minnesota Twin Cities; A Studio in the Woods, a program of Tulane University’s ByWater Institute; and local and Native American community members and arts organizations near Itasca, including rural arts advocate Rebecca Dallinger.

“Art and science are two ways to build shared understanding of what is, as well as what could be.”

The program, dubbed Big River Continuum, launched this September with a simple set-up: A New Orleans-based artist — Monique Verdin, member of Houma Nation — spent a few weeks at Itasca learning about the place, the people and the science happening at and around the Station. This winter, an artist from northern Minnesota — Karen Goulet, who is a member of White Earth Band of Ojibwe — will make the trek downstream to A Studio in the Woods. With Dallinger in a curatorial role, both artists are piloting the exchange with the goal to dial in something sustainable, fruitful and art-forward.

“Ultimately, we hope that this partnership will contribute to a broader conversation about our relationship to the river — how we understand it and how we assign value to it,” says Schilling. “Art and science are two ways to build shared understanding of what is, as well as what could be. This is the essence of conservation.”

—Stephanie Xenos



First person: The perfect summer

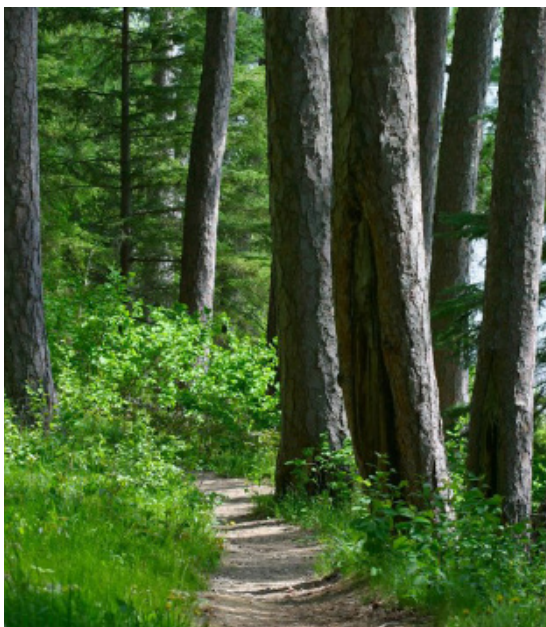
College of Biological Sciences undergraduate Benton Fry sums up his summer experience at Itasca.

Two days after the spring semester ended, I was all packed up to head north to Itasca State Park, not knowing all of the amazing things I was about to get involved in. My time spent as the summer intern at the Station was filled with research, field learning and public engagement, along with countless hours on the water.

I spent the first few weeks at the Station interacting with field biology students, tagging along with them as they studied the animals of the north woods. The most notable experience came on our trip to Leech Lake where we learned about nesting gulls, pelicans and terns on Pelican Island. Not only did we learn about reproductive behavior, we also walked amongst the nest birds to see all the baby chicks.

As the field courses ended, the weather started heating up and so did my research. With the help of Dr. Lesley Knoll and Dr. Jim Cotner, I designed and conducted nutrient-limitation experiments in three lakes within the state park. The information I obtained from my research and my experiences with the field courses gave me enough background to lead a river walk for the public.

This “Science in Nature” talk was my first experience presenting to a large audience about my passion for aquatic ecosystems. Wrapping up my summer and reflecting on all I did, I find it a miracle that I still found time to fish almost every day. This past summer will be one not soon forgotten. —*Benton Fry*



Itasca's history of research leadership

Many who visit the Itasca Biological Station spend time on state land whose protection was enabled by the work of scientists at Itasca. Our closest neighbor is one example. Iron Springs Bog State Natural Area owes its establishment, in part, to the botanical work of Murray Buell. Frenchman's Bluff, Waubun Prairie, and Itasca's Wilderness Sanctuary are all protected lands with roots tied to University scientists working regularly and for long stints at the Station.

In this edition of *Upstream*, we highlight a manuscript that offers a snapshot of the research energy that graced Itasca's past. It is an 88-page review by John Tester and Mary Jo Kenyon focused on Itasca's pine forests, including recommendations for management that include prescribed fire. This document is both foundational and current, as Itasca's prescribed burn program has been on pause since the early 2000s.

Scroll through the 215 citations and you see decades of shared purpose and a biological field station at its best. You can access the article at z.umn.edu/Itascapines.



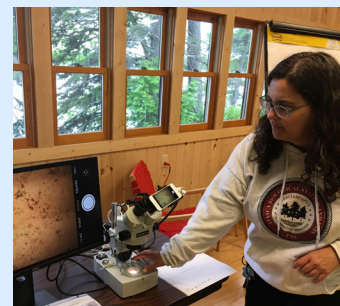
PHOTOS BY NICK MINOR



The Great Itasca Get-Together

This summer, alumni and their families made their way to Itasca to relive the memories.

The College of Biological Sciences hosted an alumni weekend in June bringing together alumni and their families across generations with an affinity for the Station. They enjoyed nature talks, a launch party for the *Itasca Come and Get It Cookbook*, bonfires, gorgeous sunsets and even a polka performance in the towering white pine just outside the dining hall!





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Parting shot

Thanks to Professor Emeritus John S. Anderson — Nature of Life's unofficial staff photographer — for his dedication to capturing the moments over the years including, this beautiful scene from this past summer.