



UPSTREAM

News from Itasca Biological Station and Laboratories



Winter comes early to Itasca. West Twin Lake along the south entrance of the park. Photo by Lesley Knoll.

Onsite to Online: A Research Experience Reimagined

Itasca Biological Station and Laboratory's (IBSL) undergraduate student, Ben Fry, was looking forward to his second summer lake sampling, assisting professors, doing public outreach events, and catching fish. When summer courses and Nature of Life were cancelled, Ben's summer also appeared to be cancelled. Not all activity was halted at IBSL though. Dr. Lesley Knoll had a computer based project in its larval phase collaborating with the Minnesota Department of Natural Resources and the University of Wisconsin - Stout, in need of a sharp mind that had a broad understanding of limnology. Ben was a great fit to give this project momentum given his research experience and ability to work from home. The direction of Ben's summer work narrowed drastically, yet opened up a new world to him including R studio and zebra mussels (*Dreissena polymorpha*).

Over a decade's worth of previously collected temperature and oxygen profiles from several Minnesota lakes were analysed as the project moved forward. One of the lakes being analyzed was invaded by zebra mussels in 2018, with data captured prior to, during, and post invasion. The known effects these small invasives have on lakes may include heavily filtering the lake water and thus decreasing parts of the indigenous aquatic food web, immobilizing and reducing local populations of bivalves, and attaching to and clogging water pipes. There are many remaining questions as to how Minnesota lakes may be altered as this exotic bivalve hitches mostly anthropogenic rides to waterways around the state. Ben's

question is "Do zebra mussels decouple optimal oxygen habitat volume and resource availability?" To provide an answer, a model was built "predicting the long term changes in oxygen depletion" once a lake is invaded by the zebra mussel.

Oxygen concentration in lakes varies based on many factors including but not limited to temperature, atmospheric pressure, lake depth, local climate, respiration, decomposition, and photosynthesis. Spring thaw generally leaves a lake full of oxygen, while summer brings stratification with oxygen declining over the summer from the lake bottom up. Ben defined the volumetric hypolimnetic oxygen depletion rate as the speed at which "oxygen decline[s] throughout the summer." On Lake Carlos four years post zebra mussel invasion, this rate decreased, "suggesting that zebra mussels create an additional challenge for lake managers, balancing the mismatch between an increase in cold water fish habitat at the cost of lost primary productivity."

Asked whether Ben missed Itasca this past summer, he responded with a resolute yes, saying "working remotely taught me a lot of new skills, but I would have given it all up to be at the station." And although so much of Ben's summer life was altered, thankfully for Ben fishing was not shut down. "Luckily for me, not so lucky for the fish, I caught the muskie of a lifetime (54", 50lbs)," Ben says of his best evening out fishing this summer when taking a break from the world of data analysis and zebra mussels.

-Lindsay Blake

Director's Message



Greetings from Itasca!

I hope this note from the North finds you well. I wonder what will have happened since I wrote this? You never know these days. Assuming we are still limiting indoor interactions, my hope is that we are toughening up, getting outside, and sharing stories.

Coronavirus has been a lesson in the power of stories. SARS-CoV-2 is a positive-sense single-stranded RNA virus. It is a tiny ribbon of nucleic acids inside a spherical lipid envelope with glycoprotein decorations. It looks like a dog's squeaky toy, but is 70 million times smaller. Science is helping us learn more about it, but the virus, of course, is not science. It is a ball of molecules that can replicate inside of you and make you sick. Masks are not science, either. They are cloth 'mud flaps' that keep the virus from flying out of our mouths. That stuff is not science – it is just stuff. Science is the process we use to understand it and recommend management.

Stories, however, have scripted the virus and masks as symbols of culture, leaving science on one side of a narrative. As Sir David Attenborough recently said, "Saving the planet is now a communications challenge." To me, this means communicating who scientists are, more than what our data say. We need to demonstrate ourselves and share our process as a common good. As COVID restrictions lift, field stations have great potential to help us do this and reach beyond the echo chamber of academia – to toughen up, get out there, and share our stories.

-Jonathan Schilling

Big River Residency Update

Artist Karen Goulet fills us in on her experience and how it has shifted due to the pandemic.

In Early spring 2019, as the curator for the Miikanan Gallery, at the Watermark Art Center in Bemidji, I was asked to be part of a regional meeting to conceptualize a rural art program that could intersect arts with science. Being from a family with both artists and scientists and having team taught art/science courses at the tribal college, I was very enthused to be part of the conversation. Out of this the Big River Continuum was created by the Weisman Museum and Itasca Biological Station of the University of Minnesota working with a Studio in The Woods in Louisiana.

Months later, I was encouraged to apply as an initial artist for the pilot year 2019-2020. I had the good fortune of being selected along with Monique Verdin from the Houma Nation of Louisiana, a brilliant artist in film, photography and public political art. In Fall of 2019, Monique and I made a solid connection during her three-week residency at Itasca Station and traveled within Ojibwe country meeting artist and elders collaborating with the Curator in Residence Rebecca Dallinger.

Since the cancellation of my March Residency to New Orleans at Studio in the Woods Artist program, I was determined to immerse myself in my creative processes. My Misi-Ziibi Detour was manifested out of a need to make art and contend with the changing variables of the Covid Pandemic. I created. What emerged was art in many forms; poetry, fiber and photography and handmade paper culminating in the blog; <https://watermarkartcenter.org/the-big-river-continuum-detour/>

Today Monique and I continue our dialogue about our relationships with the Mississippi collaborating on a body of work that we aim to exhibit in multiple locations. Due to Covid we are postponing the exhibit until Fall 2021.

-Karen Goulet

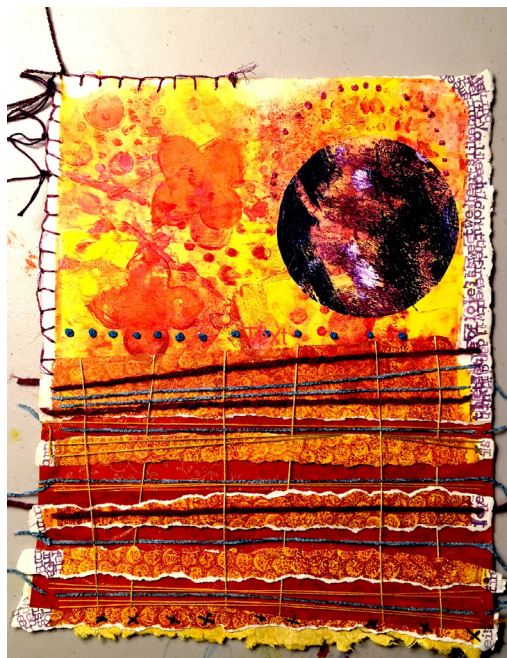


Photo above: art piece by Goulet titled "Dramatic Departure." Artist Karen Goulet is a member of the White Earth Ojibwe. To read more about Monique and Karen's Weisman Instagram take over visit z.umn.edu/BigRiverUpdate

First Person: Itasca Graduate Research Fellowship

Plant & Microbial Biology PhD Student Hailey Sauer sums up her research at Itasca.

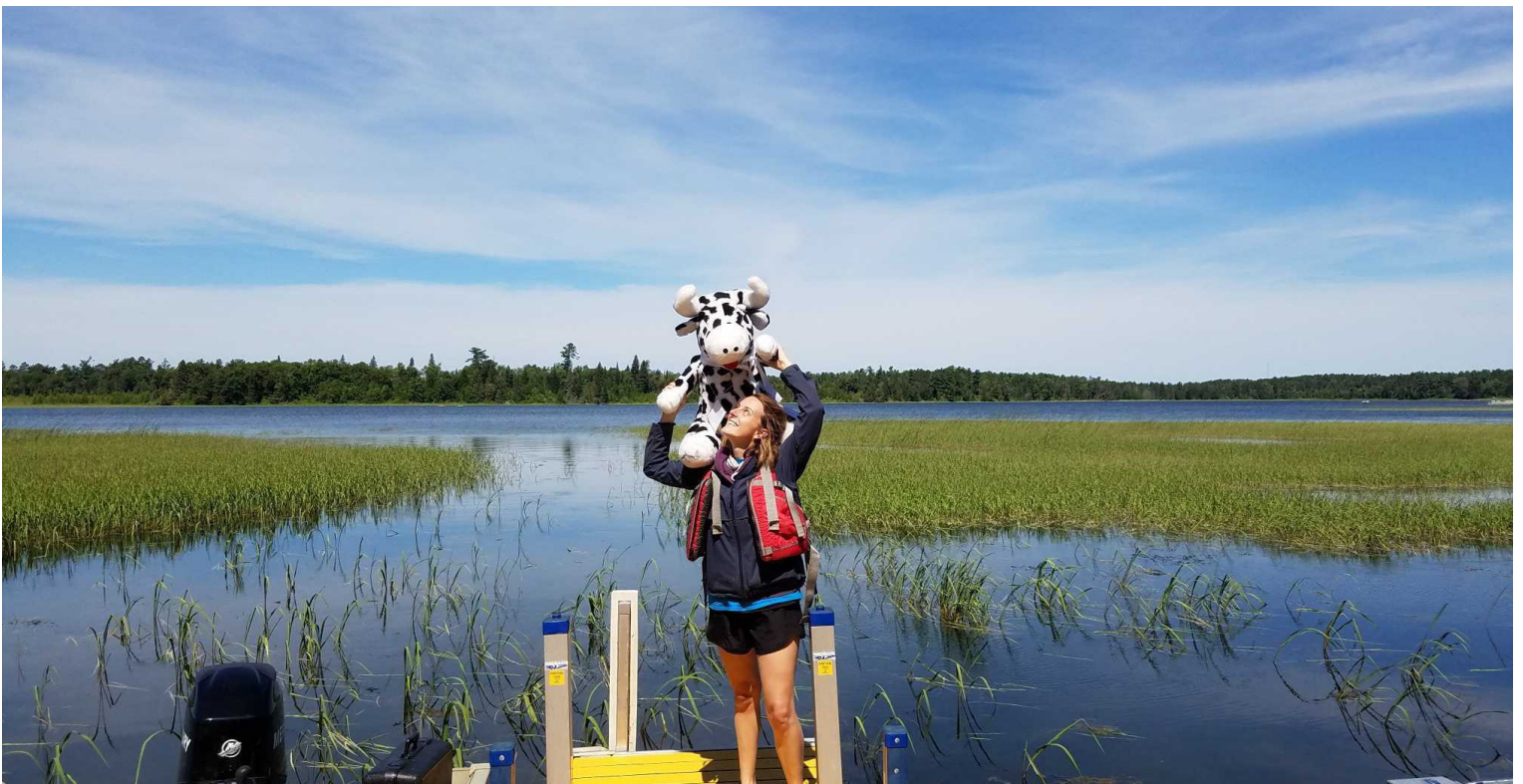
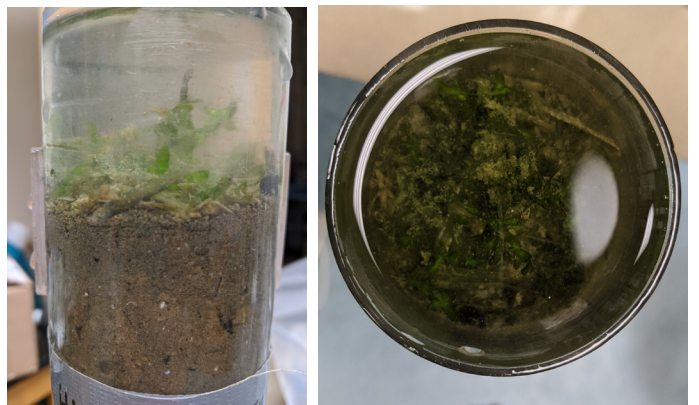
This Spring I received the Itasca Director's Graduate Research Fellowship to study the role lakes play in climate change. Specifically, I was interested in how different areas of Lake Itasca, Elk Lake and the Mississippi River contribute to the production and emission of methane.

Methane is a greenhouse gas that is produced in lake sediments when organic matter like plants and algae decompose. Overtime, this methane can leave the sediments and escape the lake water to the atmosphere. Currently, I'm finishing up the data analysis for the water and sediment samples I collected all summer and fall, and I hope to have some really exciting data to share by the spring 2021. In general, there are still a lot of unanswered questions about the role lake's play in climate change, and I hope to continue addressing them as I progress in my degree.

Oh I almost forgot! One interesting aspect of this summer's field-work was COVID. Given the safety measurements in place, I had to get a little creative and hire a new field tech. Ms. Moo is the mascot for PMB, and she willing joined me on every trip to Itasca. Together we collected over 20 sediment cores and close to 50 water samples. Ms. Moo is currently writing a short blog series about all our adventures, if you're interested in reading it when it's complete be sure to follow @phytograds on Twitter!

-Hailey Sauer

Photos by Hailey Sauer: 1: Ms. Moo using secci disc to check visibility 2&3: Views of a sediment core taken from Lake 4: Hailey & Mrs Moo on the Station dock at Lake Itasca.



Program Highlight: LSSURP

Get to know one of the many groups that come to the Station for a glimpse at the variety of programs that we typically see in a year!

What is LSSURP?

The Life Sciences Summer Undergraduate Research Program (LSSURP) is a group of multidisciplinary programs that offer a 10-week summer research experience supported by the University of Minnesota Medical School. LSSURP brings a diverse array of students from all over the US and US Territories to the University of Minnesota. Students are placed in UMN research labs where they complete a research project in their area of interest under the direction of a UMN faculty mentor. The programs kick off with a joint orientation weekend at Itasca, followed by 10 weeks of research and activities focused on professional development and social interaction back on the Twin Cities campus. In August, LSSURP concludes with a poster symposium, banquet, and boat ride on the Mississippi River. To learn more please visit z.umn.edu/lssurp



What is the program's history at Itasca?

The LSSURP joint orientation weekend has occurred at Itasca for over two decades! All LSSURP participants come up to the Itasca Biological Station where they spend four days in cabins in a beautiful setting to participate in a weekend of orientation and group bonding activities.

Why come to Itasca?

LSSURP loves going to Itasca for their orientation because it is a great place for group bonding! They spend four days at Itasca at the end of May. Bringing students from outside of MN, LSSURP coming up to Itasca allows for a unique opportunity for learning in nature, which many have never experience like Itasca before. Over the long-weekend, participants attend seminars in the Itasca Campus Center, sleep in the cabins, compete in a Itasca-specific scavenger hunt, enjoy the food from the dining hall, and spend their free time using the Station's recreation equipment. The weekend closes with a Saturday evening talent show, which is famous for lots of laughs and an overall good time. Participants always come back to the Twin Cities feeling bonded with their fellow LSSURPers and raving about their amazing time at Itasca!

Photos provided by LSSURP coordinator Kendra Strickland: views of their time at the Station during a typical orientation weekend.



White Earth & Itasca Internship

This past summer marked the second year of the White Earth and Itasca (WE&I) internship. WE&I is a three-week, paid research internship for White Earth students to participate in a scientific field season. For the past two years, students from Waubun High School in Waubun, MN have been paired with a scientist on a scientific study based at the Itasca Biological Station and Labs.

The 2020 WE&I intern Logan Stech from Waubun High School worked with a graduate student, Jessica Gutierrez from the University of Connecticut, along with a research staff Suzy Tupy who is a graduate from the University of Minnesota. This group studied the evolutionary ecology of host defenses of box-nesting birds (i.e. bluebirds and swallows) against the parasitic nest fly *Protophthora* sp. in northern Minnesota. Due to COVID-19 policy protocols, the 2020 internship turned virtual - that did not deter Logan or these scientists, who pivoted to software-based data management and analyses to support the ongoing work in the field.

The research is a long-term project, working with over 200 bird boxes primarily located beyond Itasca State Park along roadsides, farms, and home properties. The internship focused on professional development, along with two scientific aims: collecting bird box camera data remotely and analyzing field-collected data using software (RStudio and Behavioral Observation Research Interactive Software (BORIS)). RStudio is for coding and analyses, and BORIS is an easy-to-use event logging software for scoring video/audio recorded observations. If you imagine an 'Eagle Cam' to watch bald eagle chicks hatch and fledge, Logan was working the 'Bluebird Cam' using far more sophisticated data collection and analyses.

The bird system itself is used to address an array of questions such as: 1) funda-

mental questions related to the evolution and the life-history of host parasite interactions, 2) how intra- and inter-seasonal environmental conditions affect host defenses, and 3) the role of gut microbiota of hosts affect immunity to parasites. These scientists were particularly interested in determining costs and benefits of host tolerance of parasitism in relation to host fitness. More information on the science can be found at the: www.knutielab.com

The WE&I program is currently funded by a generous donation in the American Indian Fund through the Itasca Biological Station. The program is slated to extend to 2023, currently, but the infrastructure is in place to grow the program. Director Jonathan Schilling, the project liaison with the White Earth schools Rebecca Dallinger, and Waubun High School science teacher John Short are the leads who collaborate to provide a program to White Earth students that is committed to long-term engagement. In the coming years, we can extend WE&I opportunities to all White Earth area High Schools - Circle of Life Academy, Bagley, Mahnomen and Waubun.

There are also two key elements to this program that are important to mention and essential to inclusivity and equity. First, we have a local project liaison Dallinger, in this program as a bridge between the Station and White Earth

community. This helps us find the balance needed to share program highlights and create inroads with local schools and teachers as well as offering an outlet for students as a direct contact that can take their questions and possible concerns to the University or scientists. Second, since the internship takes place at Itasca station in Northern MN, instead of the Twin Cities, collaborating locally enables stronger boosts for community inputs and impacts. This extends the reach of the funding by creating a project that creates a project with local community by fostering personal relationships, trust, and shared aspiration.

All photos taken at least 6ft apart with proper PPE and shared by Jessica. The Knutie Lab has proper training and permits to handle nestlings (baby birds). Please do not approach any nests as this may cause direct/indirect harm to the parents and/or nestling.



Eat like an Itasca!

Did you miss the tasty eats from the dining hall this year? Enjoy one savory and one sweet recipe from the Itasca Station Cooks to give you a taste of Itasca at home.

Minnesota Wild Rice Soup

- 1 cup butter
- 1 onion, diced small
- 2 ribs celery, diced small
- 3 carrots, diced small
- 2 Tbsp. sherry
- 2 cups flour
- 2 quarts chicken stock, divided
- 12 oz. (about 2 ¼ cup) uncooked wild rice
- Salt and pepper to taste
- 2 cups heavy cream

In a heavy cooking pot, melt butter. Add onions, celery and carrots; saute until onions are translucent. Add sherry and stir. Add flour and stir until flour is dissolved and beginning to cook.

Add half the chicken stock; stir until thick. Slowly add the remaining chicken stock and stir. Add the uncooked wild rice and simmer 45 minutes. Season with salt and pepper. Slowly add the cream, stir and cook until heated through.

Banana Cupcakes

- | | |
|-----------------------------|----------------------|
| 1 ½ cups sugar | Frosting: |
| ½ cup of shortening | 3 Tbsp brown sugar |
| 2 eggs, beaten | 2 Tbsp butter |
| 1/2 cup of milk | 2 Tbsp of milk |
| 2 large or 3 medium bananas | 1 cup powdered sugar |
| 2 cups flour | 1 tsp vanilla |
| 1 tsp baking powder | |
| 1 tsp of soda | |
| 1 tsp salt | |
| 1 tsp vanilla | |

Cream sugar and shortening. Add beaten eggs and mix well. Add milk, vanilla and mashed bananas. Mix flour, soda, salt and baking powder add to first mixture. Mix well. Fill paper cups half-full, bake in a 350-degree oven for 25 minutes.

Bring first 3 frosting ingredients together to boil; cool slightly and add rest of ingredients. Frost cupcakes immediately.

New John Tester Scholarship Ignites

This was the inaugural year of the John Tester Research Scholarship at Itasca, with University of Minnesota graduate student Daniel (Dan) Brumm as the first Tester Scholar. It seemed fitting to have Dan, working with Dr. Kurt Kipfmüller (Geography, Environment & Society), researching fire history. In Dan's words, digging in to Itasca's fire history research has "helped me better realize how important the efforts of John and his peers were." Prescribed burns used to be an important staple of management at Itasca, but have been on hold inside the State Park for over 15 years. These forests need to burn, but there are challenges to a simple re-boot.



The natural cycles of fires varied a lot, locally, and this likely shifted over time as a function of human residence in the Mississippi River Headwater Area by the Dakota, Ojibwe, as well as Euro-American homesteaders. This history is ingrained in annual rings of Itasca's pines, dating back 300+ years in the standing giants. Dan, however, has not been looking skyward in the forest – he's been looking for stumps...the remains of giants past. There are stumps at Itasca older than the standing pines, and they can extend his predictions of natural fire cycles. "He's been reading dissertations and unpublished papers I've never heard about," Kipfmüller related. "I've been really impressed by his independence and the depth of his understanding." This understanding can push the envelope on what we know about fire history, about the interactions between humans and the landscape, and about how we talk about modern-day prescribed burns.

The Tester Fund for Research at Itasca (z.umn.edu/TesteIBSL) remains open for donations, which go directly to fund students like Dan to carry their work in John's legacy.

Photos by Daniel Brumm.

Trail Tempestry

Using Itasca Station weather data to create an artistic visual about climate change.

In 1911 the U.S. Weather Bureau set up a weather station at the fledgling University of Minnesota research and educational facility within Itasca State Park. The task of weather documentation and mailing in the monthly summary sheets was added to the resident manager's to do list. Resident managers have since come and gone, but weather collection is still occurring and is now entered into a data management website instead of being mailed to the now titled National Weather Service. Temperature data from the Itasca Biological Station and Labs (IBSL) is utilized for a variety of research projects, but never before has it been used to create a scarf until now.

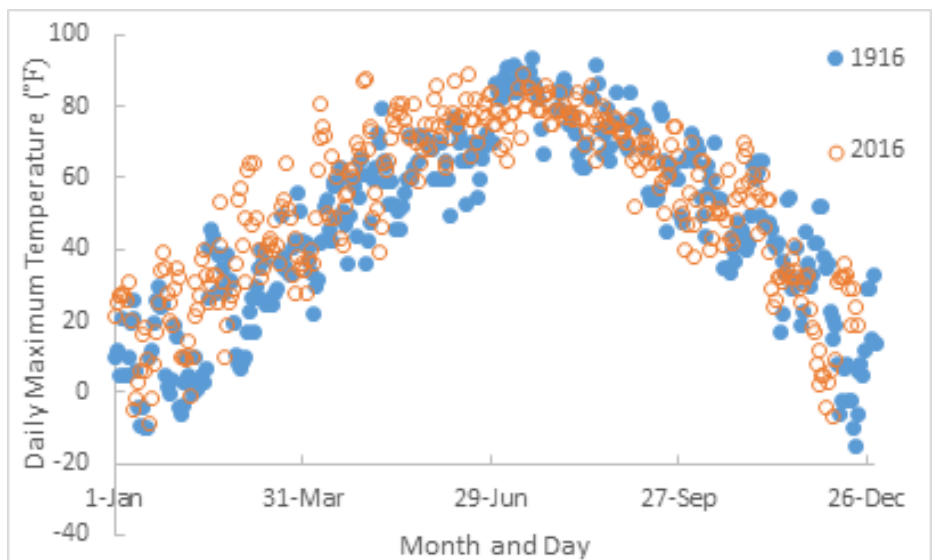
Kathy and Ric Roderick (retired UMN Conservatory Operations Manager) spent time at IBSL making some of their family's favorite memories. Once retired, Ric and Kathy made time to go on a dream road trip touring the National Parks in 2019. While coordinating trip details, Kathy discovered the National Park Tempestry Project which combines fiber arts, science, and public outreach in celebration of one hundred years of the National Park Service.

The Tempestry Project asks crafters to create two scarves per national park service location using weather data. Each scarf is meant to represent one year of maximum daily temperatures with each row representing that day's maximum temperature. Temperatures are given a specific color (e.g., warmer temperatures are varying hues of red, and cooler temperatures are blues) in order to show the variation. An avid environmental supporter, Kathy wanted to join in the fun and important work of crocheting a tempestry. Early this year she began crocheting the maximum daily temperatures collected at IBSL for 1916 and 2016 using the historic data from the U.S. Weather Bureau. Ric and Kathy photographed the completed tempestries along the North Country National Scenic Trail within Itasca State Park, with 1916 on the left, 2016 on the right, with January at the bottom of the photograph. The results of this project are beautiful and easy to understand. The graph below plots daily maximum temperature along the y-axis and month and day along the x-axis to mirror the data represented in the scarves.

-Lindsey Blake



Photo by Kathy Roderick. 1916 on the left, 2016 on the right, with January at the bottom.



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Itasca Biological Station
and Laboratories

UNIVERSITY OF MINNESOTA

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