Winter 2023

Field Notes

Cedar Creek's Quarterly Newsletter

Contents

80+ Year Retrospective

2022 marked Cedar Creek's official 80th anniversary as a University of Minnesota biological field station! Over those decades, the reserve has gone by a variety of names, hosted a wide range of impactful scientists, and trained thousands of new researchers. As we wrap up our anniversary year and look forward to the future, we wanted to highlight some of the notable activities that have put Cedar Creek on the map.

The reserve is located on the traditional, ancestral, and contemporary lands of the Wahpekute (Dakota) of the Očhéthi Šakówiŋ and the Ojibwe of the Anishinabewaki. This part

photo by R. Lindeman

Fig. 2. Midsummer aspect of Cedar Bog Lake, July 16, 1937.

of Minnesota was originally Dakota land, though conflicts with Ojibwe people led to the 1825 Treaty of Prairie Du Chien which established a 'paper border' (through what is now Cedar Creek) between the two nations. The land that would become the reserve was then ceded to the United States government in the 1837 Treaty of St. Peters, with the tribal affiliates receiving a small amount of money and goods, as well as treaty rights to hunt, fish and gather.

1930s: A 1958 letter from Dr. W.S. Cooper to Mrs. Cora Corneia describes Dr. Cooper's "discovery" of Cedar Bog Lake. He writes "The airplane trip on which I first saw the bog took place on April 6, 1930. My pilot was Mark Hurd and the plane was a very small one intended for one person; two of us crowded into it. There was a terrific north wind blowing, and I remember noticing that the north-bound cars were moving faster than we were. It was quiet when we turned around and headed for home. Our route that day was straight north over New Brighton, Ham Lake,

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Notes from the Associate Director

Happy New Year! Like the rest of Minnesota, we've spent the last few days and weeks shoveling out from the season's snow. What a way to ring in 2023! In between breaks in plowing, shoveling, and de-icing, we've found time for reflection and hope you have too. 2022 marked our official 80th anniversary, and it's been a great excuse to look both backwards and forwards at our research, infrastructure, personnel, landscapes and public programs. We hope you enjoy a taste of it in this newsletter!

We especially excited to highlight some art, science and data collaborations in this issue, and to announce our first few Lunch with a Scientist speakers of the new year. We have many other things in the works as well, with new research projects getting started, hiring underway for the busy summer season, and school groups scheduling visits and tours. Although the winter looks like a quiet time at the reserve, just like a frozen lake appearances can be deceiving :) There's lots going on under the surface at the reserve!

Sincerely,

Caitlin Barale Potter, Ph.D
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Infrastructure Updates

Fall and winter are an important time to deal with maintenance and updates in our physical buildings. Thanks to infrastructure support from the College of Biological Sciences Dean's Office, the CBS Research and Learning Technologies Department, and the University Health and Safety office, we are tackling some BIG projects this year! A few of them include:

- doing major repairs on a handful of internal roads that serve both as access points to field experiments and as firebreaks for our prescribed burning work
- upgrading the audio/visual system in the Lindeman Center main room, to provide a better acoustic experience for students and community members attending lectures and to make our hybrid programs better for online attendees
- demolishing an unsafe and unusable cabin, and prepping the area for future use as an education and community engagement outdoor teaching space
- making deferred repairs to several lodging units, including replacing a roof and adding gutters / drain tile to units that are heavily used by visiting researchers and interns

Of course, our buildings and grounds team is **also** doing all their normal winter work of keeping the driveways, sidewalks and parking areas plowed, fixing broken furnaces, deep cleaning carpets, rescuing stranded researchers, and much more. We're lucky and grateful to have such a dedicated and hardworking team keeping the facilities functional!

Roof repairs are underway at the Dragonfly Dome House

Data and Art at Cedar Creek

An update from artist in residence Emily Dzieweczynski

We feel data all the time—the temperature, the changing climate, bird songs. Within scientific research, however, feeling is often taken out of the equation. While the quantification of something as sensational and visceral as the environment can be useful in obtaining a near objective understanding, it removes the drivers that often bring people to action—emotion, connection, beauty.

Artists and scientists across the world are beginning to imagine new ways of conveying data in ways that are both more experiential and accessible. For example, Finnish artist Timo Aho's series of work *Lines* (http://www.timoaho.org/works/lines-57-59n-7-16w/) depicts the predicted future sea level rise caused by the changing climate by projecting lines onto structures. In this work, data becomes something tangible that the viewer can see themselves in relation to, allowing the viewer to not only derive mental understanding from but also bodily feeling.

Timo Aho & Pekka Niittyvirta, Lines (57° 59' N, 7° 16'W), 2018.
Photo: Pekka Niittyvirta.

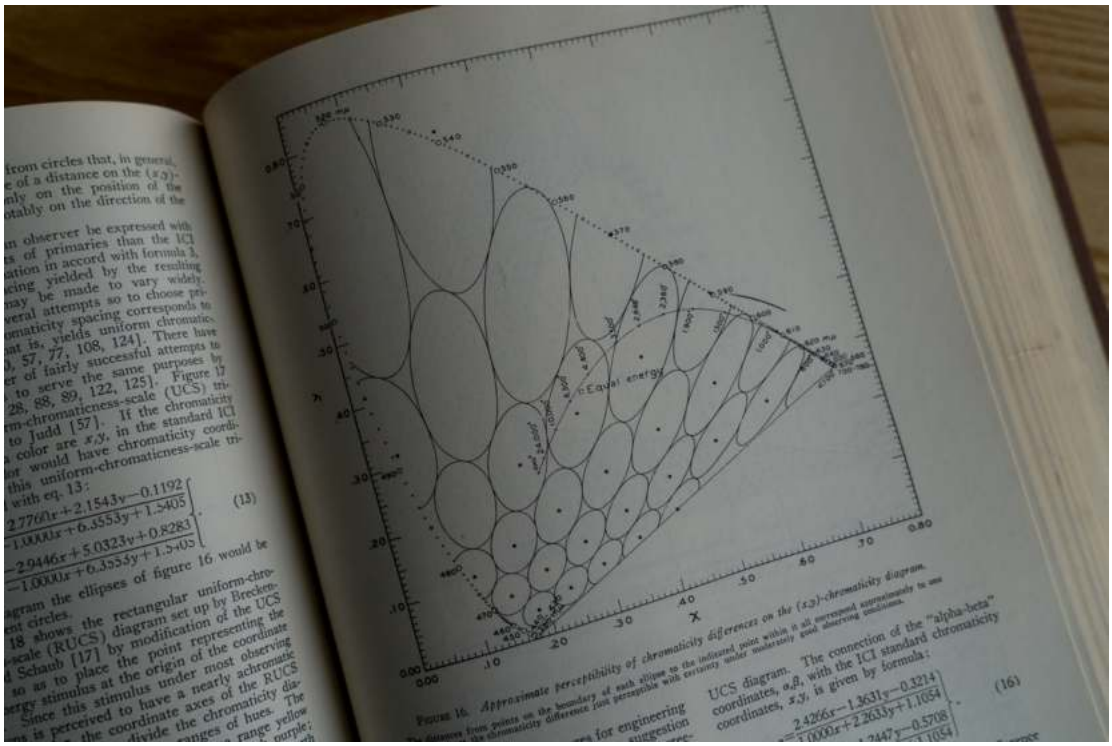
Closer to home, local artist Aaron Dysart's piece *Latitude* (http://www.aarondysart.com/work#/latitude/) uses data collected by meteorological sensors across the globe to measure atmospheric conditions like temperature, humidity, and carbon dioxide levels. In this installation, large swaying cylinders represent the flow of carbon between the ground and atmosphere at various locations. For each location, as carbon transmission into the atmosphere increases, the cylinder shifts its color to a warmer spectrum. When an ecosystem collects more carbon, it will shift to a cooler color.

One thing that is particularly interesting to me about *Latitude*, is that the data used was all open source and accessible. However, without substantial scientific training, I wonder who the data is actually "accessible" to. Dysart's installation made data more experiential and, in doing so, perhaps more accessible to individuals without extensive backgrounds in science.

Data and Art at Cedar Creek

For as long as Cedar Creek Ecosystem Science Reserve has existed, researchers have been collecting data, surmounting in extensive data records dating back 50+ years. While this data is invaluable to researchers across the world and across time, it's not necessarily accessible or meaningful to the general public as it stands. Last spring, I started working at Cedar Creek as an artist in residence, with a curiosity about their data, accessibility, and its experiential quality. Some of my driving questions became the following:

- What does it mean for data to be accessible?
- Who is this data accessible to? Who is it not accessible to?
- In what ways could we reimagine these datasets so that they could be more accessible or experiential?

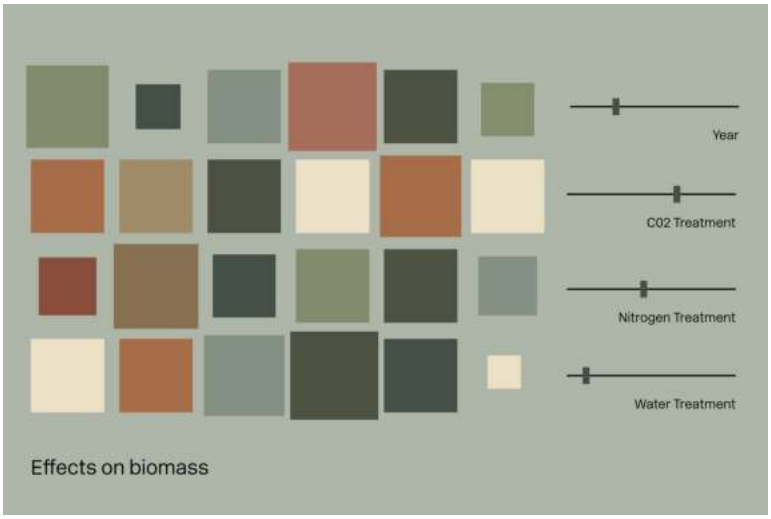


A graphical representation of the "Approximate perceptibility of chromaticity differences on the (x, y)-chromaticity diagram", found in the Cedar Creek's ICON House in spring 2022

Artistic representations, visualizations, and sonifications of data can be particularly useful in this effort to make data experiential and accessible. While a smaller scale than both Aho and Dysart's works, I decided to create several visualizations and sonifications using Cedar Creek's long term datasets as a means of approaching these questions. Right now, I'm working on two separate data reimaginings, with more to come.

Data and Art at Cedar Creek

BioCON Visualization: The BioCON global change experiment is one of Cedar Creek's more well-known projects. To reduce this complex project to a very simple explanation, researchers on this project manipulate different variables—such as soil and air temperature, nitrogen levels, and native plant species diversity—on different plots of land to see how the plots react. In the visualization that I am working on, users will be able to play with different "variable toggles" to adjust the parameters and see how the various plots of land will react, using real data collected over the past 25+ years.



A mockup of the BioCON visualization

Woodpeckers Sonficiation: Cedar Creek has also gained a reputation for its red-headed woodpecker research. During one of my stays at Cedar Creek, I went on a private bird walk with Jim Howitz, a retired professor and experienced birder. During our walk, he mentioned that one pattern he was seeing over the years was the way the woodpeckers tend to move and nest in relation to the prescribed burns that happen at Cedar Creek. In this visualization/sonification, users will be able to toggle the year while looking at aerial maps of Cedar Creek and the burn sites from that year. As they adjust the year, they can hover over spots on the map where woodpeckers nested in a given year. When a user hovers over an area where a lot of woodpeckers nested, their songs will get louder.

I think artists can play a critical role in collaboration with scientists, not only in assisting in the communication of scientific research, but considering the sensory aspects of research. It's been such an honor and pleasure to be working at Cedar Creek—to dig into the data and mysteries of this very special place. While I haven't found answers to all of my questions yet, and maybe never will, my conversations with researchers and scientists have confirmed that environmental data is deeply experiential. They advise me to move slowly, to look closely, and, over time, I may too notice the nuanced and esoteric patterns emerge. When we think about data and science, I think it's important to remember how it feels to be there—with the winds, water, and woods. Furthermore, to remember that this data exists in a complex system, affected by and affecting us.

If you'd like to read more about my research about the intersection of art and data, you might like this article published on MNArtists: https://mnartists.walkerart.org/feeling-data-aesthetic-empathy-in-art-and-science-collaborations. If you have any questions or would just like to reach out and chat, feel free to contact me at edzieweczynski@gmail.com.

80+ Year Retrospective

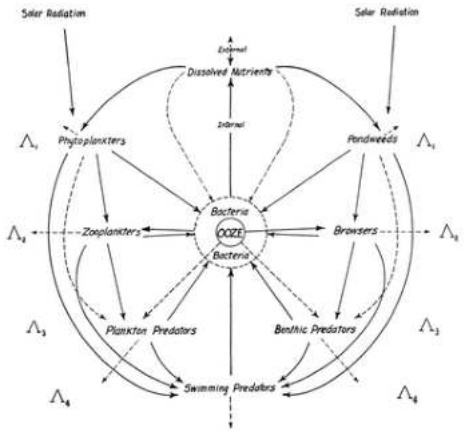
(continued from page 1) Fish Lake, then circling around to cover the northeast corner of Anoka County. Incidentally, the door on my side of the plane was removed, to give me a little more extra room and to make vertical shots possible. I don't mind looking down.

As to the date of [my first on-the-ground visit], I cannot give an exact date. I made a very complete set of field notes on July 11, 1931, but I cannot believe that I waited more than a year to investigate the place that had interested me so much from the air. I can say with some assurance that this visit was sometime during the summer of 1930, probably early in the season. I took along the picture that I had made from the air, and we struck in from about where the Crone property now is. On our first attempt we missed the lake entirely, coming out on the upland east of it. Our second try brought us to the south end of the lake.

By 1937, Dr. Cooper and other scientists had raised the potential of purchasing the land around what would later be called Cedar Bog Lake to the Minnesota Academy of Science's newly-formed Committee on the Preservation of Natural Conditions. In their 1938 proceedings, the committee recommended protecting the lake and its surrounding bog and woodlands. Simultaneously, a devoted community member, Mrs. Cora Corneia, was purchasing tracts of land in the area and hosting scientists, policymakers, and University and Academy staff on visits to appreciate the landscapes that would become the reserve. Corneia personally purchased nearly 600 acres of land!

Cora Corneia

1940s: The land acquired by Corneia and other acreage purchased by the Academy of Sciences and other supporters was deeded to the University, and on December 11th, 1942 an official agreement was executed establishing 'Cedar Creek Forest'. In the agreement, it as stipulated that the area would be maintained as far as possible in its natural condition and was to be used for scientific and educational purposes. One of the first major scientific projects to take place at the reserve also became one of the best known: Raymond Lindeman's work into food web dynamics. In the late 1930s and early 1940s, Ray and his wife Eleanor intensively sampled Cedar Bog Lake - the water, the 'ooze' at the lake's bottom, the plankton, the crustaceans, the fish and more - and used their data to develop what would become know as 'Lindeman's 10% Rule', a fundamental theory and accounting of how energy flows through food webs. Although Ray Lindeman died before his ground-breaking work was published, his legacy lives on in biology textbooks, guided hikes to Cedar Bog Lake, and in Cedar Creek's primary public-facing building, the Lindeman Research and Discovery Center.



80+ Year Retrospective

1950s: New research projects were added in the late 1940s and 1950s, including work on energy flows in terrestrial ecosystems by Don Lawrence, breeding bird research by Walter Breckenridge, a comprehensive flora catalogue compiled by John Moore, and a detailed report on land use and vegetation history by Richard Pierce. Additional funds, including a large grant from the Fleischmann Foundation, were raised to acquire more land and construct work space for scientists. On Sept. 14, 1957 dedicated the Cedar Creek Forest Laboratory was dedicated and began to serve as the official headquarters for the reserve. This building is still in use today, and functions as the primary lab space for our scientists. It is now called the Lawrence Laboratory after Don Lawrence, a long-time researcher, supporter and resident of the reserve. In 1958, another name change took place: Cedar Creek Forest was retitled as Cedar Creek Natural History Area, a name it would retain for nearly 50 years..

Arthur Wilcox (Cedar Creek director), Mason Boudrye (MN Academy of Sciences secretary), and Alvar Peterson (Cedar Creek resident manager) in the laboratory assembly hall, 1957.

Prescribed burning research

Radio telemetry research

1960s: By the 1960s, some of the research and land management projects that continue into the present day began. Most notably, Cedar Creek scientists led by Frank Irving began what is now one of the world's longest continuously-running prescribed burn experiments, exploring the role of fire frequency in Midwestern oak savannas. The 1960s also saw the development of radio telemetry and methods for automatically tracking wildlife. As part of this project, a team of wildlife biologists, engineers and students installed two towers with directional antennae that became the first round-the-clock, non-military telemetry system in the world. The team captured, collared and tracked a wide variety of species including badgers, owls, deer, foxes, fish, and raccoons. In time, members of the telemetry projects spun off a private company, Advanced Telemetry Systems, that still manufactures and sells telemetry equipment in Isanti, MN.

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Distinct ecology of the grasslands at 40° N

by Maowei Liang, research scientist

I just started as a Research Scientist this fall at Cedar Creek. So far, I have been exploring more and more about the data and projects, as well as having more and more conversations with students, staff, and researchers who have worked at Cedar Creek for a long time. During that process, I've started to notice that the grasslands at Cedar Creek have distinct ecological and sociological values, such as climate, fire and grazing regimes. A better understanding of these unique values could guide us to maintain Cedar Creek landscapes' integrity and management.

Grasslands, one of the largest land biomes, are dominated by grass species and cover more than one-third of the earth's land surface. Here, in the US Midwest, these systems are commonly called prairies. I have worked for more than 10 years on a different set of grasslands in Inner Mongolia (China) – these grasslands are dominated by Stipa species, and are commonly called steppes, (particularly in Central Eurasia). Despite both steppes and prairies being located at a latitude of approximately 40° N, their ecological-sociological expectations are distinct.

Figure 1 Grassland landscapes in the Cedar Creek prairies with a herd of bison (left) and a flock of sheep in a typical steppe (Xilingol) of Inner Mongolia, China (right).

In Inner Mongolia, researchers - both ecologists and sociologists - are primarily studying the effects of grazing intensity on steppe vegetation structure and dynamics, as well as the stability of native households (the Mongols) (Chen et al. 2018). Since there is an increasing need for meat production, especially sheep meat, a rapidly raising sheep stock in Inner Mongolia between the 1990s and 2000s has become a major cause of land degradation in the area (Wu et al. 2015). However, no single study that can simply answer the questions of how grazing affects the grasslands and human society in Inner Mongolia, especially with its long grazing history.

Distinct ecology of the grasslands at 40° N

A similar relationship between people, grasslands and grazers exists in the Midwest. Bison were historically widely-assembled in the North American prairies, and played a critical role in North American ecological-sociological systems (Ratajczak et al. 2022). After European colonization, bison were nearly hunted to extinction in the last two hundred years. At Cedar Creek, reintroducing bison is advancing our understanding of how native mega-grazers might affect Minnesota's most threatened ecosystems (i.e., the oak savanna). Researchers expect that bison are essential for savanna restoration and preservation likely because they preferentially graze the most abundant native prairie grasses.

References:

Chen, J., R. John, G. Sun, P. Fan, G. M. Henebry, M. E. Fernández-Giménez, Y. Zhang, H. Park, L. Tian, and P. Groisman. 2018. Prospects for the sustainability of social-ecological systems (SES) on the Mongolian plateau: five critical issues. Environmental Research Letters 13:123004.

Ratajczak, Z., S. L. Collins, J. M. Blair, S. E. Koerner, A. M. Louthan, M. D. Smith, J. H. Taylor, and J. B. Nippert. 2022. Reintroducing bison results in long-running and resilient increases in grassland diversity. Proceedings of the National Academy of Sciences 119:e2210433119.

Wu, J., Q. Zhang, A. Li, and C. Liang. 2015. Historical landscape dynamics of Inner Mongolia: patterns, drivers, and impacts. Landscape Ecology 30:1579-1598.

80 Year Retrospective

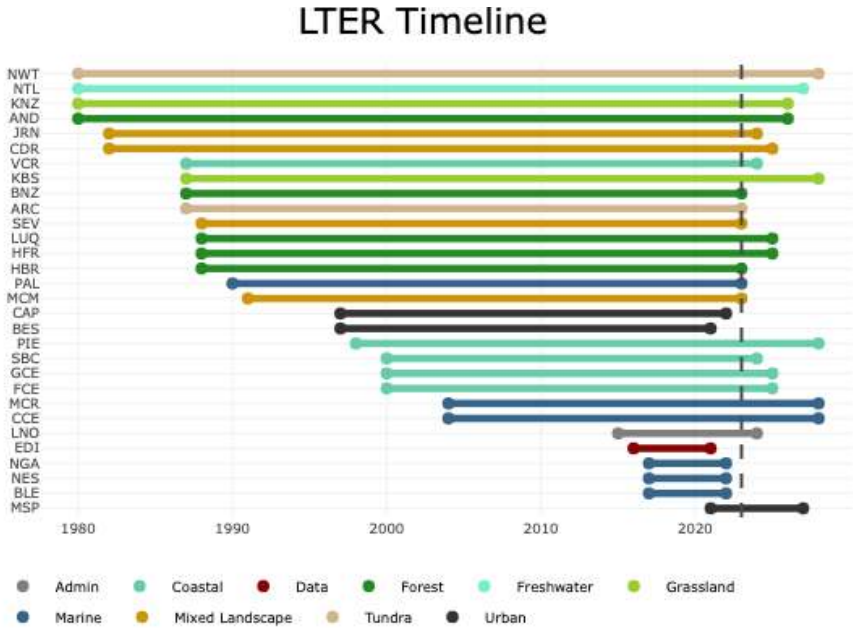
(continued from page 5) **1960s, continued:** Cedar Creek also saw an uptick in high school and undergraduate visitors and in new research projects spanning disciplines. Annual reports from that time mention work on soils undertaken by Eville Gorham and John Sanger, astronomy and solar radiation projects managed by R.C. Burkebok and members of the Physics department, waterfowl behavior studies done by Frank McKinney, research on wetland communities by Roberta Lammers, and collections and study of diverse taxa including fungi, spirochetes, bacteria, deer, fish and wetland plants.

Cedar Bog Lake, view NW.
Photo taken from a small plane by Don Lawrence, 1966

80 Year Retrospective

1970s: Cedar Creek was designated as a Natural National Landmark by the National Park Service in 1975, setting the stage for the many long-term experiments it is now known for. It was designated an Experimental Ecology Reserve a few years later, part of a proposed national network that would become the Long-Term Ecological Research network. During this period, Cedar Creek continued to grow as a learning destination. For example, the 1972 progress report detailed in AC Hodson's *History of the Cedar Creek Natural History Area* (the primary source for much of our understanding of Cedar Creek's history and growth) states: "*There were visits by 720 people from 8 Minnesota colleges, 5 University departments and from the University of Wisconsin and North Dakota State University. Students from 7 secondary schools numbering 271 also visited the Area. Among the 13 Special Groups there were 426 visitors, and there were also foreign visitors from Japan, England and Canada.*" Other reports from the '70s mention visits from the Izaak Walton League, the Minnesota Hiking Club, US Fish and Wildlife Service and a variety of local school districts, as well as researchers visiting from far-flung places like Germany, Australia, Norway, Israel and Mexico. Research continued to expand as well, with numerous plant and wildlife studies started, as well as large-scale projects on dragonflies and phenology by John Haarstad, and the establishment of the old field chronosequence succession study. Some of the researchers who are active to this day began work at Cedar Creek during the 1970s, including ornithologist "Chickadee Jim" Howitz and our current director, David Tilman.

1980s: In 1982, Cedar Creek became one of 11 locations designated and funded as Long-Term Ecological Research Sites by the National Science Foundation. Through the LTER program as well as others, research blossomed in this era, with long-term work being started (or continuing) on topics like succession, phenology, arthropod distribution and behavior, productivity, seed dispersal, human impacts, and more. Grants and fundraising made it possible to add to Cedar Creek's physical building portfolio, which provided much-needed space for offices, storage, labs and housing. Many of the personnel, projects, buildings and place names currently operational at the reserve today originated in the 1980s.



A timeline of currently-active LTER sites, through their current grant cycle. Cedar Creek is 'CDR', the orange line sixth from the top.

80 Year Retrospective

1990s: We launched a number of major research efforts focused on better understanding ecosystems and human impact on global change in the 1990s. These experiments are some of our most recognizable and widely cited projects. One is the Big Biodiversity experiment, which evaluates the impact of species number and diversity on ecosystem function. This decade also featured the birth of the BioCON (Biodiversity, CO2 and Nitrogen) experiment to evaluate the impact of interacting global change variables on ecosystems. We continue with these and other projects today to understand the relationship between human-caused changes, plant communities, and ecosystem functioning They also feature prominently in K-12 field trip visits, tours for community members, intern independent projects, field tours for visiting researchers, and station open houses.

Big Biodiversity experiment (left) and BioCON ring (right), photographed with a drone by Forest Isbell

2000s: The early 2000s brought a continued effort to understand the broader impacts humans have on our global ecosystems, and to better gauge the extent to which Cedar Creek results are generalizable. This included launching the Nutrient Network, an international research effort led by Elizabeth Borer and Eric Seabloom, to evaluate human impact on more than 130 grassland sites around the world. We also began the Biodiversity and Climate Experiment to better understand the roles of temperature, rainfall, and biodiversity on prairie ecosystems, and launched an effort to study the red-headed woodpecker, a species declining across Minnesota but stable at the reserve. Formal K-12 programs also took off in this decade with the hiring of a dedicated 'Schoolyard' coordinator to develop and deliver science and environmental programming for local youth. (continued on page 17)

Map of Nutrient Network sites - the project is headquartered at Cedar Creek but truly globally distributed!

Red-headed woodpecker at Cedar Creek. Photo by Siah St. Clair

Research equipment grants awarded

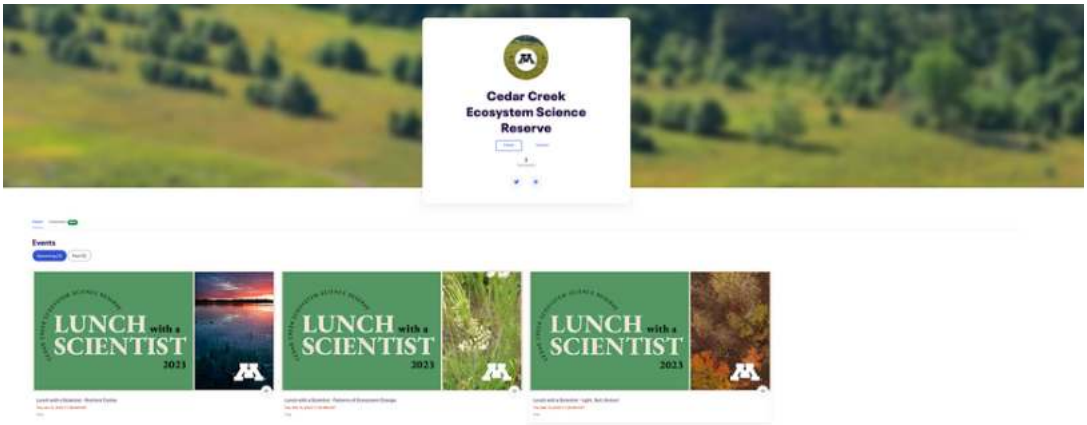
The College of Biological Sciences, home to five departments and two field stations (including Cedar Creek) recently announced the recipients of the new 'Enhancing CBS Research Equipment Infrastructure' internal funding opportunity. Faculty and staff from across the College submitted proposals that totalled. more than $900,000 in equipment that spanned fields, taxa, and biological scale. The selection committee selected 15 proposals to fund, including two from Cedar Creek!

The first proposal, written by Cedar Creek Research Coordinators Troy Mielke and Kally Worm, will fund the purchase of a Mettler XPR10 Microbalance (range 0.082mg-10.1g). Across the broad constituent pool of Cedar Creek researchers, there is consistently high demand to improve our lab capabilities, and specifically to have a microbalance available for use. Every year, researchers collect thousands of plant and soil samples from experiments at the reserve; many of these samples need to be analyzed for carbon, nitrogen, or isotopes, which requires weighing samples on a microbalance. Weighing these samples prior to analysis is a primary bottleneck for obtaining these data. Although two microbalances are housed on campus at the Ecology Building, they are often booked for use weeks or months in advance and are challenging for Cedar Creek users without cars to access. The new microbalance funded by this research equipment grant will allow more projects to take place onsite, make it possible for samples to be packed in a timely manner, and provide access to a microbalance for dozens of researchers each year that do not have transportation from CCESR to the main UMN campus.

The second proposal, written by Associate Director Caitlin Barale Potter, Information Manager Dan Bahauddin, and Site Scientist Maowei Liang, will help purchase a modern, multi-sensor weather station to be installed near the major experimental fields at Cedar Creek. Meteorological data is an essential component of ecological research at Cedar Creek Ecosystem Science Reserve. Long-term, repeated measurements of variables like precipitation and temperature contribute to analyses in most (if not all) of our major experimental platforms. The new station will enable researchers across the College and beyond to access and work with precise, accurate, local climatological data. This funding provides the opportunity to phase out our aging station with one that is more functional, secure and accessible for the broader research community, as well as adding two portable weather stations for hyperlocal data..

New Event Software

From our University of Minnesota friends at the Bell Museum and College of Biological Sciences, we learned about an event software entitled Eventbrite. We have decided to trial Eventbrite for program regsitration and details in 2023, starting with the Lunch with a Scientist lecture series (more on pages 18-20!). Keep a lookout on our Eventbrite page for upcoming programs and program descriptions! You can follow our account to get notifications about newly-added events, search through existing events, and get more details about programs at the reserve. Check it out as we add new things at **https://z.umn.edu/cedarcreek_eventbrite**



Get excited for spring and summer!

First Ever Garlic Mustard Pull Volunteer event

We are excited to partner with Anoka County to remove invasive species within Cedar Creek. This spring, join us for a Garlic Mustard Pull to remove an invasive Garlic Mustard patch from the interior of Cedar Creek property. Bring yourself, some bug spray, long pants and hiking boots as we walk to the site. Learn more about how to identify and remove garlic mustard. Tools, gardening gloves, and other supplies will be provided. **Tuesday, May 16th** - watch for details in the April newsletter!

Minnesota Astronomical Society Star Parties and Special Events

This year we are excited to work closely with the Minnesota Astrological Society to host Star Parties at Cedar Creek. We are currently finalizing the 2023 Star Party schedule. In addition to regular star parties, we are also excited to include special seminars prior to the programs including how to use your telescope and things to keep in mind when you purchase a telescope, as well as special programs including sun observations and other topics. Keep a look out for more details at the MAS and Cedar Creek websites as dates are confirmed!

Art and science: a year-end card

(reprinted with permission from the College of Biological Sciences)

Maria Park spends her days studying tree communities. The Ecology, Evolution and Behavior Ph.D. student is a keep observer of nature who turns those observations into insights about how trees influence one another. Her love of nature and penchant for looking closely at the world around her started early and fed a lifelong interest in both science and art. Park, who is a trained artist and serves as a teaching assistant for the University's Art and Ecology course in addition to her work in the Cavender-Bares lab, produced the art for the college's year-end card. She used natural pigments to create a scene featuring species found in the Forests and Biodiversity experiment at Cedar Creek Ecosystem Science Reserve, where Maria investigates how tree community composition influences the growth and stress of trees.

Can you say a bit about your area of study and how you got involved?

I have always been curious about how the natural world works. I love exploring outdoors, and am fascinated by the complexity and beauty of the diverse lifeforms that inhabit Earth. We, humans, are so deeply interconnected with our non-human neighbors. Knowing this, and realizing how severely we are impacting the world's ecosystems motivates me to better understand and steward the ecological systems we are part of.

I am currently a Ph.D. student in the Ecology, Evolution, and Behavior program at UMN, as part of the Cavender-Bares Lab. I study how plants grow and interact with each other in the context of forest communities (plant ecophysiology). I am interested in how tree community composition affects resource availability, stress, and growth of individual trees. Essentially, I am working to understand how trees influence other trees in their neighborhood by altering the local availability of light, water, and nutrients. I hope that this work can someday help inform conservation, restoration, and sustainable use of our forest ecosystems.

When and how did you first get interested in art? What appeals to you about it?

I have been drawing ever since I could hold a pencil in my hand, and playing music since I could plunk notes on a piano. Art has always been a way for me to observe, interpret, and learn about nature. I have found art to be a language that can transcend borders, cultural differences, and political leanings. Art, in all its forms, can bring joy and pain, grief and enlightenment. Art helps people make sense of the world around us, and connect with each other. Now is an exciting time to be making art, as the definitions and boundaries of art are being shattered and expanded upon.

Art and science: a year-end card

I find myself at the intersections of visual and auditory media, community engagement, activism, and all-around experimentation. I do not desire to be constrained by disciplines. Art is a practice that enables me to weave together the many facets of who I am, giving me the freedom to connect and learn from everyone around me.

How do art and science intersect for you?
As a child, I would doodle dogs, deer, flowers, cardinals, and bluejays. As a college student in biology labs, I would sketch labeled diagrams for organisms including plants, birds, and marine invertebrates. As a college student in art classes, I would both paint and carry out social experiments with the trees I was researching. As a post-graduate fellow in the Seychelles island archipelago, I did marine conservation (corals! turtles! tortoises!). I also collaborated with Seychellois artists, listening to stories of local Seychellois to understand and document how climate change and other factors are changing their environments, cultures, and societies. In return for the stories, we created personalized paintings and photographs for our interviewees. This collaboration was exhibited in the Seychelles Biennale of Contemporary Arts 2022.

As a Ph.D. student, I collaborate with art professor Christine Baeumler, forestry professor Rebecca Montgomery, and other members of the academic and local communities to practice socially engaged art. We aim to bring awareness of how climate change and human disturbances are changing ecosystems, and build a collective understanding of how we can best steward our local landscapes and waterscapes. Recently, I have been experimenting with making pigments and painting with foraged natural ingredients. I thank artist Kimberly Boustead for bringing me into this realm of artistic, ecological, and chemical experimentation!

What's your favorite thing to draw and/or paint?
I have a watercolor journal that I bring with me when I go explore new places. When I arrive at a place that calls to me, I will plop down or stand wherever is most convenient, and do a quick plein air painting of my surroundings. There are typically people traveling with me, so I try not to make them wait too long for my painting session. This time pressure forces me to focus, be truly in the moment, in the place, in time. I do love when curious people, oftentimes children, come up to me and ask what I am doing! The act of painting in public opens the door for fun, spontaneous human connection, sometimes communicated in non-English languages. In the end, the paintings capture what I find to be interesting – my observations and interpretations of a place. These paintings are my way of documenting life experiences and fleeting moments as a visual memory.

Art and science: a year-end card

Walnut pigment making. Boiling, simmering down. Result is a yellow-brown.

Sumac pigment making. Boiling, simmering down. Result is a reddish-pink.

Buckthorn charcoal. Charcoal made by Kim Boustead out of buckthorn branches from Franconia Sculpture Park.

Drawing. Charcoal outline.

Setup. Experimentation with pigments, and changes in pigment acidity (and color) with baking powder and vinegar

Final card. Trees (from left to right): Jack pine (*Pinus banksiana*), northern red oak (*Quercus rubra*), American basswood (*Tilia americana*), paper birch (*Betula papyrifera*); mushrooms: *Amanita* sp. birds: Cedar waxwing (*Bombycilla cedrorum*); border: Hairy vetch (*Vicia villosa*)

80 Year Retrospective

(continued from page 11)

2010s: In the 2010s, we returned bison to Cedar Creek for the first time in over 150 years to evaluate their impact on oak savannas. We also kicked off long-term, large-scale forestry research - including planting more than 40,000 young trees - to tease apart different dimensions and impacts of biodiversity in wooded communities, and launched Eyes on the Wild (https://eyesonwild.com/), a community science research project that is helping us better understand animal interactions onsite. Public-facing programs grew to reach a record 14,761 people by 2019, as Cedar Creek added regularly scheduled community opportunities including Lunch with a Scientist and the bison gazebo.

Forests and Biodiversity experiment (left) and research bison on the oak savanna (right).
Photographs by Jeannine Cavendar-Bares and Caitlin Barale Potter.

2020s: The 2020s are still young, and we can't wait to see what emerges from them! Although they started in dramatic fashion with the COVID-19 pandemic forcing scientist, staff and students to adapt to new policies and procedures, we have continued to make headway on many fronts. Already, two large-scale new projects have begun - the RESCUE (Rescuing Ecosystems and Species Currently Undergoing Extinction) experiment which studies habitat fragmentation, and the ASCEND Biology Integration Institute (https://www.spectralbiology.org/) which explores the causes and consequences of plant biodiversity across scales from genes to the biosphere.

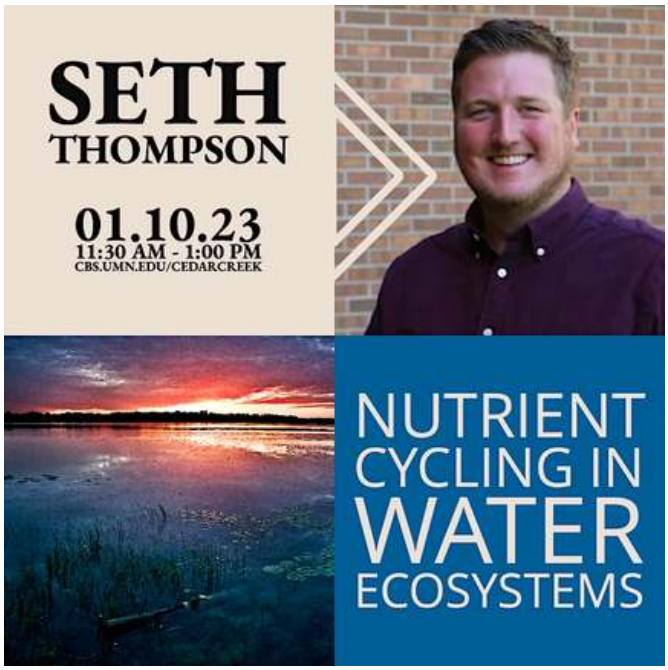
The experimental plots of RESCUE as seen from the air.
Photo by Forest Isbell.

We have learned so much over the last 80 years, and yet it feels like our work is just beginning. Thank you for being part of this great community! We look forward to sharing the next 80+ years of discoveries, insights, explorations and impact with all of you.

2023 Lunch with a Scientist - Local and International!

This winter, join us for the Lunch with a Scientist webinar series. January, February, and March programs will be hosted entirely online and feature topics including nutrient cycling in inland waters, patterns of change within ecosystem landscapes, and light resources within forests. We are also excited to highlight researchers from around the world including live seminars from Canada and Germany. Cedar Creek's unique research opportunities attract researchers from around the world who then take what they learned at Cedar Creek and expand it to other contexts and countries' ecosystems.

The Lunch with a Scientist Lecture Series is free to the public. Please consider making a suggested donation of $5-10 if you are able to. Donations go toward the Cedar Creek Fund which supports education and community programs at Cedar Creek, including science field trips, public events, and other education initiatives. We are grateful for donations of any amount and they do make a difference. Donating only takes a few moments, and your tax-deductible gift can be done completely online at https://z.umn.edu/cedarcreekfund.



January 2023 Lunch with a Scientist

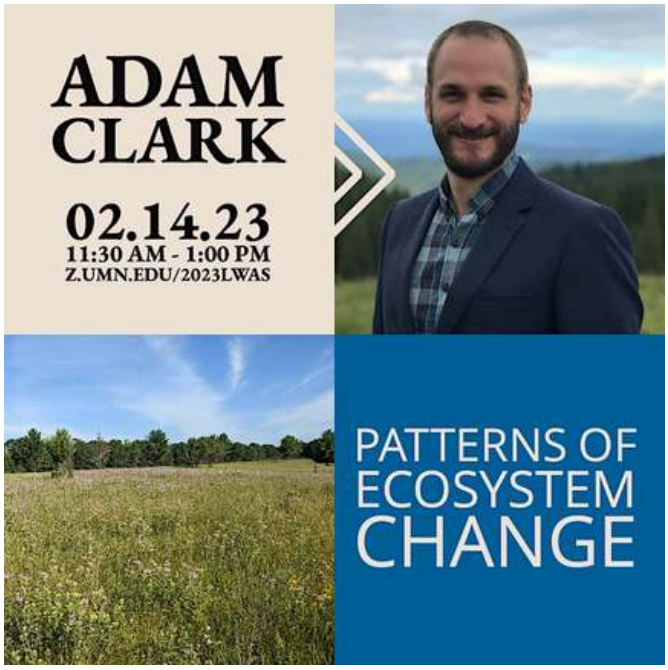
Ever wonder how nutrients, like phosphorus, move through the environment? The January 2023 Lunch with a Scientist will kick off with Dr. Seth Thompson. He will discuss his research relating to geochemical processes within freshwater systems. Seth's work focuses on aquatic bacteria, their role in transforming phosphorus in freshwater systems, and how microbes break down organic matter. In addition, he considers how global change and environmental factors influence nutrient cycling within inland waters.

About the Scientist

Dr. Seth Thompson received his PhD in Limnology and Oceanography from the University of Minnesota in 2019. In addition to exploring phosphorus biogeochemistry and dissolved organic matter in freshwater systems, Seth is active in research related to environmental education and equity in STEM fields. He completed a post-doc focused on educational research in 2020. He currently serves as the Director of Outreach in the College of Biological Sciences at the University of Minnesota. In this role, he organizes the Market Science program and works with scientists to connect, collaborate, and engage communities in science research and science-based activities.

Details and registration at **https://z.umn.edu/2023LWAS**

2023 Lunch with a Scientist



February 2023 Lunch with a Scientist

Change is constant, which is also true of habitats and ecosystem communities. Our Lunch with a Scientist will focus on patterns of ecosystem community change within abandoned farm fields and the mechanisms behind these patterns. The end of the presentation considers how to use models to predict changes in ecological communities in Minnesota and beyond.

About the Scientist

Dr. Adam Clark received his PhD in Ecology, Evolution, and Behavior from the University of Minnesota in 2017. His dissertation work, conducted at Cedar Creek Ecosystem Science Reserve, explored how interactions among prairie plant species and their environments influence ecosystem properties. During his postdoc at the German Centre for Integrative Biodiversity Research in Leipzig, Adam continued to explore ways to quantify stability and coexistence in real-world ecosystems. Since 2020, Adam has worked as an Assistant Professor in the Institute of Biology at the University of Graz in Austria. His research currently focuses on how ecological communities are able to persist across space and time, using both empirical data, and theoretical models.

Details and registration at **https://z.umn.edu/2023LWAS**

2023 Lunch with a Scientist

March 2023 Lunch with a Scientist

Through the Forests and Biodiversity (FAB) experiment at Cedar Creek, researchers are gaining an understanding of how trees interact with one another. One of the strongest interactions between neighboring trees is shading, which can cause trees to compete for light energy or to shield each other from stress caused by excess light. The March Lunch with a Scientist program welcomes Dr. Shan Kothari, an ecophysiologist, to discuss his research on light's role as both an essential resource and stressor for trees, as well as other recent results from FAB.

About the Scientist

Dr. Shan Kothari comes from Michigan and finished his PhD in 2020 at the Department of Plant and Microbial Biology at the University of Minnesota, during which he lived, did fieldwork, and mentored interns at Cedar Creek for three summers. Currently, he is a postdoctoral researcher at Université du Québec à Montréal in Montréal, Canada.

Details and registration at **https://z.umn.edu/2023LWAS**

Caught on Camera!

Fall colors on Cedar Creek

Snow comes to the BioCON experiment

Staff planning 2023 invasive species work with our Anoka County partners

Dr. Kara and a middle schooler explore aquatic plant adaptations

Heritage E-STEM 8th graders get up close and personal with a millipede!

Upcoming Events

THE BISON GAZEBO IS CLOSED FOR THE SEASON. THE FISH LAKE NATURE TRAIL REMAINS OPEN, AND THE SAVANNA SKI LOOPS ARE OPEN WHEN THERE IS CONSISTENT SNOW COVER.

ONLINE ONLY: January 10th, 11:30 - 1pm. Lunch with a Scientist: Nutrient Cycling in Water Ecosystems. Ever wonder about how nutrients, like phosphorus, move through the environment? The January 2023 Lunch with a Scientist will kick off with Dr. Seth Thompson. He will discuss his research relating to geochemical processes within freshwater systems. Seth's work focuses on aquatic bacteria, their role in transforming phosphorus in freshwater systems, and how microbes break down organic matter. In addition, he considers how global change and environmental factors influence nutrient cycling within inland waters. This program is online only. Details and registration for this and other programs available at https://z.umn.edu/2023lwas. (free, adults recommended)

ONLINE ONLY: January 25th, 6:30-8pm. Cedar Creek Ecology Book Club. Are you interested in our impact on Planet Earth? The web of life? Climate change? Nature? Ecology? If so, this community-led book club is the place for you! Join us as we continue our journey of lifelong learning! We generally meet the 4th Wednesday of each month on zoom, and a few times a year in person at Cedar Creek. Our January book is South Pole Station: A Novel by Ashley Shelby. Register for this and upcoming zoom meetings at http://z.umn.edu/bookclubonline. Details on upcoming books are available at https://www.cedarcreek.umn.edu/bookclub (free, adults recommended)

ONLINE ONLY: February 14th, 11:30 - 1pm. Lunch with a Scientist: Patterns of Ecosystem Change. Change is constant, which is also true of habitats and ecosystem communities. Our Lunch with a Scientist lecture, presented by Dr. Adam Clark, will focus on patterns of ecosystem community change within abandoned farm fields and the mechanisms behind these patterns. The end of the presentation considers how to use models to predict changes in ecological communities in Minnesota and beyond. Details and registration for this and other programs available at https://z.umn.edu/2023lwas. (free, adults recommended)

Upcoming Events

THE BISON GAZEBO IS CLOSED FOR THE SEASON. THE FISH LAKE NATURE TRAIL REMAINS OPEN, AND THE SAVANNA SKI LOOPS ARE OPEN WHEN THERE IS CONSISTENT SNOW COVER.

IN PERSON ONLY: February 18th, 9am-4:30pm: Cedar Creek Wildlife Survey. The Cedar Creek Wildlife Survey is a joint venture between the Minnesota Wildlife Tracking Project and Cedar Creek . It is a unique opportunity to improve your tracking skills, connect with nature, and help Cedar Creek scientists learn about the wildlife living on their property. Our Winter Survey will be an all day affair. We will head out in teams to survey snow-packed roads and trails for animal tracks, then come back in to share our discoveries with one another. Each team will be led by an experienced wildlife tracker, certified in Track & Sign identification. In past winter surveys, our teams have identified the tracks of about 20 species including southern flying squirrel, fisher, mink, red fox and grey wolf. Since then, many of our observations have been verified by the trail cam network at Cedar Creek. With the bison enclosure vacant for the season, we have a broader range of places we can roam, and the opportunity to follow trails in the snow for longer distances. Who knows what we will find? No experience necessary, but but registration is required. Bring your own lunch and snacks. For details or to register email Kirsten Welge (kirsten.welge@gmail.com). (free, ages 15+ recommended)

ONLINE ONLY: March 14th, 11:30 - 1pm. Lunch with a Scientist: Patterns of Ecosystem Change. Through the Forests and Biodiversity (FAB) experiment at Cedar Creek, researchers are gaining an understanding of how trees interact with one another. One of the strongest interactions between neighboring trees is shading, which can cause trees to compete for light energy or to shield each other from stress caused by excess light. The March Lunch with a Scientist program welcomes Dr. Shan Kothari, an ecophysiologist, to discuss his research on light's role as both an essential resource and stressor for trees, as well as other recent results from FAB. Details and registration for this and other programs available at https://z.umn.edu/2023lwas. (free, adults recommended)

The Nature Conservancy invites you to volunteer at the Helen Allison Savanna as we work to enhance an oak savanna, a globally rare ecosystem, by helping to reduce brush and invasive species.

Saturday, January 7th
Wednesday, January 18th
10:00AM- 3:00PM

Where: 229th Ave NE, East Bethel, MN 55005

Parking Location: Roadside shoulder of Durant St. Please pull as far off the road as possible.

Please bring/wear appropriate work clothes, sturdy shoes, water bottle, snacks/lunch, work gloves, sunglasses/safety glasses. Loppers and other equipment provided.

RSVPs Encouraged but not required

To RSVP or ask any questions please contact Michele Beadle:
michele.beadle@tnc.org

The Nature Conservancy
Protecting nature. Preserving life.™

The Nature Conservancy in Minnesota
North Dakota & South Dakota
1101 West River Parkway, Suite 200
Minneapolis, MN 55415

Tel (612) 331-0700
Fax (612) 331-0750

nature.org

Support Cedar Creek

From the 1940s and Raymond Lindeman's field-shaping insights to the present-day work of world-renowned ecologists, Cedar Creek Ecosystem Science Reserve is a highly influential field station, research destination and teaching laboratory. Our work plays a critical role in advancing our understanding of how we are affecting the environment and how we might protect it. Be part of this incredible legacy and bright future by supporting the field station.

Your gift can support any aspect of our mission!
Choose the category that speaks to you:

Research: Gifts to one of our named research funds supports undergraduates, graduate students, and faculty in a variety of ways. Your gift could be used to provide room and board support for a research internship participant, to purchase equipment for a student project, to enhance faculty collaborations, or in other ways that help us advance the field of ecology.

Education and Community Engagement: Gifts to our E&CE funds provide field trip and transportation scholarships for K-12 students, support our artist in residence program, help provide supplies for our participatory science events, and allow us to offer stipends to guest teachers in our pubic programs.

Conservation: Gifts to the Cedar Creek Conservation Fund help us understand, manage and restore the species and ecosystems of the reserve. This includes supporting red-headed woodpecker and bison initiatives, invasive species management, and prescribed burning.

Capital Improvements: Gifts to the Cedar Creek Capital Improvements Fund support the development of infrastructure onsite. Current priorities include the Minnesota Ecology Walk and an addition to the Lindeman Center, both of which will enhance our ability to provide interpretive experiences for visitors.

General: The Cedar Creek Membership Fund provides general support to the areas of greatest need at Cedar Creek, to ensure community support, equipment and research.

Make a gift online: https://z.umn.edu/cedarcreekgiving