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VOLUME 7 / ISSUES 1 & 2

A PUBLICATION OF THE UNDERGRADUATE CERTIFICATE IN ENVIRONMENTAL WRITING AT THE UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

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Our Gracious Donor...

A very special thanks to Janelle Joseph, who has continued her support of the Institute for Sustainability, Energy, and Environment (iSEE) with several generous donations to help *Q Magazine* student writers go on location and research their stories.

Her gifts have also funded the Janelle Joseph Environmental Writing Contest, which debuted in 2020 and offered U. of I. undergraduates the opportunity to submit articles for cash awards and publication in *Q*!

"Through my dear friend Joel Friedman, I became aware of iSEE's dedicated programs," said Joseph, pictured here with her dog Moonbeam. "The planet and the environment are where all things future begin. All needs and other great causes depend on where we live and are safe. After hearing about iSEE and *Q Magazine*, I felt HOPE, for the first time in many years, that brilliant young people are working on improvements and solutions."

With Joseph's funding, student writers are inspired to explore environmental issues up close and in person.

We are grateful!

Welcome to *Q Magazine*, a showcase for inspired environmental writing at the University of Illinois Urbana-Champaign.

Q Magazine features outstanding articles by U. of I. students, most of them enrolled in the Undergraduate Certificate in Environmental Writing (CEW), a joint venture of the Institute for Sustainability, Energy, and Environment (iSEE), the School for Earth, Society, and Environment (SESE), the English Department, and the Journalism Department.

When enrolled in the CEW capstone course (ESE 498), students have the opportunity to submit their writing for publication in *Q*, working closely with instructors and production staff to develop their work to a professional, publishable standard.

The motto of the CEW is "turning data into narrative" — to absorb the latest environmental research and communicate that research effectively to the public. Certificate courses allow students to engage with the latest on-campus research in sustainability science and identify environmental issues they are passionate about.

Whether dropping in to take one of our courses or completing the full three-course sequence, students work with dedicated professors, meet enthusiastic students from disciplines all across campus, and build marketable skills in environmental communication.

Enjoy these student voices, broadcasters for change and a livable planet.

The Writers

Sophia Beem

Julianna Gerdes

Molly Grossman

Vivian La

Gabe Lareau

Ren Lashley

Sam Levenhagen

Sara Merkelz

Nina Sally

Sakshi Vaya

Anjali Yedavalli

Madeline Yu

Notable Alumni

Andy Sima, a May 2021 alumna and *Q* contributor, published the nonfiction book *Climate: Our Changing World* in 2023. The book breaks down one of the world's most complex subjects in a way that can be understood by middle school readers.

Nidhi Shastri, a May 2019 alumna of the University of Illinois and a former writer for *Q Magazine*, was named one of 16 New Voices by the Associate of Independents in Radio (AIR) in July 2021. Shastri has an award-winning podcast, *Model Minority*, and has worked as a freelance writer.

Editor's Note

The authors in this 7th volume of *Q Magazine* have us thinking about the idea of choice: how small decisions made by ordinary folk can impact our lives in a big way, while *systemic* change still matters most.

It's all quite existential. But as much as the stories remind us how meaningful change is hard to achieve, they also remind us how important it is to continue to care.

Whether it's Ren Lashley and Sara Merkelz trudging across the frigid Arctic, Nina Sally and Maddie Yu digging deep in our home Midwestern soils, or Julianna Gerdes tracking migrating flocks to the neotropics — when you abandon what you *think* you know, a clearer picture emerges.

Think about the recycling bin in your kitchen, for example. You may choose to sort your papers and plastics but, as Sakshi Vaya points out, corporations managing a global market for plastic packaged goods are the real culprits in our ongoing waste emergency.

Gabe Lareau raises a similar point — you can choose to ride a bike or carpool to work for the sake of cutting down your CO_2 emissions, but how does that compare to the vast greenhouse gas emissions produced from just one college sports game?

Who cares? We all must. In our cover story, which brings this all this close to home, Sophia Beem provides us with a firsthand account of the corporatization of Midwest farming and how it's changed the Illinois landscape she loves forever.

Learning what others care about and what they're doing to protect it is no less important —and inspiring. Sam Levenhagen's conversation with a Colorado national park manager about the endangered pinyon jay and sage-grouse is a grade-A example of this. Just like for these birds, our best future depends on being attentive to what's close at hand while also keeping a weather eye on the changing horizon.

So, as you dive into this issue of *Q*, remember that your passion for the natural world around you is the first step to making positive change. After all, it's people who care who make the real and lasting impacts.

Molly Grossman & Gabe Lareau

Student Editors & the *Q* Editorial Team
April 2025

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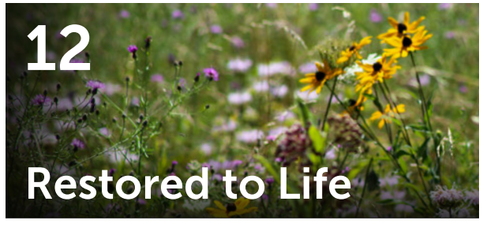

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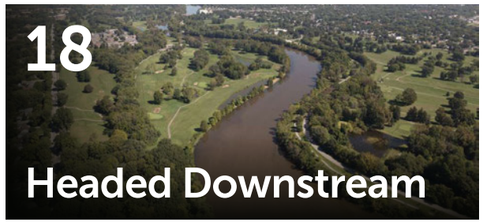

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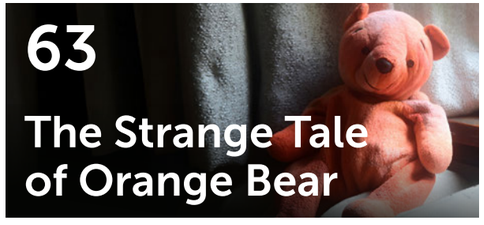

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All article citations can be found online at Q.Sustainability.Illinois.edu

Learn more about the Certificate in Environmental Writing at the University of Illinois, including certificate courses, links to registration, opportunities, support, and more.

RUFFLING FEATHERS

SAM LEVENHAGEN

In between the Sierra Nevada and Wasatch Mountains, a war is raging, cloaked in unassuming shades of gentle brown and green. Gnarled, shrunken trees line the perimeter of the basin, limbs outstretched in attack. Tough, short grasses, dotting the open landscape like stubble, stand stoutly in defense.

At the forefront of the fight are two reluctant generals: the bastion of the sagebrush, the greater sage-grouse, and the hero of the encroaching trees, the pinyon jay. It's a habitat versus habitat crusade.

Pinyon jay in flight.
Credit: Tim Lenz via Wikimedia Commons

Female greater sage-grouse.
Credit: Tom Koerner, U.S. Fish and Wildlife Service Mountain-Prairie via Flickr

If the warring habitats fail to strike a balance, the pinyon jay and greater sage-grouse both risk extinction.

The pinyon-juniper woodlands at the fringe of the expanse are trying desperately to expand inwards, sending legions of stocky pines to the frontlines, while the sagebrush sea is struggling to keep its open range from shrinking any further. It's a losing battle for both sides. The populations of the pinyon jay and greater sage-grouse are in decline, making the need for a truce all the more imperative — the lives of legions of unique birds depend on it. If the warring habitats fail to strike a balance, the pinyon jay and greater sage-grouse both risk extinction.

Resembling a portly general, the greater sage-grouse is a rather strange looking bird. Wispy feathers, like an old man's hair, cap its small, dark head. Combine that with a round body and sharp, fanned tail feathers, and you have a bird that certainly makes an impression — that is, if you can spot it. Its dull, brown color is the perfect camouflage, matching the hues of the sagebrush environment it calls home. The sage-grouse relies on this shrubland habitat, which stretches across 11 states in the Western U.S., for food and shelter. During the spring and summer, the low-elevation basin offers insects and soft plants for the birds, while in winter, their diet consists almost entirely of sagebrush (unlike other grouse, their stomachs cannot digest nuts and seeds). To accommodate their seasonal changes in diet, the birds — who live in social groups that usually consist of 20 to 30 individuals — often travel several miles between winter and summer nesting sites. They are creatures of habit, preferring to return to the same nesting locations year after year.

In stark contrast to the greater sage-grouse, the pinyon jay wears no camouflage. With blue-grey feathers and bright, beady eyes, the jay stands out against the brown and green backdrop of its home. The white undersides of their wings and quick, darting movements between sky, tree, and ground are eye-catching, especially as dozens or even hundreds of the birds flock together. Their war cry, a loud, shrill call that is a clear marker of a flock's presence, also lacks subtlety. The bravery of these birds is in large part due to the environment in which they make their home: pinyon-juniper woodlands. These woodlands are a transitional zone lying between the low elevation shrubland of the greater sage-grouse and higher elevation montane environments, such as ponderosa pine forests.

This pinyon-juniper transition zone is at the heart of the greater sage-grouse and pinyon jay's war. Both the sage-grouse and the jay are inching closer to endangered species status, ringing alarm bells for conservationists across the Great Basin and surrounding areas. Many regions have enacted species protection plans for each bird. However, the expansion of pinyon-juniper woodlands into sagebrush environments is throwing a wrench into these conservation strategies. The conifers of the pinyon-juniper environment are an obstacle for the greater sage-grouse, whose sagebrush home is rapidly shrinking, but a necessity for the pinyon jay, whose livelihood depends on the trees.

The greater sage-grouse, left, and the pinyon jay, right. *Credit: USFWS National Digital Library*

A representation of the juniper-pinyon woodland's intersection with sagebrush prairies at Owen's Peak Wilderness.
Credit: Tom Koerner, USFWS via Flickr

The Tree of Life

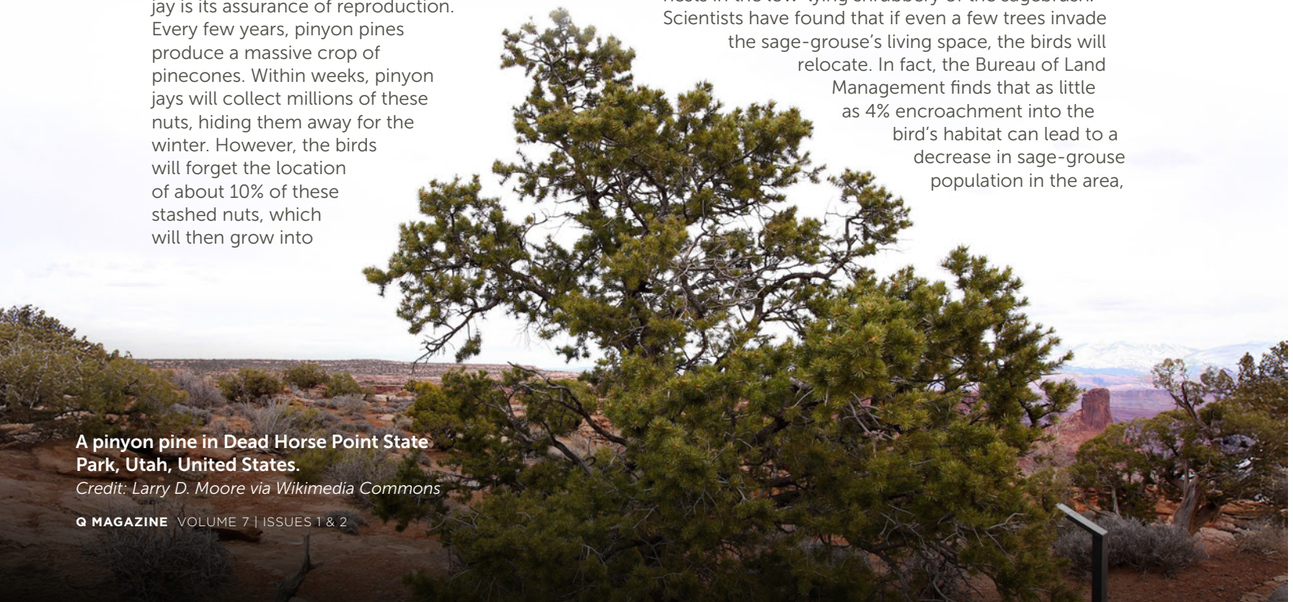
The pinyon pine isn't what most people think of when you say the words "pine tree." Rather than the Christmas-tree look of conifers like the Douglas fir or white pine, the pinyon pine has a long, bare trunk. Its branches are twisted and brimming with needles. Its pinecones look like a roasted head of garlic that has burst open with the edible pinyon nuts, oblong and white, resembling the cloves.

For most of its 20,000 years of existence, the scraggly pine was content to occupy the edge of the western sagebrush environment. Nuts, bark, and other components of the tree were significant to the Indigenous peoples who lived on the land; they carefully stewarded the groves, helping to keep the tree's population steady. Naturally occurring wildfires restricted the trees to rocky, mid-elevation ridges. The shift in range for the pinyon pine began in the 1860s with the movement of Euro-American settlers through the West. The settlers converted much of the land of the Great Basin into grazing space for livestock, discouraging once-routine wildfires. The pinyon pines, encouraged by this reduction in fires as well as several seasons of above-average rainfall in the late 1800s and early 1900s, began their expansion across the West. It is estimated that the eager little tree's population has grown somewhere between twofold to sixfold since the 1850s; its range now extends hundreds of miles across the Great Basin. While scientists are unclear as to what exactly is causing the continued expansion — be it fire reduction, grazing, climate change, or some other reason entirely — what is clear is that the shifting range of the pinyon pine is affecting a wide variety of plants and animals, including the pinyon jay and greater sage-grouse.

It comes as little surprise to learn that the pinyon pine and pinyon jay rely on each other — they share a name, after all. For the pine tree, the jay is its assurance of reproduction. Every few years, pinyon pines produce a massive crop of pinecones. Within weeks, pinyon jays will collect millions of these nuts, hiding them away for the winter. However, the birds will forget the location of about 10% of these stashed nuts, which will then grow into the next generation of pine trees. In return, the pine offers the pinyon jay not only food, but an important sheltering place for their large flocks. The jay nests in the boughs of the trees, returning to the same nesting site each year. However, due to myriad problems including deforestation and climate change, the symbiosis between the jay and the pine is beginning to unravel. Pinyon pines are producing fewer seeds and smaller trees, meaning the jays have less food and shelter, while deforestation destroys the jays' nesting sites, stunting population growth. As a result, the population of pinyon jays has decreased (despite the increase in pinyon pines), making consistent nesting locations all the more imperative in ensuring survival of the species.

Pinyon pine nuts.
Credit: Intermountain Forest Service USDA Region Four via Flickr

The new pinyon pine regime likewise poses a problem for the greater sage-grouse. The rotund birds, who much prefer the ground over the skies, build their nests in the low-lying shrubbery of the sagebrush. Scientists have found that if even a few trees invade the sage-grouse's living space, the birds will relocate. In fact, the Bureau of Land Management finds that as little as 4% encroachment into the bird's habitat can lead to a decrease in sage-grouse population in the area, likely due to the multitude of issues trees create for the species. The conifers replace native plants and drive away insects, both important parts of the sage-grouse's diet. The pinyon pines hide predators such as ravens and coyotes, who think the sage-grouse makes a tasty treat. These trees also create perfect conditions for larger and hotter wildfires, sucking up precious groundwater from the already-dry environment.



A pinyon pine in Dead Horse Point State Park, Utah, United States.
Credit: Larry D. Moore via Wikimedia Commons

A lone greater sage-grouse.
Credit: Tom Koerner, USFWS via Flickr

It is here, in the needled boughs of the lanky pinyon pine, that we arrive at the heart of our avian conflict. Two bird populations, both in decline, have opposing needs surrounding this tree. The pinyon jay is fighting for the tree to retain its stronghold, dependent upon the food and shelter it provides. Meanwhile, the greater sage-grouse, try as it may to resist the pinyon pine's expansion, has been forced to flee, pushing its population into the parcels of remaining sagebrush steppe. And even these parcels will soon be threatened, if the march of the pinyon pine is allowed to continue.

This situation facing the jay and the grouse is a classic conservation conundrum, sometimes called a "wicked problem," whereby helping one species involves disadvantaging another. Conservationists are no stranger to wicked problems, however. Dedicated workers are even now negotiating what they hope will be a lasting truce in the life-and-death struggle between these two wonderful birds.

The Complexity of Conservation

Amy Seglund, a species conservation coordinator for the state of Colorado, is striving for solutions to the problem. Seglund is one of dozens of researchers compiling their findings for the jay and grouse, fostering the development of more comprehensive conservation strategies for each bird. Her latest research involves mapping the nesting sites of pinyon jay colonies across the state. She hopes that recording these sites and examining the nesting habits of the flocks will give clues toward a sustainable management strategy for the species.

Seglund explains that there is no all-encompassing or national conservation strategy for the pinyon jay or the greater sage-grouse. This means that researchers often focus on creating solutions to be implemented on a local or regional scale. For example, Seglund's research offers data specific to the state of Colorado. However, the patterns found in small-scale data are often applicable beyond regional or state boundaries. This, Seglund notes, is where the importance of communication and research sharing comes into play. She and many other conservationists believe that information dissemination is one of the key components to creating a strategy that is compatible for multiple species sharing a habitat.

One of the places where Seglund shares her research is the Pinyon Jay Working Group, a collaborative effort between hundreds of agencies and individuals across the Western U.S. dedicated to protecting the blue-gray bird. The working group is a hub of information, with data being shared from all regions the jay calls home — from Seglund's office in Colorado to areas across the Great Basin, from Utah to Arizona. The same type of information dissemination is taking place among researchers of the greater sage-grouse. The grouse also boasts a cross-state working group dedicated to sharing research and creating useful management strategies for the squat little bird. The species-specific strategies that emerge from these working groups are an important piece in solving the wicked problem facing the sage-grouse and pinyon jay.

So, what exactly are these strategies? Well, for the greater sage-grouse, it's all about battling the intrusive trees taking hold of the sagebrush environment. Seglund, though focused mostly on the pinyon jay, is

no stranger to this task. In northwestern Colorado, she's overseen treatments designed to reopen sagebrush environments swamped by trees. "A lot of the push has been to remove encroaching pinyon and juniper trees," she notes. This is no easy job: Since 2001, more than 1.1 million acres of new pinyon-juniper forests have taken root in the northern Great Basin alone, eradicating swathes of land the sage-grouse once called home. But the consistent efforts of land managers like Seglund and her team are paying off. Populations of sage-grouse have grown an average of 12% more quickly in areas where pinyon-junipers have been removed. These encouraging results, coming less than 10 years after initial tree removal began, seem to show that the act of ridding the sagebrush steppe of pinyon-juniper woodlands has an immediate and rapid impact on the greater sage-grouse. To put it simply, Seglund says with a smile, "It's going really well."

Though the answer for conserving the sage-grouse is pretty clear-cut, the path toward reestablishing a healthy pinyon jay population is not so obvious. Seglund notes that research on the decline of the pinyon jay is far less developed than that of the greater sage-grouse. This is why Seglund's work is so important. Prior to 2019, not a single breeding site for the charismatic birds had been mapped in the entire state of Colorado. Now, with roughly a hundred nesting locations mapped, Seglund is finding a potential cause for the jay's plight.

"It's been really important to identify exactly where the pinyon jays' nests are," Seglund remarks. "It's really fortunate that we're mapping them out, because they're in areas where treatments are occurring." These treatments that Seglund references are the very same treatments meant to benefit the greater sage-grouse: the clearing of pinyon-juniper woodlands. Pinyon pines containing the jay's nests are being mowed down, hindering the bird's ability to reproduce and raise its young. In one instance, Seglund's team set out to map a nesting site, only to find the entire breeding area — which had likely held dozens of nests — had been turned into mulch just prior to their arrival. "It was a wake-up call for me," Seglund noted gravely. These nest-destroying treatments offer an explanation as to why the pinyon jay population is decreasing despite the expansion of pinyon-juniper woodlands.

Seglund's research shows that one of the keys to recreating a healthy pinyon jay population is to assure the proliferation of the pinyon pines that contain the bird's nests. At the same time, she also knows that those same pinyon pines can be damaging to the population of the greater sage-grouse. However, Seglund and her team have found a way to bridge the gap between the jay and grouse's needs: selectivity.

"We can definitely make winners for both the jays and the sage-grouse," Seglund says. Selective management is a strategy in which thin, encroaching stands of pinyon-juniper woodlands are removed, opening up sagebrush environment for the greater sage-grouse. Importantly, trees with pinyon jay nests and colonies are left untouched.

Selective management is a strategy in which thin, encroaching stands of pinyon-juniper woodlands are removed, opening up sagebrush environment for the greater sage-grouse. Importantly, trees with pinyon jay nests and colonies are left untouched.

As it turns out, pinyon jays are not necessarily opposed to the clearing of pinyon-juniper woodlands. The removal of trees via controlled burns creates the perfect buffet for the birds, exposing insects and understory that the forager jays will gladly chow down on. As long as the trees containing their nests are left intact, the jays will readily adapt to the removal of other pinyon pines.

Getting rid of the thin, fringe pinyon-juniper woodland that is choking out the sage-grouse restores the sagebrush habitat the bird so desperately needs. Both the jay and grouse benefit from the food sources created by clearing the trees. The pinyon jay retains its nesting sites. It's the win-win solution scientists have been looking for in the dilemma facing these two bird species.

With this potential solution in hand, Seglund knows that the next path of action is to raise awareness. Management agencies and landowners in the range of the sage-grouse and pinyon jay need to know which trees to avoid, and which to cultivate. Parkgoers and average citizens who enjoy seeing the birds can also play a part in advocating for the protection of both species.

Seglund is hopeful for the future of the pinyon jay and the greater sage-grouse. "We're on the right track," she says. Though researchers and management both still have much to do to protect these birds, the successes she's seen both in her work in Colorado and her working group colleagues across the Great Basin and Western U.S. are encouraging. "It's always hard to tease out the specific mechanism that's driving things. But I'm hopeful because of the interest, the dedication that people are showing will help conserve this bird."

If the good work continues, the long-fought, mutually destructive battle between the pinyon jay and greater sage-grouse may finally be declared over. No longer will the birds be forced to compete, but instead will live in harmony in what Seglund describes as a "mosaic of habitats." There's growing hope that the pinyon jay and sage-grouse will not only survive, but flourish — winning examples of how to restore natural balance and bring peace to ravaged ecosystems for all their native species.

Pinyon jays perched in a pinyon pine.
Credit: Alan Schmierer via Flickr

"We can definitely make winners for both the jays and the sage-grouse."

A female greater sage-grouse takes off.
Credit: Tom Koerner, USFWS via Flickr

Sam Levenhagen is a junior who hails from San Antonio, Tex. She is studying Geology and Political Science with a minor in Earth, Society, and Environmental Sustainability. Sam is pursuing a career in paleoclimatology, with current research focusing on using climate proxies to determine past changes in global wind circulation.

Prairie. *Credit: Emily Lewis via Unsplash*
Garden. *Credit: Anguel Hristozov via Unsplash*
Cardinal. *Credit: Gerhard Crous via Unsplash*

Just before I returned to campus for my final year of undergrad, I paid my grandpa a visit. He resides in a home for memory care, and is a long-time nature lover with a special fondness for cardinals. Toward the end of our visit, we found ourselves talking in the cafeteria. The view from the floor-to-ceiling windows was nothing special: a fence lined with ornamental grasses and bushes, a dull uniformity of dark green. As we sat looking out the window, my grandpa lamented that he never sees cardinals anymore; in fact, he rarely sees any birds or animals at all. Without thinking, I told him that environments with little diversity won't attract the same species as, say, a native prairie. This morsel of information was something I had learned that summer working as a restoration technician. I was proud of myself for utilizing my newfound knowledge, but that satisfaction evaporated when I realized the bottom line: My grandpa doesn't get to see his cardinals.

Accessible fixes exist that can make a difference for the wellness of our planet.

With industrialization and urbanization, humans have disrupted the natural world, and we must now deal with a rapidly changing climate. Species are going extinct; our natural resources are severely depleted; and nature's wonders that we adore are receding as time ticks on. It's easy to despair at the thought of never seeing your favorite bird or butterfly again. But all hope is not lost—accessible fixes exist that can make a difference for the wellness of our planet.

One of these fixes is ecological restoration, the process of rehabilitating damaged environments. Tasks such as planting, invasive species removal, and prescribed burns all encourage biodiversity and increase the overall resilience of an ecosystem. But there is so much more to gain from pursuing restorative work. Restoration efforts made now will not only further the goal of rehabilitating ecosystems and reintroducing species, but also delay the impending effects of climate change. Having been deeply moved by my experience working in this field, I believe it's only right that I make a proper case for the work of ecological restoration.

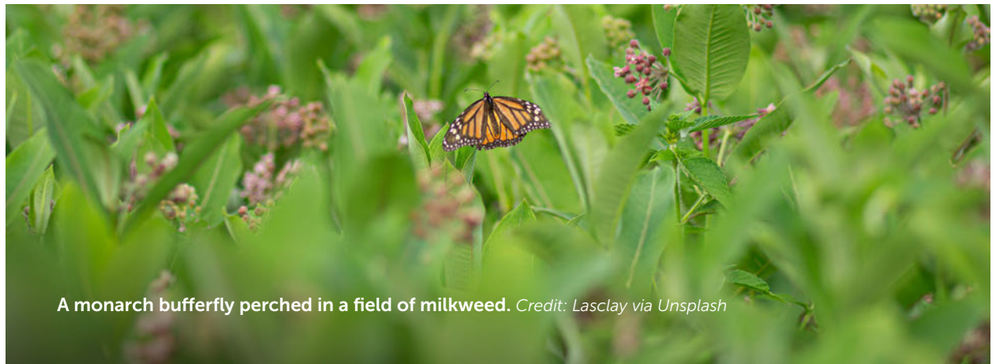
I spent most of last summer working at the Ferson Creek Fen Nature Preserve, a 40-acre wetland sandwiched between the Fox River and Route 31 in St. Charles, Ill. Over the summer, it became a second home to me. We all were, in our own ways, protective of our prairie domain. Like a pack of guard dogs, our heads would turn in unison when a car pulled into the Fen's parking lot, as if its passengers might pose a threat to our hard work.

This preserve has been to hell and back — literally. There were areas my supervisors referred to as "hell" and "super hell" due to the terrible state they were in a few seasons prior. But as we stepped out of the park district trucks each morning, and the symphony of sweet and earthy smells from the unique plants flooded my senses, Ferson Creek seemed the very opposite of hell. If the smell wasn't attractive enough, a feast for my eyes lay just a few paces away. I couldn't even attempt to count how many different flowers were visible along the boardwalk. As the sun rose higher into the sky, the birds trilled their distinctive calls, and the sedges waved a quiet good morning. Before the removal of invasive species and the reintroduction of ecologically friendly plants began, the scene here consisted of dense tangles of ugly cattail from the boardwalk to the river — hell, in other words. This new Fen Preserve, by contrast, is a poster child for the bountiful efficacy of a restoration approach.

I consider myself very fortunate to have received the introduction to restoration work that I did. My supervisors, Patrick Bochenek and Stephanie Wolfe, acted as my mentors during the summer. There was a lot for me to learn, but they were there to answer all of my questions with a smile. Stephanie (or Steph), a U. of I. alum, studied environmental science and was drawn to this field by positive outdoor experiences from her upbringing in the Midwest. Patrick, on the other hand, boasts that he came to restoration ecology through a "mid-20s crisis." I grew to admire their passion for and knowledge of the natural world. As a result of their guidance, not only was my understanding of plants and ecosystem function transformed, but my appreciation for nature was irreversibly deepened.

In a recent conversation with Patrick and Steph, I asked how they would convince a complete stranger that restoration is important work ... and they laughed. Both agreed that it's hard to make someone care about something they have no empathy for. And it's equally difficult to inspire action toward goals that require sustained commitment. Restoration is a long-term game and has to be strategically planned. Most people tend to focus their energy on immediate concerns, hence the lack of attention this field receives. Something I heard my supervisors utter more than once is that restoration is "understaffed and underfunded." Despite these challenges, it is crucial. In the end, Patrick and Steph helped me compile a list of convincing arguments for prairie restoration — many I hadn't even thought of before.

I could easily recite these reasons for pursuing restoration like a to-do list, but where's the fun in that? As I thought through each point we discussed, specific memories from my summer in the sun resurfaced. All of the benefits of restoration, it turns out, were embodied in my experiences.



A monarch bufferfly perched in a field of milkweed. *Credit: Lasclay via Unsplash*

If certain aspects of these complex systems are lost or endangered, the entire ecosystem will pay the price, not excepting us.

While at work, mud under my nails and a blend of sunscreen and bug spray soaking into my skin, I would have people come up and thank me. Visitors of the Fen appreciated what we did; they would praise the beautiful landscape and view it as the perfect spot for a quick break. Even after spending a whole day tramping through mud and sweating out half my body weight, I still found myself to be in incredibly high spirits when I clocked out. "There's a reason why people have pictures of nature in offices and need to get out and have vacations," says Patrick. "There's this innate thing about being human that draws you to these areas."

That "good feeling" you get after some time outdoors has a documented scientific explanation. Studies show that spending more time in nature benefits human respiratory, cardiovascular, reproductive, and psychological health. Put simply, you can't ignore the refreshing feeling of a trip to the mountains, the beach, or even something as simple as a walk through your local nature preserve. Setting all the environmental benefits of high-quality natural areas aside, restoration grants us the privilege of experiencing beautiful green space. The collective morale of humans would be measurably lower without access to nature. At the same time, we must remind ourselves that nature doesn't exist solely for our benefit. Ecosystems sustain themselves and everything within them. If certain aspects of these complex systems are lost or endangered, the entire ecosystem will pay the price, not excepting us.

In order to understand why my grandpa's beloved cardinals aren't sticking around, one must understand biodiversity and ecological niches. For instance, let's look closely at the relationship between swamp milkweed, monarch butterflies, and cardinals. Monarchs lay their eggs on milkweed, a caterpillar host plant. Cardinals like eating monarch caterpillars and can be spotted foraging through stands of milkweed in search of a meal. Losing milkweed would eliminate monarchs in that ecosystem, in turn taking away a source of food for cardinals and forcing them to search elsewhere. You'll witness a domino effect of species disappearance if you take away the ecological niche of just one species.

Steph mentioned that there has been a noticeable decline in monarch butterflies at our sites. "We've only seen a few within the last month or so, whereas you used to see hundreds of them migrating at a time." Changes in land use and extreme weather events are having an effect on the amount of thriving milkweed and many other flowering plants, influencing monarch feeding and reproduction. Milkweed was actually one of my favorite plants I learned about on the job. Its countless buds craft a flower comparable to a firework. The flower was easy to spot at the Fen Preserve thanks to our restoration work, but more can always be done. If there's an obvious reduction in monarch numbers at a restored site, odds are other areas are experiencing this, only worse.

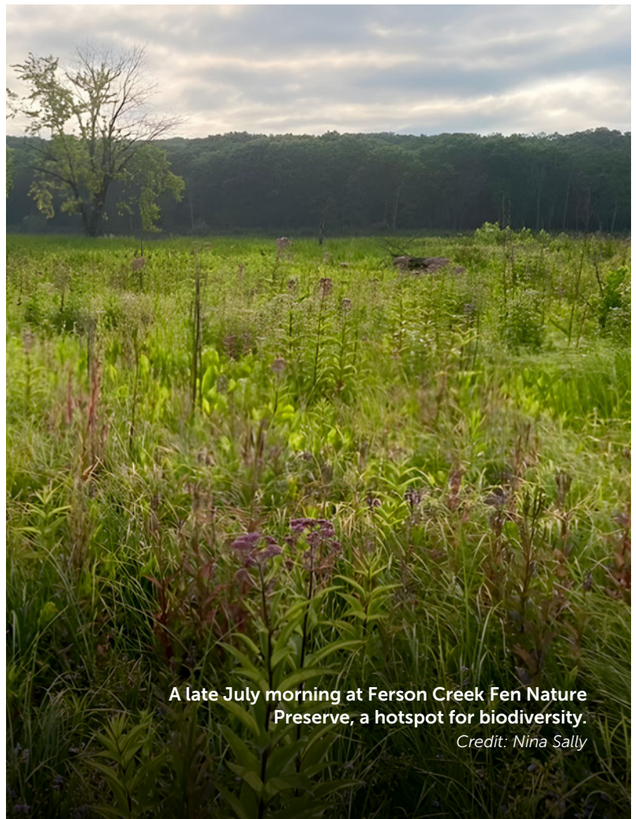
It stands to reason that biodiverse ecosystems attract more animals and insects than a strip of ornamental grasses. For my grandpa to see his cardinals, their ecological niche needs to be established in the surrounding environment — something that isn't happening in our suburban habitats. Biodiversity means species variation on every level of biological organization. When an ecosystem has a wide range of plant life, plants that provide different benefits and have different needs, the ecosystem will attract a greater array of animals and insects to fulfill those needs and reap the benefits. With greater variation in the ecological niches found in an ecosystem, competition for habitable space and food is reduced, allowing more species to coexist. Restoration allows for more species, plants and animals, to inhabit a natural area.

Swamp milkweed in bloom at the Ferson Creek Fen.
Credit: Nina Sally

Monarch caterpillars rely on the swamp milkweed.
Credit: Nina Sally

Plants in particular do a lot for an ecosystem on top of attracting different creatures. As I survey the Fen from the start of the boardwalk, I am stunned by the variation in color and shape provided by the plants. Identifying different plants was the most important part of my job because, in many ways, they were my coworkers. At the beginning of the summer, I started a list of every plant I learned about; it wasn't long before I stopped keeping track due to the sheer number of plants I was encountering. But that's a really good thing. The variety of plants will influence how resilient an ecosystem is.

Resilience is a very favorable trait for ecosystems. Its importance becomes obvious when we face extreme weather events and changes in climate. A site with greater plant diversity can adapt to these changes much more easily, as one species may be able to take over if another is threatened. Many plant species serve similar purposes, so it's like having a handful of back-up plans. As Patrick says, "once you start disturbing the whole synergistic relationship between plants, they won't come back." But providing the proper conditions through restoration will allow plants that once thrived in the area to reappear. As we see circumstances change, the most diverse environments will have the greatest chance of surviving. And as restoration directly influences the plant species in an area, restored environments will have a much better chance of lasting as the stress of climate change increases.



A late July morning at Ferson Creek Fen Nature Preserve, a hotspot for biodiversity.
Credit: Nina Sally

The main force driving climate change today is the presence of greenhouse gases in our atmosphere. But plants can positively impact carbon dioxide levels. When I survey the swaying sedges and bubbling peat bogs at the Fen, the whole place seems to be alive and breathing. Natural areas, especially forests and wetlands, are carbon sinks; they absorb more carbon dioxide than they produce. As we continue life in the Anthropocene, more and more carbon dioxide will be pumped into our atmosphere with no end in sight. Protecting and nurturing environments contributes to the regulation of Earth's carbon cycle and the effective removal of carbon dioxide from our atmosphere.

These restored environments aren't just carbon sinks, they are also filters. Because of the Fen's unique location, nestled between a road and a river, any sort of runoff from that road filters through the site before reaching the Fox River. I remember one day during the summer, we were planting right off the side of the road. My supervisors had strategically chosen certain plant species for that spot because it would experience the most intense runoff from the road, increasing the salinity of the soil. Effects of climate change, as well as pollution, are taking a toll on our access to safe and fresh water. "Promoting a healthy aquifer, as we undoubtedly run into a groundwater crisis in the next 20 years, is huge," says Patrick. "As a selfish sort of incentive, if you like water, and you like your river, all of this stuff is a giant filter." If the Fen wasn't there, that runoff would reach the river, contaminating an important drinking water source for surrounding communities.

Each task we carried out had a purpose that made St. Charles and its natural areas a better place. I was lucky enough to witness everything unfold. With a judiciously applied herbicide, for example, you could see its positive effects in just days. The invasive species we targeted turned yellow and frail, eventually crumbling to the ground. Within a week or so, the patch we hit would be gone, opening critical space for native re-planting.

Our progress was possible due to the relatively small size of the sites we cared for. The availability of resources and working hands will strongly dictate the efficacy of your restoration efforts. Remember, "understaffed and underfunded." Where I worked, we had a modest team of six, but our little task force was reduced to four once the other seasonal worker and I headed back to school. We were able to get plenty of work done, but would obviously have been able to do much more if we had the means to. That's why it gets tricky when you increase the size of the area that needs restoring. Tricky, but not impossible.

Bison calves are born in the springtime at Nachusa Grasslands Preserve, Illinois.
Credit: Charles Larry via The Nature Conservancy

A misty dawn at Nachusa Grasslands.
Credit: Charles Larry via The Nature Conservancy

Midewin National Tallgrass Prairie and Nachusa Grasslands, for example, are two of Illinois' most successful large-scale restoration projects. Nachusa has 4,000 acres of restored remnant prairie, while Midewin sports a whopping 20,000 acres. Midewin was established as the country's first national tallgrass prairie in 1996. Funnily enough, the land that is now Midewin once housed an ammunition manufacturing plant. Since its establishment as a restoration zone, over 600 plant species and nearly 150 species of birds, mammals, and fish have taken up residence at Midewin. They even have bison! Bison also roam the landscape of Nachusa, which one-ups Midewin with its impressive assortment of 700 plant species and 180 bird species. Both sites have the luxury of being managed by large organizations — the U.S. Forest Service and The Nature Conservancy — which enables the ongoing efforts that make their restoration possible.

Big Bluestem Grass
Credit: National Park Service

Prairie Burning Star
Credit: Joshua Mayer via Wikimedia Commons

Purple Coneflower
Credit: Jakob Spring via Pexels

White Wild Indigo
Credit: Eric Hunt via Wikimedia Commons

My own trip to Nachusa was very special. On a bitter November afternoon, the big bluestem grasses whispered to each other as the relentless wind wound its way. Accompanied by my boyfriend, Jack, we found ourselves alone on the restored prairie. While all the plants had reached the dormant stage in preparation for winter, I could still point out to him the white wild indigo, coneflower, prairie blazing star, and so many more. We hiked around, observing the rippling scene blanketed by different shades of orange, green, and brown plants. Seeing just how far this prairie stretched was incredible. My eyes focused on a dark, moving blob in the distance ... bison! A welcome surprise, since I hadn't expected to see any. As we weaved through the trails that had been shaped for visitors, I was in complete awe of the fact that this was a restored site. With all that I now know about restoration, I can't even begin to fathom how much work has gone into rehabilitating Nachusa through the years.

The scale of a restoration project will greatly affect how much can feasibly be done, but if the funding is there, you're golden. Working on the small site at Ferson Creek allowed our efforts to be physically manifested in front of us, though certain restorative tasks took longer to show their results than others. For example, we could plant 1,000 sedge plugs in a day and see them grow a few inches within a week, but it would take years for them to become a lush, coherent sedge meadow. This variability of return based on the task is something that holds the field of ecological restoration back. Restoring environments will yield positive long-term outcomes, but investors often prioritize projects that offer more immediate returns. This stands in the way of upscaling restoration efforts that come to fruition only in the long term.

We will continue to see our world change, and whether that change is for better or for worse will depend on what is done today. Restoration ecology is a force for good in this equation.

When I think back to my first day at the Fen, I realize just how little I knew. At my first sight of it, all that crossed my mind was how beautiful it was. But looking at the Fen for the last time, at summer's end, was different. Everything I learned about this ecosystem in only three months came rushing back. Ferson Creek isn't just a place for people to admire natural beauty or enjoy some fresh air; it is also a powerful, miracle-working machine. The Fen performs key functions that support humans, wildlife, the atmosphere, and waterways by simply existing. Pity us if we only come to appreciate these precious places when they're gone.

Just as my grandpa no longer sees his cardinals, our own favorite species might soon disappear under a business-as-usual regime. But we have the ability to defer and even prevent this; we just have to put in the effort. To some, restoration may seem like glorified landscaping. But when you understand its purpose and long-term benefits, it quickly becomes clear how crucial this work is for the future of the environment — and our own. We will continue to see our world change, and whether that change is for better or for worse will depend on what is done today. Restoration ecology is a force for good in this equation. Without the work of the St. Charles restoration team, the city's residents would miss out on brilliant displays of flora and fauna at the Ferson Creek Fen Preserve, as well as its countless flow-on benefits to the atmosphere, animal life, and human health. As I can vouch from personal experience, taking care of even one small-scale nature preserve can create lasting impacts. Mother Nature does so much for us — she deserves a bit of reciprocity.

Ironweed, native, grows next to invasive wild teasel.
Credit: Mike Robinson via Unsplash

Nina Sally graduated in May 2025 with a B.S. in Earth, Society, and Environmental Sustainability and a minor in Political Science. She is also a recipient of the Certificate in Environmental Writing. She hopes to work in species and natural resource conservation.

Credit: Marco Buschini via Unsplash

GABE LAREAU

HEADED DOWNSTREAM

“Don’t splash any water into my mouth,” I said. “I don’t wanna get sick.”

“Do you think I’ll need Dramamine?” my girlfriend asked. “I might throw up.”

“If you do,” I replied, “you’d be doing the White River a favor.”

We were at Frank’s Paddlesport Livery in Indianapolis to canoe the city’s sole body of water, at our own risk. Owned and operated by experienced paddle-sporter Peter Bloomquist — “Frank’s my dog,” he said — the livery is hidden by trees, sandwiched between the Central White River Trail and the White River itself. Across the water, Bloomquist pointed out Herron-Riverside High, which looks more like a fortress than a school. D-Day was planned there. And like Eisenhower’s soldiers, I thought, I’ll also be saying my prayers in the water today.

Bloomquist was quick to reassure us. “Things are definitely looking up for the White River,” he said. “As an experienced rafter, looking at comparable rivers around the country, I’d rather be in the White River. Moving water is good.”

Bloomquist’s boathand, a local high-schooler named Cameron, wasn’t so sure. “I told my mom I got a job here and she was like, ‘You’re *really* gonna work on the White River?’”

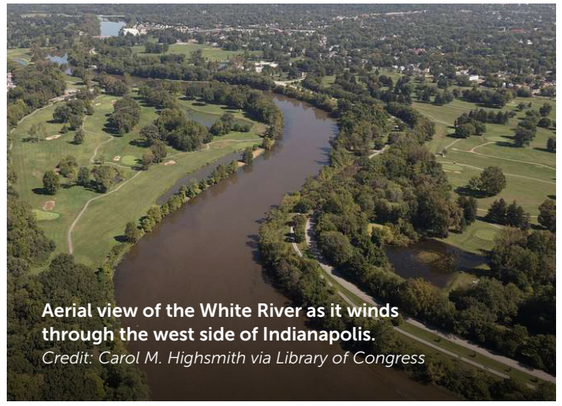
When you look at what the White River has tolerated, its C grade is borderline miraculous.

It was not too far away from Frank’s Livery when, in May of 2022, author John Green took out his phone to record a TikTok that brought White River pollution home to a wide audience. In his sweat-soaked Indy 500 ballcap, Green panned his camera to a gently flowing brown stream surrounded by greenery. “Never before did so many fecal coliform bacteria come together to form such a beautiful river,” Green said. Under his narration, a closeup of a shoe insole appeared, gently bobbing in the murky effluvia.

In May of 2023, one year after Green posted his video, a team of organizations — the White River Alliance, the Nature Conservancy, and the University of Maryland Center for Environmental Science among them — finalized the first ever “White River Report Card.” The University of Maryland Center for Environmental Science has compiled multiple such River Report Cards which grade individual aspects that culminate in a final score. Across different categories assessing its health, the White River watershed earned the surprising, if not remarkable, grade of C.

“I would say Cs are pretty typical,” Brown said, referencing Maryland’s other river report cards. “[The White has] some indicators that are doing well. We have some categories earning a B or B+” — the Wildlife Diversity, Aquatic Life, Sediment, and Education categories. “And then we have a couple that scored a D” — Bacteria and Environmental Burden. The Wetland Change category sits at an F. But even averaged out at a C, the White River is fundamentally unsafe. For those wanting to take a dip, “feet, not face” is advised.

Consisting of two forks, the White River basin covers 11,350 square miles of west and central Indiana, home to over 2 million people. In its 362-mile span, just 15 city blocks meet EPA standards as swimmable: from 67th Street to 82nd Street in Indianapolis. Eating its fish is unadvisable in most cases. Drinking the water is out of the question. After kayaking on the White for five years, Green gleefully reported that he’s “only gotten giardia twice.”



Aerial view of the White River as it winds through the west side of Indianapolis.
Credit: Carol M. Highsmith via Library of Congress

When you look at what the White River has tolerated, its C grade is borderline miraculous. *E. coli* from human waste have plagued the White since industrialization. Toxic waste, like coal ash, packed with heavy metals, occasionally finds its way into the river. Agricultural runoff, rich in phosphorus and nitrogen, makes the White’s stagnant portions a breeding ground for harmful varieties of cyanobacteria. And then there’s the governmental problem. The Indiana state government has a notorious history of neglecting the state’s aquatic resources. Seventy-three percent of Hoosier rivers and streams fail to meet federal swimming standards, more than any other state in the United States. Such a lackluster governmental approach signals to industries they can dump whatever they please into the White with little consequence. It took the Guide Corp., a subsidiary of General Motors, to knowingly discharge thousands of gallons of toxic wastewater into the river in 1990 — killing over 4 million fish and contaminating the drinking water for hundreds of thousands — for the State to sue.

The ecosystem known today as the White River resembles its former self in name only. That name translates the Miami-Illinois moniker for the West Fork, *waapikaminki* — “on the white water, at the white water.” The “white” referent: frothy suds atop a healthy, flowing river. Now the murky color of greasy cardboard, this contaminated river-sewer is only known as the “White” because its name would be too difficult to change. For 150 years, until the Clean Water Act of 1972, Indiana’s industrial magnates, and everyone else on the river, shat where they drank.

David Heighway, the resident historian of Hamilton County, north of Indianapolis, reports that industry first arrived at the White River’s banks in 1830 with a small animal hide tannery. In the following decades, water quality declined as industry grew. “By the 1870s, there were already complaints about the quality of the water,” Heighway writes. “The long-feared event” occurred on May 30, 1896, when a levee separating refuse ponds brimming with waste from the American Strawboard Co. burst into the White River. “From Noblesville to Broad Ripple, the shore was lined with dead fish.” And they weren’t the only animals floating down the White. “In the late 1800s, early 1900s,” Kelly Brown told me, “meat processing plants were disposing of so many pigs you could literally see animal carcasses floating down the White River.” The American Strawboard Co., after being sued by the Indianapolis Water Co., was found guilty. The court imposed a fine of $250.

"You want some water?" Bloomquist asked me, before launching the canoe. I said sure, thinking it might help with the nausea. Soon enough, I was holding "genuine Indy water" in a sky blue can emblazoned with the logo of the Citizens Energy Group — the company in charge of the new DigIndy sewer system. Its mission, to keep poop away from the White River, seemed especially urgent when I tasted the water. Even treated, it had an odor.

Indy's 19th-century sewer was not constructed for a growing population. That's why, today, a rainfall of *a quarter of an inch* is enough to overflow its capacity and discharge feces into the White. Called "combined sewer overflows" (CSOs), these events have long plagued the White River and rendered it an extension of Indy's sewer.

DigIndy aims to remedy this problem with the same solution as London's original modern sewer: If you don't have enough space to hold the poop, you make more space by expanding the sewers. Its solution is coming at the hefty cost of $2 billion.

That's partially because at DigIndy's 250 million gallons of added storage to Indianapolis' sewer — six 18-foot tunnels totaling 28 miles in length — are 200 feet underground. Four tunnels are already in use. "We're set to have everything online next summer," Bloomquist told me, with genuine excitement.

"Will it be enough?" I asked, feeling bad seeing Bloomquist's joy evaporate as soon as it had appeared.

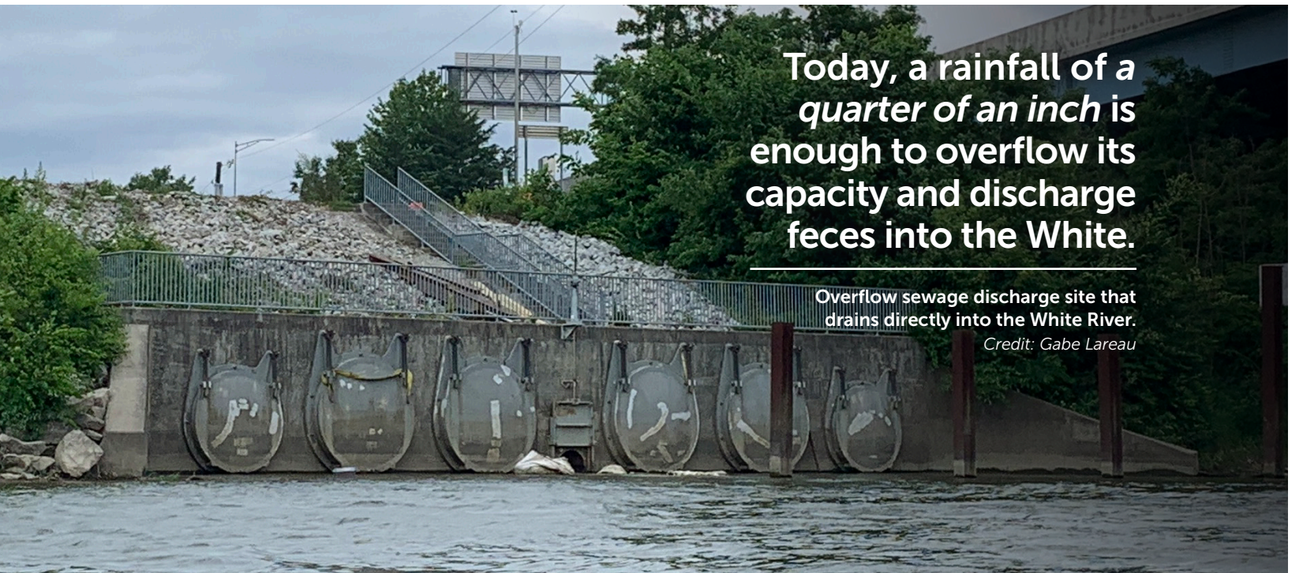
A few problems persist with the "Big Dig," as Brown put it. Yes, DigIndy will significantly allay the amount of *E. coli* making their way into the White River with every quarter-inch rain event. But "they have engineered the tunnels based on data from the late 1990s," Brown said. "It will collect 95% to 97% of illicit discharge. And, due to climate change [causing increased rainfall], there's a lot of anxiety we won't even reach that capture rate." Make no mistake, a 95% to 97% crap capture rate would be a good thing — and one of the first "A"s the White River has ever earned — but it may not be enough.

To swim recreationally in Indiana, state standards require no more than 235 Colony Forming Units (CFUs), or fecal bacteria colonies, present per 100mL of water. Based off data collected by White River Alliance River Assessment Field Teams — volunteer squads enlisted by the White River Alliance to make up for the state government's refusal to consistently fund water sampling — the White River has averaged 1,112.25 CFUs per 100mL since June 2020. If the "Big Dig" removes 90% of illicit discharge, the number of CFUs per 100mL would slide under the state standard at 111.2 CFUs. However, if the "Big Dig" allows "even just six or eight overflows," writes *Indianapolis Star* journalist Sarah Bowman, quoting Dr. Gabe Filippelli, the director of IUPUI's Center for Urban Health, "[it] could create a breeding ground for *E. coli* bacteria."

If Indiana is indeed set to receive 6% to 8% more annual precipitation by midcentury, as reported by Purdue University's Indiana Climate Change Impacts Assessment, then the Big Dig's shallow safety margin over the projected amount of discharge will quickly evaporate. As severe storms become more frequent, so will more intense urban flooding events; not only will *E. coli* make their way into Indy's drinking water, but also its basements.

The greatest aid that Indianapolis could provide the Big Dig, aside from more tunnels for the already $2 billion project, is a well-known environmental hero: green infrastructure. By making Indianapolis more permeable, less liquid crap will make its way into the White. Rain gardens, green areas, and more porous cement all reduce flooding by absorbing stormwater runoff.

However, "green infrastructure is expensive to initially install and is expensive to maintain if you do it properly," Brown conceded. "But compared to the cost of water just being held, pumped to a wastewater treatment plant, getting cleaned and then discharged, it's something that [the White River Alliance] has been interested in talking about. But I would say green infrastructure hasn't been widely adopted by the city yet." Indeed, as Bowman points out, "roughly 34% of Marion County" — where Indianapolis is located — "is impervious, and that number is expected to grow by as much as 5% over the coming decades."



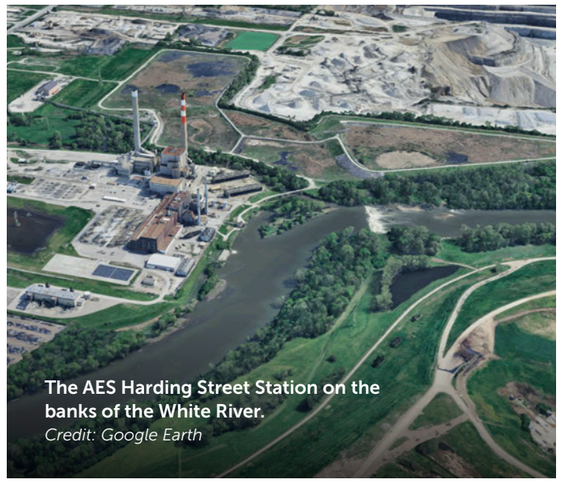
Today, a rainfall of *a quarter of an inch* is enough to overflow its capacity and discharge feces into the White.

Overflow sewage discharge site that drains directly into the White River.
Credit: Gabe Lareau

"It's a very rural-focused Senate and House of Representatives. There is a huge focus on developers and their wishes over environmental quality."

The Harding Street Coal and Natural Gas power plant in south Indianapolis is one of the last remaining visual indicators of how Indiana industry has treated the White River. Its position on the river's banks carried with it easy access to barges and trains carrying coal but also easy access to the plant's nearby dumpster. Pre-Clean Water Act, not only was it easy to dump industrial waste into the river, but Indiana statute *required* industry to discharge its waste into the water. Before the crime was a crime, it was a law.

Today, the Harding Street facility is operated by Indianapolis Power & Light Co. — a subsidiary of the AES Corp. that, in its words, "sustainably" transitioned Harding Street from coal to natural gas in 2015. After 57 years of burning coal, the leftover ash is stored in ponds, an outdated practice most states have phased out but Indiana refuses to ban. These four coal ash ponds situated next to the river are unlined, uncontained, and leak continually. In 2019, 88% of groundwater testing sites near the Harding Street ponds contained pollutants — like antimony, sulfate, and arsenic — above federal advisory levels, which will seep into the White.



The AES Harding Street Station on the banks of the White River.
Credit: Google Earth

In some cases, coal ash ponds fail altogether. In 2007 and 2008, the ponds at the Eagle Valley power station — another AES site several miles downstream of Harding Street — burst. Those ponds, covering 82 acres and containing 2.9 million cubic yards of waste, spilled 60 million gallons of coal ash into the White River. Because of accidents like these, it's now federal law for companies to provide plans to close their coal ash ponds. AES Indiana submitted a plan to do so with Harding Street by 2021. And yet, Harding Street's four ponds — along with 82 others across the state — will remain out in the open until October 2024 when a new EPA rule will take effect.

One option for managing these toxic pits, as other states have done, is to drain them, ship the contents out, and deposit the refuse into a lined landfill that doesn't lie in a floodplain. Instead, the Indiana Department of Environmental Management (IDEM) has renewed Eagle Valley's permit, one which the Hoosier Environmental Council and Conservation Law Center are challenging. Their claim: The state is aiding and abetting AES Indiana to dump 1 million gallons of contaminated water into the White River every day.

Brown says Indiana state government's environmental record is the result of its politics and geography that focuses on economic development over natural resource protection. Where other red states like Wyoming or Idaho have an interest in protecting natural settings where the deer, antelope, and cash-dispensing tourists play, Indiana has no such incentive. "It's a very rural-focused Senate and House of Representatives," she says. "There is a huge focus on developers and their wishes over environmental quality."

Not that the government will know the extent of the damage it has allowed. According to Brown, the state used to sample the White's water quality every three years, until IDEM lost funding. "Now [IDEM] only has enough money to come back and conduct detailed water quality analysis every nine years." Instead, it's the aforementioned White River Alliance volunteer RAFT Program that consistently provides monthly water quality data. "The White River Alliance also does four river cleanups a year," Bloomquist says, an effective morale-boosting and awareness-raising community event during a time when it's "hard to celebrate progress." Even so, the White River volunteer fleet would likely be a sight that General Eisenhower, planning the Normandy invasion, would regard as needing backup. Or even congressional support.

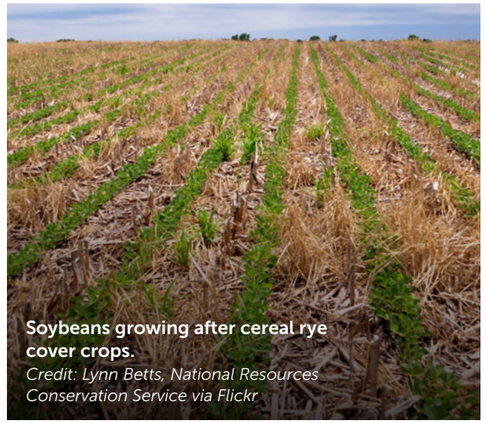
Indiana's crop-dominated landscape is a major contributor to White River algae pollution. Maize and soybean fertilizer — rich in nitrogen and phosphorus — infiltrates the water cycle, providing a steady food supply for cyanobacteria. When introduced to stagnant freshwater, these elements sink to the bottom and supply nutrients to plants that grow alongside the bacteria. The plants and bacteria reproduce at astonishing speed until there's no room for anything else. Once the stagnant pool reaches maximum plant- and nutrient-density, the body of water becomes eutrophic — all the oxygen gets sucked out, killing every aquatic lifeform that hasn't evolved to breathe bacteria soup. That is, all of them.

Like its other issues, the White's cyanobacteria problem is preventable. In this case, there is consensus in the agricultural and scientific community that planting cover crops in every farm across Central Indiana is the solution. These plants, seeded in the offseason, act in much the same way as green infrastructure — filtering out contaminants, reducing soil erosion, and recharging groundwater. By keeping cover crops as offseason wards, the soil stays loose and permeable.

"Farmers get less surface water flow from storms, and therefore less flooding," Brown said. "Depending on what type of cover crop you're using, you'll have healthier soil and won't have to use as much fertilizer the next growing season."

Getting farmers to actually use cover crops is a challenge. The Nature Conservancy, operating out of Indiana, is hard at work trying to convince farmers to use them. But because change can seem challenging and scary, the work faces an uphill battle — fewer than 10% of Indiana farmers plant cover crops.

Cyanobacteria pollution.
Credit: Lamiot via Wikimedia commons



Soybeans growing after cereal rye cover crops.
Credit: Lynn Betts, National Resources Conservation Service via Flickr

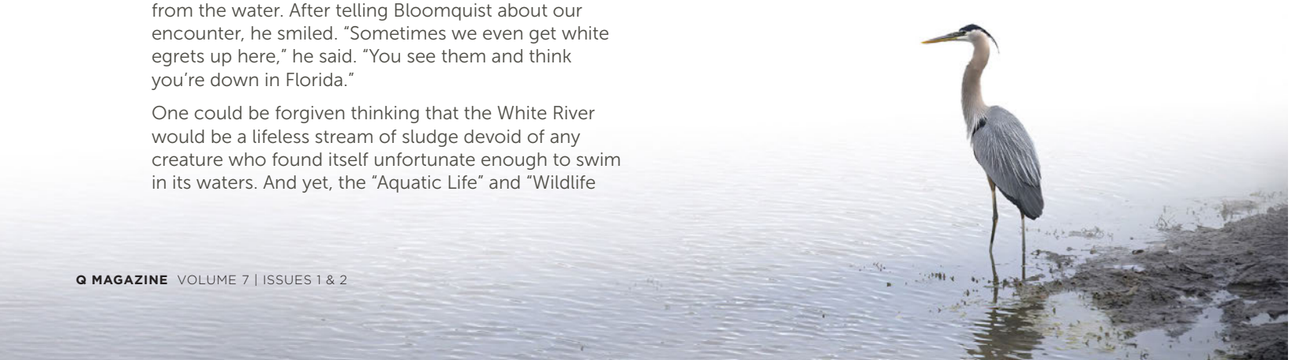
> **"60% of Indianapolis' drinking water comes from this river. The cleaner it is initially, the cheaper it is to treat."**

While canoeing on the White River, we spotted a great blue heron. Attempting to sneak up on a bird as tall as a 7-year-old was a fool's errand. Zig-zagging from bank to bank, we tried to snap a picture, but it always flew away in time — at one point gliding inches from the water. After telling Bloomquist about our encounter, he smiled. "Sometimes we even get white egrets up here," he said. "You see them and think you're down in Florida."

One could be forgiven thinking that the White River would be a lifeless stream of sludge devoid of any creature who found itself unfortunate enough to swim in its waters. And yet, the "Aquatic Life" and "Wildlife Diversity" categories are among the highest scoring in the White River Report Card; they're both B minuses.

"If the animals are okay," I can imagine many thinking, "just don't go in the water. Who cares if humans can't swim in it for a few warm months out of the year?"

"Well, uh, 60% of Indianapolis' drinking water comes from this river," Brown replied a little incredulously when asked this question. "The cleaner it is initially, the cheaper it is to treat. You have to think long-term, too. As the climate changes ... there might not be enough water and we could start to see things like what happens out West."



Author Gabe Lareau canoes along the White with a can of "genuine Indy water" at his feet.
Credit: Karen Kopecki

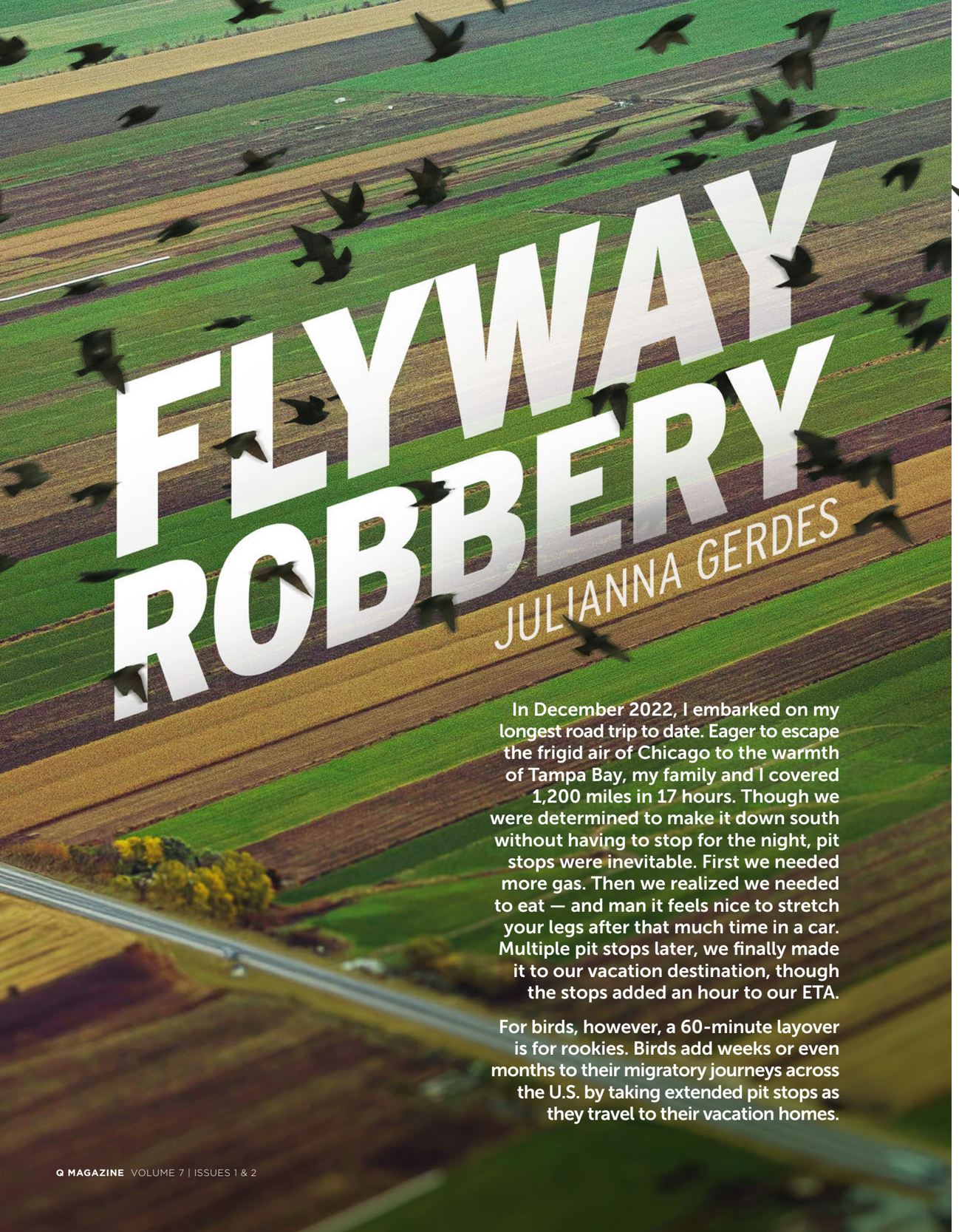
For now, the White River's health is looking up. DigIndy will take care of most of the *E. coli*, coal plants have long been on their way out, cover crops are slowly starting to take root. And, amazingly, the White River still teems with life. We rowed under a canopy of birdsong, outplaying the din of the highway above. If the water were clearer, we'd have seen fish swimming alongside us.

The White's biggest benefactor, and polluter, is Indianapolis. In its diversity and size and location, Indy calls itself a "little America." It is so thoroughly unremarkable, an exact average of every American locale. John Green himself has even described his home city as "spectacular in our ordinariness." That comparison extends to its river, too. The White is a C student. It's just America's average, polluted, neglected, brown, dirty river. Because the White's problems are not unique, its solutions are well-known and widely applicable. If Indiana can revitalize the White, every other river restoration of comparable size looks not just doable, but plausible.

And it's worth saving for its own sake. Every Hoosier I spoke to expressed how much they depend on the White River, and also how much they revered it. Just on a short canoe trip — finding a few moments of solace near Indy's urban epicenter filled with the grind of a million daily lives not seeing a single hint of human-built structure — the river and its birds and its trees went on existing and then persisting and then daring to be beautiful, despite what's been wrought upon them.

At that thought, I couldn't help but smile. But not too big, in case any water splashed up into my mouth.

Gabe Lareau graduated from the University of Illinois with his B.A. in English in May 2024. Originally from Moline, Ill., Gabe currently works on the communications team for the Forest Preserve District of DuPage County.



In December 2022, I embarked on my longest road trip to date. Eager to escape the frigid air of Chicago to the warmth of Tampa Bay, my family and I covered 1,200 miles in 17 hours. Though we were determined to make it down south without having to stop for the night, pit stops were inevitable. First we needed more gas. Then we realized we needed to eat — and man it feels nice to stretch your legs after that much time in a car. Multiple pit stops later, we finally made it to our vacation destination, though the stops added an hour to our ETA.

For birds, however, a 60-minute layover is for rookies. Birds add weeks or even months to their migratory journeys across the U.S. by taking extended pit stops as they travel to their vacation homes.

These rest areas are so critical that birds often spend more time at these stopovers than in the air actually migrating.

Migratory birds are a lot like people: They move south when it gets too cold. That means every fall the birds pack up and hightail it to the neotropics, which stretches from the tip of Florida to South America. Likewise, every spring they start their long trip back up north. This journey of thousands of miles is inspired by nothing less than the essentials: breeding and food. "Most birds are migrating because their current breeding habitat is no longer amenable for survival," explained Janice Enos, an avian biologist at the University of Illinois. These migratory birds spend the warm summers breeding up north, and once temperatures and daylight hours begin to drop, they start a fall migration down to Mexico or South America, until spring rolls around and the cycle continues. "It's not so much of a choice but a fixed behavior that environmental cues will tell a bird when it is time to leave," Enos said.

These birds aren't just "winging it" though. In the U.S., they generally follow four main flyways: the Pacific, Central, Atlantic, and the most populated, Mississippi Flyway. Like cars navigating a highway, birds follow these general paths and can pull off to find stopover points that are critical for their cross-country journeys. Stopovers serve as gas stations or hotels, where birds can rest and refuel for days to weeks at a time before they start the next leg of their migration. These rest areas are so critical that birds often spend more time at these stopovers than in the air actually migrating.

Champaign acts as an excellent stopover site for birds following the Mississippi Flyway. According to Enos, you can see "50 to 60 species on a good day" during their spring and fall migrations. At grassland parks and wetland areas throughout Champaign and Urbana, birds can find adequate food and shelter to rest up along their journey. From a birds-eye view, Champaign County is a green oasis surrounded by a desert of agriculture spanning miles and miles. For much of the route along the Mississippi Flyway though, stopover sites are a much different story.

Habitat Lost and Found

One of the biggest issues facing migratory birds is habitat loss, especially to agriculture, which covers roughly 127 million acres of land across the Midwest. Illinois alone has 27 million acres of farmland, making up roughly 70% of the state. Farm practices like monoculture, tilling, and pesticide use make it very hard for migratory birds to find the food and shelter they need at a stopover, meaning successful migration is much less likely. Fortunately for these birds, they have a famous piece of legislation on their side: the Farm Bill.

Introduced in 1933 as a way to raise sinking crop prices and help struggling farmers by regulating commodity prices, the Farm Bill has since grown to include food stamp programs as well as conservation programs. While the Farm Bill's primary purpose is ultimately to aid farmers, migratory birds also reap the benefits of some initiatives detailed in this legislation. Even better, it is renewed and (usually) improved every five years. Though we are currently operating under a one-year extension of the 2018 Farm Bill, it expires in September 2024.

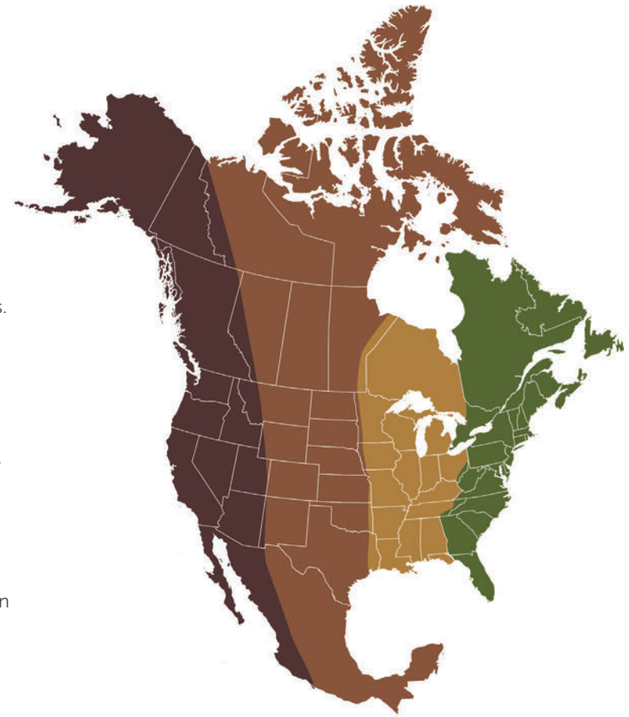


Illustration based on data from the American Bird Conservancy

> “ The Conservation Reserve Program is probably the biggest creator of habitat in the Midwest. ”

“It is enormous and has cascading impacts on lots of different areas for migratory birds — where they’re breeding, where they’re migrating, even outside of the U.S.,” said Mike Ward, head of the Avian Behavior and Ecology Lab at Illinois. He especially noted the importance of the Conservation Reserve Program, better known as CRP, which is outlined in the Farm Bill.

Since 1985, the goal of the Conservation Reserve Program has been to encourage farmers to set aside “environmentally sensitive” land to be used as wildlife habitat in exchange for a yearly rental payment under 10- to 15-year contracts from the Farm Service Agency. This land gets filled with native prairie grasses and wildflowers, while farmers still get paid for land that is no longer producing crops. Migratory birds are able to use this land for shelter as well as a source of food to fuel up before continuing their journey. Call it an environmental win-win-win. “The CRP is probably the biggest creator of habitat in the Midwest. Without that, migratory grassland birds would not be doing very well,” Ward emphasized.

The good news for birds is that CRP is very popular. As of February 2020, about 330,000 farms participated in CRP, setting aside about 22 million acres of reserved grassland. That grew to just under 25 million acres in 2023, providing migratory grassland birds with more places to rest and refuel.

The increase in CRP acreage indicates that this conservation program is having an impact. In 2016, Partners in Flight, a landbird conservation group, created the “Partners in Flight Watch List,” comprising 86 bird species of the highest conservation concern. Several migratory species on this list, such as the Cassin’s sparrow, dickcissel, grasshopper sparrow, lark bunting, and upland sandpiper, have all utilized CRP land during their migrations north and south.

While it is promising that more farmers are using the CRP, there is still work to be done in the name of quality habitat. For a model stopover habitat, Enos said, “You want a lot of native species that are supporting insect or berry populations.” Frustratingly for birds, there is no real standard guaranteeing these qualifications. CRP lands “tend to be strip habitats, really small and edgy,” which are not ideal for migrating birds, Enos said. “In those habitats predation risk tends to be higher.” Birds have very little to gain from low-quality stopover sites, and much to lose. It wouldn’t be a very fun road trip if you were eaten at a rest stop along the way. Unless changes are incorporated in the new Farm Bill this calendar year, farmers will continue to be paid for any CRP land whether it’s quality habitat or not.

The Farm Bill still has quite a way to go before we can stop worrying about the conservation status of migratory birds. Studies suggest that since 1970, migratory bird numbers have dropped by about 2.5 billion — roughly eight birds for every person in the United States. Migratory species that rely on grassland habitat — like sparrows, blackbirds, and larks — are among the most at-risk due to the food and habitat they require at stopover sites.

Cassin’s sparrow, lark bunting, and grasshopper sparrow.
Credit: Alan Schmeirer via Flickr

A dickcissel, a summertime Illinois resident, takes a well-earned pit stop on its migratory journey.
Credit: Wildreturn via Wikimedia Commons

Returning from its wintering grounds in Argentina, this upland sandpiper takes advantage of Kansas’s prairie habitat for nesting and feeding.
Credit: Tony Ifland via USFWS

In-Flight Pesticides

Even if a piece of CRP land offers a good size and plant make-up, another threat may halt migratory bird conservation in its tracks: pesticides.

When asked whether pesticide use was addressed in the Farm Bill, Ward responded with a quick and passionate, “It should be.” The term “pesticide” encompasses chemicals used to kill any type of “pest,” which could include weeds, insects, or diseases. Unfortunately for migrating birds, these harmful pesticides can be found in most potential stopover sites. Every year, the U.S. uses an estimated 1.2 billion pounds of pesticides, and a majority of it is applied in agricultural settings. According to the Smithsonian’s National Zoo and Conservation Biology Institute, 672 million birds are exposed to these pesticides on agricultural land every year, killing about 10% of them annually. Despite these staggering numbers, the Farm Bill has yet to address the problem.

These feathered fatalities can occur for a multitude of reasons, all centered around pesticides. As insecticides kill bugs that farmers don’t want on their crops, they also kill a valuable food source for birds looking to fuel up after a long flight. Herbicides also kill off plant species that support the insects these migrating birds rely on. And killing these plants reduces the amount of shelter available for birds, putting them at risk for predators even if they do manage to find the food they require.

While pesticides play an important role in farming, they don’t belong in a migratory bird’s digestive tract — but that is exactly where they end up. Pesticides can be ingested by birds in several ways: They can eat a berry or insect with trace amounts of pesticides; they can consume pesticides by preening feathers that may have contacted these chemicals; or they can consume the pesticides directly. Birds can mistake pesticide granules for seeds, which presents a new set of biological challenges for these migratory birds beyond struggling for food or shelter.

Studies show that pesticides can cause a multitude of problems for birds once ingested — reproductive issues such as inhibited embryo development and eggshell thinning, as well as loss of coordination, respiratory distress, and organ failure. One study correlated certain pesticides to rapid weight loss and lack of appetite in birds, and exposure to a higher dose of these chemicals led to a more severe loss of body mass. At a stopover site where a migratory bird’s primary focus is to put on fat and muscle, this is an especially concerning possibility as birds interact with these chemicals directly and indirectly. You wouldn’t want to pull over during your road trip at a gas station that takes fuel instead of giving you more — or harms your health.

One way to prevent some of these adverse effects is to use pesticides responsibly. While some pesticides, classified as “Restricted Use,” require a license to purchase and apply, many others are considered “Unclassified” and can be purchased over the counter for anyone to use. “I don’t think they’re well-regulated,” Ward said, noting the absence of pesticide restrictions in the Farm Bill. The regulatory loopholes can lead to unsafe application of these chemicals in ways that cause extra harm to birds, such as applying a higher concentration or dose than required. Increasing restrictions on pesticides, and adding them to a future version of the Farm Bill, would help safeguard our feathered friends.

Failing to follow label instructions can also increase the risk to migratory birds, if chemicals are not applied at the correct locations or times. There may be an easy fix: requiring manufacturers to print labels in multiple languages. An estimated two-thirds of farmworkers primarily speak Spanish, while most pesticide labels are exclusively in English. Many bird conservation organizations, such as the American Bird Conservancy, argue that the next Farm Bill should include requirements to label pesticides and harmful chemicals in multiple languages, giving people who apply them a better understanding of how to do so safely. Though any pesticide in any dose can potentially be harmful to birds, taking actions to ensure that these chemicals are used correctly would be a step in the right direction.

A tractor disturbs a flock of birds.
Credit: Paddy Pohlod via Unsplash

How Do You Like Your Coffee?

Addressing shortcomings in the Farm Bill and pesticide use in the U.S. is only the tip of the iceberg for migratory bird conservation. Improvements like high-quality CRP land or increased pesticide restrictions can definitely help birds migrating domestically, but they also fly internationally twice a year. Birds spend a good deal of the year vacationing down in Central or South America, far away from paid programs like CRP. Though a trip to the neotropics sounds like a relaxing getaway, birds and a wide variety of other animals are threatened by deforestation of lands converted to agriculture.

This agriculture largely consists of growing coffee beans. Latin and South America produce most of the world's coffee. Brazil is the world leader, growing more than a third of the coffee we consume; Columbia is the third largest producer, and Peru sits at No. 9.

Americans alone drink about 179 billion cups of coffee a year, and worldwide 511 billion cups are consumed annually. It's no surprise that coffee is the world's second most tradable commodity. The only problem is that it comes at a heavy cost in the form of habitat loss. In Brazil, 1.7 million hectares of land — roughly the size of Delaware — are set aside for coffee production, and many other Central and South American countries have followed this trend.

Habitat loss from this large-scale production may have adverse effects on migrating birds looking for their winter vacation spot. Deforestation and agriculture in Central and South America shorts birds on both habitat and food sources, making it a challenge for migratory birds to find a viable place to stop for the winter. It would be a shame to spend all that time heading south, just to find out that your winter home had been demolished and no one bothered to tell you.

This problem could potentially be fixed with one change the Farm Bill could encourage. Most coffee is sun-grown, requiring open and tree-free fields to thrive. However, there has been a push to produce more shade-grown coffee — plants that are tolerant to living under the canopy of a habitat-rich forest. "Shade-grown coffee is much better for migratory birds," Ward emphasized.

Sun-grown coffee presents more issues than just habitat loss for migratory birds. Like many agricultural operations, traditional coffee production involves intensive care. Coffee plants require fertilizers that often leak into water sources, hurting both aquatic and terrestrial populations that rely on that water to survive. Coffee growers also use pesticides; as in the U.S., birds face the risk of directly and indirectly consuming these dangerous chemicals. The neotropics have turned into another minefield of risks and dangers that migrating birds need to navigate — except this time, there are no safe spaces like CRP to provide quality shelter or food.

Shade-grown coffee, on the other hand, is much less damaging to the environment and birds. Besides being a much healthier alternative for the land by reducing deforestation and soil erosion, it can save farmers money on production costs. Shade-grown coffee plants do not require fertilizers or pesticides, due to the nature of their environment. Because they are planted among trees, rather than in a monocultural coffee-crop fields, shade-grown plants benefit from nitrogen-fixing bacteria provided by the trees. Soil is also healthier in forest settings, offering more nutrients for these crops. This cuts down on the need for fertilizer, which in turn keeps waterways safe for wildlife. The forest setting also provides plenty of habitat for both migratory and resident birds. And that helps farmers save on pesticides: Birds living among the coffee plants are more than happy to eat the pests that insecticides would have targeted.

Fields of sun-grown coffee in Costa Rica.
Credit: Wikimedia Commons

A forest of shade-grown coffee in Columbia.
Credit: Brian Smith via American Bird Conservancy

Shade-grown coffee sounds like a win for birds, but there is a downside. Sun-grown coffee is more productive and much easier to harvest. Sun-grown plants can produce three times as many coffee beans as their shade-grown counterparts, due to the extra sun exposure and synthetic fertilizers. But while sun-grown coffee may have the advantage in production efficiency, it is possible that the Farm Bill may be able to tip the scales.

"We're trying to get the Farm Bill or other policies to promote the import of more shade-grown coffee," Ward said. "The Farm Bill can't dictate what people in South America grow, but it can dictate how valuable that commodity is in the U.S."

The Farm Bill includes several commodity programs that can manage and control the prices of different crops. While these programs were put in place to protect the income and livelihood of farmers in the U.S., it has inadvertently given us a way to lower the value of some imported goods in America, like sun-grown coffee, and increase the value of other goods, like shade-grown varieties. To do so, however, these commodity programs must be reauthorized when the current Farm Bill expires in September 2024.

Protecting stopover sites for birds is critical for successful migration, especially considering the length of their cross-country journeys. A 1,200-mile road trip was, to my standards, brutal, and I couldn't imagine completing it without pit stops. Any time we were low on gas or food, we were just a quick stop off the highway from a gas station. And fortunately for us, our vacation home did not get torn down and replaced by agricultural fields; nor was our food poisoned (or downright missing). It is no more acceptable to leave migratory birds without shelter and food. Humans are to blame for disrupting migratory flight paths, and it's our responsibility to safely restore them before it is too late to reverse the damage. As more and more habitat is lost to development, pollution, and agriculture, and climate change exacerbates a decline in bird biodiversity, it is only a matter of time before we see these beloved birds begin to disappear for good. While current policies give winged travelers a few options for refueling, there's no guarantee they will be healthy pit stops. All eyes are on Congress as the newest Farm Bill is drafted. Birds everywhere are hoping for good news.

Julianna Gerdes graduated from the University of Illinois in May 2024 with a B.S. in Integrative Biology and a minor in Conservation Biology and Ecology, as well as the Certificate in Environmental Writing. She now works as an environmental educator at Max McGraw Wildlife Foundation, and continues to write in her free time.

Learning with the Land

MOLLY GROSSMAN

If there's one thing environmental historian and U. of I. history professor Rosalyn LaPier is familiar with, it's sharing knowledge.

An enrolled member of the Blackfeet Tribe of Montana and Métis, LaPier has been featured in many projects that have reached wide audiences, including Ken Burns's documentary *The American Buffalo* and its companion novel, *Blood Memory*. Growing up on a reservation, her grandmother and aunt trained her in what Western science calls ethnobotany, an experience that led LaPier to a career centered around the teaching of traditional ecological knowledge.

A distinguished scholar, LaPier's book "Invisible Reality: Storytellers, Storytakers, and the Supernatural World of the Blackfeet" won the John C. Ewers and the Donald Fixico Book Awards in 2018. Another book, "City Indian: Native American Activism in Chicago, 1893-1934" earned the 2016 Robert G. Athearn Book Award. In addition to these publications is an ever-growing list of research papers and articles devoted to contemporary Native American issues.

LaPier's research examines how Indigenous people interact with the land, the overlap of land stewardship and religion, and how traditional ecological knowledge (TEK) can be preserved for the future. *Q Magazine*'s Molly Grossman talks with LaPier about her upbringing on the Blackfeet reservation in Montana, her extensive TEK background, and how Indigenous perspectives can help solve our greatest challenges.

Credit: Rosalin LaPier

Rosalyn LaPier is an award-winning Indigenous writer, environmental historian, and ethnobotanist. She learned ethnobotany by apprenticing with her grandmother, Annie Mad Plume Wall, and aunt, Theresa Still Smoking, for more than 20 years.

Credit: Molly Grossman

How would you define traditional ecological knowledge to someone who has never heard of the concept before?

Traditional ecological knowledge is a term that was created by Western scientists to define what they saw occurring in Indigenous communities. It's not an Indigenous term, it's a Western science term. Most Indigenous communities have different terms and words to describe their relationship with the natural world.

The most-used definition was created by an ecologist in Canada named Fikret Berkes. He was an ecologist in northern Canada who studied Indigenous relationships with fish in the 1970s. And he was recognizing that Indigenous people had a kind of a different relationship with the natural world. He went back to the same community over and over again to look at the way that they were dealing with their own fish ecology.

The definition that he came up with is this: Traditional ecological knowledge is based in three things. The first is knowledge. Indigenous people have an understanding of the natural world, usually based on a long relationship. The second thing is practice, meaning that they practice knowledge of the natural world some way in their daily life. And then the third thing is belief. This is the main difference from the way Western science thinks about the natural world. Almost always in Indigenous communities, there is some sort of religious belief or religious practice around the way the people think about the natural world.

When I first started doing this, I was not using the term "traditional ecological knowledge." I had not learned about it yet. Again, it's a Western science term. But now I like the term and I do embrace it.

The first thing I learned about it was within my own community and with my grandmother and my oldest aunt, who I apprenticed with for many, many years to learn what is called "ethnobotany," also a Western science term.

We keep using Western science terms to describe your work in ethnobotany.

Different communities have different words. When I was growing up, my grandmother always used the English term, "root medicine," which is an understanding of how roots are raised. When she said root medicine, she actually meant all parts of the plants and everything about plants — understanding the climate, weather, ecosystems, and ecology, too.

Can you tell me more about your experiences learning from Blackfeet elders?

When I was learning about it within my own family, the depth of their knowledge never occurred to me until after I came at it from the academic side. Then I was like, "Wow, there really are these like incredible connections between religious practice and everyday knowledge about the natural world."

I worked for a while for an organization on the Blackfeet reservation that did Blackfeet language revitalization and documentation. I worked there for 12 years, and one of the things that I did was interview a lot of elders in order to document the language. I wanted to write about the idea of purification, so I was collecting information from them about smudging. Smudging is a form of purification — you purify yourself, then you can pray and communicate with the divine.

It took them a while to explain it to me in a way I would understand. I'd have to ask them a question like, "What happens to you when you smudge? What are the plants used for smudging?" Really ask things step-by-step. They'd have to think about it, because it takes a while to explain to a young person why you would do things one way versus another way, or why particular plants are used, or why you do something differently than the way another group does it.

I get those questions now myself with young people asking me about plants. Even when I am speaking English to somebody who knows English, it takes a while to explain the "why" of their question.

It seems like your family and community played a big role in pushing you toward learning about traditional ecological knowledge.

I learned way more about soil health from my grandmother than I thought I ever would. I just thought she just knew about plants, but soil is what makes plants work.

She taught me how to smell soil. At first I thought, "Okay, that's weird." She'd always be like, "Smell this. Is it right? No, it's not. You need it to smell a certain way before you can harvest the plants." And then it wasn't until later I was like, "Oh, wait, okay. We're actually waiting for certain microbes to be in the soil in order to know that we're harvesting it at the right time."

The elders I interviewed possessed a lot more knowledge than I thought. Unless somebody really unpacks what they're doing, they're almost always going to answer with, "Well, we've always done it that way. That's just the way we do it." I realized, for example, that we have to wait till there's certain tannins in the root, which give off a certain odor. When we can smell that, that's when we're going to harvest this particular plant.

How can studying Indigenous belief systems help us understand topics surrounding sustainability and ecology?

That's a great question, and I think people are beginning to recognize this more and more. The more people do research on Indigenous communities, the more they recognize that there are these kind of deep connections between religious ceremonies and ecological practices. A lot of Indigenous communities, for example, have ceremonies that are centered on harvesting plants at the beginning of the new year. And for most Indigenous communities, the beginning of the new year is spring. It's not January 1st.

These things help us understand how Indigenous people in the past and today continue to sustain their own ecosystems. It's harder to do that today because of lots of things – climate change, colonization, and larger changes to the natural world.

There's almost always some sort of ceremony that acknowledges the beginning of spring and the beginning of the new year. We celebrate the return of rain. We celebrate planting season. So there's almost always some sort of ritual that is connected to how we use the land and rituals that are connected to the natural cycles of the world.

It's also embedded in the mythology around certain ceremonies that explains why we are doing this a certain way. And sometimes there's a myth where there's a deity who's telling humans to take care of the soil a certain way. We fertilize the soil to prioritize its health, then we can plant our plants.

Does your academic and familial training in traditional ecological knowledge shape the way you discuss it with others?

Most people back home know that I'm a teacher. In most tribal communities, people don't really care what you do for a job. And I know that sounds a little weird. It's very different from Western society where your profession is your identity. In tribal communities, your identity is your family. People don't sit around and talk about what profession they're in — I don't think anyone in my family has ever asked me about being a teacher, not even once. Let me set that as a baseline.

In reservation communities, it's much easier to transmit knowledge to other people because they're literally closer to you. My entire family still lives on the Blackfeet reservation. My mother is still living on the Blackfeet reservation. Most of my cousins and relatives are there. There's only a few of us who don't live on the reservation, and I'm one of them. It's definitely easier to pass on knowledge when you're back home.

I'm usually home every summer, so I am able to work with folks who are asking about traditional knowledge and interested in learning.

However, now we have modern conveniences like Zoom. So I actually do work with several people who are interested in ethnobotany and interested in traditional ecological knowledge. We meet on Zoom or we text back and forth. It's different than if I'm physically there. Sometimes it's a little bit harder in terms of explaining what something should look like, what something should feel like. You can't describe the smell of the soil.

I once had to explain to a student how to identify sweetgrass over Zoom. Sweetgrass is hard to find "in the wild" because it looks like what you think of when you think of grass.

We don't want our education to only come from reading — we want it to come from people and the land as well.

You can identify sweetgrass by its vanilla-y kind of smell. But then it makes the entire meadow smell that way, which makes it hard to distinguish it from other grasses that might be present. So you can identify it by what its roots and seeds look like compared to the other plants. Most grasses have seeds, but you don't notice them because they're so teeny tiny.

It seems like your senses serve as your primary tool for data collection.

Like I said, I was really surprised while learning from my grandmother and my oldest aunt that a plant's growing cycle was connected to smell, not just what I was looking at. And one of the things I've learned over time, especially with ethnobotanical knowledge, is that Western science is very sight-based. Indigenous science is much more tactile, where you're using multiple senses and not just looking or seeing what it looks like.

What resources would you recommend to our readers that want to start learning more about TEK?

It depends on the person. There's a couple of great books — one is called *Sacred Ecology* by Fikret Berkes. It is used mostly as a textbook in a lot of classes, but you can just read it.

There's another book by an ecologist named Kat Anderson titled *Tending the Wild*. And that's an excellent book about understanding Indigenous relationships to the landscape.

Beyond conservation and rehabilitation efforts, in what other ways can traditional ecological knowledge be harnessed?

I think most people, when they think about including what is sometimes called Indigenous science, traditional ecological knowledge, or just traditional knowledge, they are almost always thinking about restoring damaged landscapes or restoring overdeveloped landscapes.

But I think that another way to think about TEK is that it is a method of knowledge transfer, a method of education similar to university systems. We pay to go to school, and we almost always take classes with people who are experts in their field. Everybody has a different specialty with TEK. And when you are learning about TEK or ethnobotany, especially within a community, you pay the people that you're learning from because they're experts in their specialty.

Indigenous knowledge is very similar to Western science in that it is based on observation and testing things. If I'm talking about grass, going out into a field and talking about and showing people that grass is preferable to showing them in a classroom. There are ways we do that in Western education systems, to have experiential education and have hands-on education. We do it in agriculture, science — I think that we can continue to incorporate Indigenous knowledge and traditional ecological knowledge into Western education systems.

Any final words related to learning traditional ecological knowledge and sharing information?

There's a lot of information out there in our modern world. A lot of books and articles have been written, and there's a lot that people can learn from reading about traditional ecological knowledge. I think one of the things to remember as people educate themselves using these methods is that behind that information and knowledge are people.

The people who know this information are connected to the land and landscape, right where that knowledge comes from. We don't want our education to only come from reading — we want it to come from people and the land as well. We can continue to protect those places, the land and landscape and the Indigenous people from those lands, because that is where the knowledge comes from.

Molly Grossman is a December 2024 graduate with a B.A. in English and a recipient of the Certificate in Environmental Writing. Originally from the northwest suburbs of Chicago, she served as *Q*'s student editor for the Spring 2025 semester.

THE GOOD FARMER'S DILEMMA

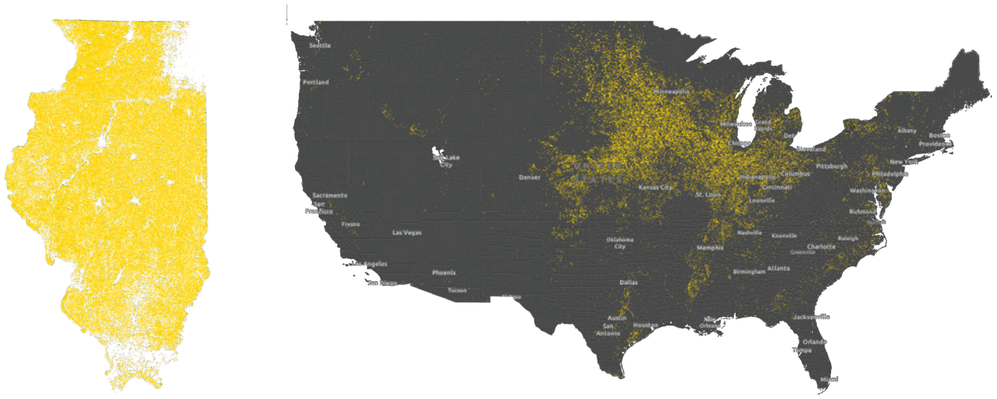
SOPHIA BEEM

The legacy I once took for granted is more fragile than I realized, a tension between tradition and change that I've only just begun to understand.

As a kid I ran among the corn with my cousins, green stalks rough against our red elbows. We played until we were tired and sweaty and ate ice cream that Grandma scooped for us out of a gallon plastic tub, which would later be used for scraps to feed the chickens. In my grandparents' house I slept on the couch under a scratchy wool blanket. I watched out the big window beyond the trees and Grandma's vegetable garden and the rows of corn swaying in the moonlight. My grandpa always woke up first, tending to his farm with a devotion that was as much reverence as routine.

To him, the land wasn't just a place. "A farmer has to care for the ground," he always said. He worked, we played, the fields were whole and green and coarse. The corn was steady. My cousins grew up and learned how to tend the corn and the land, while to me, living in the city, it was always just a childhood memory of tag.

Now, I approach the farmhouse from the road, its white siding visible against the blue horizon. There's a weight in the air here that feels tied to more than just the soil and stalks — it's tied to a legacy of stewardship that runs through my family. This is the stewardship that I have never known in that same way. It smells of tilled soil and the sweetness of ripening crops. As I park the car and step out, I can see Grandpa up ahead, his familiar, steady gait, his silhouette framed against the corn that he knows so well, each season, each yield, a testament to his bond with the land and the generations of my family who have known it. The cornfields are still steady and unchanging, but they no longer feel untouched. The legacy I once took for granted is more fragile than I realized, a tension between tradition and change that I've only just begun to understand.



Corn fields in Illinois and the United States in 2024, highlighted in yellow.
Credit: USDA National Agricultural Statistics Service

My grandparents live and work on a farm in Western Illinois of about 100 acres, a modest portion of the state's agricultural tapestry. Illinois has 27 million acres of farmland, making up 75% of the state's total land area. My grandparents rotate corn, soybeans, and pasture ground for the cattle livestock on their acreage. Corn is a constant — it always has been. "Corn to me is a good crop because you plant it and you spray it and you get it right, it's an easy crop to grow, easy to harvest," my grandpa says. Most of the corn he grows is used to feed his cattle in a self-sufficient loop of production. My grandparents display this resourcefulness in many ways: growing their own fruits and vegetables, collecting fresh eggs from their wire chicken coop, reusing all plastic containers, and mending their own clothes. They are always finding ways to repurpose bibs and bobs, but when there is surplus corn crop to sell, its fate becomes a mystery. They take it to Meredosia on the Illinois River. "We don't have any idea where it goes after we sell it," Grandpa says. This is the nature of the industry.

Corn is a global commodity, with prices rising and falling based on exports, weather, and demand. The economics of it all, the prices and the selling rates, are no strangers to my grandparents, with unpredictability one of the constants of farming. Still, the intricacies of subsidies and international trade feel distant compared to the immediacy of tending their fields. "If you have a good crop and have something to sell, that helps, too," Grandpa says, a simple truth that has echoed across the generations.

That said, the importance of buying and selling has shifted over my grandparents' lifetimes. Since World War II, the U.S. Corn Belt has been transformed by large-scale, industrialized farming. This has been mainly focused on corn and soybean monocultures. This system has boosted crop yields and driven economic output — but at a cost. The tallgrass prairies that once dotted the region have given way to uniform fields, the land homogenized, the diversity of the land and the farms shifted to a highly specialized, productivist approach.

A recent study by Ben Leitschuh, William P. Stewart, and Carena J. van Riper introduces the concept of the "good farmer" as a framework for understanding how these systems fit with local community identity. Conducted through the Department of Natural Resources and Environmental Sciences (NRES) at the U. of I., their research highlights how this "good farmer" identity includes a sense of place-making, land stewardship, and farm viability beyond mere profit. As my grandpa says, "A good farmer has to care for the ground, firstly." There's a level of dedication to the earth itself that is manifested in the daily toil of the job. "You got to want to till it, got to want to treat it right, got to want to put in the right fertilizer."

When I ask Grandpa about his experiences in agriculture, I learn just how this rhythm is etched into his daily life. He's a fourth-generation Illinois farmer. He started milking cows before sunrise when he was just six years old. His dad kept about 40 cows and the kids milked them morning and night. Back then, their farm consisted of a cycle of cows, corn, and hay. As a kid, my grandpa worked the farm two hours in the morning and two hours at night after school, and there was always something to do on Saturday. That is the life he's always known.

I didn't grow up on a farm like my parents and grandparents did, but living in Central Illinois means that corn was always nearby. Every year I played in a local 3v3 soccer tournament at the Chatham Sweet Corn Festival. Always falling on the hottest weekend of the year in late July, the small-town festival had

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For my grandparents, farming is more than a livelihood — it's a legacy.

vendors and food and live music. Apple juice pouches were passed out at sponsored booths at the soccer fields, and parents would set up camp in patches of shade with coolers and canvas camp chairs. Each year I knew the sun might make me sick — someone invariably threw up from the pounding heat — but I still looked forward to the steaming ear of buttered sweet corn I got to eat after the games. This festival was more than just a few days of food and soccer. It was a celebration of identity, showcasing how this crop is a symbol of local pride and connection to the land. Illinois runs on homegrown corn.

Yet, sweet corn is just a tiny parcel of a vast industry. It's a variant species, less than 1% of the annual harvest in Illinois, picked early before the extra sugar has a chance to turn into starch. Field corn, the dominant crop, isn't the stuff you eat off the cob at festivals. It's destined for livestock feed, ethanol, and processed foods. Sweet corn is representative of the local farmer, the plot of crop in the backyard, not the industrial beast that corn is today. Corn, whether it be sweet corn or field corn, has a conflicting place in Illinois identity. It's both a cultural touchstone and a cornerstone of big agriculture.

This duality reflects a growing tension. The historical context of Illinois agriculture reveals a significant shift from small, family-run farms to large-scale, mechanized operations focused on maximizing yield and profit. According to Leitschuh et al., this transition from small to big agriculture has resulted in "massive farm consolidations, soaring farmland prices, population decline in rural communities, and families coping with the loss of land and livelihoods that had been passed down for generations." The corn is reshaping rural life. "A lot of the trees are gone," my grandma tells me, reflecting on the area in West Central Illinois where she was raised and where she raised her children. "It's all big fields now." This evolution of Illinois agriculture from small, family-run operations to expansive industrial farms has reshaped not just the land, but also the identities of those who work it. For my grandparents, farming is more than a livelihood — it's a legacy.

Corn has a paradoxical dominance in the "good farmer" framework. Corn receives the highest level of federal subsidies, yet most of it is not directly edible and instead feeds industrial processes, like biofuels and livestock feed. This seems at odds with the "good farmer" identity of legacy and farm-to-table. Growing corn is resource-intensive, requiring large amounts of water, fertilizers, and pesticides. The cost of corn seed has just about doubled in the past three years. There are endless layers to peel back, like the husk of an ear of corn, layers to the place-making of corn in the state. An Illinois farmer with thousands of acres of corn may struggle to produce food without substantial processing, highlighting yet another conflict in how this crop is supported and exists within the history and heritage of Illinois.

"You're gonna get rain or you ain't gonna get rain," Grandpa says. "The weeds are gonna come up or not. After you put it in the ground, it's up to God until you take it out." This balance of control and surrender defines the mindset of many farmers. The "good farmer" understands that stewardship doesn't mean mastery — it means humility, working with nature rather than against it.

This fabric has frayed in recent years. This isn't the same land where generations have raised their children. Grandma says that people living nearby who've recently bought farms are usually hunters with other income sources or absentee owners. They buy land and have someone else farm it and use it

Sweet Corn.
Credit: Imran Mohamad via Unsplash

Field Corn.
Credit: Árpád Czapp via Unsplash

Credit: Sherlock P via Unsplash

Can we reconcile the economic demands of modern agriculture with the preservation of cultural heritage and environmental sustainability?

for weekend getaways during deer season. Along the way, farmers' connection with nature drifts from its roots. Livestock farming is turning more and more to confinement-based methods. Grandpa says it's hard to find a farmer with pigs that live outside. First this shift happened with chickens, then pigs, and now the trajectory for cattle looks similar.

This shift isn't just about efficiency — it's about economics. Most people can't afford to put up these facilities, so the big hog operations finance them. "They come out, put a fancy hog farm in your place, and you have so many years to pay it back and manage the facility," Grandma explains. These transitions strip away independence and deepen reliance on industrial systems. And at the center of it all is corn — the crop that feeds these confined animals, fuels biofuel production, and defines much of Illinois' agricultural identity.

The environmental implications of industrial corn farming are significant and complex. Research reveals the detrimental impacts of monoculture practices, including soil degradation, water pollution, and loss of biodiversity. Corn's water footprint is immense. Its carbon footprint is equally staggering. The inputs required for industrial corn production — such as nitrogen fertilizers and synthetic pesticides — are derived from fossil fuels, contributing heavily to greenhouse gas emissions.

The reliance on corn extends beyond the crop itself, transforming livestock farming. Subsidies from the Green Revolution, taking place from the 1940s to the 1980s, made feed grains like corn inexpensive, incentivizing a shift from open-range grazing to confined feedlots. Over the past century, the diet of cattle has shifted from grass to 90% corn and soy. While this system maximizes output, it has significant downsides. Animal waste, once a valuable fertilizer, now accumulates without purpose. These large-scale industrial practices threaten the fabric of local communities that events like the Sweet Corn Festival aim to celebrate.

"We're the oldest people in this area," Grandma says, looking out at the fields. "When we started farming, it was all small family farmers, but everybody could make a living. Now they've combined all these farms." But they couldn't, really. Grandpa worked for decades in a warehouse managing shipments and my grandma worked at the local Farm Extension office when my mom and her siblings were growing up. Maybe my grandparents remember a time when a family could support themselves with a small farm, but this hasn't been possible for many years. They worked to be able to pay the bills; they worked to be able to farm.

My grandparents' lives, their histories in farming, and their devotion to their land now in retirement raise a fundamental question: Can we reconcile the economic demands of modern agriculture with the preservation of cultural heritage and environmental sustainability? The answer isn't clear. Outsiders may perceive farmers merely as contributors to an industrial system of agriculture. As we ponder the question of preservation and environmental awareness, it becomes evident that Illinois must find ways to better protect its family farming while balancing modern economic and environmental pressures. These small farmers might not fully recognize the environmental impact of their practice, but the reverence and sense of responsibility is always there.

Like many farmers across Illinois, author Sophia Beem's grandparents rely on corn as one of their staple crops.
Credit: Sophia Beem

Beem and her brother, ages 6 and 4, in an Illinois corn maze.
Credit: Sophia Beem

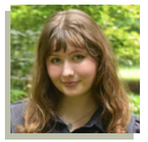
Despite the challenges, farming has always been about more than just the crops. It's about the relationships, the shared knowledge, and the sense of community that sustain rural life. My grandpa's stories, often rambling and peppered with names I don't know but are somehow familiar to all 12 of my aunts and uncles, reveal this tight web. I always assumed my mom didn't really know her neighbors growing up. Playing on Grandpa's farm in the middle of nowhere as a kid, any other home always seemed so far away. But the connection is apparent in my grandpa's roundabout stories: "I was out getting weeds out of the fence-line. Ann came out with a glass of water, give me the water. Brought me out a roll of deer salami, her brother was in Jackie's class, named T-Bone. T-Bone lives in Payson now, was driving truck for a while..." This kind of reciprocity — the gossip, the trade of information and food and water, the lively chatter — is a big part of farming communities. It's not just about survival, though survival often depends on it; it's about connection. These relationships forged over borrowed tools and shared meals form a network that stretches across fields and gardens and weathered front porches. These relationships are worth saving.

Now, as I walk along the fields when I visit my family, corn stretches out beneath a sky that feels both infinite and intimate, a place that has always known me. I think of my grandparents, my aunts and uncles, my parents, of the land that holds their stories and their work — of a way of life that has always been about more than the crops in the ground. It's about roots, not just in the soil. Grandpa tells me why, after all these years, he gets up and tends to the land everyday: "It's just something... to farm you have to enjoy doing it. You have to enjoy seeing the changes. Harvesting the crop. That's the satisfaction of it. I love it. I grew up with it. I didn't realize when I was young that I would be a farmer. It came with me."

Among all the faceless corporations and ever-expanding urban sprawl, local farming communities, my grandmother's vegetable garden, the Sweet Corn Festival, my grandpa's corn field, are a reminder of what we risk losing.

And yet, like so many other urban and suburban people with farming roots, these traditions seem far from my reach. I could not tell how the turns of the weather will green the crop. My fingers tap the plastic keypad of my laptop; they don't dig the soft soil. In Central Illinois, the days get hotter and the livestock are increasingly crowded indoors. Corn sucks up resources even as it provides vital income.

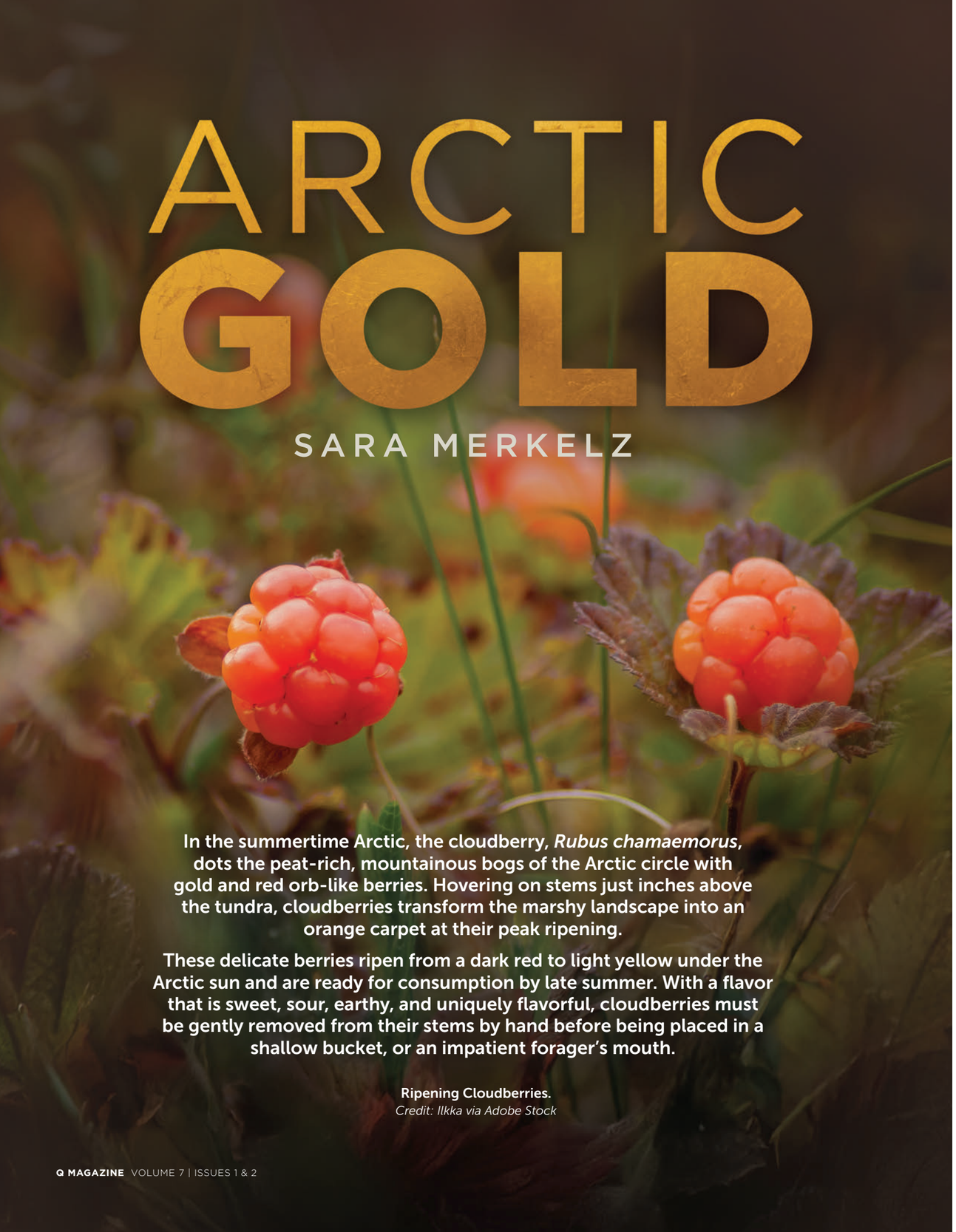
It's a quiet kind of loss — the one I feel when I stand on the edge of the field, or seated inside with my family as they chatter about tractors and prices and harvest schedules — knowing that the life my family has built for generations is slipping through my fingers and theirs, even as it remains rooted in the land.



Sophia Beem is a junior from Springfield, Ill., studying Creative Writing and Global Studies with a minor in German. She is pursuing the Certificate in Environmental Writing and is a Communications Intern for iSEE. Sophia is involved with campus environmental organizing as the Editor-in-Chief of the *Green Observer*.

ARCTIC GOLD

SARA MERKELZ

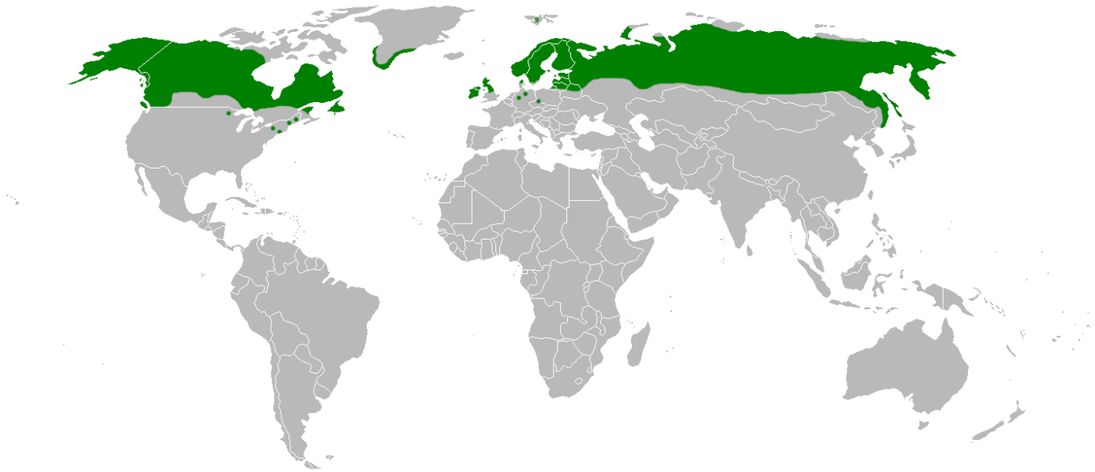


In the summertime Arctic, the cloudberry, *Rubus chamaemorus*, dots the peat-rich, mountainous bogs of the Arctic circle with gold and red orb-like berries. Hovering on stems just inches above the tundra, cloudberries transform the marshy landscape into an orange carpet at their peak ripening.

These delicate berries ripen from a dark red to light yellow under the Arctic sun and are ready for consumption by late summer. With a flavor that is sweet, sour, earthy, and uniquely flavorful, cloudberries must be gently removed from their stems by hand before being placed in a shallow bucket, or an impatient forager's mouth.

Ripening Cloudberries.
Credit: Ilkka via Adobe Stock

The range of the cloudberry shown in green.
Credit: Wikimedia commons



The cloudberry is an important factor in community wellness, a link made increasingly fragile by climate change and commercial marketing.

Upon close inspection, a crouched forager will notice that despite their close relations to the raspberry, these berries are not supported by long prickly vines, but slender stems two to eight inches above the boggy tundra. Each stem produces a single cloud-colored flower that must be pollinated by insects to transform into a sun-like berry. With a range spanning across cultures in Alaska, Canada, Scandinavia, and Russia, the delectable clusters have gained several common and traditional names: low bush salmonberry, bakeapple, knoutberry, *aqpik, aqagwik, algnan, nex'w*, and more, but are most often referred to simply as cloudberries.

When those of us south of the 50th parallel think of activities to do in the Arctic, berry picking isn't the first thing that comes to mind. However, for many Indigenous and long-term residents, berry picking is a cherished activity come end of summer, so much that some Indigenous languages have a verb for it: *Lleech'L*, in the Eyak language of Alaska. Families often have knowledge of a berry patch which has been passed down from mother to daughter, along with traditional knowledge and recipes. Berry picking is a key example of the Inupiat way of flowing with the seasons. Groups will go out for days or weeks to camp at berry sites, gathering as a community and reconnecting with the land.

The Arctic's fauna are also active participants in cloudberry foraging. Bear nutrition expert Charles Robbins noted that Alaskan bears are more often than not foraging in berry fields after satiating themselves on salmon. Leaving no parts to waste, moose and caribou enjoy the leftover woody stems while a small caterpillar in northern Russia feeds exclusively on the leaves. This consumption comes with no complaints from the cloudberry, as the excretion of their indigestible seeds naturally facilitates their wide distribution. The cloudberry is an important food source for many, and while it may be small its absence would leave a larger footprint than just barren soil.

Recently the time-honored practices of Arctic cloudberry picking have experienced a range of threats, including globalization, habitat loss, and climate change. What was once a source of nutrition and pride — not to mention summer beauty — for Indigenous peoples and animals of the north now faces an uncertain future.

Cloudberries are a rare and rich source of vitamin C, vitamin A, and vitamin E, supporting historical references to their use as a remedy for scurvy and other medicinal uses of the plant's roots and leaves. Not only that, cloudberries are rich in antioxidant compounds of carotenoids and ellagitannins that prevent damage from the free radicals that contribute to premature aging and cancer. An essential ingredient to the diet of Indigenous communities who are recently seeing declines in health and nutrition due to food insecurity, the cloudberry is an important factor in community wellness, a link made increasingly fragile by climate change and commercial marketing.

In many Arctic cultures, it is tradition for surplus berries to be shared with neighbors and those who are unable to go berry picking themselves. Even in years with low yields, members of the Gwich'in — located in current day Alaska, Yukon, and the Northwest Territories of Canada — will ration berries, sharing a portion with those who are sick. Inupiat families often create a game of berry picking, where it is a matter of pride to pick more than other family members. The reward: Having the most to share come winter. A source of community, their excess bounty is not meant to be sold. In an interview with researchers in southeastern Labrador, Canada, Gwich'in elder Dorothy Alexie explained: "I just give it away for nothing because it is important for me to do this ... A long time ago people used to give berries away because it was a tradition, just like our culture." While a market may exist for berries, cultural traditions are valued much more highly than the potential profits, a mentality that is now harder to come by outside of Indigenous communities.

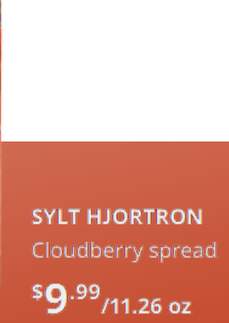
Despite being out of arm's reach from the rest of the world, cloudberries have not been immune to globalization. Not all berry pickers race for the Inupiat prize of sharing; the drupelets resemble a sunset to some, but others recognize the gold glint of profit. The once familial practice of berry picking has since become industrialized to a degree. The issue preventing mass production lies in the fact that cloudberries cannot be cultivated domestically; they thrive in boggy swamps with sufficient winter snowfall. So the pickers must make the treacherous journey through the Arctic swamps to access the 90% to 98% of cloudberries that are left unpicked by Native residents. The brunt of this labor is performed by migrant workers.

In late summer, local families are not the only ones making the journey through the Nordic swamps. They are now outnumbered by workers from Thailand recruited by Swedish and Finnish companies to meet the rising demand for Arctic berries in Asia. For migrant workers, berry picking isn't exactly leisurely skipping through the woods with a picnic basket. They work hard in poor weather conditions, all for pay that is highly dependent on their crop and barely offsets the cost of travel. These working and living conditions have caught the attention of Thai labor and human rights activists, who declare migrant berry picking a human trafficking problem long overlooked by authorities. Thanks to the efforts of migrant workers, this rare and sought-after berry can now be brought to a table near you (in jam form) for under 10 U.S. dollars.

While the berries are only ripe for consumption in late summer, the demand remains year-round. The Thai government made an exception for the travel of migrant workers during the height of the COVID-19 pandemic, allowing workers to risk their health to bring immunity-boosting berries to consumers thousands of miles away. While the majority of cloudberries remain unpicked, it is only a matter of time before conflict emerges between the hands of the global market and local families' berry picking traditions. Of course, in this scenario, it will not be the local cultural traditions and lifestyles but the global demand that out-picks the competitor.

The globalization of the cloudberry has created yet another victim in the loss of seasonal appreciation. A key component of cloudberry culture in the Arctic is the eager anticipation of the changing seasons. The land controls when berry pickers must make their outings, not the individual's schedule. But as commodities are exploited, the growing season cannot last long enough. Any variability, even such caused by climate change, is not allowed.

Cultural traditions are valued much more highly than the potential profits, a mentality that is now harder to come by outside of Indigenous communities.



Cloudberry jam, as listed on Ikea's website for a meager $9.99
Credit: IKEA US

These close yet fragile relationships with the land make Indigenous communities increasingly vulnerable to climatic changes as global temperatures rise at unprecedented rates.

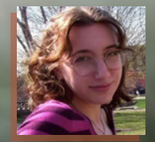
While families often return to known berry patches for generations, these habitats can have highly variable yields, as cloudberries are influenced by factors including precipitation, temperature, soil moisture, and the surrounding vegetation — all of which are at risk of increased unpredictability with climate change. Slight fluctuations are expected, but as Gwich'in community member Dwane Burdett stated in an interview, there are now more extremes in the crop: "Some years there's none nowhere! I've been up there and sometimes you can literally see that the land has an orange glow to it. Like an orange ... a big orange carpet."

Weather events and abnormal variation at any time can have implications on cloudberry success. Locals in Southeastern Labrador have noted that berries have been ripening earlier than normal due to earlier springs, and more frequent intense storm events can wipe out a crop. Some discuss landscape changes at picking grounds, with encroachment of shrubby vegetation that competes with the berries. Palsas (the boggy areas where cloudberries are often found) are estimated to have decreased in area by 64.5% from 2004 to 2016, accompanied by habitat fragmentation and inconsistent ripening time across patches.

On top of the unpredictable nature of the cloudberry crop, it is becoming more and more challenging for community members to participate in berry picking. Resettlement programs and a resulting loss of cultural connection in younger age groups have transformed the simple tradition into a more involved event. Families must now pay more for fuel to reach access points, travel longer distances, and commit more time to the activity. Since it is not always known when the berries will peak, families must risk all their efforts coming up fruitless. Traditionally, berry picking was organized by the women of a family, but now that routine has been lost as single men are often the only ones able to commit to this effort.

These close yet fragile relationships with the land make Indigenous communities increasingly vulnerable to climatic changes as global temperatures rise at unprecedented rates.With the Arctic warming four times faster than the rest of the globe, there is growing pressure for organisms to either adapt or shift their habitat ranges to avoid extinction. While species that rely on the coldest climates of the Arctic may not fare well, there may be hope for the cloudberry as these areas warm into suitable habitat. Ripened cloud berries were discovered for the first time in Svalbard, Norway, in July 2023, the warmest month on record at the Arctic archipelago. Temperatures in the area have risen by 3-5 degrees C in the past 50 years, leading vegetation researcher Virve Ravolainen to believe that the range of cloudberry plants will continue to shift into Svalbard and other southern shores near Isfjorden. Growing on the edge of permafrost, Arctic thawing may actually benefit cloudberry growth as recent studies have found that the additional nitrogen at the thaw front led to increased biomass of cloudberry plants.

However, greater variations in spring temperatures may lead to a mistiming between pollinator emergence and cloudberry flowering. Warmer temperatures may coax cloudberry flowers out earlier in the year, but their insect companions dependent on the amount of sunlight in a day may not follow suit. Along with this shift in seasonal timing, the impacts of climatic changes are also threatening the habitat of potential pollinators. Not much is known about what species facilitate the transfer of pollen that gives life to the fruits of the cloudberry. And with anthropogenic pressures threatening the diversity and abundance of pollinating species around the world, the fate of a key aspect in the cloudberry equation remains unknown. With so many variables at stake, the future of the cloudberry — like the entire Arctic ecology and its communities — is hard to predict.



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Credit: Till Daling via Unsplash

Fizzy Truths

SAKSHI VAYA

It's a hot afternoon on the U. of I. campus. As I step out of class and head toward the Illini Union, the five-minute walk feels like three miles in the sun. Thirsty, I go straight for the vending machine and get a bottle of classic Coca-Cola.

There are few things as refreshing as this sugary fizzy drink in the summer, and billions of people from over 200 countries in the world agree with me.

Every vending machine on the U. of I. campus is contractually bound to sell only Coca-Cola products.
Credit: Kenny Eliason via Unsplash

The trouble starts when I throw the empty plastic bottle draped in familiar red into the recycling bin, feeling good about myself for just a moment. I thought I had chosen the sustainable option.

Most of us have come to believe that recycling is sustainable, thanks to recycling campaigns all around us. But the truth is much more complicated. The bottle I just threw into the recycling bin has less than a 50% chance of being recycled. It's more likely to end up in a landfill or the bottom of the ocean. If someone else decides to dump a bunch of food in the same bin that I used, the trash bag will be discarded due to contamination. And if the bottle does make it to the sorting belt and gets handpicked by the overworked and underpaid worker at the waste station, this type of plastic can be recycled only a couple of times before the polymer becomes too weak to be recycled again.

Unlike metal or glass, plastic is not infinitely recyclable. Even when we successfully "recycle" a Coca-Cola bottle, we're only saving a fraction of virgin plastic that will need to be extracted for the next bottle produced.

I'm talking about Coca-Cola specifically because I'm surrounded by it. Like 63 other U.S. universities, the U. of I. has sold something called "pouring rights" to Coca-Cola in exchange for a percentage profit on all sales on campus. "Every single beverage that is sold on this campus must be Coca-Cola," says Daphne Hulse, the university's Zero Waste Coordinator.

Every vending machine, dining hall, and university-owned convenience store is contractually bound to sell Coca-Cola beverages only, making these bottles a significant component of the waste stream, and a major sustainability concern. But of course, the world's largest beverage company cannot be seen as an enemy of the Earth. Not if their well-marketed sustainability campaigns have any say, at least. Coca-Cola has been involved with campus sustainability at the university for the last five years.

"There is money set aside by Coca-Cola for supporting sustainability initiatives; $10,000 per year," says Jennifer Fraterrigo, Associate Director for Campus Sustainability. Funding recycling campaigns on campus and branding recycling bins on game days with the company logo sure works to trick people into seeing the green side of the beverage company. What few fans realize are the actual numbers on how much plastic is saved.

In her monthly meetings with Coke representatives about campus sustainability, Hulse has voiced her concerns about the company's focus on recycling alone as a sustainable waste management solution. She explained to me that their efforts need to focus more broadly on reducing, reusing, and repurposing items, so that they don't end up in the waste stream in the first place. "Recycling is always the last resort."

The "recyclability" of the packaging does not translate into the circularity of their economy.

Hulse is not alone. People around the world are beginning to question the promises made by their beloved beverage brand. Coca-Cola runs many sustainability campaigns in its markets across the globe, like "World Without Waste," which promote and promise the recycling of their bottles and cans.

In its 2022 Business and Sustainability Report, Coca-Cola claims that 90% of its packaging globally is recyclable. That's a tall claim. In simple words, being "recyclable" means an item can be broken down and remolded into another. This depends on not just the material, but also the existence of infrastructure and systems that make this "recycling" happen. There's a significant hole in Coca-Cola's claim — its material is recyclable, but most countries that the company sells in don't have waste management infrastructure that allows for recycling. The "recyclability" of the packaging does not translate into the circularity of their economy.

One might wonder why a beverage company needs to make any sustainability claims at all. The answer is ESG reporting: the mandated annual public disclosure of information relevant to three sustainability criteria — termed "Environmental, Social, and Corporate Governance." In theory, these reports allow companies to demonstrate their sustainability credentials, thus attracting more investors.


Credit: Maria Mendiola via Unsplash

Year ended December 31,	2014	2015	2016	2017	2018	2019	2020	2021	2022
World Without Waste									
Total weight of our packaging (metric tons)[1]							5.10M[2]	5.30M	**5.95M**
Percentage of recycled material in our packaging[3]					30%	20%[4]	22%	23%	**25%**
Percentage of recycled material used in our PET plastic packaging globally					9%	9.4%	11.5%	13.6%	**15%**
Percentage of bottles and cans we collected and refilled or collected for recycling[5]	61%	59%	59%	59%	58%				
Percentage of bottles and cans we collected and refilled or collected for recycling[6]					56%	60%	60%	61%	**61%**
Percentage of packaging recyclable globally[7]				85%	88%	88%	90%	90%	**90%**

7 Only recyclable where infrastructure exists.

Coca Cola's 2022 Business and sustainability report.
Credit: Coca-Cola Company

However, no one ensures that a company doesn't lie or misrepresent data in order to paint a more sustainable picture of the brand. To quote an article from Harvard Business Review, "reporting is not a proxy for progress. Measurement is often nonstandard, incomplete, imprecise, and misleading."

On one hand, Coca-Cola claims that it collects back and recycles 61% of all bottles and cans that it introduces in the market. On the other hand, Coca-Cola has been ranked as the world's number one plastic polluter brand for three consecutive years, according to Break Free from Plastic's global brand audit report. This is only one example of the many contradictions that exist between Coca-Cola's sustainability self-reporting and the findings from news sources and global agencies regarding the company's environmental impact.

In June 2021, Coca-Cola was sued by the Earth Island Institute, a non-profit, for deceptive marketing regarding its sustainability efforts. More recently, in November 2023, a legal complaint was issued by a consumer body and two environmental groups to the European Commission over Coca-Cola's greenwashing, according to a BBC article.

"A '100%' recycling rate for bottles is technically not possible and, just because bottles are made with recycled plastic, does not mean they don't harm people and the planet," Rosa Pritchard, a plastics lawyer at ClientEarth, told BBC. "It is important companies don't portray recycling as a silver bullet to the plastic crisis. Instead they need to focus efforts on reducing plastic at [the] source."

Coca-Cola has been acquitted time and again from greenwashing lawsuits in the U.S. and Europe, on the grounds that its claims "were merely general and aspirational goals."

The Center for Climate Integrity has released a report titled "The Fraud of Plastic Recycling," which discusses in detail how most plastics can never be recycled. Plastic recycling as a sustainable solution is a false hope, it explains: "The plastics industry has deceptively promoted recycling as a solution to plastic waste management for more than 50 years, despite their long-standing knowledge that plastic recycling is not technically or economically viable at scale."

Coca-Cola chooses to continue selling its drinks primarily in plastic packaging. It chooses to not invest in finding sustainable alternatives to the type 1 plastic bottles, such as reusable bottles, returnable schemes, open dispensing stations, or even a complete shift to metal containers that can be infinitely recycled. Instead, it continues to extract petroleum to fulfill the requirement of virgin plastic. Hundreds of court cases and climate protests later, the company still refuses to make any changes that could cause the slightest dent in its fast-climbing revenues.

> **"The plastics industry has deceptively promoted recycling as a solution to plastic waste management for more than 50 years, despite their long-standing knowledge that plastic recycling is not technically or economically viable at scale."**

Bottles collected for recycling in Nigeria.
Credit: Brighten Silas via Unsplash

The corporate messaging distracts you, and when the climate worsens and plastic pollution increases, you do not blame Coca-Cola, you blame yourself.

Rather, it uses its money to run campaigns to tell you, the consumer, that climate change is in your hands, so you must throw those bottles in recycling bins. The company tells you that the choice to change is yours when it has made the more relevant choices already. The corporate messaging distracts you, and when the climate worsens and plastic pollution increases, you do not blame Coca-Cola, you blame yourself.

Many argue that we don't need Coca-Cola in the first place — the carbonated sugar is bad for humans, the environment, and not a necessary product by any means. "So, let's shut down the industry itself, instead of debating over plastics and recycling," a passionate friend suggested to me.

That is not only controversial, but also a sadly misinformed argument. When you hear "Coca-Cola," you envision a clear plastic bottle with a bright red label. However, that is only one of 3,500 different beverages that the company sells across 200+ countries!

Popular coffee and tea brands like Costa Coffee and Georgia are owned by Coca-Cola. If you drink fruit juices from Minute Maid or Simply, you are drinking from a Coca-Cola bottle. From Powerade to Topo Chico Hard Seltzer, the company bottles a wild variety of drinks. In fact, even if the only bottled liquid you consume is water, it would be hard to avoid Coca-Cola's plastic! Aquarius, Dasani, and Smartwater are all part of the same family.

Hulse shared with me that "Coca-Cola sells significantly more bottled water on campus than soft drinks." In the United States, the company makes a total of $10 billion to $12 billion in yearly revenue, of which over a billion dollars comes from the bottled water brand Dasani alone. This wide range of brands and products ties Coca-Cola to billions of people worldwide.

The choices made in the offices of one company impact everyone — from consumers falling prey to greenwashed marketing, to the low-income communities in South Asia and Africa dealing with massive amounts of plastic waste, to fish in the Atlantic Ocean choking on bottle caps. The company that has made itself a global symbol of refreshment and happiness has also become the reason why a kid in Bangladesh walks barefoot in a landfill to collect plastic bottles that can be sold to scrap dealers for a small profit.

Some of Coca-Cola's Brands.
Credit: The Coca-Cola Company

Ironically enough, in the face of these impacts, Coca-Cola was ranked the world's most sustainable beverage company in 2023, for the seventh time, by S&P Global's Dow Jones Sustainability Indices, which is considered one of the world's leading sustainability benchmarks. It seems it's possible to be the most sustainable company and the biggest plastic polluter at the same time, if you can just display your wares from the right angle to the right people.

Marketing itself as an eco-friendly company, Coca-Cola's sustainability report boasts successful initiatives across all realms — water, climate, waste, agriculture, and global communities. James Quincey, Chairman and CEO of Coca-Cola, notes in the very beginning of the company's ESG report that the strategy seeks "to respond to current and future challenges, while creating positive change for the planet." Conveniently, this comment leaves out the part about also manufacturing and perpetuating the said challenges.

The problem is not just exaggeration in marketing. Greenwashing is not as mild a problem as the word itself might sound. As University of Colorado Professor Ellis Jones remarks in his interview with WUSA, "It's basically just a form of lying . . . It means that [consumers] spend money that they otherwise wouldn't have spent, because they believe something [sustainable] is being done when it's not being done. What makes it harmful at a very core level is that it's a distortion of what is actually happening in the world."

Consumers like us are conditioned to be satisfied with such “work-in-progress,” happy with the idea that companies are at least doing the bare minimum.

We’ve been lied to for so long, corporate greenwashing is no longer an exception but an expectation. Think about that the next time you toss your favorite bottled beverage in the recycling bin. If a brand sells you cloth marketed as pure silk, and you later find out it is actually made of rayon or fake silk, that would be considered a lie, not error. You’d feel deceived, cheated, and would hold the brand accountable for false marketing.

But when a brand uses misleading advertisements and false claims on its packaging to tell you that it cares about environmental issues, and that by buying its product you would not be causing any environmental harm, we tend to not view it as a lie. Even when faced with reports and data suggesting that said company is making false claims, more people are likely to consider it an error, slight exaggeration, or even a work in progress, saying “their claims might not be 100% true right now, but they’re working on it.”

In fact, that is exactly how Coca-Cola responded to the complaint made to the European Commission about its greenwashing practices — “[we are] working to reduce the amount of plastic packaging we use.”

Consumers like us are conditioned to be satisfied with such “work-in-progress,” happy with the idea that companies are at least doing the bare minimum. This lenient forgiveness from the masses is what gives them the liberty to claim results they haven’t achieved, to promise measures they haven’t planned, and to market sustainability as an ad campaign.

We allow brands to lie.

We are in a toxic relationship with corporations, stuck in a cycle where we realize that they cause harm, we raise voices, stage protests, and then they promise amends. They promise to be better, to create positive change, and we believe them, like we believed them the last 26 times. It is hard to break out of toxic relationships.

The Institute for Sustainability, Energy, and Environment (iSEE) and Facilities & Services (F&S) partner with Coca-Cola for many initiatives at the U. of I., like the “Don’t Waste” campaign, which aims to recycle all plastic bottles and metal cans used on campus, or the “Zero Waste Illini Games” where Coca-Cola provides massive recycling bins, well-branded with its logo, for bottles and cans at athletic events. Coca-Cola gets to have a bigger say (since it funds the initiatives) in designing the campaigns, likely resulting in many initiatives being focused on recycling waste instead of reducing it.

An infographic on Coca Cola’s Phillipines website.
Credit: The Coca-Cola Company

As an Environmental Sustainability major, and an intern in the Zero Waste team at F&S, I help organize many zero waste-related events at the university. The organizing team wears Coke sponsored green t-shirts, both to be identifiable and to symbolize the campaign.

It makes one feel incredibly conflicted — actively working toward addressing a problem created by Coca-Cola, while wearing the brand on your back.

As part of my job, I design presentations for collaborations between Coke and campus sustainability, and I also visit the Waste Transfer Station where thousands of Coca-Cola bottles come in from

As part of the Don’t Waste campaign, Coca-cola is providing portable receptacles for recyclables and landfill waste. Look for these bins at Illini games and major campus events.
Credit: Institute for Sustainability, Energy, and Environment

campus each day. I attend monthly meetings with my team and Coca-Cola representatives to discuss ways to increase recycling, and I also set up educational stalls telling people how a plastic bottle can only be recycled a handful of times.

This dilemma, combined with a personal liking for fizzy drinks wrapped in signature red, puts me in the unfortunate position where I’m funding the problem, working in collaboration with the creator of the problem, criticizing the problem, and trying to solve the problem. It’s exhausting.

But this dilemma is not unique to me. All environmentally conscious consumers stand at the same intersection, debating the longer-than-life debate of who’s responsible for making a change — corporations or consumers.

So, as the bottle that I threw in the recycling bin at the Illini Union makes its way along the cycle of waste, I type words into this article as an attempt to conclude this debate. When over 2 billion consumers stand on one side and a single corporation on the other, trying to ascertain which party should make the necessary change, it only takes kindergarten math to see that one decision is easier than 2 billion. One decision is faster than 2 billion. One decision is more possible, more logical, more practical. One corporation impacting billions is more accountable than billions impacting one corporation.

Coca-Cola is responsible.

Sakshi Vaya graduated from the University of Illinois in May 2024, with a B.S. in Earth, Society, and Environmental Sustainability, and the Certificate in Environmental Writing. She is the Founder-Director of Jeevatva, a waste-management startup in India. Currently, she’s pursuing her master’s in Environmental Engineering, focusing on Carbon Neutrality, at the University of Seoul, South Korea.

HAIL MARY FOR THE CLIMATE

GABE LAREAU

Amidst March Madness 2023, the U. of I. women's basketball team sat idle. On the tarmac, waiting to fly to the Big Ten Tournament, their plane couldn't take off. It wasn't the weather; the only reason the aircraft couldn't fly was because it was nearly empty.

Several Illinois Hoops Band members on board — including myself —were voluntold by the flight crew to move to the back to even out the plane's weight distribution. After a quick reshuffle, the charter flight was ready for its one-hour journey to Minneapolis. Every person had a row to themselves. Some rows were still completely vacant.

The next day, when I walked into Minneapolis' Target Center, it boasted a shiny new basketball court made especially for this one-week occasion. As is standard during every March Madness, branded paraphernalia were rampant. T-shirts, towels, chairs, wallpaper, banners, and postseason-specific warmup shirts were manufactured for thousands of fans traveling across the Midwest. All of this to celebrate the culmination of a near-30-game season where, for each game, television crews and equipment were transported, food was catered, floors were shined, and countless planes took off to see a ball go through a net.

Nearly two years later, in January 2025, I attended an in-conference men's basketball game between my beloved Fighting Illini and the University of Southern California. The Trojans, in their inaugural season as a member of the traditionally Midwestern Big Ten Conference, had flown nearly 2,000 miles to play two conference games. Some back-of-the-television-contract-math calculates that the roundtrip emitted over a ton of carbon dioxide (CO_2). Meanwhile, just a few miles from the USC campus, multiple fires raged, claiming nearly 40,000 acres of land, $30 billion in damage, and 28 lives. We observed a moment of silence for the victims.

Credit: Jake Weirick via Unsplash

At both of these events in Minneapolis and Champaign, waiting for the games to start, I thought about all of the energy that humanity puts into sport — keeping hockey rinks cold, manufacturing thousands of custom soccer balls for the World Cup, flying half-empty planes two states over. If you love sports as much as you hate climate change, you're probably thinking exactly what I thought: "That's a lot of carbon."

On the metaphorical Basketball Court of Sport Greenhouse Gas Emissions (BCSGHGE), an emission can be assigned one of three values. Those in the sustainability business call these "scopes." Determining scope, just like assessing how much a basket is worth, depends on where it comes from and how difficult it is to control. The environmental impact generated by spectators flushing toilets isn't equal to an entire flight; each differs in scope.

Scope 1 emissions are your layups, those closest to home, easiest to make and carrying the smallest impact. "These have to do with the stadium — your waste, your water, your energy at the stadium," said Katie Gavitt, Assistant Manager of Operations, Member Services, Communications & Events at the Green Sports Alliance (GSA). "Scope 1 and 2 emissions are more direct."

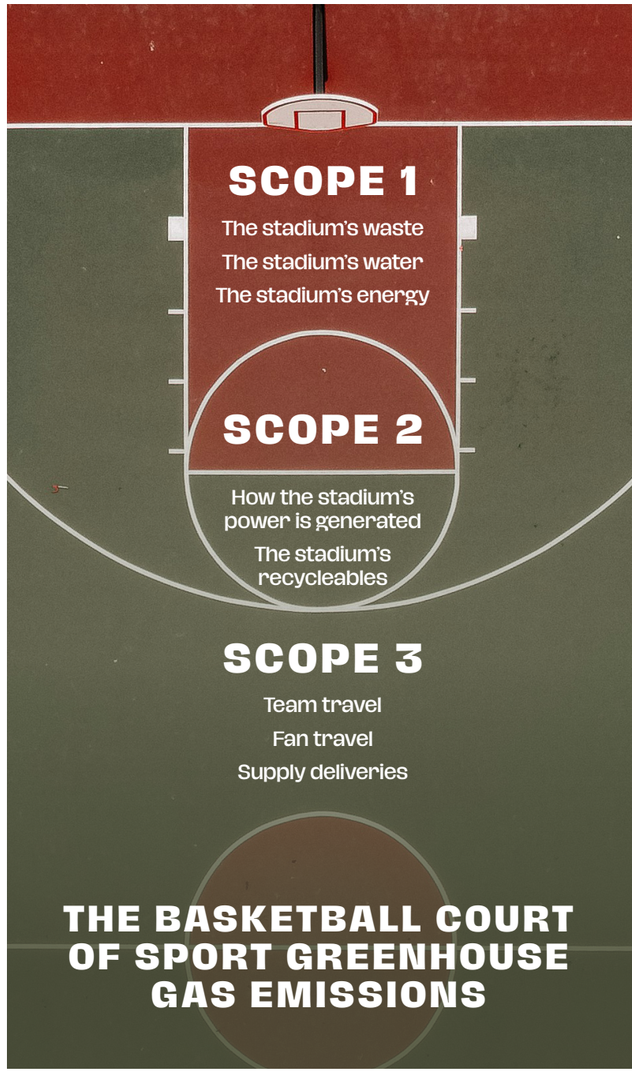
Scope 2s, inside the arc at around 15 feet, are a little harder to control but manageable enough if you're willing to put in the work. How the stadium's power is generated or how much of its recyclables are actually recycled would fall under this category.

And then there are Scope 3s, your three-pointers out to your half-court shots: The opposing team's travel, fan travel, and the way supplies are delivered to your stadium — all things that you can influence but remain ultimately out of your control. "These are really hard to track because it's all indirect," Gavitt said.

That considered, calculating every ton of CO_2 caused by sports is likely impossible. It's undoubtedly astronomical. For scale, the emissions related to soccer, the world's most popular sport, are estimated to clock in at 30 million tons of carbon dioxide every year, about the same size as the country of Denmark, according to the Carbon Literacy Project.

Tonight's contest at the BCSGHGE, capacity 8 billion, is the global game of the century: the Climate Solutions vs. the Fossil Fuelers. While the Solutions boast a strong defensive front, proficiently blocking Scope 1 layups and Scope 2 15-footer shots, the Fuelers are the best Scope 3-point shooting team in the world. They're also up by a considerable margin, with only a few minutes to go. The fate of sport itself, and the world, depends on this matchup.

The fate of sport itself, and the world, depends on this matchup.



Credit: Jonathan J. Castellon via Unsplash

How so? Costs are mounting. Every year, more matches are rescheduled to escape the day's heat, or canceled altogether out of concern for both athlete and spectator safety. More moments before games are being spent in silence to remember victims of climate-related natural disasters.

During the Tokyo 2020 Olympics, temperatures routinely rose above 90ºF. "It was simply too hot for these athletes to perform there," Gavitt told me. "They were passing out. They weren't used to the humidity, which makes a difference when you're in an endurance race." The International Olympic Committee (IOC) elected to move the race walk and marathon to cooler northern Sapporo. The decision was for naught. The women's marathon was delayed and took place in 86ºF heat with 65% humidity; 17% of the field did not finish.

The reason the world has invested so many of its resources into finding the most effective way for a team to hit a ball with a stick or kick it across a line is because sports are beneficial. They promote healthy minds, bodies, and practices. Competition, too, paradoxically, brings communities together, on global and local scales. Professional teams are a boon for cities and bring in billions of dollars annually.

Also, people just like them. In an increasingly polarized country, 61% of Americans identify as following one sport or another. Because getting 61% of Americans to agree on anything is miraculous, it's no wonder that Pope John Paul II (purportedly) said, "Of all the unimportant things, football is the most important."

If the will is there, sports can implement climate solutions quickly and efficiently.

What's more, sports have the flexibility to show the world how to tackle climate change, functioning as semi-independent states in a country. They're overseen by governing organizations — the NCAA, MLS, NBA, etc. — but how individual teams run their operations is mostly "up to the states." And teams don't have to navigate democratic red tape; they're free to maximize impact with less hassle. If the will is there, sports can implement climate solutions quickly and efficiently: The most unimportant of important things helping solve the most important of important things.

Re: if the will is there: "Who's gonna be the person who is getting s–t done?" is the first question Gavitt asks potential GSA members.

The GSA was an early pioneer in getting sports and sustainability on the same team. Founded in 2010, it started out with only a few members local to its native Pacific Northwest. The Seattle Seahawks, Portland Trailblazers, and Vancouver Canucks were early adopters.

Today, its bench is deep. In 2024, 263 organizations hailing from every major professional and collegiate league held GSA memberships. To do so, the Chicago Cubs, the Denver Broncos, ESPN, and even the Indianapolis Motor Speedway all had to provide examples of sustainability initiatives and shell out the $1,000 annual fee. That $1K — couch change in the executive suite — provides access to a sustainability network to which the GSA is the hub. The Alliance works like a small town Casey's: If you need to find the right person fast, chances are they can point you in the right direction.

However, the GSA doesn't issue any regulations. Members are not required to meet any sustainability standard. There are GSA members whose sustainability initiatives begin and end with waterless urinals. They will obviously not make the impact of a GSA member running on 100% renewable energy.

Tackling Scope 3s, the significant emissions, largely goes un-marketed and unpursued by teams. Fans are left to conclude that the only way to help the environment is through small, individual changes. Consider "Zero Waste Games" — a popular phenomenon that has become something of a misnomer. The idea is that everything in the arena — half-eaten hot dogs, crushed beer cans — will be put back to use or biodegrade into the natural environment. A 100% diversion rate is a tall order.

Still, the concept has noble motivations. Waste Management estimates that the decomposition of trash generated at events from the "big four" American professional sport leagues — MLB, the NFL, NHL, and NBA — emits approximately 35,000 metric tons of CO_2 into the atmosphere every year. That is equivalent to the annual greenhouse gas output of 6,000 cars.

Zero Waste Games are green marketing tee-ball, easily integrating the "fun" of recycling into the fan experience. The U. of I. rolled out a giant green bin to multiple football games in 2023 and 2024, and Michigan State made "Scrap Sparty," a statue of its mascot fashioned from reclaimed metal, to promote sustainable football games.

Credit: James Kirkup via Unsplash

The U. of I. hosts several "Zero Waste Tailgates" every season at Memorial Stadium.
Credit: Gabe Lareau

And yet, they're being outplayed by a common rival. The University of Michigan, as part of its "Planet Blue" sustainability program, claims "nearly" all of its food and beverage packaging at football games can either be composted or recycled. Its goal is to divert 90% of game-day waste from the landfill. In 2023, the University of Tennessee diverted 44,950 pounds of recyclables from landfills — a record that it challenged Michigan to beat in a "Recycle Bowl." The maize and blue came up short, but still impressively recycled just over 40,000 pounds. By contrast, Illinois averages about 1,000 pounds of recycling at each of its Zero Waste games, and Michigan State achieves a diversion rate of 12% to 15%. This is what those in the sporting business call a "blowout."

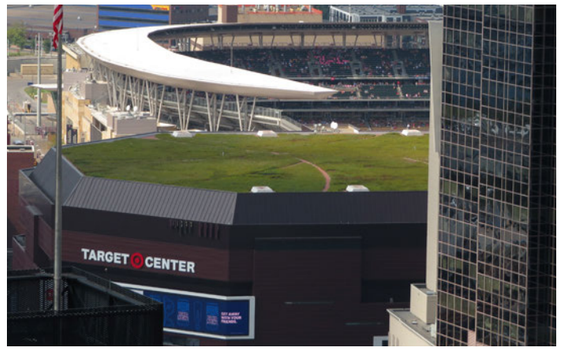
However, the waste pendulum swings far. It's standard practice in professional sports, especially Major League Baseball, for each game to have its own specific promotion. Thousands of bobbleheads, jerseys, hats, posters, and sunglasses are branded and given out to fans during the regular season purely as incentive to attend — the kind of hyper-consumerism environmental activists say is unsustainable.

And there are things that fans actively enjoy wasting during the game. After 20 years of its popular "dollar dog night," the Philadelphia Phillies canceled the promotion after a 2022 food fight resulted in thousands of wasted franks.

Reducing Scope 1 and 2 emissions can still be impactful — recycling and reducing food waste are both extremely efficient greenhouse gas mitigation strategies. They can also be precursors to larger things. Early in the GSA's existence, after partners in the Pacific Northwest were established, "The next people who came on board were the Philadelphia Eagles," Gavitt said. "They wanted to join because they had realized that the toilet paper they were using was detrimental to the eagle habitat." Since then, the Eagles have become environmental paragons, diverting 99% of their waste and generating a third of their power from built-in solar panels at their home stadium, Lincoln Financial Field.

Other stadiums have started to follow suit, drawing up their own plays on how to cut down on Scope 1 and 2 emissions. Unbeknownst to me when I visited in 2022, Minneapolis' Target Center had thatched its 20,000-seat arena with a green roof 13 years earlier, a huge energy-saver and emissions-cutter. Down the street, U.S. Bank Stadium, the gargantuan $1 billion home of the Minnesota Vikings, was the first professional stadium to achieve LEED Platinum status. Atlanta's Mercedes Benz Stadium not only also claims that title, but produces enough solar energy to power nine home games each season.

The green roof of the Target Center.
Credit: Ken Lund via Flickr



Opened on Oct. 19, 2021, the Climate Pledge Arena serves as a long-lasting and regular reminder for the urgent need for climate action.
Credit: Climate Pledge Arena

Then there's the appropriately named Climate Pledge Arena, the net-zero-carbon home of the NHL's Seattle Kraken and WNBA's Seattle Storm, marketed as the "most progressive, responsible and sustainable arena in the world." That was only possible because Climate Pledge Arena wasn't built, but renovated, using far less material.

Unfortunately, retroactive renovations on existing arenas aren't in vogue when teams, or entire countries, are looking for new playing venues. The 2022 FIFA World Cup spawned seven brand new stadiums, a new metro system, new airport, and hundreds of new hotels just for the one-month tournament — a costly endeavor, both environmentally and fiduciarily. The oil-rich Qatari government spent $220 billion on the World Cup and emitted the equivalent of 5.4 million tons of carbon dioxide, in part by air-conditioning roofless venues in the middle of the desert.

American sports, too, have a fervor for new facilities as unquenchable as their lust for championships. Whether in the name of "a better fan experience" or an increased competitive advantage, teams just keep pouring money, and concrete — and, therefore, emissions — into stadiums.

Despite the NFL and MLB both existing for over a century, more than half the teams in each league use stadiums that were built in the 21st Century. In the NBA, just one arena — Madison Square Garden — was built before 1990. While some of these upgrades were necessary, many were done in the name of over-extravagance. Newer MLB stadiums feature manta ray tanks, pools, and goofy home-run sculptures. The Las Vegas Raiders' brand new Allegiant Stadium has a nightclub.

Sports' emissions don't start and end on gameday, either. The Tampa Bay Times reported in 2018 on a college football "facilities arms race," citing how in a five-year span, "Power Five schools spent more than $800 million" renovating or constructing just *football* facilities, oftentimes excessively. Illinois' Smith Football Center has a bowling alley. Professional teams top even that. At the Jacksonville Jaguars' practice facility, every urinal is equipped with sensors that assess individual athlete hydration.

As for sports' Scope 3 emissions — anything that involves a third party like fan travel, media travel, and deliveries — they are, according to Gavitt, "a very hot topic right now. That's because they're all indirect." Because stadium deliveries involve third parties, it's not each team's direct responsibility to make sure that the supply chain is run sustainably, Gavitt told me. Still, teams are caught in a double bind —held responsible for emissions beyond their control, but which are nevertheless attributable to their business.

The immensity of Scope 3s can be hard to grasp and even more difficult to calculate. Consider sports' largest contributor to global climate change, by far: travel. David Goldblatt, contributing to *Play the Game*, estimated that MLB fan travel emitted between 1.5 and 2 million tons of CO_2 equivalent (tCO_2e) annually. Assuming that the NFL and NBA emit similar quantities of greenhouse gases, then those three leagues dump around 6 million tCO_2e into the atmosphere every year just from fan travel. There is little teams can do about that.

"It's hard to ask for behavior change," Gavitt said. "People go for the most convenient route. The only thing that teams can really do is incentivize. For the San

SoFi Stadium, the most expensive sports venue ever built, being constructed in LA in 2019.
Credit: Dan Klco via Unsplash

Francisco Giants, fans get free public transit two hours before and two hours after a game." As for team travel, the most road-weary professional clubs are located in the Pacific Northwest. Geographically isolated from most other teams, the Seattle Seahawks will fly nearly 30,000 miles during the 2024-25 season; Major League Baseball's Athletics, 100,000 miles; the Portland Trail Blazers, 130,548 miles during their 82-game NBA season. For a team that plants three trees for every successful three-pointer, the Blazers would have to make about 589 every game to offset their travel.

In a world where sustainable aviation is decades away and carbon offsets are far from an exact science, the solution may be to travel less or over closer distances. Or both.

"Every league has divisions and most of these divisions are correlated geographically," Gavitt said. "These teams play each other more often. Each league has tried to figure out, 'How do we make these trips shorter and keep them within the same vicinity?' so it's not so crazy throughout the season."

This increased compartmentalization approach to team travel has proved effective. During the COVID pandemic, the NBA moved to a "bubble" system at Walt Disney World, in Orlando, Fla. Every team flew in and stayed there for the entire season, saving thousands of tons of emissions. However, in part to make up for COVID, both professional and collegiate leagues have since relapsed. During the 2023 season, MLB shifted its schedule so that every one of its 30 ball clubs will play each other at least once. In the 162-game schedule, 52 games will be played intra-divisionally, a steep drop from what used to be 76 played against close geographical rivals.

As for collegiate sports, "all the sustainability people seemed to be pretty pissed when UCLA, USC, Washington, and Oregon got added to the Big Ten [in 2022]," Gavitt told me. "Their footprint is going to be so much larger than what it's been." The acquisitions set off a ripple effect, making sustainability as much of an afterthought as the conferences' names. Northern Illinois University football is now a member of the Mountain West. The Atlantic Coast Conference added three new schools, including the University of California and Stanford.

"I don't think sustainability was brought up in great length in those discussions would be my guess," said Marty Kaufmann, Executive Senior Associate Director of Athletics & Revenue Operations at the U. of I. "I was not in the room for those discussions, but in all of the feedback and updates that I've received, it was not brought up."

When the Big Ten expanded to its second shining sea, the league didn't just create a sustainability problem, but logistical and competitive headaches as well. "Every traditional Big Ten team will make just one trip out west," Kaufmann said. For example, Illinois volleyball played Sept. 27 at Oregon and Sept. 28 at Washington. The West Coast teams are the ones shouldered with most of the travel burden — a cost paid in both carbon dioxide and performance on the court.

As of January 2025, the UCLA men's basketball team had already traveled over 7,000 miles to New York, Nebraska, and Maryland during the regular season. According to Bruins head coach Mick Cronin, his team is feeling road weary. "Good luck west going east," Cronin told *USA Today*. "Ask me UCLA's record east of the Mississippi in their last 20 years because, when I got the job, I looked it up for scheduling purposes. It's under .500.

"We've seen the Eiffel Tower, er, the Statue of Liberty, twice in the last three weeks while we were landing. We also saw the Capitol building. And we still got to go back. And then we've got to go back for the Big Ten Tournament."

Cronin won't have to wait much longer for his team to see the Eiffel Tower. In 2028, the Big Ten Tournament will be held in Las Vegas.

The global sports industry can still make a comeback. The gameplan: Significant scale-backs. The excesses of wasteful promotions, league expansions, outdoor air-conditioned desert venues, and urinal sensors, framed as "necessary" competitive advantages or fan experiences, will need to be the first roster cuts.

There are some small signs of life. In 2023, FC Barcelona announced its intention to increase team travel by rail, instead of flying. The 2024 Paris Olympics, unlike the 2022 World Cup, used

95% existing or temporary venues to host its games. The process required some creativity, which paid massive dividends — fencing bouts were held at the breathtaking *Grand Palais des Champs-Élysées*, the equestrian events in the gardens of Versailles.

Systemic solutions are starting to be implemented in both the governmental and private spheres, too. "The U.N. has just come out with ESG laws — environmental, social, and governance," Gavitt said. "Every company with a certain number of employees has to report on how much waste, how much energy, and how much water they're putting in the Scope 1, 2, and 3 emissions."

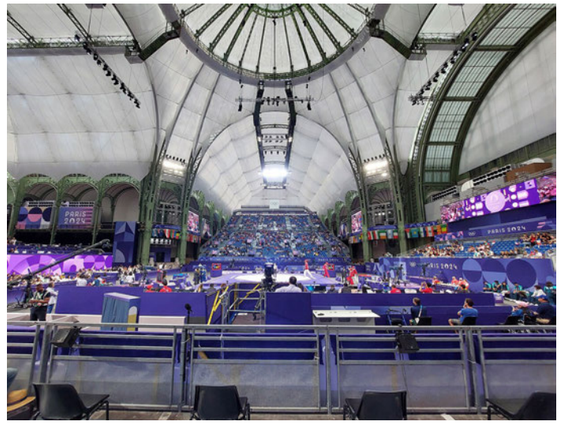
ESG-required transparency is already changing policy. Of all sporting organizations, Formula 1's ESG brief stands out. Reporting a goal of net-zero emissions by 2030 is one of sport's more ambitious, and F1 has made significant strides in increasing EV battery capacity and the development of "synthetic fuels." Of course, it is doing so by partnering up with the likes of Exxon Mobil and BP, but its shrinking carbon contribution doesn't lie.

The world's largest economy, the United States, has not ratified ESG laws and is unlikely to do so in the future, especially under its current administration. However, California, the world's fifth-largest economy and home to 19 professional teams, has adopted ESG laws. "The teams in California are forced to do a lot of these things which make sense — they're doing much better with sustainability," Gavitt said.

As for organizations without sustainability practices in place, a little education can change behaviors and herald more extensive efforts. The U. of I. now has a color-coded trash bag system: Black bags don't get sorted with recyclables. "In the past, we would pick up trash in black plastic bags. I don't think any of us knew that it wouldn't get sorted and all go to the landfill," Kaufmann said. "I think if we can continue to get more efficient and work sustainability into our everyday operations more, that would be great. It's not that difficult."

Just ask Forest Green Rovers FC, an English football club with sustainability integrated into its brand. The club serves only vegan food at its matches, has a pitch that recycles rainwater, is entirely powered by renewable energy, and offsets every fan's travel. Renderings of its new planned stadium, Eco Park, feature the stadium surrounded not by parking lots but lush greenery.

The Rovers are outliers — relatively small-scale and sustainability-obsessed. But "they combine all of it," Gavitt said. "They are the answer to what a sustainable sporting future looks like." They have rapidly implemented changes that take other teams years to complete and that other world governments, with vastly more resources, have yet to accomplish.



The Grand Palais at the 2024 Paris Olympics.
Credit: Nicolas22g via Wikimedia Commons

The iconic Silverstone Circuit installed solar panels, powering their 2025 Grand Prix with entirely green energy alternatives. *Credit: Lee Dyer via Flickr*

Equally important, athletes have been making demonstrations of climate solidarity. Chloe Kim, one of snowboarding's biggest names, testified at the 2019 U.N. Youth Climate Summit. A 16-year old British cross-country runner named Innes FitzGerald turned down an invitation to the 2023 World Cross Country Championships because it required her to travel to Australia. "I would never be comfortable flying in the knowledge that people could be losing their livelihoods, homes and loved ones as a result," she wrote in a letter to *Athletics Weekly*.

Athletes are some of the most sought-after spokespeople in the world and have the capacity to change how their sport confronts public issues. In just five years, the NFL went from spurning Colin Kaepernick for kneeling during the National Anthem to allowing social justice messages to be displayed on players' uniforms and behind endzones.

Whether those mottos, which can be as vague as "End Hate" and "It Takes All of Us," are reflections of an effective attitude shift or the racial justice equivalent of greenwashing is up for debate. The parallel ironies with environmental justice, though, are hard to overstate. The turf for Super Bowl LVIII featured the message "End Racism" next to an endzone for the Kansas City Chiefs. That same game was marketed as the greenest Super Bowl ever, which thousands flew to see in private jets.

Nevertheless, sports do not exist in a bubble. Every decade has a moment in sport that has thrust a larger issue into the spotlight: Jesse Owens winning gold and breaking the color barrier at the 1936 Berlin Olympics; democracy prevailing over communism in the "Miracle on Ice" in 1984; Mike Piazza's September 2001 home run for the New York Mets helping a nation heal from its greatest tragedy.

If the same can be done for climate change, with organizations taking meaningful action and athletes continuing to speak out, then global sports can emerge as climate leaders in a world that desperately needs them. At the BCSGHGE, the planet is trailing badly with time running out, but defeat is not inevitable.

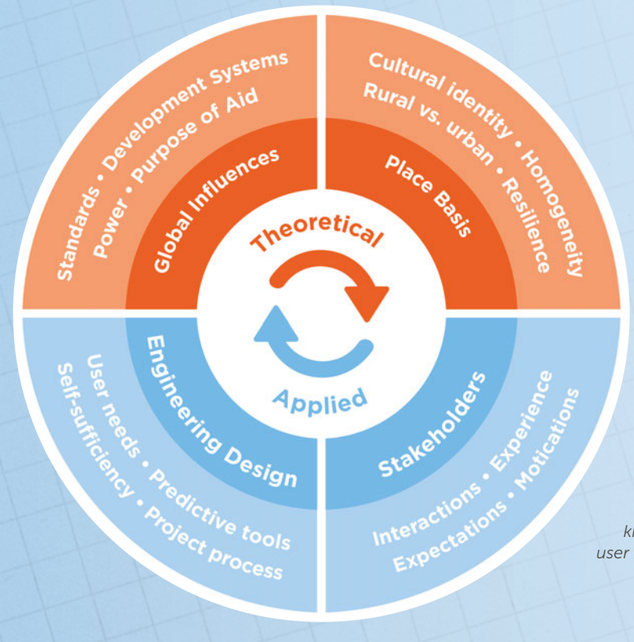
For proof, ask any fan: "Do you believe in miracles?"

Gabe Lareau graduated from the University of Illinois with his B.A. in English in May 2024. Originally from Moline, Ill., Gabe currently works on the communications team for the Forest Preserve District of DuPage County.

Credit: Taylor Rooney via Unsplash

What Makes a Good Engineer?

VIVIAN LA



CONTEXTUAL ENGINEERING

The creative application of science, mathematical methods, societal understanding, and place-based knowledge to address a physical need that serves the user of the innovation while recognizing the influence of stakeholder motivations, capabilities, and values.
Credit: Contextual Engineering Research Group

On Tuesday afternoons, a group of engineering students gather for a weekly lab meeting at the Carle Illinois College of Medicine. A man held the door open for me the day I made a visit to one of these meetings. After I thanked him, he asked if I was a med student. "No," I said with a laugh, "I'm actually a journalist going to an engineering lab meeting." Surprised, he said he was also on his way there. He was an electrical and computer engineering student, Listowell Appiah. It seemed like we were both rarely on this part of campus.

More people filed in. One woman asked another student if she was a part of the lab and she responded with, "I'm not a part of this research group, I just come to learn." There were two students present who weren't actively doing research with the lab's lead, which is uncommon for a lab group.

But even more uncommon is the lab's focus. This was a meeting about contextual engineering, a concept that you likely won't find at any other institution because it started at the University of Illinois.

The idea is that engineers too often go into communities with a predetermined idea of what the problem is and how to fix it, rather than considering the contextual issues at play. The result is an engineering "solution" that ends up being rejected by the people it was supposed to help.

Context can mean a lot of things. It can be social — what are some of the existing inequities or unique historical factors that might make a community wary of a group of researchers? And it can also be environmental. The people living in a place are often the experts on the land, the water, the animals. Contextual engineering tries to center the knowledge that is already present in a place.

In the lab meeting, graduate student Jason Kandume was presenting his idea for a potential research project in his home country of Namibia. He observed his mom extracting oil from Kalahari melon seeds, a staple crop in the region, through a laborious process that takes hours. Kandume wanted to help his mom and the other women in the community with this process.

But an important part of Kandume's thinking was that he didn't want to compromise the flavor if he were to mechanize this process. Or take away from the social aspect of the extraction process, since women often gathered to do this extraction together.

After his presentation, Kandume looked over to Ann-Perry Witmer, engineering professor and the lab's principal investigator for guidance. "Hopefully this generates a lot of questions," Witmer said to her students. She coined the term contextual engineering, and many of the students in the room — most from outside the U.S. — came to the University of Illinois to study under her.

Students peppered Kandume with questions like how much money women could get from selling this oil to the government or how the melon was used. Through all of this, Witmer sat at the front of the table with a slight smile as she listened to all the different directions the conversation was going. Later, she would tell me that her role in these meetings is to act like guardrails, steering her students only if they veered off-track. Witmer only chimed in at the end when students began thinking about the goal of improving this process — specifically how scaling this process could improve the community's economy.

"We're contextual engineers, not contextual development assistance," she reminded them. It's not an engineer's job to market, but to innovate. It becomes contextual when you ask people what they want and use that to guide the design process, she said. Students decided at the end of the meeting that the best course of action is to innovate, return the knowledge to the community, and let them decide how they want to use it, or if they want to use it at all. One student's moment of realization was visible when his eyes lit up and he sat back in his chair with a long "Oh."

Witmer said these moments make her excited because that's just one more student who is thinking more contextually about this work. What initially draws a lot of people to the technical field is that it's purely objective, so recognizing engineering as something deeply tied to social or subjective factors takes time. Witmer herself was guilty of this. After a career in journalism and frustration about confronting gray areas, she decided to make a switch into engineering thinking it would be more straightforward. She was wrong.

"The Kool-Aid that you drink in engineering starts when you're a child, because everything is fact-based," Witmer said. At the beginning of the semester, she always asks her students, when do you stop making

Ann-Perry Witmer, Teaching Associate Professor at the Carle Illinois College of Medicine and leader of the Contextual Engineering Research Group.
Credit: Ann-Perry Witmer

decisions and follow the engineering? They'll say it's when the problem is defined. But Witmer argues this approach is flawed.

"Do you know how many decisions you make every day based on your own knowledge and your own expertise? And everybody is convinced that there is no personal identity involved in engineering?" she said.

The reason her lab meets in the College of Medicine is because of Witmer's position as a lecturer, which began in 2024. It's also a chance to connect her engineering work of solving physical needs to medicine's work of solving internal needs. Witmer said medical students are good at cramming information for exams but also intimately aware of their relationship with patients. It very much parallels the goals of contextual engineering.

"Every time we go to a doctor, you're aware that doctors are either good at listening and working with you, or completely dismiss you and tell you what's wrong with you," she said. "And so I think there's a kind of a consilience there that will help me in thinking about how to convince engineers."

Contextual engineering both requires an understanding of historical influences like colonialism and inequity, and centers the knowledge that already exists in a place. These ideas are closely aligned with Indigenous knowledge or traditional ecological knowledge — and most often dismissed by Western science.

One such example comes from the Navajo Nation. Dean Dempsey, a field engineer who is Diné, recalled how his grandmother could often look at a type of grass and predict with startling accuracy how much snow there would be in the winter. It's called *tł'ohnást'ąsí* in Navajo, or blue grama grass. There's a curl attached to the tip of the grass that grows a certain height in the summer, which is a good predictor for snowfall amounts.

When Witmer first learned about this while on the reservation with Dempsey, she started brainstorming all the ways this phenomenon could be explained by science. "There could be confirmation bias on the years that she gets it right," she said. "Or there could be something about that plant physically that responds to barometric conditions, atmospheric moisture, whatever, that actually makes it a reliable predictor. But we don't know."

Dean Dempsey, field engineer at DigDeep's Navajo Water Project.
Credit: Navajo Water Project

What she does know is that people are quick to judge any knowledge that isn't validated by institutions or Western concepts. She told researchers in agricultural and bioengineering about this fascinating finding and some dismissed it as witchcraft.

Place-based knowledge doesn't usually align with us, and so we throw it out. "But there's a lot of knowledge that's out there that is derived from place. That knowledge is there because these people have been there. They understand the relationship of their surroundings with themselves," Witmer said.

Dempsey said it's really just about observing your environment. And for engineers, that means learning to observe people as well. "We have all kinds of emotions and all kinds of feelings."

Dempsey got to know Witmer and some of her students when he lived in Danville, Ill. and has since moved back to the Navajo nation to work on water infrastructure issues. He works on DigDeep's Navajo Water Project, an Indigenous-led organization that centers place-based knowledge. The project aims to help the estimated 30% of families there without access to pipe water, according to data from the Navajo Nation Department of Water Resources.

> **"Do you know how many decisions you make every day based on your own knowledge and your own expertise? And everybody is convinced that there is no personal identity involved in engineering?"**

Blue Grama Grass.
Credit: Matt Lavin via Flickr

Left: The Navajo Water Project serves hundreds of families across New Mexico, Arizona, and Utah.
Right: The Navajo Water Project helps install home water systems for Navajo people who don't have them.
Credit: Navajo Water Project

Dempsey sees firsthand how the ability to shape the environment, as engineers do, can have a profound positive effect. "One of the most awesome things is watching a child get excited to see rainwater, to see water come out of the sink and they touch it — it's mind-blowing to them and for us."

As for the concepts of contextual engineering, Dempsey sees how his daily practices of listening and learning overlap with what Witmer teaches her students. It's a more formal translation of what he tries to do every day on the reservation.

"I think one of the best ways to become an engineer is to listen and to work off your resources, getting to know your resources, you know, because you don't know everything," he said. "Even on the Navajo reservation. The people, we're all Navajo but everyone's different. Every community is different."

Contextual engineering is growing at the University of Illinois, evidenced by Witmer having to turn down numerous graduate applications. But at such a prestigious engineering school, there's bound to be some skepticism. The clout of the school is also why Witmer feels this is the right place to shore up contextual engineering than at a smaller institution. "I could probably make inroads a whole lot faster, but I wouldn't have the impact. So in a way, I would rather be here knowing that I'm reaching top-tier engineers, even in small numbers. To just set that group growth of critical mass up."

Most engineering instructors understand where Witmer is coming from, but not as its own area of study. "I think there's a fear that this waters down the technical focus, rather than a recognition that it hones that technical focus," she said.

This was the case for Melody Rasoulian, a first-year Ph.D. student in electrical engineering. Rasoulian spent her entire engineering education in Iran focusing on control and power systems, the epitome of technical focus. But she noticed there was a gap in what she was supposedly optimizing for clients and what clients actually wanted.

"I feel like my mind is trained to just focus on the technical part and just come up with different equations and just get the answer out of those equations. I am not used to just zooming out and analyzing a problem from another perspective," Rasoulian said. This is where a lab meeting on Kalahari melons in Namibia, something she has never experienced before in engineering school, is hugely eye-opening.

In the same way that Rasoulian was drawn to power systems because of how she can see tangible, physical elements like transformers and cables, she's now drawn to seeing real change in communities through her work. "That is the marker because they have to see the difference. To see the change, to see the progress," she said.

Rasoulian's first venture into contextual engineering outside of learning about it in classrooms or lab meetings will be this spring. She and Xiomi Echeverria, master's student in agricultural and bioengineering, will visit the Navajo reservation to meet with local leaders and continue the work of other engineers addressing water access for livestock.

Some of Witmer's Contextual Engineering Research Group's current initiatives:

- Addressing infrastructure needs for indigenous populations
- Contextualizing climate-change entrepreneurship in Zambia
- Addressing intrinsic power dynamics in infrastructure planning
- Optimization of stand-alone solar power units based on context of the Navajo Nation's Bodaway Gap Chapter
- A contextual assessment of dam siting and operation in Mambwe District, Mambia
- Contextualizing identification of energy solutions in austere societies

Credit: Contextual Engineering Research Group

Echeverria, who is from Bolivia, had a similar educational experience in engineering. "You're just going to design," she said about how teachers or bosses would talk to her. It wasn't until Echeverria worked with the engineering non-profit *Fundación Ingenieros en Acción* — Bolivia's office of Engineers in Action — that she began to understand the importance of building relationships with the communities you're working in.

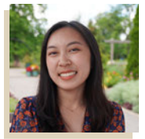
The goal of the project was to introduce renewable solar technologies to rural communities throughout the Sica Sica municipality of Bolivia. Echeverria's work focused on how communities received all this new information while also not pushing an agenda. They found that the interest was there but there wasn't enough guidance on how to actually implement some of these technologies. "The community members were like, 'I want to learn more about this technology, because we don't know about these technologies,'" she said. "We wanted to show them other possibilities, and we don't want to impose an idea."

In a way, Echeverria was practicing some of these ideas of contextual engineering before pursuing her master's at the U. of I. But she was curious to learn more about the theory behind the practices she knew were necessary when working with rural communities.

She and Rasoulian are also keenly aware of how their work requires explaining some very complicated concepts . Not only to the communities they're working with but also each other. "I have an idea of how electricity and energy works, but if I ask (Rasoulian), 'What is this about?' And she can't use the proper words to me, I'm not involved in her field, I'm not going to understand, right?" Echeverria said. "We need to learn how to express our ideas in the proper way for different clusters of people."

To prepare for their trip to the Navajo reservation, both are doing as much research as they can. Not just about the engineering concepts but about the culture, past failures, and the language. Echeverria said she'll be going to more of the lab meetings to learn as much as possible, learning how to not box herself into a specific idea of what an engineer should be. What she wants to accomplish echoes something Dempsey said he tries to live by.

"Nobody knows everything," Dempsey said. "You never stop learning. You're always learning about something, so never close your mind to education." Especially when the stakes for the future of engineering, and a just, sustainable world, are so high.



Vivian La graduated in May 2024 with a B.S. in Journalism. She is a multimedia journalist interested in the intersection of environment and equity. Her work has been published in *The Daily Illini, Illinois Public Media, the Chicago Tribune,* and *Science magazine*.

Credit: Sophia Beem

One morning, I sit idly in bed and toss my teddy bear in the air, catching him on my chest and throwing him back up again. Of the myriad stuffed animals that once populated my childhood bedroom, most are now gone. But with his name reflecting unparalleled creative instinct, Orange Bear stayed. I toss him up again, making him somersault in the air. Once bright orange, Orange Bear has softened to tangerine, paling pink, and yellow in patches. He smiles with an earnest grin stitched in black thread, seeming never to tire of playtime. But his once plush body is now worn, the stuffing lumpy, the fabric matted. On the next toss, a flash of white catches my eye. A loose thread? A piece of lint? I flip him over. No, it's Orange Bear's tag. Of course, it has been there for over 20 years, but I never took a moment to really look.

"Polyester fiber, PE pellets in cloth bag," it reads, in faded red lettering. Most people don't know where these materials come from, or even what exactly they are, but they're everywhere in our products and toys. The stuffing that gives the "bag" — the irreverent name for a stuffed animal's main body — its plumpness and shape is made of fluffy fibers or tiny pellets. These fillers, which may be synthetic polyester cotton, polyethylene, and polypropylene, are hyper compressed and heated up oil products. The process: Refined petroleum and crude oil is morphed under intense heat and high pressure into a malleable plastic. This is spun and pulled and pinched by big machines, transforming raw fossil fuels into soft fibers and smooth, round pellets. From the oil refinery to the guts of a child's best friend, polyethylene pellets and polyester fiber are what gave life to Orange Bear. Orange Bear, like most stuffed animals, only exists because of the burning of fossil fuels.

Orange Bear wears the label "Ty Incorporated" on his tag. This multimillion-dollar company is responsible not only for Orange Bear, but also the Beanie Babies

Credit: Chris Leboutillier via Unsplash, Jay Turner via Unsplash, Oregon State University via Wikimedia Commons, Beaniepedia

Orange Bear, like most stuffed animals, only exists because of the burning of fossil fuels.

craze of the 1990s, a whirlwind era of rampant consumerism. Like Orange Bear, Beanie Babies are also filled with plastic pellets. At the height of the company's success, millions were captivated by Beanie Babies. Limited edition releases, surprise retirements of certain models, and soaring resale values fueled a buying frenzy. Mass production, theft and counterfeit, and a hysteria that ended in a huge bust in the value of these plush toys all generated waste. When the fad ended, many Beanie Babies were thrown away.

Ty Inc. is based in Oak Brook, Illinois. Yet Orange Bear began his life overseas: "Made in China," the tag cites. There, in a factory, he came together in fragments — cutting, sewing, binding, stuffing — an ear here, an eye there, a leg and an arm on an assembly line being fit to a hollow body before seamstresses sewed up his body and stuffed it with filling. This process is decentralized. Maybe his eyes were shipped in on a hulking cargo ship from a different factory, the stuffing in his belly spun from melted petroleum in a different country. We do know what the process entails: Scrap fabric and plastic bits tossed into heaping piles to be dumped into landfills; columns of thick smoke billowing out of factories; machinery dumping toxic particles into nearby waterways until these are saturated with gunk and oil. After a quality inspection, packaging, and warehousing, Orange Bear was deemed fit for play, then wrapped up in more plastic and tucked away until the supply chain sailed him across the ocean, loaded him onto a truck, then plopped him onto a shelf conveniently placed at toddler eye height.

In 2020, retail sales of plush toys in the United States amounted to approximately $1.25 billion. Americans love their stuffed animals. A lot. There are thousands of kids with clones of Orange Bear or a menagerie of other creatures — birds, lizards, cats, elephants, cows, frogs — that each offer a comforting presence. Up to 70% of children develop strong attachments to objects such as stuffed animals or blankets, for good reason. The emotion and nostalgia they embody is enough to earn them a permanent bedroom home. They're a friend who will never fight with you, a companion to clutch in the nighttime darkness. But here's a troubling consideration: These toys are often discarded as children grow older. While some, such as Orange Bear, endure as special mementos, most others are tossed aside, adding to the list, and garbage pile, of consumer culture victims. Orange Bear himself has witnessed the gradual disappearance of his many friends from my early childhood collection. Kids grow up and move on. Old friends become unwanted and few survivors remain.

Each year, an estimated 8 million stuffed animals are thrown away, ending up in landfills or oceans. How many people buy a cheap stuffed toy to commemorate a vacation or as a last-minute gift for a niece or nephew, only for it to be thrown out two months later? It's just who we are: A society that puts convenience and quick purchases at a premium. While these cute animals seem harmless, once thrown out their remnant forms prey on biodiversity and ocean life. Severed stuffed bear limbs float in the ocean for unwary fish to swallow. Dismembered stuffed animals drift together in vast numbers in the Great Pacific Garbage Patch, like a floating island of misfit toys. In landfills, their non-biodegradable synthetic fabrics and stuffings can take hundreds of years to decompose. Plastic eyes deteriorate and poison the soil. The one-time playmates of imaginary games, the once-were gifts to friends, kids, grandkids, the long-ago guardians of a scared child from the monster under the bed, now degrade slowly and are forgotten. They find themselves down the gullet of a hungry pelican or into the downy hollow of a burrowing vole or snatched up by tiny grasping raccoon hands, hurting the very creatures they were modeled after. Yes, recycling programs exist, and resale shops are available for redistribution, but there are simply too many plush toys in the world to prevent the majority from ending up as waste, along with all the detrimental impacts on wildlife that their abandonment entails.

My bedroom is full of mementos and personal artifacts, Orange Bear among them, that will all be thrown away. Is the future of disposal and decomposition darker than the light of the memories I associate them with? To some extent, yes. In my room, Orange Bear is nestled between a purple pillow and a panda bear stuffed animal. The panda holds marginally lower sentimental status, a fact that nearly guarantees its fate in the Great Pacific garbage patch. Yet, despite holding high favor in my stuffed animal court, Orange Bear will also eventually be thrown out, sitting next to Unnamed Panda on a faraway garbage heap, waiting to be incinerated. There is no stuffed animal rainbow bridge; how much we love them doesn't change where they end up.

The arbitrary lifespan of these toys ultimately serves as a reminder of how we're treating the planet like we do everything else. Disposably. For now, however, my plush friend smiles cordially, unaware of the damage wrought by his creation and the forthcoming hazard of his fate. After 20 years of being loved deeply and unapologetically, Orange Bear is old and tattered, but it will take 450 years for the polyethylene pellets in his feet and legs to decompose. He is falling apart already, but pieces of him will take years to dissipate slowly through the soil and ocean waters—all long after I'm gone. Once an inseparable friend, he'll be lost and reduced to microplastic particles, with no child to squeeze him at night or toss him in the air.

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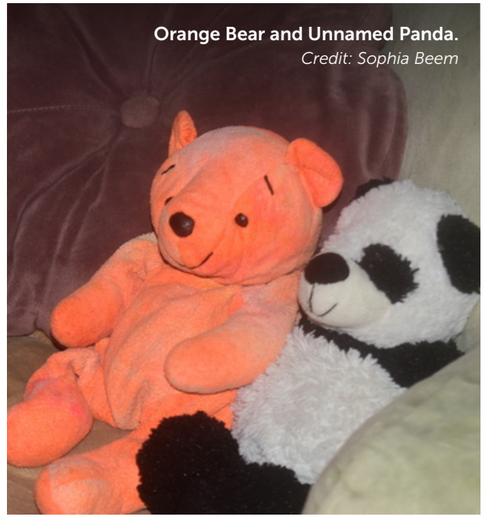


Orange Bear and Unnamed Panda.
Credit: Sophia Beem

Sophia Beem is a junior from Springfield, Ill., studying Creative Writing and Global Studies with a minor in German. She is pursuing the Certificate in Environmental Writing and is a Communications Intern for iSEE. Sophia is involved with campus environmental organizing as the Editor-in-Chief of the *Green Observer*.

ANJALI YEDAVALLI

MAPPING THE FUTURE

Perhaps no one knows Illinois' climate as well as State Climatologist Trent Ford — and not just because it's his field of study. Ford is intimately familiar with every corner of the state. He grew up in Roanoke, completed his undergraduate degree in geography at Illinois State University, taught at Southern Illinois University, and now works as State Climatologist for the Illinois State Water Survey at the University of Illinois.

As State Climatologist, Ford is responsible for documenting weather patterns and climate data for various stakeholders, including farmers and policymakers. He specializes in hydro-climatology and droughts, and studies their intersection with climate-driven social issues. He believes that community engagement is a cornerstone of climate preparedness and resilience.

Q Magazine's Anjali Yedavalli sat down with Ford in August 2024 to discuss his efforts to communicate climate concerns with the agricultural community, and track weather patterns to inform policy — and how a combination of systemic and individual action can make a profound impact, not only in Illinois but the nation at large.

State Climatologist Trent Ford.
Credit: Trent Ford

Could you share what initially sparked your interest in climate science and how that led to you ultimately becoming Illinois State Climatologist?

All three of my degrees are in geography. Climate science, or climatology depending on what you call it, is a broad discipline. Some have more of a physics background or math background. Others go to atmospheric science or meteorology to do more weather work. And then a significant number come from geography as well. That's where I came from. I've always been more interested in spatial patterns, differences both in humans and physical systems, or social and physical systems.

What got me interested in climate was also statistics. I had an interest in numbers — not math, but stats. A lot of climate science or climatology deals with statistics, making sense of patterns and numbers, as opposed to more of the pure math or physics background of something like meteorology. That's what drove me to climate science.

After I graduated with my Ph.D., I was a professor for four years at Southern Illinois University in Carbondale. I loved it. I was in the geography department there. I taught and did research; it was so much fun. But then this position opened up. Both my wife and I are from central Illinois, so I was moving closer to home, having what I felt was a job where I may be seeing more climate impacts. It's worked out. Lots of pieces brought me to this path, either coincidences or mentors who pointed me in a direction, and in some cases, happenstance. Since the 1970s, the state of Illinois has only had four State Climatologists, myself included. So that's not a job that comes up very often. And so it happened to work out with timing. I'm very grateful for that.

Could you explain what the Illinois State Water Survey is, how it collects data, and why it is so important?

The State Water Survey has been around for over 125 years now. It was originally started in response to public health. Cholera and other waterborne diseases used to run rampant in Illinois. The State Water Survey was set up in response to ensure the quality of water across Illinois was sufficient, as well as the quantity of water for the population growth that the state was experiencing. That still is largely the mission of the water survey today.

Now — as opposed to being a state agency — we're part of the University of Illinois under the Prairie Research Institute, along with a few other surveys like the Illinois State Geological Survey and the Illinois State Archeological Survey. What we're tasked to do is to ensure, at a basic level, the quality and quantity of water across the state of Illinois. As you can imagine, Illinois is a much more complex place than it was 125 years ago. That means that we are doing everything from collecting data to running field stations and sites of stream sampling, groundwater sampling, atmospheric sampling, flood modeling, and mapping. We're also doing a lot of technical analysis — like water supply analysis — as well as a lot of applied research which requires sophisticated methods — things like machine learning and AI — to apply our findings to important societal problems across Illinois. There's a diversity of expertise here, from people who are in hazard mitigation, to urban planning, all the way to atmospheric scientists and climatologists like myself.

How is climate data gathered and collected across the state?

As far as the long-term climate data for the state of Illinois, most of that's actually used for climate assessment, for understanding climate change and its impacts. That's all collected at the federal level by either National Weather Service (NWS) or Federal Aviation Administration (FAA) stations that are automated at airports like Willard or at what are called Cooperative Observer stations all across the state.

There's a weather station out back of the water survey, right outside my office door, that has been the station of record for Champaign for over 100 years. It started up at the Morrow Plots on campus back in 1888 and then in the 1980s, moved to the water survey. It's those stations that have been operating over such a long period of time that are necessary to have the record and understand the changes in our climate on those longer-term century scales.

It's a lot of data. In climate science, we usually have more data than we can process. A lot of my job is curating those data, processing that information, and interpreting that information to answer questions that people around the state have about weather and climate.

What significant trends have you observed in Illinois' climate over the past few years?

Illinois has gotten warmer and wetter since the Industrial Revolution at the turn of the 20th century. We've seen all seasons get warmer, but winter has warmed at a much faster rate than all the other seasons. Our winters have warmed about five times the rate of our summers, as far as average temperature is concerned.

That being said, in the spring and the summer, our warm season, we do see an increase in temperature as well as humidity. Those shifting seasons can cause changes in our overall climate, especially the changes in plant and animal species composition for our ecosystems. A lot of milder winters overall can make more attractive conditions for different types of non-native — or in some cases invasive — species of plants and animals to move in. That can have an impact not only on native ecosystems, but also on agriculture.

Trent Ford evaluates and records the data from a soil moisture and weather monitor as part of his research. *Credit: Trent Ford*

Switching to those low-carbon energy sources and agriculture are the most pressing needs globally to reduce greenhouse gas emissions. But, along with mitigating climate change, reducing vulnerabilities and adapting are also extremely important.

On the precipitation side, arguably the largest impact that we've seen is heavier rainfall. The state is wetter now than it was 100 years ago. More of that rain is falling because of large rainfall events that occur over a short period of time. That's changing how the land is responding to that water: where we see runoff, the impacts related to flooding, and where that flooding occurs. That's really one of the biggest impacts we've been noticing.

Overall, when we think about regional issues across the U.S., we have certain regions where it's a real question if they can sustain the agriculture or urban design paradigm that they've been working within for the last 50 years. We don't necessarily have that in the Midwest, but we definitely have issues that we have to deal with. I think heat and the increased frequency of flooding, especially outside of river systems, are two of the pre-eminent issues that we've been dealing with. Based on the projections that the models are putting out, we're likely to continue to deal with them in the future.

What do you believe are the most pressing climate-related challenges Illinois is facing now?

There are a handful of issues that climate change creates. Mostly, though, what climate change does is exacerbate existing societal problems, inequities, and injustices that we just haven't fixed or have gotten largely ignored. Issues like housing and security, urban sprawl and urban design, and energy efficiency are what climate change is putting at the forefront.

Switching to those low-carbon energy sources and agriculture are the most pressing needs globally to reduce greenhouse gas emissions. But, along with mitigating climate change, reducing vulnerabilities and adapting are also extremely important.

Where the rubber meets the road is locally. For example, in Illinois, if you were to map just extreme heat vulnerability across any place, you're going to see large disparities between neighborhoods. There's a lot of that in Chicago, but we also see it here in Champaign, just across the tracks.

There are big differences in vulnerability to extreme heat. Much of that has to do with income, housing security, and all of these things that are adding up that have existed for a long time and have been perpetuated. Fixing those problems reduces overall vulnerability to the hazards we're seeing more frequently.

Like I said, you have this global focus of climate change being this huge problem, but a lot of the solutions can actually be local. The fact that we have those big disparities here in Champaign-Urbana between neighborhoods has nothing to do with the Intergovernmental Panel on Climate Change (IPCC) or ExxonMobil. That can be fixed locally, the same way that the state can do a lot to decarbonize its economy.

How would you say Illinois measures up to other states in terms of climate policy?

Pretty well. Regionally, I would challenge anyone to argue that we aren't leading the Midwest in climate policy from both an adaptation standpoint and, I think more importantly for Illinois, a mitigation standpoint. I think we're leading the region.

The state is prioritizing its adaptation, and, there's a lot more work to do. There's a lot of vulnerability out there. A lot of times, the Midwest is seen as this haven for climate change. We try to push back on that narrative because even though, yes, our problems are maybe not at the same scale as other places in the world, we do have our own issues that we need to make sure we shore up. But I think overall, the state has been a leader as far as climate action is concerned.

Could you talk about food insecurity and agriculture? Is there any relation there?

Roughly 90% of our land is used for food production or grain production. We are a net importer of food in Illinois, meaning we export less than we are bringing in from other states. A lot of those states, paradoxically, are states that are producing food based on water that is running in short supply — places like Arizona and California. If you think about food as water, in many cases, California is exporting water to Illinois, which doesn't make a lot of sense. So, this system makes unhealthy calories cheaper. It can make things like fresh produce a lot less available for especially low-income folks and families. That's a real issue. But it also means that we are, again, not sustainably producing that food.

One of many solutions to climate change — not a silver bullet, but still a solution — is sustainable and local food production. Increasing the resilience of those supply chains for food by reducing the geography over which they have to travel is a huge way that we can ensure food security in Illinois.

What lessons can we learn from our climate history in Illinois to better prepare us for future challenges?

Drought is my own personal research interest. Illinois is getting wetter, and we have gone now 12 years without a significant drought. And I would argue we've gone several decades without a really serious drought. But if we look back in the history of Illinois, we have really serious droughts. It's part of our natural climate variability. And despite the wetter trend, we are very likely going to see a very serious drought sometime in the near future. I don't know when it'll be, and if somebody tells you when it'll be, they're lying because they don't know either. But I can guarantee there will be one.

We have a lot of water in Illinois, fortunately, but it's an extremely important resource, never more so than when we're in a drought situation. That's one use where we look back on the climate record and say, "Yeah, it's been great, but we can have these issues." If we do, we need to make sure that we have the water that we need.

Do you have a climate wish list or a desired set of legislation to improve climate outcomes in Illinois or even nationwide?

I'm politically agnostic in this job, so I don't tee up policies. A lot of times there'll be discussions about the needs from a climate change standpoint, and then the people who are paid to draft the policies will draft the policies or not. I will say that there are definite shortcomings in many areas usually when I'm talking to state agencies.

One, for example, is farm worker safety, because there's many different issues that are unique to farm work. One thing that we lack is any coherent policy on or regulation of farm worker safety in Illinois. That's something that is mirrored in most states in the U.S. right now. When talking with state agencies, I show them the projection of increased extreme heat in Illinois. This is something that's likely going to continue happening and increase the exposure risk to farm workers. Not having any workplace protection could really increase the risk of bad outcomes.

Do you think that climate outcomes can truly improve with individual action, or does it truly require systemic change?

Systemic change is the most efficient and effective way to get there. And I think we could argue that it's absolutely necessary. But individuals ... it's funny because we designed the system. Individuals have agency to make change to that system through civic engagement. But it can be hard to feel the power of your vote. You protest and you go home and nothing's changed, and it can be hard to feel that way.

If you're a land manager or owner, making those conservation efforts to reduce the impacts of climate change, like soil erosion, can slow biodiversity decline. If you're somebody who wants to make changes to their diet or the way they're using energy or the way their transportation works, that does make a difference, even if it doesn't seem like it does. So both are true. We need the system to change, but individuals can make a huge difference, too.

Anjali Yedavalli is a senior studying Integrative Biology and minoring in Public Health and Chemistry. She is a Communications Intern for iSEE and is heavily involved in public health and bioethics research on and off campus. Anjali is also the President of a competitive a cappella group, the Illinois Rip Chords. After graduation, she hopes to attend graduate school for public health and epidemiology.

Content advisory: the following article contains graphic descriptions and images of animal cruelty.

REN LASHLEY

SLAUGHTER & SURVIVAL ON THE ICE

A Canadian hunter raises a *hakapik* to the sky, prepared to club a young seal to death. *Credit: Stewart Cook via Getty Images*

It is April 8, 2022, the first day of the Canadian seal hunt, and the ice teems with death.

Hundreds of men scatter along the snowbanks with weapons in hand. Most sport identical synthetic snowsuits in shades of orange, green, or black — a stark contrast against the vast plain of piercing white snow. As they roam the landscape, trails of sloppy red boot prints mark their progress. Pools of blood soak the previously pristine landscape, infant bodies lining the icy coast. In the corner of this bloody tableau, a lone pup makes a break for it. Its black eyes frantically scan the surroundings, desperately pulling its small body away from the slaughter. Isolated on the ice, the pup, separated from its herd, screams out in fear for its mother. The man hoists a *hakapik* above his head, hammer side down. With one clean motion, he slams the wooden hammer down onto the pup's skull, its cry dying in its throat. But the pup still breathes. He brings down the hammer again. And again. And again, until blood streams across the frozen wasteland, the pup's skull crushed. Despite the damage, the pelt itself is free from punctures — a bullet would be a quicker death, but a hole in the skin won't do. The man drags the lifeless corpse to the pile with the rest of the slaughtered, tossing the remains before moving on in search of more victims.

On a separate snowy plain, still within the upper Canadian borders, a different style of seal hunt takes place. A few pairs of Inuit hunters approach the ice drifts on snowmobiles, thick hoods ruffling in the icy wind. Their jackets, made from the very creature they are hunting, are a deep brownish-grey, distinct from the white landscape. They slow their speed as they near the typical hunting grounds they frequent, scanning the ground for an *aglu*, a breathing hole in the ice made by seals. After looking into a few holes, they spot one without the thin layer of ice that indicates it has not been used. They park their snowmobiles a few meters away, approaching the hole on foot. Then they settle downwind, making sure not to cast a shadow into the hole, and wait. Inuit seal hunting involves a lot of waiting — waiting for weather to clear, waiting for seals to arrive, waiting for the right time of day.

After anywhere from minutes to hours, the easily identifiable sound of a seal breaching rings out. The hunter quickly grabs his rifle and shoots a single shot into the hole, killing the seal. Without wasting time, he hooks the seal with a gaff hook, preventing it from sinking back into the sea, and begins to widen the *aglu* to get the body out. After the body is freed, the hunter moves it several meters from the hole to avoid offending the other seals. Upon hearing the shot, the other hunters converge on the *aglu* to help with the skinning process. The first man who arrives brews tea for the ones to follow, a communal practice to allow the hunters to warm up and unite over the kill. They skin the seal, washing the fat skin in the *aglu* as they share tea and a small part of the kill, consuming the meat raw. The successful hunter covers the meat on a sled attached to the back of the snowmobile, allowing the skin to drag behind to free it of more fat. The others return to their posts, waiting once more for the catch they need to feed their families.

Inuit hunters have many uses for seals beyond just their meat. The blubber, when melted down into oil, is a vital source of fuel that keeps lanterns lit and stoves burning. The skin, when cut into strips, is incredibly versatile: It can be used as bowstrings, harpoon/towing lines, bootlaces, ties for tightening clothing/bags, thongs for lashing sleds, and even boot soles. When kept whole, the entire skin can be used as tents or covers for kayaks and *umiaqs*, open skin boats used by the Inuit. The most important role of seal skin is to create jackets, gloves, socks, boots, and other clothing to keep Inuit warm. Without access to seal skin, one of the only renewable resources in the Arctic, the Inuit would have been frozen out of the Arctic ages ago.

Both of these hunts occur annually, in March or April (right after the breeding season), when the Canadian seal hunt officially begins. Hundreds of companies flood the ice in search of baby seals for one reason: their fur. When young, certain species of seals possess nearly solid white coats that slowly turn gray as they age. These pelts are a hot commodity for commercial hunters, as many seek out these furs for use in coats, hats, mittens, boots, and a variety of other garments. While the killing of white coat baby seals is illegal, it becomes legal when they start to shed their coats at about 12 days old. A majority of these hunters are Canadian fishermen looking to earn some cash during the off-season. Commercial fishermen make about one-twentieth of their incomes from seal hunting. Most sealers live in Newfoundland, where income from the hunt accounts for less than

An Inuit family regroups after catching a seal. *Credit: Peter Prokosch*

A harp seal pup and adult, boasting vastly different coats.
Credit: Gunnar Sætra via Institute of Marine Research

These bans threaten not only cultural practices, but seal hunts that are vital for the livelihood of the Inuit.

1% of the province's economy. With the meager income provided by these killings, it's a wonder the commercial sealing industry still exists at all.

The two sides of the seal hunt, commercial and traditional, are vastly different in both their goals and methods, yet fit within the same overall system. Both hunters face the Arctic cold in search of seals to hunt, fighting to survive in climates people rarely seek out willingly. Despite the long cultural history and traditions associated with the seal hunt, the Inuit are trapped within the same economic structure as the Canadian fishermen. The Inuit, however, are disadvantaged due to a long, complicated history of colonialism that has left them destitute. This muddies the waters of the issue, as those who seek to ban the seal hunt would save the lives of the seals while leaving the Inuit without their cultural traditions. These bans threaten not only cultural practices, but seal hunts that are vital for the livelihood of the Inuit.

Archeological evidence reveals that seals have been hunted in the Canadian Arctic for over 4,000 years. Inuit began hunting seals due to a warm period from 900 to 1350 AD, which allowed "herds of harp seals, and, perhaps, walrus to extend their summer ranges into waters that had been closed for a thousand years. In turn, [Inuit culture] was able to expand eastward, hunting these animals along the northern coast and islands of Canada." The subsequent arrival of European colonizers led to trade between the Inuit and the settlers. After the whaling industry began to decline in the 1870s, the seal took its place as the dominant trading product. The Inuit would trade sealskin, blubber, and sealskin boots to foreign hunters and trappers, forging ahead in the confusing new economy they found themselves in. They began to rely on the seal as the primary source of income, sticking to their cultural roots while also entering into the global marketplace.

Many today question the spiritual relationship between the Inuit and the seal. Some believe that "the use of modern equipment to hunt seals and the selling of their skins for any reason are incompatible with presumed tenets of Inuit spirituality." Yet, their history with the seal has spun a cultural web of survival for the Inuit and has always played an important role in their beliefs. The Inuit believe that the relationships between humans and animals are beyond the typical predator-prey dynamic — the animal can consciously decide to show itself to the hunter. The animal decides if a hunter has a worthy enough intent to make the kill, only showing itself if the hunter maintains *Inummariit* — being a genuine, real person not just in their relationship to other people, but also to the creatures they hunt. They see animals and people in a constant dialogue, reacting to the intent of the other, which "brings them together into a single cognitive community." The Inuit use every part of the seal as a sign of respect, to make sure that the sacrifice of life is not taken for granted. What parts of the seal they don't use, they sell, fueling Inuit economies and providing their people with a fairly reliable source of income they would not find elsewhere.

However, the industrialization of seal hunting has made the sale of seal products difficult for Inuit communities. Public outcry against seal clubbing, done almost exclusively by commercial hunters, made the practice taboo. In 1976, the international environmental organization Greenpeace began a campaign against seal hunting, broadly condemning the practice by using emotional language and violent, evocative imagery. It depicted the more violent actions done by these hunters, focusing primarily on seal clubbing. The public loudly voiced its distaste for the practice, refusing to buy products made from seals in protest. Although only 3% of seal clubbing in southern Canada is attributable to the Inuit people, they faced considerable backlash alongside the industrial hunters. This led to the Council of Ministers of the European Economic Community banning the import of seal pup skin for two years. In 1987, commercial hunting for 6-to-12-day-old harp seal pups was officially stopped in Canada, further tanking the market and leaving Indigenous populations destitute. Indigenous products made with seal skin did not use pup fur, as the Inuit exclusively hunt grown seals. They have no use for the white pelts the commercial hunters sell.

The ban led to Inuit communities losing nearly 60% of their already meager income. Without the financial boost seal hunting offers, Inuit hunters struggled to afford fuel and ammunition. Commercial seal hunting bans have exceptions for Indigenous communities, but they make so little money due to the wide condemnation of their products that they can barely afford to hunt for their families, let alone for profit. The documentary *Angry Inuk* reports that the ban led to seal skin prices falling from around $100 to about $10, in turn causing average incomes of Inuit seal hunters in Nunavut to drop from $53,000 to $1,000. As income plummeted, suicide rates skyrocketed. One study found that "between 1999 and 2003, the rates in Inuit regions averaged 135 per 100,000, more than 10 times higher than the general Canadian rates."

Given the high poverty rates and their isolated location, a majority of Inuit have little to no access to affordable foods. One study on Canadian Inuit communities found 68.8% of Inuit lived in a household experiencing food insecurity. Seal meat can supplement the poor-quality food sold by supermarkets due to its high nutritional content. When compared with other meats like beef, pork, and chicken, seal has not only the highest ratio of iron, calcium, magnesium, and vitamin B12 but also the most protein. Seal meat is incredibly lean, with less than 2% total fat compared to beef's 23%, which can help decrease the rate of heart disease. Consuming traditional seal-based foods also helps connect the Inuit to their culture as "It is *niqituinnaq*, real Inuit food, that conceptually and concretely integrates the human community through harvesting with the natural environment." The seal hunting ban, while beneficial to the seals themselves, destroyed Inuit livelihoods and made it difficult for them to connect to their culture through the stigma surrounding their cultural foods. Without the seal hunt, Inuit communities struggled to survive and continue to do so to this day.

Men's seal fur gloves.
Credit: Roberto Fortuna via Wikimedia Commons.

A piece of harp seal meat.
Credit: Kim Hansen via Wikimedia Commons.

Inuit women wearing *amauti*, traditional parkas. The one on the left is made of sealskin.
Credit: Ansgar Walk via Wikimedia Commons.

By publicizing their experience and the important role seal products play in their culture, Inuit activists are reclaiming their narrative, centering their culture as important and deserving of respect as any other culture.

However, the Inuit refuse to let their practices be dismissed without a fight. Documentarian Alethea Arnaquq-Baril and her 2016 film *Angry Inuk* are raising awareness of the effects of the seal hunting ban. Her documentary counters much of the dominant narrative on seal hunting, such as the myth that harp seals are endangered and that the governmental exceptions on Indigenous seal hunting are the only thing required to repair this damaged community. The film presents the lives of the Inuit to a primarily Western audience, showing the vitality of this practice, and follows Inuit lawyer and seal skin clothing designer Aaju Peter as she travels with Inuit students to Europe to counter-protest against animal rights groups like the International Fund for Animal Welfare. However, Inuit protesters struggle against the larger organizations with much better funding and were ultimately unable to stop a 2009 vote to ban all seal products. A few animal rights organizations have issued statements that they are not against the subsistence farming that the Inuit practice, but it has been too little too late.

In addition to the documentary, a more recent trend known as "sealfies" has been raising controversy amongst animal rights activists. After the 2014 Oscars, television personality Ellen DeGeneres held a selfie-focused anti-sealing charity event that raised $3 million to petition the Canadian government to further restrict seal hunting. As a response, some Inuit began to post their own "sealfies" of themselves wearing products made from seals or consuming seal meat, some even posting pictures of themselves next to dead seals.

The founder of the campaign, mask dancer and poet Laakkuluk Williamson Bathory, said that she "wanted to it to be a tongue-in-cheek protest to all these very serious animal rights activists. Many ... Inuit use humor to make a strong point instead of anger." Williamson Bathory "also wanted the sealfie to focus on cultural celebration and positive self-esteem" to detract from the negative lens through which many people view seal hunting. This movement took Twitter and other social media platforms by storm, drumming up support for the traditional Inuit way of life. By publicizing their experience and the important role seal products play in their culture, Inuit activists are reclaiming their narrative, centering their culture as important and deserving of respect as any other culture.

At first glance, seal hunting seems barbaric. It's an easy target — "Seal hunting is done out on the open for anyone to see. It's red blood on the white ice. There are no abattoirs: it can't be hidden away." Despite the attempts to stop it, the seal hunt continues in both forms — as an Indigenous method for survival and a massive commercial excursion. Inuit have adapted their traditions to the modern age yet cannot make a profit like this. Multiple anti-sealing campaigns claim to not be targeting Inuit seal hunting, but by making these products taboo, the market for seal products has dried up considerably. Without a place to sell their wares, the practice of traditional seal hunting is at risk of fading away. Lacking proper awareness of the cultural importance of seal hunting, environmental activists are endangering this millennium-long practice, which may soon be abandoned forever.

Ren Lashley graduated from the University of Illinois with a double major in English and Sociocultural Anthropology, spending much of their time dedicated to the environmental humanities. They also received certificates in Environmental Writing and Museum Studies. They are currently employed at the Museum of the Grand Prairie in Mahomet, Ill., and intend to pursue their master's in library science and history at the University of Illinois in the spring.

It's 9:19 a.m. and 73º outside, which is really weird for mid-September in Wisconsin. My classmates and I are in the middle of nowhere — Baraboo, Wis. — at the Aldo Leopold Foundation for a field studies class. Our professor introduces us to a wildlife identification app, Seek by iNaturalist. We all hunch over, waving our phones around trying to find just the right camera angle for the app to tell us which plant and bug species we are looking at. Although we don't know it, using the app to satisfy our curiosity is contributing to a much larger research goal.

According to their website, iNaturalist is "a crowdsourced species identification system and an organism occurrence recording tool." In other words, iNaturalist is a citizen science project, one that many people are a part of without even knowing what citizen science is. The website SciStarter is just one forum everyday people can use to find opportunities to volunteer and contribute to larger scientific research. According to SciStarter, iNaturalist was the #3 citizen science project of 2023 with over 150,000 new contributions.

Participatory science, traditionally known as citizen science, refers to projects where professional scientists rely on volunteers (who are largely not professional scientists) to help them collect data. There are hundreds of participatory science projects nationwide, and you can find them on websites like NASA, National Geographic, the EPA, university

...Studies demonstrate time and time again that the groups who could benefit the most from participatory science projects are also the least likely to participate.

websites, citizenscience.gov, and Zooniverse to name a few places. The longest-running participatory science project in the world is the Audubon Christmas Bird Count, where people have helped researchers collect data on bird populations since 1900.

Although most participatory science projects do not have restrictions or requirements on who can participate, many people don't know what participatory science is, and even fewer know of local opportunities or other ways to get involved. Unfortunately, studies demonstrate time and time again that the groups who could benefit the most from participatory science projects are also the least likely to participate.

RiverWatch volunteers monitor stream habitat and aquatic invertebrate populations.
Credit: National Great Rivers Research & Education Center

> **“One of the reasons it’s really important to have diversity is because we need to be able to trust each other, and when people are too isolated in their groups, that’s when they start to lose trust. ”**

For example, one study focused on a river monitoring project showed that the volunteer demographic was disproportionately white and educated, inadvertently resulting in river sample sites that excluded low-income areas with more polluted water.

At the Smithsonian Environmental Research Center (SERC) in Maryland, Participatory Science Program Assistant Shatiyana Dunn is working to get middle and high schoolers involved in native plant conservation and growth condition research. “I like to work with marginalized communities because that’s the type of community I come from, and so I try to make it a point to work with public schools and leaning towards the more Title I public schools,” says Dunn. Title I schools are schools where a high percentage of students have financial need.

“Classroom Cultivation,” an SERC program organized by Dunn, provides science classes with everything they will need to grow native orchid species in different conditions, including plants and pots, water, soil, watering cans, sheltering units, and lights. Dunn mentions that scientists have been struggling to grow the orchids in labs, and through employing middle and high school classes the program expands the scope of the research and helps get results faster.

Over the course of the two-week program, Dunn visits different schools to help students and teachers get started. Students build shelters, plant and label the orchids, and collect data. “A lot of students like hands-on things when it comes to science, not just looking at a video, not just reading.” Dunn continues. “I don’t necessarily want to create scientists. I understand that the science is hard and it’s not something that everyone does, but I like the term ‘Earth advocates.’”

According to Dunn, “Earth advocates” are people who are aware of their environmental impact, who can see how their actions fit into the science, and “who make conscious decisions that advocate for the Earth, advocate for their local environments.”

Meanwhile at the Field Museum in Chicago, Youth and Community Partnership Coordinator Ylanda Wilhite leads the Green Ambassadors Program, which aims to get young people involved in science. Like Dunn’s project, Green Ambassadors partners with local high schools. These high schools are largely on the South Side and represent a diversity of students, Wilhite explains, and includes a military academy, a selective enrollment public high school, and neighborhood schools.

Bruce Colravy, Champaign associate of RiverWatch and Citizen Science Coordinator at the Upper Sangamon River Conservancy, identifies a “deep-seated distrust” between communities of color and white scientists, remembering an interaction where a youth group leader was suspicious of Colravy’s intentions when inviting a group of underserved kids to do science. The group leader assumed ill intent and a desire for free labor, while the project wasn’t actually lacking for volunteers. Colravy says, “You know, history supports that: his distrust. One of the reasons it’s really important to have diversity is because we need to be able to trust each other, and when people are too isolated in their groups, that’s when they start to lose trust.”

In my conversation with Dunn, she discussed the problematic history of white scientists entering non-white spaces, referring specifically to birth control experiments in Latin America that left tens of thousands of women sterile, and a persistent rhetoric that implies Black and Indigenous stewardship practices are barbaric. “You can’t just have a group of white scientists walking up to a community like, ‘Hey, we’re here to do science.’ It helps to have a person of color on your team, more specifically someone from that community that you’re going into. There needs to be some sort of liaison at all times that can relate to that community.”

When it comes to upping engagement, Wilhite says, “The vocabulary we use, like ‘citizen,’ just that word itself can deter people. They might think, ‘No, I’m not a citizen. I’m not gonna participate in anything like that,’ because they’re nervous. There may be uncertainty if is this a situation where the police are gonna pop up and detain them.” Instead of “citizen science,” Wilhite suggests shifting the vocabulary to “community science.”

Many well-known citizen science institutions have begun re-branding what they do as “community science.” One journal article from 2023 listed 16 organizations that have moved away from “citizen science” language. These include the Field Museum in Chicago, natural history museums in multiple states, and the Natural History Museum in London. All but one of these organizations adopted the term “community science” — the 16th group adopted “participatory science.” Every group noted how using the word “citizen” could be alienating, limiting, or discourage community participation.

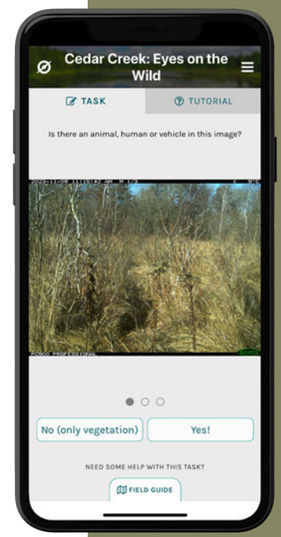
Beyond the discourse around “citizen science,” Wilhite also mentions an awareness of language surrounding plant ecology and how even terms such as “native” and “invasive” species might lead people to question whether they belong in various spaces, be it the science space or the broader community.

Not everyone agrees with the move away from “citizen” science language. An article published in 2021 in *Science* argues that the citizen science field should be focused on changes in approach to increase participant diversity, not a name change.

Both things can be true. Changing the language without changing approach could easily come across as performative. Changing the approach could do wonders to increase diversity but some would-be participants will still balk at the term “citizen.”

Another challenge which may limit the diversity of participatory science volunteers is the accessibility of projects. Many people don’t know that there are projects right in their backyards. Even in urban locales like Chicago, participatory science programs offer a variety of ways to get involved, from working in the garden around The Field Museum to lending a hand in the greenhouses at local universities.

There are opportunities to contribute even if you don’t have a local project. Sitting at home, procrastinating college assignments that do not keep my interest in the same way that “science stuff” does, I find myself detouring to Zooniverse again and again. In addition to making 42 classifications for the Chicago Wildlife Watch animal identification project, I have also helped identify cloud coverage on Mars using readings of climate data taken on Mars at high altitudes, identified germinal centers in lymph nodes for breast cancer research, and classified clips of sounds in a study on language and speech development.



Some examples of environmental projects on the Zooniverse app.

I get to choose my projects, and the training has been straightforward, taking no more than 5-15 minutes. I can do however many classifications I feel like, be it one or 20. The open-ended time commitment makes these projects incredibly accessible — something I can choose to do without any pressure. As a college student who also has a part time job, I found the best part of the Zooniverse projects was that I could do them on my own time from anywhere. Simultaneously, I am satisfying my desire to learn and helping further research.

The diversity of project types is vast, and participatory science isn't limited to just the physical sciences. Some projects ask for help digitizing museum collections, some seek out people who will help transcribe handwritten historical documents, and other projects explore social science topics such as studying human behavior. There is something online for everyone — as long as you have internet access.

For some participants, in-person projects are a must. One cloudy morning in early April, I connected with Wendy Harris, a National Great Rivers Research & Education Center volunteer working on the Winter Chloride Watch. Wendy studied Archaeology and is a Master Naturalist but works in finance for the School of Social Work on the U. of I. campus. She marries her interests in scientific research and environmental justice through volunteering for participatory science projects.

The Winter Chloride Watch asks that volunteers sample water at least three times in the winter season (December to April) using a titrator to collect data monitoring chloride levels in rivers. Chloride levels can be highly variable from month to month, and especially from year to year since a milder winter means less road salt. One of the perks of this project is that participants get to choose their own sample site and sampling itself doesn't take very long at all.

Titration strip from water quality testing at Scott Park.
Credit: Madeline Yu

I tagged along with Wendy to collect her April sample. Wendy picked me up and we drove to Scott Park, her site of choice since it is near where she works. The National Great Rivers Research & Education Center, which runs this project, mailed Wendy everything she would need for sampling free of charge. The package contained a small tube to collect the water sample, a titrator (test strip), and a guide with instructions on how to collect the sample, use the titrator, and get a measurement.

Expanding diversity in participatory science is a form of environmental justice, actively working to counter the historic exclusion of non-white people from science spaces.

Wendy and I got out of the car and climbed through the dead plants and tallish grasses down to the creek where she filled the tube. At most, it took us 5 minutes to climb down, get the water, and climb back up. In the car, Wendy checked the air temperature to log alongside the data while the titrator sat in the water until the test strip changed colors, indicating that the reading was done. Using the numbers on the titrator and the corresponding values on the little guide, Wendy entered the data on a website, where you can see images people took at their monitoring sites, the air temperature data, the all-important chloride levels, and a map view of the site.

After the data was logged, Wendy dumped the water sample in the parking lot and that was that. Participation in this project was easy, straightforward, and took less than 30 minutes. The organization running the project takes care of getting materials to you, and you don't need to send anything back. The data entry can be done from your smartphone in minutes. Many participatory science projects, such as this one, require very little technical expertise, allowing large numbers of people to collect many more data points than projects with highly specialized skill set requirements would be able to.

RiverWatch is one of roughly 7.5% of participatory science projects that collect demographic information. According to Colravy, "We've done really well with really reaching out. Our age diversity is great, gender diversity is great. We are still working on race diversity. It's not that there isn't any there. It's just that it doesn't really reflect the population like it should." This diversity is important, he explains, because "diverse organizations simply do better than organizations that are not. The right thing to do is to give everybody an opportunity to experience science and volunteerism."

Without a diverse participant pool contributing to these projects, the data collected isn't truly representative. Expanding diversity in participatory science is a form of environmental justice, actively working to counter the historic exclusion of non-white people from science spaces. By intentionally centering the people most directly impacted by local issues, participatory science projects can foster a greater connection with the community, the environment, and with nature.

If you enjoyed science at any point but aren't getting enough of it, the wide range of project options is an excellent way to get a little (or a lot) of hands-on science back in your life. There is absolutely something for everyone regardless of where you are or how much free time you have. Anyone can be an Earth advocate. Science is everywhere, and it's for everyone. You just have to be willing to look.

Volunteers participating in the Smithsonian Environmental Research Center's salt marsh census.
Credit: Smithsonian Environmental Research Center

Madeline "Maddie" Yu graduated in May 2024 with a B.S. in Earth, Society, and Environmental Sustainability and a minor in the Sustainability, Energy, and Environment Fellows Program. Originally from Chicago, Ill., Maddie currently works as a Visitor Services Resource Assistant with the USDA Forest Service in the Columbia River Gorge National Scenic Area.

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