



Montana Natural History Center

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# MONTANA Naturalist

TO PROMOTE AND CULTIVATE THE APPRECIATION, UNDERSTANDING AND STEWARDSHIP OF NATURE THROUGH EDUCATION

**On the Wings  
of the Belted  
Kingfisher:**  
A Celebration of  
Interdependence on  
Rattlesnake Creek



Monkeyflowers in Yellowstone | The Salmonfly Project | Pondering Pasqueflower | Morel Moon

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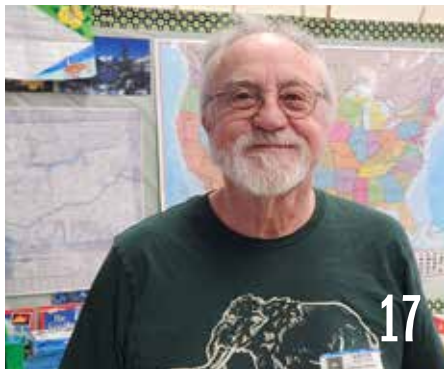
##### ON THE WINGS OF THE BELTED KINGFISHER

A celebration of interdependence on Rattlesnake Creek

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**Cover** – A female Belted Kingfisher perches on a branch at the Lake Creek Reservoir just outside of Troy, Montana. Photographer Don Jones has been observing her and her mate for a couple of years, and took this gorgeous shot from a photo blind with a 600mm lens. See more of his photography at [donaldmjones.com](http://donaldmjones.com).

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## tidings

### One of the things I most admire about my friend

**Cedar** is that he notices, and draws attention to, subtle natural phenomena that most of us completely miss. Maybe we're looking at our phones, or thinking about what we're going to make for dinner, or hurrying to pick up our kid from school. Maybe we're hiking a trail quickly, focused on the lake or the peak or the viewpoint ahead. So, unlike Cedar, we don't notice the hoarfrost-lined cavity in the snow that means a small animal is tucked inside, breathing.

I was thinking of that ability to slow down and take notice while I was running along the river trail this week. As the thought surfaced in my mind, a huge, dark form swooped into a tree just a few feet away. (Some of us require more obvious natural wonders.) It was a Bald Eagle, head gleaming white, beak and talons sharp, perching on a winter-bare branch to look into the tumbling water below. In that moment, I stopped thinking about deadlines and dinners. I felt the bracing wind, heard the river's splash, looked into the fierce bright eye of the eagle. I breathed.

For every tiny (or not-so-tiny) marvel that we do manage to notice, there are a thousand more we don't. We could fill a universe with the things we don't notice—oh. Wait. The fact that there is always something new to discover and admire in this gloriously complex world we live in brings me unquenchable joy.

I loved putting together this issue, because the pieces here, every one of them, celebrate the rewards of paying attention to the small things. Writer Lia Mendez tells a story of monkeyflowers in Yellowstone National Park—specifically, those that have adapted to live in geothermal habitats. It was one evolutionary biologist, Lila Fishman, who noticed that some of the plants growing near the hot springs looked different from other monkeyflowers, decided to investigate, and made an unexpected discovery (page 4). Writer Marina Richie shares what she learned from studying a pair of Belted Kingfishers for seven seasons, observing how life-altering following one's curiosity can be (page 8). Naturalist Stephanie Murphy seeks out spring pasqueflowers, delighting in their purple beauty and place in the ecosystem (page 24). Aquatic ecologists Jackson Birrell and James Frakes have spent years studying salmonflies, and their love for these charismatic creatures inspired them to found a non-profit organization dedicated to conserving them (page 22). And, yes, my naturalist friend Cedar Mathers-Winn delights in the tiny marvels that so often go unnoticed (page 12).

Each piece, each story, is a reminder and an inspiration to, as Marina Richie writes, "Open our senses at every level....Be curious. Be startled by joy."

**Allison De Jong**

EDITOR

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Watching children explore the natural world is another reminder to slow down, observe, let in joy. I'm daily grateful for my son's enthusiasm and curiosity.

ALLISON DE JONG



# monkeyflower as missing link

BY LIA MENDEZ

**HOW ONE LAB AT  
THE UNIVERSITY  
OF MONTANA  
IS LOOKING TO A  
SMALL WILDFLOWER  
TO ANSWER  
BIG EVOLUTIONARY  
QUESTIONS**

If you live in Montana or almost anywhere in the western half of the United States, chances are you've run into *Mimulus guttatus*, known by the common name yellow monkeyflower. The plant's canary-colored flowers—which look strikingly similar to those of its distant relative, the snapdragon—are easily identified by their pursed, flared petals, said to resemble the face of a monkey.

This scrappy, unassuming plant grows happily in even the most inhospitable environments. Patches of yellow monkeyflower can often be found stemming from the banks of streams, bobbing on the breeze in alpine meadows, or blooming defiantly in the face of poor—or even contaminated—soils. This is because when it comes to survival of the fittest, *M. guttatus* is a champion among the plant kingdom. In fact, yellow monkeyflower's proclivity for adaptation has convinced some scientists that the

lowly wildflower might just hold the key to unlocking the most sought-after secrets of evolution.

Since the publication of Charles Darwin's *On the Origin of Species* in 1859, scientists have been working hard to untangle the mechanisms driving adaptation and the emergence of new species. As a concept, evolution may seem simple in theory, but it tends to get messier the more you unravel it. At the tip of the evolutionary iceberg is the basic premise that populations of organisms change over time. We see evolution unfold at the scale of deep time among plants and animals in the fossil record. On the scale of human time, we see evolution play out in the rise of antibiotic-resistant bacteria, or the proliferation of mosquitoes with a genetic resistance to DEET. Life is forever reinventing itself, finding new and ingenious ways to thrive in a dynamic and ever-changing world. And although we think we have a pretty

PHOTO: NPS / JACOB W. FRANK FLOCKER.COM





# wer ink:

**ABOVE:** Looking at this field of yellow monkeyflower along Firehole Lake Drive in Yellowstone, it's easy to believe that a single plant can generate up to 2,000 seeds per pollination.

**RIGHT:** The stems of thermally adapted monkeyflowers are much shorter than their non-thermally adapted counterparts, keeping the plant closer to the thermally heated soil.

solid understanding of how external factors drive adaptation and evolution, questions remain. For example, what's happening at the level of the individual? How does a gene pool evolve over time? And what exactly determines the flip of each genetic switch?

Enter the humble monkeyflower.

Though a common feature in many a watercolor-worthy landscape, *M. guttatus* is more than just another happy little flower. The plant also happens to possess a unique combination of traits that make it particularly well suited for genetic study. Due to its relatively small genome,

quick reproductive cycle, ability to self-pollinate, and high fecundity (a single plant may generate up to 2,000 seeds per pollination), researchers across the globe have devoted countless hours to developing monkeyflower as a model organism.

A model organism is a heavily studied species that can help answer big questions about life in general. By examining the genetic mechanisms responsible for monkeyflower's numerous and varied phenotypes (individual traits or characteristics), scientists hope to better understand how and why new species arise.

Evolutionary biologist Lila Fishman's fascination with monkeyflower was sparked while conducting postdoctoral research at Duke University under evolutionary geneticist John Willis, a longtime veteran and well-known figure in the field of *Mimulus* genetics. Today, monkeyflower is the focus of Lila's research at the University of Montana. In particular, her team has been studying a special population of this fascinating flower growing within Yellowstone National Park.



It all began with an innocent observation back in 2012. On her first visit to Yellowstone, Lila noticed clusters of monkeyflower growing near geothermal hot springs. Not only did the stunted plants look different from the monkeyflower growing in non-thermal areas of the park, those rooted around the hot springs had already reached the end

of their life cycle at a time when other populations were just beginning to bloom. "Cute," Lila thought to herself. "They're clearly all done [for the season] and they're small and they're annual-looking. And I was like, oh, *Mimulus guttatus* is so great, it can live anywhere it's so plastic."

It's monkeyflower's plastic quality that makes it a master of adaptation.

If you've ever attempted to grow a garden in less-than-ideal conditions, chances are you've witnessed firsthand a sample of a plant's wide range of *phenotypic plasticity*. "Plasticity" refers to some variation in the form and function of an organism's parts in response to its environment. Phenotypic plasticity is why a weed growing in full sun is likely to have thicker leaves than its sibling in the shade. Or why a stalk of corn growing in poor soil will direct more energy to sending down deeper roots compared to corn living in soil that is nitrogen-rich.

Plasticity is an especially important survival mechanism for plants. Because unlike other organisms, if a plant's needs aren't being met by its environment, it can't simply uproot and relocate. Which is why, although each plant species is genetically programmed to allocate resources in a consistent pattern—resulting in similarly structured roots, leaves, and seeds—in reality, these patterns are far from fixed. Hence, light availability, temperature, and soil conditions can all influence how a plant's genes are expressed.

While phenotypic plasticity may help individual plants adapt to their specific environment, genetic adaptations are inherited and may be passed on to the plant's offspring. What Lila Fishman wanted to understand about the monkeyflower growing near Yellowstone's hot springs was whether or not she was witnessing plasticity—or the evolution of an entire population.

Although the unique traits exhibited by thermal populations of monkeyflower are observable with the naked eye, identifying the genetic basis for these traits takes a considerable amount of digging. Lila's first step was to propagate seed that had been collected from the park (with a research permit) in a standard greenhouse environment, and see whether or not the plants retained their thermal adaptations. "In the field, things look different for many reasons," Lila explains. The "common

garden”—as it’s referred to in research settings—is the great equalizer.

Lila found that even in a controlled greenhouse environment, the unique traits among the thermally adapted plants were retained. This was enough to convince her that something interesting was happening at the genetic level.

The primary engine driving evolution in all living things is selective pressure: external forces which affect an organism’s reproductive success, or “fitness.” Types of selective pressure include the availability of resources (such as food, habitat, and potential mates), environmental conditions (such as weather and geography), and biological pressures (such as disease or predation).

In the case of Charles Darwin’s famous finches, the selective pressure driving adaptations among birds across various islands in the Galapagos was food source. Initially, Darwin believed that the different birds—whose beak shapes varied dramatically from island to island—were unique species. It wasn’t until the naturalist presented the specimens to English ornithologist John Gould that this theory was disproved. Gould examined Darwin’s so-called “blackbirds,” “grossbeaks,” and “mockingbirds,” and concluded that the birds all descended from a single species of “finch” (now believed to belong to the tanager family) which came to the islands more than one million years ago. After considering this, Darwin ultimately concluded that the unique beak shapes were adaptations to the food sources present on different islands. The geographic barrier between islands limited gene flow among populations, eventually giving rise to numerous unique species. It was this understanding that sparked Darwin’s theory of natural selection.

The Yellowstone ecosystem looks nothing like the Galapagos. Yet in a way, it too is made up of islands. Because of the park’s unique geothermal features, it’s home to an incredible diversity of biomes all stitched together like a patchwork quilt—a rich mosaic of habitats. And while the geography may not present physical barriers to gene flow among plants, might other differences—such as specialized flowering time—create reproductive barriers? Like Darwin’s finches, could we be witnessing the emergence of a whole new species of



**ABOVE: The unique microclimate around Lone Star Geyser is ideal for thermally adapted monkeyflower, and is the one of Fishman Lab’s research sites.**

**RIGHT: These monkeyflowers, though they’re clustered near one of Yellowstone’s innumerable hot springs, are not the thermally adapted variety, as evidenced by their long stems.**

monkeyflower specially adapted to thrive in Yellowstone’s geothermal conditions? These are the questions the research team at Fishman Lab hopes to answer.

**N**ot many people have the privilege of getting up close and personal with Yellowstone’s delicate geothermal features, and for good reason. On average, more visitors to Yellowstone National Park die of scaldings than from bear attacks, despite the presence of staff and signage reminding visitors not to stray from boardwalks and designated trails. Part of the danger of these hydrothermal features is how seemingly innocuous they can appear; even areas that look to be solid ground may be hiding a cauldron of boiling-hot water just a few inches below the fragile crust.

Colette Berg is keenly aware of the dangers lurking in and around Yellowstone’s geothermal vents. It is only because of the training she has received and the significance of her research that the park has permitted her access to these delicate areas.

It’s early April 2021. Despite the glow of the spring sun in a bluebird sky, most areas of Yellowstone National Park remain buried under heavy snow. Colette, a doctoral candidate at the University of Montana, travels by snowshoe to one of Fishman Lab’s research sites near Lone Star Geyser. Her mission: to install two carefully placed cameras. But rather than capturing images of wolves or grizzlies, Colette trains the camera

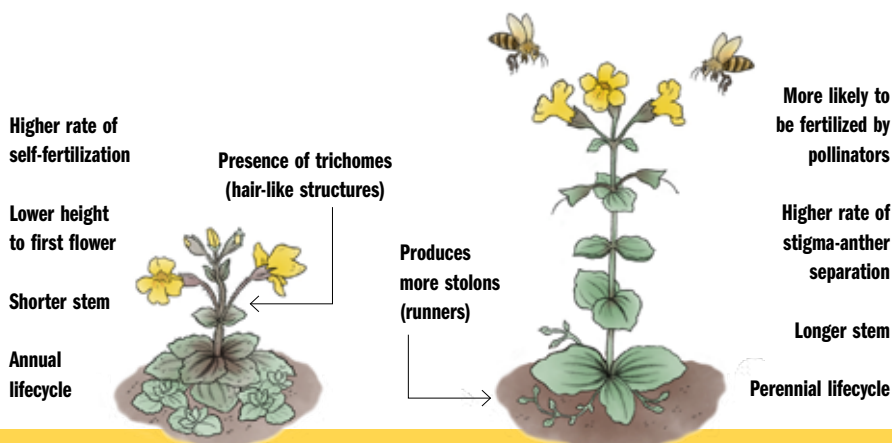
lens on a patch of small, stubby plants quietly thriving in this warm geothermal oasis.

As Colette works, a gale whistles through the trees. Wind sweeps past the geyser below and showers the landscape with a fine, sulfurous mist. Colette secures one of her high-definition cameras to a fallen log just a few yards away from where vapor billows up from steam vents. It is in this unique microclimate that monkeyflower has adapted an early flowering season. Although elsewhere winter has yet to retreat, all around the vents are signs of spring.

It’s these signs that Colette hopes to capture with her cameras. She homes in on a smattering of bright-green growth scattered like buckshot across the bare earth. The plant is hardly recognizable as *Mimulus*. It takes a sharp eye to make out the broad, tiny leaves of the emerging monkeyflower fanning out in tight rosettes. The dime-sized plants more closely resemble groundcover than the typical long and leggy incarnation of the species. Its height is one of thermal *Mimulus*’ most obvious adaptations. Researchers at Fishman Lab believe the plant’s shortened stem helps protect it from the cold air temperatures of early spring.

Another trait of thermally adapted monkeyflower is the prevalence of trichomes: tiny, hair-like appendages that poke out from a plant’s stem and leaves. Fishman Lab initially observed that the plants’ trichomes were much more prominent than among non-thermal





### Thermally Adapted Yellow Monkeyflower

Found in dry, geothermal habitats

### Yellow Monkeyflower (*Mimulus guttatus*)

Found in wet, non-thermal habitats



populations. It's believed that growing heftier trichomes is a genetic adaptation which helps the plants to survive wet and icy conditions: the bristles help repel water and prevent ice from blocking the plant's stomata (the minute pores through which a plant "breathes").

Colette hopes that her work today will help document one of the unique adaptations which enables thermal *Mimulus* to better survive in its extreme microclimate: early flowering time. Only by tracking the reproductive cycle of this unique population of *M. guttatus* can Fishman Lab researchers identify the presence (or lack) of gene flow among thermal and non-thermal monkeyflower at Yellowstone National Park.

Determining with whom the plants reproduce isn't as easy as it sounds. Yellow monkeyflower has the ability to reproduce with itself. Self-fertilization—also known as *selfing*—is common among hermaphroditic plants, especially those growing in stressful conditions. For Yellowstone's thermal

population of *M. guttatus*, self-pollination is far more dependable than relying upon insect pollinators, which typically don't emerge until later in spring.

It is the plant's flowering time and the presence of pollinators that Colette will look for when she analyzes the time-lapse photos captured by the cameras.

**F**ast forward to present day. Fishman Lab has learned a lot about thermal *Mimulus* since the installation of Colette's cameras in the spring of 2021. Yet like the nuance in Yellowstone's varied thermal tapestry, the answers are far from clear-cut.

Perhaps most intriguing is the answer to Lila Fishman's big question: Are thermal populations of yellow monkeyflower evolving into a unique, novel species right before our eyes? In general, the researchers' findings seem to suggest no. It turns out that true islands—isolated by geographic barriers—are better at blocking gene flow than thermal islands. And although the

plant has carved out a unique temporal niche by adapting an earlier flowering time, Yellowstone's thermal populations of *M. guttatus* still manage to interbreed with nonthermal populations, while maintaining heritable genetic differences.

And yet, among all the populations of thermal *Mimulus* in Yellowstone Park currently being studied by Fishman Lab, there is one outlier. This exceptional population, known as AHQT, is the only population whose genome is highly differentiated from all others. Through DNA sequencing, researchers have also observed less genetic diversity among AHQT, indicating a high rate of self-fertilization. So what's going on with this specific population? For starters, it's located in the most extreme thermal environment, where soil temperatures reach a staggering 150°F in summer and where the only source of moisture is melted snow. There is also—you guessed it—a sizable geographic barrier (a distance greater than the length of two football fields) separating AHQT from the nearest nonthermal population, creating what the researchers describe as a "perfect storm of habitat-specific selection for reproductive assurance."

In layman's terms: Fishman Lab has identified a large population of thermally adapted monkeyflower that appears to be evolving into a new, genetically distinct species, right before our eyes. Whether or not the population continues upon its nascent trajectory towards speciation remains to be seen.

If you find yourself among the geothermal features of Yellowstone National Park this spring, keep an eye out from the boardwalks and hiking trails for green rosettes and popcorn-sized pops of yellow. You might just catch a glimpse of thermally adapted *M. guttatus* in bloom. And as you take in the beauty and wonder of the magma-heated red and aqua-tinted pools, you may also be reminded of the so-called primordial soup from which Darwin theorized life on Earth first emerged. 🐦

—Lia Mendez is an artist and writer whose work explores interdependence, identity, and relationship to place. She earned her Master's degree in Environmental Studies from the University of Montana and holds a BA in Literary Journalism from the University of California, Irvine.



# On the Wings of the Belted Kingfisher—

A celebration of interdependence on Rattlesnake Creek

BY MARINA RICHIE  
ILLUSTRATIONS BY RAM PAPISH

Belted Kingfisher whizzes headfirst from a cottonwood branch to scissor a fish from just below the surface of Rattlesnake Creek. Osprey snatches cutthroat trout in talons. Dipper dips. Spotted Sandpiper bobs. Western Tanager nabs a stonefly in midair. Great Blue Heron strikes from stillness. Western toad eludes and plops into a pool.

From headwater springs high in the Rattlesnake Wilderness to a confluence with the Clark Fork River in downtown Missoula, Rattlesnake Creek hums, riffs, and lulls for 23 miles of free-flow. The creek and the riparian forests, shrubs, and meadows are as entwined as lovers. The ways of wildlife are inseparable from their water-nourished habitats.



Ruffed Grouse thrums his rounded wings on a log in a *whumph whump* of courtship. Black bear seeking grubs turns over a decaying log that once was a living ponderosa, then a shelter snag for woodpeckers, and now a nursery for new life. The log rolls into the creek and rides the currents to snug up against a downed cottonwood. Drifted leaves and needles packed tight invite fungi, bacteria, insect larvae, and crustaceans, which in turn feed fish that feed kingfishers. The tree jam has slowed waters to form a petite pool. Kingfisher perches on an upraised root, flicking her tail and raising her crest. She's on the alert for a fish shimmy. One action sets in motion another.



Come with me now to Rattlesnake Creek. Join the Belted Kingfisher on a fine early June day. Ride the flutter-and-glide wingbeats. Hover with head held steady, wings beating hard, short tail balancing, and sharp eyes focusing on darting fish below. Dive without hesitation in one sizzling arrow to snap up a trout. Splash blue and white wings on ripples and muscle up to a limb. Thwack a four-inch rainbow on the branch and swallow headfirst. Give a roll-your-Rs trill of happiness.

For this is the happiness bird—linked to an ancient Greek myth of lovers Halcyon and Ceyx, transformed by the gods into kingfishers destined to nest on the sea over winter solstice. This was the time when Aeolus, god of the winds, calmed the waves for fourteen days, a state of tranquility that sailors would name the “halcyon days.”

While the bird of myth, the Common Kingfisher, dwells in Europe and Asia, the Belted Kingfisher bears the Latin name of *Megaceryle alcyon*. The genus *Megaceryle* translates to “big blue,” and the species name *alcyon* is the Greek spelling of halcyon.

Where better to find the happiness of halcyon days than along a creek, river, pond, pool, or bay? In Salish, the Belted Kingfisher is *čális* (pronounced “ts ah lease”), a word I learned from fluent speaker Aspen Decker of the Salish tribe. The confluence of Rattlesnake Creek with the Clark Fork is *Nłʔayc̓stm* (pronounced “in lah eye ch stm”), meaning “Place of Small Bull Trout.”

The more time I spent with Belted Kingfishers, the more intimate relationships I witnessed among the inhabitants of Rattlesnake Creek. My respect deepened for the Salish whose knowledge and practices reflect thousands of years of close observations.

*Hover with head held steady, wings beating hard, short tail balancing, and sharp eyes focusing on darting fish below.*

When I dove into observing, pursuing, losing, and finding a pair of nesting Belted Kingfishers on Rattlesnake Creek in the spring of 2009, I soon discovered how little I knew of the stream. I'd only skimmed the pages, despite decades of hikes, runs, and bushwhacks; of birding, wading, daydreaming, pulling weeds, and defending the creek from harm.

The Belted Kingfisher drew me into the book of Rattlesnake Creek like a classic novel's lead character—exasperating, quirky, seductive, good-looking, and secretive. The plot unfolded with questions, wrong turns, and hard-earned revelations.

Eventually, the jazzy jay-sized angler guided me to write *Halcyon Journey, In Search of the Belted Kingfisher*. The skittish birds led and I followed the convolutions and conundrums for seven seasons on Rattlesnake Creek. Attuning to a pair of kingfishers alerted me to intimacy within the creek's wild community.

Curiosity bordering on obsession lured me to the water's edge in sun, shadow, hail, snow, thunderstorm, drizzle, wind gusts, and in the darkness before dawn. In those years, I interspersed staying put with long trail runs. I learned to run differently—ready to pause, stop, notice, and sprint when I heard the telltale ratcheting call. Sometimes, I held my arms out wide to slalom around tree roots. Kingfishers entered my dreams.



Know that everything is sentient. The trees are breathing. The creek speaks in the language of spray, froth, glug, eddy, and whirlpool. Even the colorful mudstones inlaying the creek bottom

tell a story of a shallow sea that existed more than a billion years ago. The stones birthed in the mud and sand have become the polished rocks of today. Their colors derive from oxidized iron for the reds and purples, and unoxidized iron for the greens and grays.

June is an exuberant month for tracing the flight of a kingfisher along Rattlesnake Creek. On this imagined-yet-possible morning, the female is in full fishing mode, as is her mate. Flying with a two-inch sculpin clenched lengthwise in her formidable dagger beak, she twists past a Calliope Hummingbird nipping a hatch of mayflies sifting up from the waters. The sky is lupine blue. The air trembles with bird song. She wings past thickets of alder, willow, and red-osier dogwood leafing with Song Sparrow serenade. When an American Redstart rings the crisp air in high-pitched melody, she gives a chittery-chat in response.

Her underwings sizzle with a chili-pepper red belt declaring her as the Queenfisher. She wears the bright belt and the male does not, although his upper blue-gray band dipping to a point on a white breast is quite debonair. Why is she more colorful, in the bird world where males almost always hold the corner on high fashion? This is her signature, her way, and her special power.



Rounding a corner, she greets her mate with a *kkkkkkk!* He has plucked a three-inch fish from the currents and flown up to a tennis ball-sized hole—one of many peppering the vertical earthen bank, forming a high arc. A single hole is the active nest for only one pair of birds. The male folds his wings, squeezes into the entry, and vanishes for a few minutes. Then, he backs out and pirouettes on the furrowed lip to fly empty-billed upstream.

Queenfisher has landed on a lichen-frilled boulder splitting the whitewater in two. Her sodden crest is slicked back. Black eyes shining, beak clamped on sculpin, she's poised for flight and not alone.

Dipper hurtles by in a seal-gray fluster of wings headed for a mossy ball nest under a rock ledge. Bumblebee buzzes toward yellow bouquets of heartleaf arnica. Hammond's Flycatcher chimes a brisk, three-part-song. White-tailed deer—sleek in her



summer coat—hooves past Douglas-firs above the nest bank.

Within the transparent waters, a net-spinning caddisfly threads silk strands between stones to trap tasty detritus. Mayfly nymphs filter feed. Stoneflies crawl into air pockets among smooth rocks jewelizing the bottom in colors of jade, topaz, and garnet.

Queenfisher strokes her wings down, lifts up, and angles toward the hole. Tucking inside, she shuffles up the slightly ascending tunnel. The passageway is five feet long and ends in a football-sized burrow where five hungry chicks heap together. They'd hatched a week earlier—pink, floppy, and featherless. Already, feathers have begun to sprout. She presses the sculpin headfirst into the open beak of a lucky chick. Soon, her mate will be back with the next morsel. Each week for about a month, the parents must catch bigger fish to match the growth of their young until fledging time.

Earlier in the spring, she and her mate dug the nest with their teensy shovel toes. After sampling the promising bank for a week, they'd excavated a new hole instead of remodeling an existing one. This is her second year raising young here, and first for her partner of the season.

*Earlier in the spring, she and her mate dug the nest with their teensy shovel toes. After sampling the promising bank for a week, they'd excavated a new hole instead of remodeling an existing one.*

Cranking skywards from the round hole, Queenfisher reels away. This is her home and haven—a place she knows in the dimensions of sky, forest, water, and earth. With every scoop of wingbeats, she hears the creek calling her name: *calis...*ts ah lease.

## The Belted Kingfisher tunes the wildlife orchestra and punctuates every drama

with an exclamation mark. From my home in Bend, Oregon, I continue my apprenticeship on the Deschutes River. When I visit Missoula, I pay my respects to Rattlesnake Creek. Thanks to my naturalist friends Lisa and Paul Hendricks tracking each season's



pair, I know the birds continue their seasonal rhythms. Not every year is a nesting success.

The removal of Mountain Water Dam in 2020 heralded the renewal of a free-flowing creek from headwaters to confluence. There's more hope for threatened bull trout to survive where waters run cool, clean, and connected. Cold waters are tougher than ever to find in this era of human-caused climate change. Drought and low flows are hard on fisheries and for all fishing birds—kingfishers included.

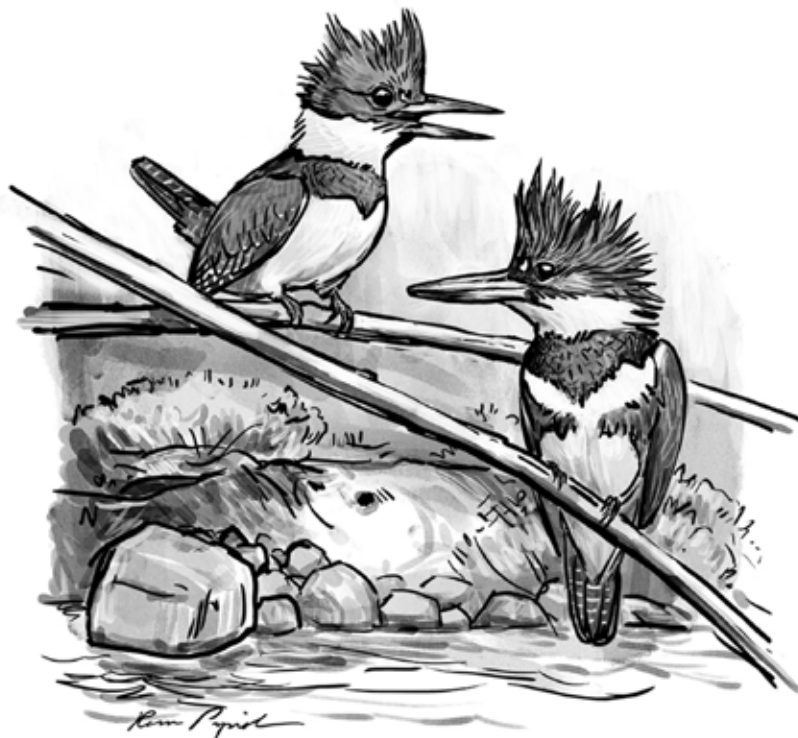
However, restoration with loud machinery came with temporary consequences for the kingfishers patrolling a territory of several miles. The birds failed to nest in a favored earthen bank—a rare feature of stony Rattlesnake Creek. The pond where fledglings learned to fish is gone, yet the rewilding is critical to a natural system where beavers naturally dam the creek in ways fish can navigate with ease. Their pools are nurseries for fledgling kingfishers and young trout alike.

Picture this possible scene on a beaver pond of Rattlesnake Creek:

Common Merganser glides. Water striders skitter on the surface. Tree Swallows orbit. Pileated Woodpecker drums a tall pine snag. Red squirrel chatters and natters. Northern rubber boa snake slides through pinegrass. Columbia spotted frog hops. Mantle slug nibbles moss. Western water shrew chases sculpin. Belted Kingfisher takes his first dive—a bellyflop. Beaver slaps tail.

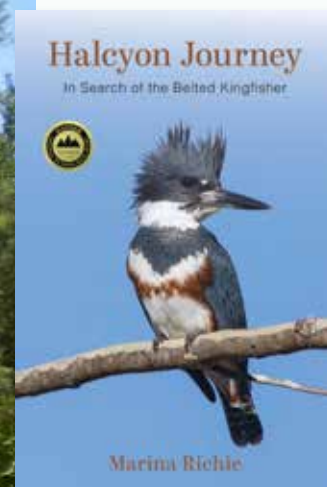
Life upon life. Layer upon layer. I turn to the kingfisher to pilot the labyrinth. At every curve, there's an exquisite interaction. How to express my gratitude? Even the smallest of gestures is a beginning—from freeing a tree of barbed wire to picking up litter.

With every awakening call, the Belted Kingfisher sends a rattling message. Open our senses at every level, from noticing



a crab spider camouflaged within a daisy to delighting in ravens tucking and rolling in the wind. Be curious. Be startled by joy. Be bold on behalf of wild nature. 🦋

—Marina Richie writes about the natural world from her home in Bend, Oregon, after living for decades in Missoula. In addition to her book *Halcyon Journey*, In Search of the Belted Kingfisher (winner of a 2022 National Outdoor Book Award), she authored two children's books (under a prior name): *Bird Feats of Montana* and *Bug Feats of Montana*.



**Rattlesnake Creek: suited for humans and kingfishers alike. If you come across nesting kingfishers, remember that they are very sensitive to disturbance. Watch from a very long way away, or just move on and enjoy nature's many other wonders.**



# Naturalist Notes *from Western Montana and Beyond*

## Nature in Plain Sight:

*Natural history of the ubiquitous but ignored—the wildness in our backyards.*

OBSERVATIONS FROM CEDAR MATHERS-WINN

### January 2, 2023

Which of these little snow crevices shows signs of life? The smooth edges in the photo on the right below might look like they've been trampled, but the snow was soft and there were no footprints. It's actually the hoarfrost rimming the hole in the photo on the left that suggests a creature has used it. But not as an entrance! These tiny ice crystals form when moisture escaping the snow meets the cold air above, and are especially common after cold, clear nights. This can come from 1) moisture naturally percolating up through the snowpack from the ground (in which case, all holes or even the surface layer of snow would be crusted with hoar), or 2) something breathing! The likely culprit in this case was a snoozing vole. This was the only hole I found on my walk that had hoarfrost around its edges like this. Hoarfrost can also tell you if a burrow or beaver lodge is occupied in the wintertime!

*—Cedar is a lifelong naturalist who loves to notice, and draw attention to, the subtle things that are so easy to pass by. He teaches the Master Naturalist course and other classes at the Montana Outdoor Science School in Bozeman. Follow Cedar on Instagram for more brain-tingling naturalist observations: [instagram.com/nature\\_in\\_plain\\_sight](https://www.instagram.com/nature_in_plain_sight), and visit his website at [natureinplainsight.com](https://natureinplainsight.com).*



### January 27, 2023

Lichens are fascinating. Part fungus, part algae, sometimes bacteria too...one of the most intimate symbioses out there. The alga makes carbohydrates through photosynthesis, which are shared with the fungus (or fungi). But plants, like algae, can't photosynthesize without water. So when it's dry, the fungal

part of the lichen covers up and protects the alga, which goes dormant. But when it's wet, the fungus has to get out of the way and let that alga see the light—so the color goes from dark and dull to bright and green! This stick was on the ground, wet on top (right photo) and dry underneath (left photo).





# Wildflower Wanders around Missoula

Spring in western Montana is a glorious season, not least because of the profusion of wildflowers that burst into bloom in the valleys and across the hillsides. Starting in March, a little wandering in the right places will reward you with the vibrant pops of color our souls crave after the whites and browns and grays of winter. Here are a few of our favorite spots around Missoula:



Pasqueflowers  
at Blue Mountain



Fairy slipper orchids  
in Woods Gulch



Bitterroots on the North Hills



Arrowleaf balsamroot on the  
Mount Jumbo Saddle



Camas at Pattee Canyon



Lupine at the Clark  
Fork Native Prairie

## Blue Mountain

With its diversity of ecosystems, from open grassland to mixed conifer forest, Blue Mountain Recreation Area is a wonderful place to seek out wildflowers, whether you're looking for buttercups, pasqueflower, bluebells, arnica, death camas, and more.

## Woods Gulch

On one memorable June hike, one of our naturalists documented 61 blooming wildflower species. Woods Gulch, with its creek, higher elevation, and narrow valley, feels like another world—and is certainly a different ecosystem from the Missoula Valley floodplain. Look for trillium, fairy slipper orchids, woodland stars, glacier lilies, and more. It's also a perfect spot to see the western larches leafing out in the spring!

## The North Hills

The North Hills really can't be beat. From the low pink cushions of douglasia to purply swaths of shooting stars to the bright yellow of arrowleaf balsamroot to the radiant pink petals of bitterroots, the North Hills glow with thousands of wildflowers from March to June.

## Mount Jumbo Saddle

Two words: arrowleaf balsamroot. If you haven't hiked the Jumbo Saddle to witness the peak balsamroot bloom, put it at the top of your to-do list NOW. They usually peak in mid-late May, and sometimes into June. The Saddle is also a great spot for douglasia, buttercups, lupine, paintbrush, prairie smoke, kittentails, and more.

## Pattee Canyon

Did you know that the south side trails at Pattee Canyon are home to a veritable army of glacier lilies once the snow melts? Or that the meadow near the group picnic area blooms purply-blue with camas in June? You know what to do.

## Clark Fork Native Prairie

You don't have to drive to the hills or hike up a mountain to see native wildflowers—just walk down the Kim Williams river trail east of Higgins Ave., where buttercups, lupine, balsamroot, yarrow, yucca, serviceberry, and more bloom in the 2.5-acre Clark Fork Native Prairie.

*Wherever you're exploring, please practice Leave No Trace principles! Stay on the trail—these soil and plant communities are fragile. Hiking off the trail can damage or kill the plants. If it's muddy or icy or sloppy, please walk through it rather than creating side trails, or come back another day.*

*Want directions to specific trails? Visit our website at [MontanaNaturalist.org/wildflower-wanders/](https://MontanaNaturalist.org/wildflower-wanders/).*



## Explore Outdoors with Us This Summer!

Our Pre-K-5th grade Outdoor Discovery Day Camps feature daily field trips, skilled instructors, unique opportunities to connect with scientists and naturalists, and lots of time for exploration and play outdoors.

We're offering ten full weeks of camps this summer, including two camps in collaboration with the Missoula Butterfly House and Insectarium, four STEEM (Science, Technology, Engineering, Environment, and Math) camps for middle school girls, and a hiking and backpacking camp in the Bob Marshall Wilderness for high school girls. Learn more and register on our website: [MontanaNaturalist.org/summer-camps/](https://MontanaNaturalist.org/summer-camps/).

We can't wait to see you this summer!

# get outside calendar



## Programs for Kids

**Join us for our Saturday Kids' Activities!** On scheduled Saturdays families can drop in between 1:00 and 3:00 p.m. for a hands-on kids' activity. Free with membership or cost of admission.

### MARCH

**March 18**

**Spring into Spring!**

From September through May, join us every Thursday morning at 10:00 a.m. for our **miniNaturalist program**—outdoors in the Nature Adventure Garden! Check our website for updates. Program is free; if you would like to visit our Center before or after, regular museum admission applies.

### APRIL

**April 8 and 22**

**Scavenger Hunt**

### MAY

**May 13 and 27**

**Wacky Wildflowers**



MNHC PHOTO



## Volunteer Opportunities

**Volunteers, we are so grateful for all you do!** Join us for our spring field trip training, and stay tuned for more events this summer and fall.

**Visiting Naturalist in the Schools Spring Field Trip Training:** We invite and strongly encourage all volunteers to participate in our VNS Staff Field Trip Training from Monday, April 24th, to Friday, April 28th. Please plan on attending the overview from 9:00-10:30 a.m. on Monday, April 24th, if you would like to volunteer on our spring field trips.

Interested in volunteering at MNHC? Fill out our volunteer application and sign up for our volunteer newsletter at [MontanaNaturalist.org/volunteer/](http://MontanaNaturalist.org/volunteer/).

The Montana Natural History Center is located within the traditional homelands of the *Tatáyaqn* (Bitterroot Salish) and *Qlispélix*™ (Kalispel) peoples who have lived here since time immemorial. The Montana Natural History Center is dedicated to the recognition of the first peoples of Missoula and the integration of Salish language, culture, and Indigenous knowledge.



**MNHC is open Tuesdays - Saturdays, 10 a.m. - 4 p.m.**  
**Please check our website and social media for details.**

#### Admission Fees:

**\$5/adults (18+), \$2/children (4-18), \$10/family rate, Free/children under 4, \$4/seniors and veterans**

**FREE admission for MNHC members, ASTC Travel Passport Members, and EBT card holders!**

**Programs and events held at MNHC, 120 Hickory Street, unless otherwise noted.**

**Programs subject to change.**

**Please check our website calendar for the most up-to-date information.**

**Visit [MontanaNaturalist.org](http://MontanaNaturalist.org) to register for programs and become a member. For more information, call MNHC at 406.327.0405.**

## PHENOLOGY FOR APRIL-SEPTEMBER

### APRIL

Ospreys return

**Western larches are growing bright green spring needles**

Bears are awake



### MAY

**Look for the bright red and yellow of Western Tanagers**

Swallowtail butterflies are fluttering

Venus shines brightly near a crescent moon on May 21 and 22



### JUNE

Kingfishers catch small fish for their young

**Moose calves are born**

Mock orange blooms in profusion



### JULY

Insects, including salmonflies, hatch in abundance

**Warmed by the sun, ponderosa pine bark releases sweet vanilla fragrance**

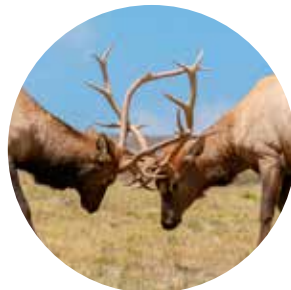


### AUGUST

**Bull elk may begin to spar**

Fireweed is in peak purple bloom

Grasses shift from green to brown



### SEPTEMBER

Autumnal equinox on September 23

Cedar Waxwings change diet from insects to berries

**Cottonwood leaves turn yellow**



LARCH: CHRIS SCHNEP; UNIVERSITY OF IDAHO, BUGWOOD.ORG; Tanager: TRISH GUSSIER, FLICKR.COM; MOOSE: MICHAEL LEWINE-CLARK, FLICKR.COM; PONDROSA: ALISON DE JONG; ELK: MARK LAND; FLICKR.COM; COTTONWOOD: MATT LAVIN, FLICKR.COM



**In-person programming may include masks and distancing, depending on COVID numbers.**



## Adult Programs

Stay tuned for other spring and summer programming including lectures, First Fridays, naturalist field experiences, and more. Check our website and social media for the latest information, or sign up for our e-newsletter at [MontanaNaturalist.org](http://MontanaNaturalist.org).

### MARCH

**March 25 & April 15, Wearable Wild Animal Heads: A Workshop in Two Parts with Jennifer Ogden,** 1:00-3:00 p.m. FREE! Registration required.

**March 27 Naturalist Field Day: Snow Geese Migration at Freezout Lake,** 7:00 a.m. - 6:00 p.m. \$75; \$70 MNHC members. Registration required.

**March 28 - May 2: Online Field Notes Writing Workshop, 6-Part Class,** Tuesdays, 10:00-11:30 a.m. \$135; \$115 MNHC members. Registration required.

**March 30, Yellowstone's Wolves and the "Mind-Control" Parasite,** 7:00-8:30 p.m. \$10; \$5 MNHC members.

### APRIL

**April 3 - May 8, Introduction to Nature Journaling, 6-Part Class,** Mondays, 3:00-5:00 p.m. \$125; \$105 MNHC members. Registration required.

**April 6, 13, 20, 27 Salish Language Sessions with Aspen Decker,** 4-Part Class, Thursdays, 10:00-11:30 a.m. \$150; \$140 MNHC members. Registration required.

**April 17 - May 8 Wildlife Tracking with Rob Rich, 4-Part Class,** Mondays, 10:00 a.m.-12:00 p.m. \$80; \$70 MNHC members. Waitlist only.

**April 19 Saving Mountain Caribou, One of North America's Most Endangered Species,** 7:00-8:30 p.m. \$10; \$5 MNHC members.

**April 27 OpenAIR Artist Presentation and Reception with Sage Friss,** 4:00-5:30 p.m. Free and open to the public.

### MAY

**May 10 Wild Wander at Maclay Flat,** 5:00-7:00 p.m. \$35; \$30 MNHC members. Registration required.

**May 25 Spring Luncheon benefiting camp scholarships,** 11:30 a.m. - 1:00 p.m. At the Visser residence in Grant Creek. \$150. Tickets go on sale April 17.

**May 26-28 Master Naturalist Rendezvous,** 5:00 p.m. Friday - 4:00 p.m. Sunday. \$150. Join your fellow Master Naturalists for a fun weekend in the Seeley-Swan Valley. Enjoy community, fabulous nature programs, and naturalist explorations! Visit [swanvalleyconnections.org/](http://swanvalleyconnections.org/) events for more information.

### JUNE

**June 5-9 Summer Montana Master Naturalist Course,** Monday-Friday, 9:00 a.m.-4:00 p.m. Waitlist only.

### JULY

**July 29 Summer Block Party, Save the date for MNHC's 1st Annual Summer Block Party!** Join us for an afternoon and evening of nature and celebration for the whole community. The day will be filled with naturalist activities, presentations, various food trucks, family activities, and live music! Come party with us in our parking lot! This event is FREE and we want to see YOU there.

### SEPTEMBER

**September 5 - November 21 Fall Online Montana Master Naturalist Course,** Tuesdays, 4:00-6:00 p.m., plus in-person field weekend, TBA. \$355; \$325 MNHC members. Registration required.



### Join us on our monthly Saunters with a Naturalist!

Bring your curiosity and your own naturalist knowledge and join MNHC Naturalist Ser Anderson on a naturalist saunter—choose morning, evening, or both! We will focus on exploring the changing seasons, making observations, following our curiosity, and learning from each other. Whether you are an experienced naturalist or just starting out, these walks are for you!

**Cost:** \$10; \$5 MNHC members. Registration required.

**Time:** Morning saunters are from 10:00 a.m.-12:00 p.m. Evening saunters are from 5:00-7:00 p.m.

#### Dates & Locations:

April 18 (p.m.) & 20 (a.m.) - the Native Plant Garden at Fort Missoula

May 23 (p.m.) & 25 (a.m.) - Milltown Dam State Park

June 20 (p.m.) & 22 (a.m.) - Council Grove State Park

July 18 (p.m.) & 20 (a.m.) - Kelly Island

August 22 (p.m.) & 24 (a.m.) - Greenough Park

September 19 (pm.) & 21 (a.m.) - Maclay Flat

## Hone your birding skills with MNHC's new Birdwatching Club!

Missoula County is home to over 200 bird species, and naturalist Elena Ulev can help you discover them! From migrating waterfowl, raptors, and warblers in the spring to flocks of red crossbills and breeding owls in the winter, each season is fun and exciting to bird in. In the Birdwatching Club, we will visit different sites twice a month throughout the year to find what species are present and how they use their habitats. All experience levels are welcome on this adult program and binoculars are available to borrow.



**Cost:** \$25; \$20 MNHC members. If you sign up for a program, you can attend one or both of the dates that month. (Yes, you can attend two programs for the price of one!) Registration required.

**Time:** 9:00 - 11:30 a.m.; 9:00 a.m. - 12:30 p.m. for Lee Metcalf

#### Dates & Locations:

March 6 & 26 - Fort Missoula gravel quarry

April 5 & 23 - Lee Metcalf National Wildlife Refuge

May 12 & 21 - Greenough Park

June 7 & 18 - Maclay Flat



## Kids' Corner

Our teaching naturalists have such fun working with the kids at Missoula Christian Montessori. Last fall they created some Andy Goldsworthy-inspired outdoor nature art. Enjoy!



MNHC PHOTOS

Kids of all ages can keep a nature journal! We're definitely inspired by the observations and drawings of six-year-old Sam Mead.



## Calling All Kids!

**Do you have any nature art, photography, poetry, or stories you'd like to share? We showcase kids' work in every issue in our "Kids' Corner" —and here's your chance for that work to be yours!**

Send submissions to  
Allison De Jong, Editor, at 120 Hickory Street, Missoula, MT 59801 or  
by email to [adejong@MontanaNaturalist.org](mailto:adejong@MontanaNaturalist.org).

PHOTOS: JENAH MEAD



## imprints

# Volunteer Spotlight: Len Johnson

BY SER ANDERSON

Len Johnson participated in the Master Naturalist course in August of 2021 and started volunteering with the Visiting Naturalist in the Schools program that November. He has been a very engaged volunteer with MNHC ever since, doing everything from helping out at the front desk, volunteering at our auction, serving as an Adult Program Intern and returning to the Master Naturalist program to help a new cohort of naturalists gain the Master Naturalist certification, and helping out with the VNS program both in the classroom and on field trips.

Len says volunteering with MNHC is his new job and the hours he puts in reflect that. In 2022, he was the only volunteer to put in over 100 hours with the VNS program (a whopping 105 hours total!). Len exemplifies curiosity and engagement with the natural world for our students. He enjoys volunteering with the VNS program in part because he gets to learn and explore

along with the students. He has made a point to work with all of the Teaching Naturalists to see how different educators teach the same lessons, to join field trips at all of our field trip sites to explore different natural areas around northwestern Montana, and to be the lead educator for each of the stations we offer during the field trip seasons to develop his own teaching skills.

Always enthusiastic and eager to learn and share with others, Len is a consistent, generous, and dedicated volunteer. MNHC is lucky to be the beneficiary of his time, energy, and passion!

*Thank you, Len!*



MNHC PHOTO

## Check Out Our New Exhibits!

### Naturalist Field Station Welcomes Kelsi Turner Tjernagel: The Write Place.

Our rotating Naturalist Field Station showcases local naturalists at work in their community. This latest installation of our

Naturalist Field Station features Bozeman writer and visual artist Kelsi Turner Tjernagel.

Kelsi's work has its roots in field journals, still life paintings, abstraction, and the curious treasures with which her children fill their pockets. She is delighted when art, science, conservation, and spirit overlap. In our new exhibit, you'll step into Kelsi's studio to learn about what inspires her and how she has developed her writing practice. Exercise your imagination, boost your creativity, and practice the art of nature writing!



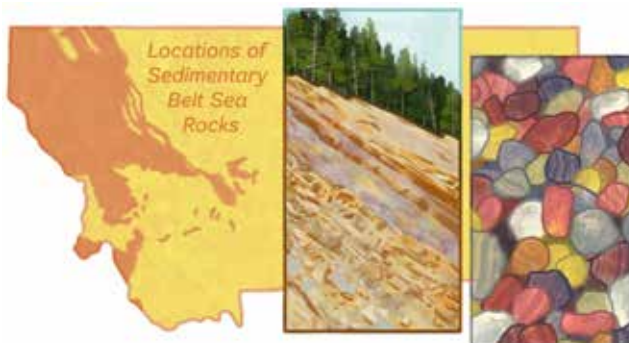
COURTESY KELSIE TURNER TJERNAGEL

ILLUSTRATION: ISABEL QUIRAN

### Coming Soon: Dig into Montana's Geology Ancient Stories Connect Us with Our Landscape

MNHC is excited to announce our newest permanent exhibit, **Stories on the Landscape**. For billions of years, geologic processes have worked their magic on Montana's landscape. Mountains rise and fall, sediments erode, and waterways spring to life. New habitats are born and animals and plants take up residence. These forces all act as characters in an ancient, geologic story.

What about humans? We have always intertwined with the stories on our landscape. Geology impacts where we live, what we do, and how we travel. Unearth the geologic stories of our region and you can celebrate the landscape and your place within it! We can't wait to welcome you to learn more about the stories on our landscape!



### Montana Naturalist Wins Award!

The spring/summer 2021 issue of *Montana Naturalist* won third place in the National Association for Interpretation Interpretive Media Awards! We're so proud of this recognition, and of our talented magazine team: editor Allison De Jong and graphic designer Eileen Chontos.

## imprints



ADAM WALKER, FLICKR.COM

## Donate your Vehicle to MNHC!

Have a vehicle you no longer need that could use a loving new home? Consider donating your used vehicle to the Montana Natural History Center!

Our Teaching Naturalists are hard at work expanding the Visiting Naturalist in the Schools Program to rural schools in areas that are farther away from the Montana Natural History Center. They could use your help by having access to a vehicle to get them to and from those schools.

Vehicles with 4-wheel or all-wheel drive are preferred (to help our team travel safely in the winter months).

Donation of a vehicle to MNHC is tax-deductible at the vehicle's fair market value. Please contact our Development Director, Mark Schleicher, at [mschleicher@MontanaNaturalist.org](mailto:mschleicher@MontanaNaturalist.org) to explore donating your vehicle to help our team reach more students in our VNS program!



## MNHC: Powered by the Sun

We're still giddy about the solar array we installed last year, and as the days lengthen, we love seeing the kilowatt hours roll in! Learn more about solar energy, see a solar panel up close, and watch how much energy our panels are generating in real time in our new mini exhibit.

## WELCOME, ANKA AND EMMA!

*We are thrilled to welcome two new staff to our ranks: Anka Rashed and Emma Swartz.*

**Anka** is our Museum Associate Educator, assisting with museum programming from drop-in kids' activities to exhibit design. Having grown up in the dense urban landscape of Hong Kong, Anka spent the first few years of her life satisfying her yearning towards nature and wildlife mostly through books and David Attenborough documentaries. After moving to Illinois for university in 2015, she was finally able to get outdoors and explore, leading her to discover how much she feels at home there. Despite studying robotics, after graduating she decided to pursue her love for the natural world instead, which brought her to Montana. In her free time Anka enjoys numerous activities—mainly working on her musical project, The Dawn Patrol, as well as climbing and just about any other activities outdoors. She also likes to spend time furthering her knowledge, both regarding the natural world and in various other areas.

**Emma** joined our team of Teaching Naturalists, working with fourth graders in our Visiting Naturalist in the Schools program. She grew up in Madison, Wisconsin, where she learned to love being outside. She earned a B.S. in Biology with a minor in Ecology and Environmental Science at Marian University in Indianapolis while competing as a professional cyclist. After graduating, Emma headed to Mount Rainier National Park, where she led citizen science research on toads and developed a passion for science communication. Mountain biking and skiing then brought Emma to Montana and she's so glad she's here! She has enjoyed connecting and learning about Montana through non-profit work at Ecology Project International, Wild Montana, Families First Learning Lab, and most recently Home ReSource, where she taught zero-waste initiatives to fifth graders. Emma is excited to reconnect with her naturalist skills and explore the natural world with students in her new role. In her free time, Emma can be found coaching the local junior mountain bike and nordic ski teams in Missoula, reading, and learning Spanish.



MNHC PHOTO



COURTESY OF EMMA SWARTZ



**Save the date for MNHC's Spring Luncheon on May 25th benefitting camp scholarships! We're excited to host you for the second year at the beautiful Visser residence up Grant Creek. Tickets will go on sale April 17. Join our email list or follow us on Facebook or Instagram for updates and to learn more.**

MNHC PHOTOS



## Thank you, Peggy, Hank, Steph, and Rick

In 2022 we said goodbye to four wonderful board members who have been deeply dedicated to MNHC for many years: Peggy Christian, Hank Fischer, Steph Lambert, and Rick Oncken. We so appreciate their energy and commitment and passion for MNHC during their tenures: all their shoes will be hard to fill. *Thank you for your service and generosity to MNHC!*



**Peggy Christian**



**Hank Fischer**



**Steph Lambert**



**Rick Oncken**

## *As To The Mission*

Change is part of the natural world. At the Montana Natural History Center, we often teach about change in nature. One example is the systemic change a butterfly undergoes, in which we see a great metamorphosis in the organism. Right now, the Montana Natural History Center is going through a systemic change of sorts. Transforming a piece of our community outreach from one thing into something else as part of our organizational growth.



Like many nature centers, museums, and nonprofits, MNHC has long held an annual gala and auction. Even if you have never attended these kinds of events, you likely know their purpose: they raise awareness and money. These events are fun and a great way to focus on the work the hosting organization does in the community.

At MNHC, hundreds of volunteers have helped the many board members and staff put on our fall auction and banquet over the years. Our annual event has celebrated our work in the schools, outside, and with people of all ages. It has brought new faces to the organization and we have raised a considerable amount of money to support our programs. To all of the volunteers, board, and staff, and to previous auction-goers, please know that you have my eternal thanks and respect.

As we continue to lean into our strategic goal of integrating diversity, equity, and inclusion throughout the Montana Natural History Center, something sticks out. There is no way to deny that our auction has not been very inclusive. The event attendance is capped due to space and catering constraints. And a ticket to the event comes with a not insignificant price tag. Now don't get me wrong—I am not saying that either of these things is bad. In fact, we have attendance limits on most of the programming we do. And auction ticket sales have been an excellent source of revenue over the years. In fact, we hold a spring luncheon that very successfully funds summer camp scholarships that follows a very similar model.

But in reflecting on our strategic goals and how we would like to celebrate our work, raise friends, and engage with the community, we recognized an opportunity to do things a bit differently.

So, I am very thrilled to announce a change to our roster of annual community engagement and events. Starting this year, MNHC will not hold our fall auction and banquet. Instead, volunteers, board members, and staff will focus their energies on a Summer Block Party.

This new event will be held onsite and will be free for the whole community to attend. We are going to have a day of learning, fun, and entertainment, with family activities, natural history talks, live music, and more—and we are enlisting an array of food trucks as well as our neighbors and friends to celebrate with us. Mark your calendars for Saturday, July 29th!

We hope you will join us in our exciting new community venture, just as we hope to engage with you across the many other community events and programs at MNHC.

**Thurston Elfstrom,**  
Executive Director

**If you'd like to join our Block Party committee, please contact Kellen Beck at [kbeck@MontanaNaturalist.org](mailto:kbeck@MontanaNaturalist.org).**

## THANK YOU TO OUR SPONSORS

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## What fun it was to celebrate last October at our Banquet and Auction!

The Wilma was a fun venue, and it was so good to see so many of you for a grand evening of revelry, community, and celebration. Thank you for your generous support! 350 members of our community helped us raise more than \$160,000 to support us in inspiring curiosity, passion, and stewardship of the natural world. And, of course, we couldn't have done it without the following businesses and individuals whose generosity and hard work made this event possible. (Please accept our apologies for any missed names.) **Thank you!**

### AUCTION CONTRIBUTORS:

Acorn Naturalists	Dick Hutto & Sue Reel
Adair Kanter	Discovery Ski Area
Adventure Cycling	Don & Andrea Stierle
Aidan Lay	The Dram Shop
Altruist Salon & Boutique	El Diablo
Bailey Zook - BZook	Fact and Fiction
Ceramics	Fairmont Hot Springs
Bathing Beauty Beads	Finn
Bayern Brewing	Fish Eye Guy
Bedrock Sandals	Photography
Bernice's Bakery	Five on Black
Betty's Divine	Five Valleys Land Trust
Big Dipper	Float Missoula
Big Sky Bikes	Garon Smith
Big Sky Brewing Co.	Gary Fee & Jo Burris
Big Sky Resort	Giles Thelen of Native Yards
BigRock Bronze Works	Glacier Ice Rink
Black Coffee	Glacier Restaurant Group
Roasting Co.	Grizzly Liquor
Blackfoot	Harper Mae by Sam
Bob & Ellen Knight	Hellgate Cyclery
Bob Brugh	Highlander Brewery
Bob Ward and Sons	Hindu Hillbilly & Rivulet
Bonnie Tyro	Apiaries
Book Exchange	Hockeywolf
Boone & Crockett Club	Home ReSource
Brian Christianson	Hunter Bay Coffee
Cabela's	International Wildlife Film Festival
Cambie Taphouse + Coffee	Jaker's Bar and Grill
Canyon River Golf Course	Jenah Mead
Caras Nursery	Jennifer Baylis
Childbloom Guitar Program	Jim Shelden
Cynthia Swidler	Joseph's Coat
Dean Christian	Kallie Moore
	Kellen Beck



Kelli VanNoppen - Valley House Woodworking  
 Ken & Shelley Anne Grant  
 Kettlehouse Brewing Co.  
 Lake Missoula Tea Company  
 Larry DePute  
 Lewis and Clark Trail Adventures  
 Linda Holding  
 Lisa Bickell  
 Logjam Presents  
 Lolo Peak Brewing Co.  
 Maclay Ranch  
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# The Salmonfly Project:

## *Shedding Light on the Plight of Aquatic Insects*

BY ALLISON DE JONG

**"Salmonflies," says James Frakes, "are the polar bears of the aquatic insect world."**

James is an aquatic ecologist with a master's degree from the University of Montana, and he loves salmonflies, those beloved bugs of the fishing world. Like polar bears, salmonflies are big (for an insect), charismatic, and people go crazy for them. Unfortunately, they share another similarity: salmonfly populations are also declining, threatened by climate change and other human disturbances.

James and his colleague Jackson Birrell, who is graduating soon with his Ph.D. from UM, have spent the past five years doing lab work and field projects to study how various factors, from water temperature to flow rates to oxygen levels, affect aquatic insects, and to try to piece together how all of those factors interact. Of course, there's a human component, too: human activity is inextricably altering natural conditions and affecting aquatic insect survival. What Jackson and James are interested in is what we can do about it.

But when they started looking around for organizations focused on aquatic insect conservation, they came up short. Agencies and organizations focused on fish? Innumerable. But on the insects on which

those fish depend? Almost none. So they decided to start their own.

The Salmonfly Project was officially launched in February 2022. Over the past year James and Jackson have worked to connect to various groups around the West to access existing data on aquatic insects and, moving forward, to do new research to better understand drivers of declines and to create widespread, systematic monitoring networks for watersheds.

Why salmonflies? *Pteronarcys californica*, the giant salmonfly, is the biggest stonefly species in the world, and ecologically important. They break down leaves and other litter to provide food sources for smaller insects, cycling nutrients into the water. While they're primarily known among anglers for the trout feeding frenzies their hatches inspire, they're a food source for other animals as well, from hawks to songbirds to mammals such as squirrels and raccoons. On a practical level, giant salmonflies are also easy to use for lab-based experiments—their survival rate in the lab is high, even after five or six months.

And they are, simply, large and charismatic insects whose presence means a river ecosystem is healthy. Found in medium-to-large, cold-water, large-bouldered mountain streams throughout western North America, they're well known and loved by anglers. "We want to use the salmonfly as a model species, a flagship species, to bring more attention to the plight of the aquatic insects more broadly," says Jackson.

Multiple studies show that salmonflies are declining in major fisheries around the

West, from Montana's Madison River to Utah's Provo River to the Gunnison River in Colorado. But so far there are few studies looking at what, specifically, is causing those declines. Without that knowledge, wildlife managers can't make conservation decisions.

"Aquatic insects are not only understudied, but there's a missing link between the research and the on-the-ground management and conservation," says Jackson. The Salmonfly Project wants to forge that link, and plans to do so by focusing on three main pillars: research, monitoring, and education.

Research is the first pillar, and the one they're focusing most of their energies on right now. "We want to understand the problem in a holistic way," says James. Their undergrad and graduate research projects have morphed into the research they're focusing on today: trying to understand as much as they can about salmonflies, their native range, and, most importantly, what is causing them to decline.

From their studies in the lab, Jackson and James have learned that salmonflies are remarkably resilient—for instance, while they're sensitive to higher temperatures, they can handle the warmth if they have time to acclimate, growing bigger gills to increase their oxygen intake. They also do swaying "push-ups" in still water to generate water flow, bringing more oxygen to their bodies. To thrive long-term, however, salmonflies need fast-flowing water, relatively high oxygen levels, and cool temperatures, among other things.

And it is those "other things" that the



PHOTOS COURTESY OF THE SALMONFLY PROJECT



Salmonfly Project is trying to suss out. To do that, they need more data—lots of it. Some of it already exists. They just accessed a data set with 90,000 samples of aquatic insects, which they'll analyze to generate new hypotheses for future studies, and they're working to collaborate with state and federal biologists and academics to access more.

The Salmonfly Project has an impressive number of collaborators for a year-old organization. They're working with several chapters of Trout Unlimited; they also work with the Big Hole River

**Salmonflies can live for 3-4 years. The nymphs (top left photo) go through more than a dozen instars, or molts, before hatching as adults (bottom photo). Adults live only a few days or weeks, just long enough to mate and lay eggs.**

Foundation, Forest Service regional fish biologists in Montana and Idaho, state biologists in Colorado, the Hutchings Museum in Utah, and more. "We're not just a local watershed group focused on protecting a particular river or a particular watershed," says Jackson. "These issues are happening everywhere."

Widespread, comprehensive monitoring is the Salmonfly Project's second pillar, and James and Jackson are working with Trout Unlimited to create monitoring networks for watersheds—Rock Creek, the Clark Fork, the Big Hole River, and more. Current aquatic insect monitoring is spotty and localized. "We want to [monitor] in a systematic way," says James, with long-term

projects and consistent methods that will result in sound data. "Then we can actually make informed recommendations."

And this is when their work will pay off, because state and federal agencies are mandated to protect species once they have the data that shows they're in trouble. In Montana, much of that protection can come in the form of preventative management, because our ecosystems are still largely intact, with many of our rivers—and their insect communities—still healthy. "It's a huge benefit," says Jackson. "To be able to not just fix problems that have occurred, but to look at the trends and perform mitigation techniques [to prevent the problems]."

The Salmonfly Project's work is generating enthusiasm, not only among the scientific community but among anglers as well. "The fishing community is excited about solving these problems and supporting us, supporting the conservation of aquatic insects," says Jackson. "Because they know: the bugs feed the fish, and the fishing is often only as good as the bugs are healthy." And while river ecosystems and aquatic insects are worth preserving in and of themselves, they also have cultural, recreational, and economic value—value that can be quickly lost when human activity degrades the rivers and decimates the insect populations.

For all these reasons and more, the Salmonfly Project's third pillar, education, is as important as the first two: raising awareness and getting the community involved. Jackson and James give educational talks to the public, sharing their enthusiasm about aquatic insects and their conservation. They're also working to create educational exhibits about salmonflies at Utah's Hutchings Museum and the Montana Natural History Center—stay tuned! And they have some great ways for interested people to get involved (see sidebar).

Ultimately Jackson and James are thrilled to be doing work that they're passionate about, both shining a light on and working to conserve creatures that are woefully understudied but so very essential to the health of our rivers—and to all the other creatures that depend on them. "We have the knowledge and power to be able to do this kind of work," says James. "I feel like we have an obligation to the salmonflies, to the trout in the stream, and to the community. We can give back."



## Want to Help?

### DONATE

The Salmonfly Project is seeking donations, grants, and sponsorships. Visit their website at [salmonflyproject.org](http://salmonflyproject.org).

### PARTICIPATE IN CITIZEN SCIENCE

Look for salmonfly larvae and adults when you're out exploring/hiking/fishing/floating, and photograph and document your finds on [iNaturalist.org](http://iNaturalist.org) or through the [iNaturalist](#) app.

### SHARE YOUR KNOWLEDGE

Have you been paying attention to salmonflies for years—as a fly-angler, scientist, or anything in between? Fill out the Stakeholder Questionnaire at [salmonflyproject.org/citizen-science](http://salmonflyproject.org/citizen-science).

### VOLUNTEER

As monitoring projects get established, volunteers will be needed to do field work and collection. Email [salmonflyproject@gmail.com](mailto:salmonflyproject@gmail.com), and they'll be in touch as projects become available.





# Pasqueflower: *Spring Renewal*

BY STEPHANIE MURPHY

**In the early days of spring, my favorite trails are a patchwork of mud, melting snow, and new growth.** Blue Mountain Recreation Area, just outside Missoula, is the perfect place to welcome the sun's warmth on the exposed, rolling hills. It's May 1st and I decided to hike in shorts and a long-sleeved shirt. I'm fooling myself—it's not quite warm enough and I should have worn pants. I quickly get moving to stay warm and start my climb up the mountain. My mission for the day is to find a pasqueflower.

Pasqueflower (*Anemone patens*) is one of the earliest wildflowers to bloom in the spring. Their arrival marks the end of winter's lulls and invites the energy of renewal and hope for longer, warmer days ahead. Pasqueflower is found in a range of habitat conditions worldwide from North America to Eurasia. Here in Montana, they are a feature of prairie grasslands and open forests, growing in well-draining soil moistened by snow melt. In the same family as the bright yellow buttercups (Ranunculaceae), this cousin is a more gentle invitation to spring with soft purples and spindly silver framing a golden center. The cup-shaped flower is made up of petal-like sepals that range from periwinkle blue to purple with a collar of slender bracts (modified leaves) below the flower. At the center, a couple hundred anthers, golden with pollen, surround a tight bundle of pistils. The soft appearance of pasqueflower is accentuated by the silky, silvery hairs that cover the entire plant.

Turning a corner on the trail, I stumble upon my quarry. An area of open forest, with green, new-growth grass, conifers, and shrubs just starting to bud is rich with pasqueflower. I immediately drop to a squat to study the five separate flowers blooming just off the trail. Across the trail to my left are additional scattered purple flowers peeking through the grass and exposed rock. Despite my certainty that this perennial will return year after year, I am delighted to be reintroduced.

According to a recent study of their life cycle, pasqueflowers spend the first years of their life focused on vegetative growth, so the blooming plants I'm admiring must be at least seven years old. In the 1970s, botanists believed that pasqueflowers didn't produce flowers until they'd been growing for 14 years! By June, fluffy, stringy seedheads will develop from fertilized flowers and wind will disperse the seeds. With a flowering period from April to May, the flowers at my fingertips are well on their way to be pollinated.



ALLISON DE JONG

MATT LAVIN, FLOCKR.COM



The bloom's timing is important as an early-spring resource for pollinators such as honey bees, miner bees, bumble bees, and hover flies. A final appreciative glance reveals another small creature capitalizing on the pasqueflower: a crab spider, waiting in the inflorescence to ambush an unsuspecting insect. Both bees and crab spiders are attracted to flowers by scent. An impressive predator, crab spiders can change color over the course of many days to better camouflage with their flower of choice. Even so, some bees can recognize crab spiders, and will refuse to visit a flower if they spot one.

**Pasqueflower thrives in disturbed areas**, growing in grasslands grazed by bison or burned by wildfire. Because of their propensity for disturbed areas, large clumps of pasqueflower may indicate overgrazing. With an increase in permanent settlements and the dramatic decline of bison in North America, the range of pasqueflower has shrunk. Without fire or grazing, each year of plant growth on the prairie culminates in a thick layer of thatch. Thatch prevents seeds, such as those from pasqueflower, from reaching the soil's surface. This buildup may also block sunlight and monopolize moisture from the soil, further combating seedling growth. Non-native vegetation grows thicker and in these conditions, pasqueflower may remain dormant.

Blue Mountain Recreation Area, my reliable pasqueflower habitat, is no stranger to disturbance. The 4,869 acres were originally part of the Fort Missoula Military Reservation until an executive order signed by President Harry Truman transferred the area to Lolo National Forest in 1952. The land was impacted over the years by military training, traveling and abandoned vehicles, grazing cattle, and trash left behind. Through the 1970s and 80s, clean-up and restoration efforts began. Under the management of Lolo National Forest, we see activity such as noxious weed treatment and trail maintenance. Out of this complicated history, Blue Mountain's disturbed acres have become a popular place to recreate, and are home to many native plants, including a wealth of spring wildflowers.

Pasqueflower has a rich history around the world in folklore and medicinal use. The plant contains compounds that are poisonous if ingested and can cause severe reactions externally and on mucous membranes. However, these compounds break down easily when pasqueflower is left to dry. The First Nations people of Canada and Native Americans utilized pasqueflower to treat rheumatism and other ailments. Women of the *Niitsitapi* (Blackfoot Confederacy) boiled the plant to make tea to aid in childbirth. As a symbol, pasqueflower represents renewal and rebirth. Its name is associated with the early-spring bloom, often coinciding with Easter, or *Pasque* in French.

**To the side of the trail**, camera out, with a big goofy smile, I'm happy to share my treasure with hikers who pass me by. Some are more excited than others and may share some other flowers they've seen along the way. I wish I had brought my plant press, but I know I can capture this observation with photos and add it to my digital collection on iNaturalist. As I continue to make my way up the trail, I am rewarded for my climb with a perfect cluster of six pasqueflowers on a rocky ridge overlooking Missoula's valley. 🐚

—Stephanie Murphy is a Teaching Naturalist at MNHC. She has an M.S. in Biological Sciences and finds joy at the intersection of education, research, and museums.



A crab spider lurks in this pasqueflower, waiting for an unsuspecting insect to stop by. Soon the flower will go to seed, creating long, fluffy seedheads that will be dispersed by the wind (lower left photo).

## What's in a name?

**Common names:** Pasqueflower, pasque flower, prairie crocus, prairie smoke, prairie pasqueflower, American pasqueflower, sticky pasqueflower, pulsatille, crocus anemone, cutleaf anemone, and more!

**Scientific names:** *Anemone patens* (Linnaeus 1753), *Pulsatilla nuttalliana* (Spreng 1821), *P. patens* ssp. *multifida* (Heller 1944), *A. patens* var. *multifida* (Gleason & Cronquist 1991), *P. ludoviciana* (Heller 1904), *A. hirsutissima* (MacMillan 1892), and more!

**W**hy so many names...and which one is right? In 1753, Swedish botanist Carolus Linnaeus published a list of known plants and classified them for the first time with a scientific binomial name. In this two-volume text, he classifies pasqueflower as *Anemone patens*. From this point forward, botanists and taxonomists have debated how this species should be classified. With such a large geographical range and variety of morphological features like color and size, there have been many names attributed to pasqueflower from researchers around the world. From North America to Eurasia, we see varying shades of blue to purple, yellow, and occasionally white flowers, each of which may be divided into proposed subspecies or perhaps separate species altogether.

Even in North America we see evidence of this ongoing debate: Montana's Field Guide lists *Anemone patens*, while *Plants of the Rocky Mountains* lists *Pulsatilla patens* and iNaturalist lists *Pulsatilla nuttalliana*. The USDA lists either *Anemone* or *Pulsatilla patens*, but includes that the North American pasqueflower is a variety of this global species, *multifida*. In general, botanists in Europe defer to using *Pulsatilla* for pasqueflower, whereas American researchers tend toward *Anemone*. The body of literature continues to grow as morphological, genetic, and historical research is published. Perhaps someday this taxonomical nightmare will be settled!

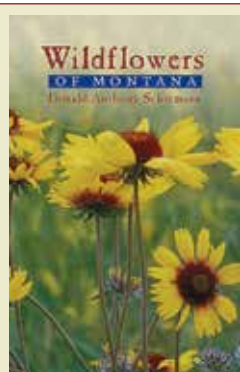
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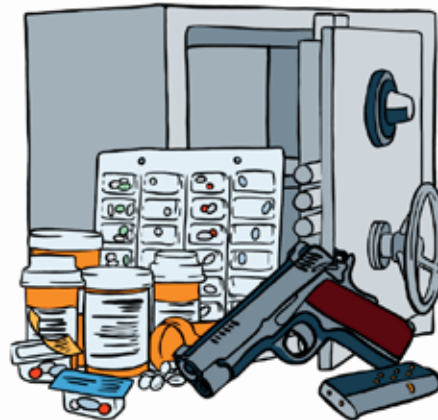


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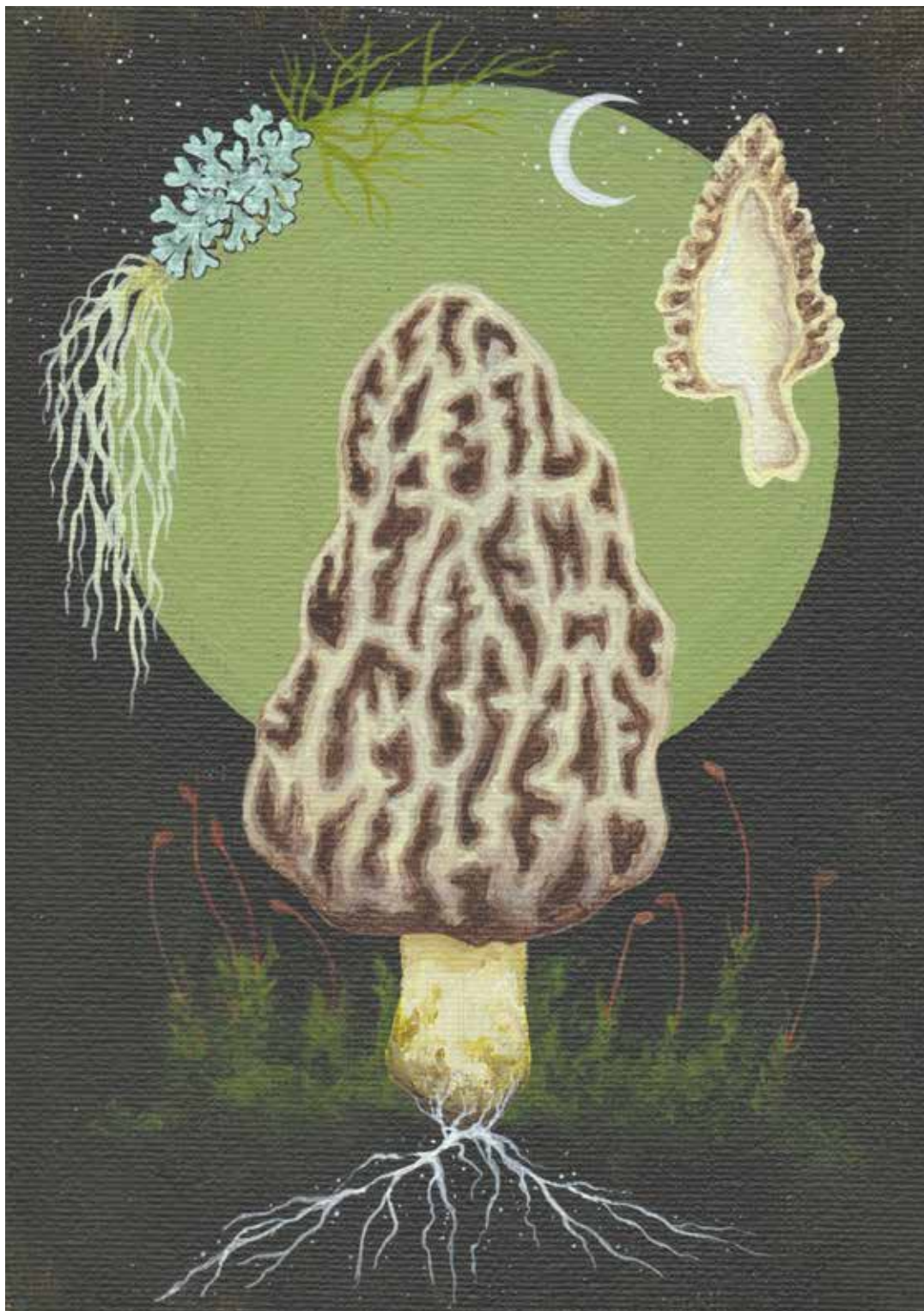


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## Common Morel / *Morchella esculenta*

The common morel can be found in a wide variety of habitats and is often referred to as the “May mushroom” due to its early and consistent fruiting season. The morel is a highly sought-after edible mushroom known for its unique and robust taste. In Montana the common morel is referred to as the “yellow morel,” and can be found most often in mossy mountain creek beds and fruiting under cottonwoods.

5x7 acrylic on canvas, 2023

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—Erynn McNeill is an artist, biologist, and scientific illustrator. They established Up Moss Creek Studio in 2021 as a habitat for experimentation where they combine their experience in botany, mycology, and multiple art mediums to create original works. They are particularly interested in the hidden worlds beneath the charismatic flora of the forest and implore their audience to watch where they step, and to ask themselves how much they really know about the diversity of the landscapes that surround us. Find them online at [upmosscreekstudio.com](http://upmosscreekstudio.com) and @upmosscreekstudio on Instagram.



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