



Montana Natural History Center

Fall/Winter 2023

MONTANA Naturalist

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

Searching for Montana's Big Trees

Pollinators in Winter | Northern Flickers | The Secret Lives of Monarchs | Hands-On History

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Cover – The golden needles of a western larch add punch to a dark and foggy day along Huckleberry Pass near Lincoln, Montana. Photo by Laura Verhaeghe, lauraverhaeghe.com.

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I dreamed it was summer, but...

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Montana Natural History Center
Connecting People with Nature

120 Hickory Street, Suite A
Missoula, MT 59801
406.327.0405
MontanaNaturalist.org

STAFF

Kellen Beck

MARKETING & EVENTS COORDINATOR

Alyssa Cornell

COLLECTIONS MANAGER

Allison De Jong

COMMUNICATIONS COORDINATOR & EDITOR

Thurston Elfstrom

EXECUTIVE DIRECTOR

Kate Folkman

TEACHING NATURALIST

Alyssa Giffin

CAMPS COORDINATOR

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TEACHING NATURALIST

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tidings

I love big trees.

On a trip to the Olympic Peninsula this summer, my family visited the Quinault giant Sitka spruce—a 1000-year-old behemoth of a tree that is 191 feet tall and whose trunk is nearly 18 feet in diameter. My son loved it. It's so big it takes multiple minutes to walk around (especially with a five-year-old who's trying to scramble up every jutting root). It's hard to comprehend the sheer massiveness, even when it's right in front of you. I was in awe not only of its size but its resilience, the centuries it had survived, quietly turning sunlight into sustenance year after year after year.

I felt the same way when I walked amongst the redwoods in northern California and the western red cedars in the DeVoto Memorial Grove along Highway 12. I feel this awe every time I visit Gus, the 1000-year-old champion western larch tree near Seeley Lake. And I can't help but wonder about the big trees we don't know about, the ones we haven't yet found. The ones hidden deep in old-growth forests, far from roads and trails and humans.

So I was delighted when Carl Seielstad from UM's Department of Forest Management sent me a piece about his experience seeking out big trees in the Swan Valley. What I particularly loved about this quest was how it had come about. Carl's research team was mapping forest structure to better understand its susceptibility to wildfire. Discovering dozens of exceptionally tall trees was incidental—but tracking them down soon became a goal in and of itself (page 24).

Getting sidetracked by the unexpected is not uncommon in scientific pursuits, as other pieces in this issue show. Kate Stone and Mary Scofield, two biologists at the Bitterroot Valley's MPG Ranch, had a similar experience while studying Lewis's Woodpeckers. While observing the Lewis's, they began noticing unusual behavior in Northern Flickers, which ultimately led to the birth of an entirely new research project centered around the variation in flicker plumage (page 4). Writer Alyssa Roggow had the startling experience of sharing her living room with dozens of yellow jackets one autumn, and her queries into these insects and their life cycle led to explorations of how honeybees and mourning cloaks and other pollinators cope during the fall and winter months (page 8).

This is one of the delights of studying the natural world, and of following one's curiosity: the path so often deviates. The more you study, the more you observe, the more you question, the more complexity you'll find. And perhaps you'll find yourself on a path even more fascinating than the one you started on.

So, this season, follow your curiosity. Don't be afraid to drift a little (or a lot). Let yourself be pulled down another path. Who knows what you might find?

Allison De Jong

EDITOR

adejong@MontanaNaturalist.org



Reveling in the majestic, massive beauty of a western red cedar at the DeVoto Memorial Cedar Grove along Highway 12 in Idaho.

ALLISON DE JONG

NORTHERN FLICKERS: *Birds of Varied Feat*

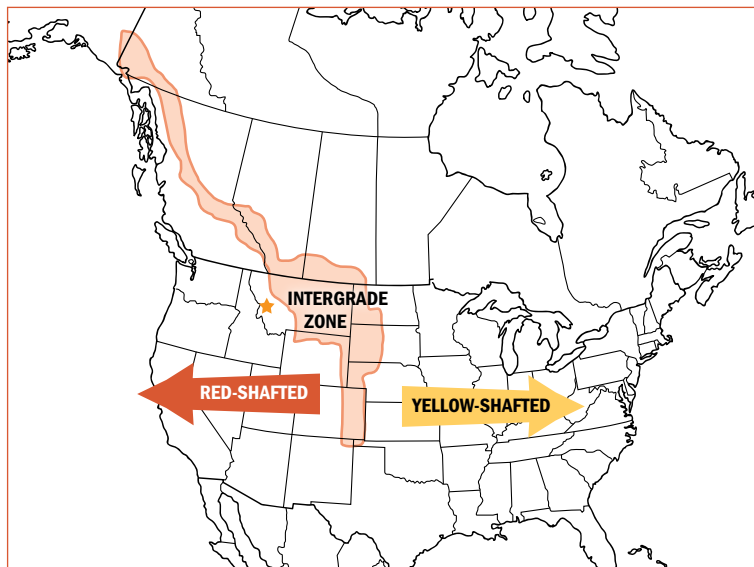
BY KATE STONE AND MARY SCOFIELD

Many people recognize the Northern Flicker (*Colaptes auratus*) as the most common woodpecker encountered in daily life. Their tank-like bodies undulate up and down as they fly, flashing a white rump patch and glimpses of salmon-pink color from the wings. They scoop ants one by one from sidewalk cracks.

Their incessant drumming on chimneys and telephone poles heralds spring and prompts crossed fingers in the hopes birds will move on and not cause damage to homes or other structures. Whether loved or reviled, few people stop to consider the beauty, movements, or population dynamics of Northern Flickers.

The Northern Flicker's distribution stretches from coast to coast and from the northern latitudes of Alaska and Canada to the southern reaches of Mexico and Central America. Though once considered separate species, in 1983 taxonomists combined various color forms into one species: the Northern Flicker. The Red- and Yellow-shafted forms are the most common of the four subspecies. As their names imply, one visible feature separating the species is the color of their flight-feather shafts. Another easily visible feature you might see is the color of the malar stripe or "mustache" of the flicker male; Yellow-shafted Flicker males have a black mustache, while the Red-shafted Flickers have a red mustache. The subspecies also vary in more subtle gray and brown coloration on the head and throat, visible through binoculars or in photographs. The Yellow-shafted occurs in the Caribbean, eastern United States, and up into eastern Alaska, while the Red-shafted lives in central and western Mexico, the western United States, and north into southwest Canada.

The intergrade zone appears to have shifted west in the past several decades. Biologists are wondering: might it now include Missoula?



MAP: MPG RANCH



hers



EUGENE BECKES: FLICKR.COM

Between these two ranges lies an extensive zone where both subspecies breed and interbreed, resulting in what biologists call *intergrade* individuals—those with mixed plumage characteristics. More on this topic later! (See *distribution map*.) Naturalist John James Audubon first noted the intergrade phenomenon in the 1840's. In 1965, Lester Short put forth the largest effort to map the intergrade zone by looking for mixed plumage. Since Short's time, researchers confirmed that the presence of mixed feather features indicates genetic mixing, giving us a convenient glimpse into the genetic identity of the flickers we see.

In his mapping study, Lester Short included 11 individuals collected in Missoula and found our region leaning heavily towards the Red-shafted form. But to the north in Alberta, the intergrade zone follows the Rocky Mountains and bends west toward British Columbia and north into Alaska. And a 2022 study in Colorado and Nebraska suggests the intergrade zone has shifted about 75 kilometers westward in the last 35 years; Yellow-shafted Flickers have extended their range west, perhaps due to changes in land-use practices. With the intergrade zone curving above us to the north, and shifting west to our southeast, is it possible that the zone has moved farther west to now include Missoula and southwest Montana?

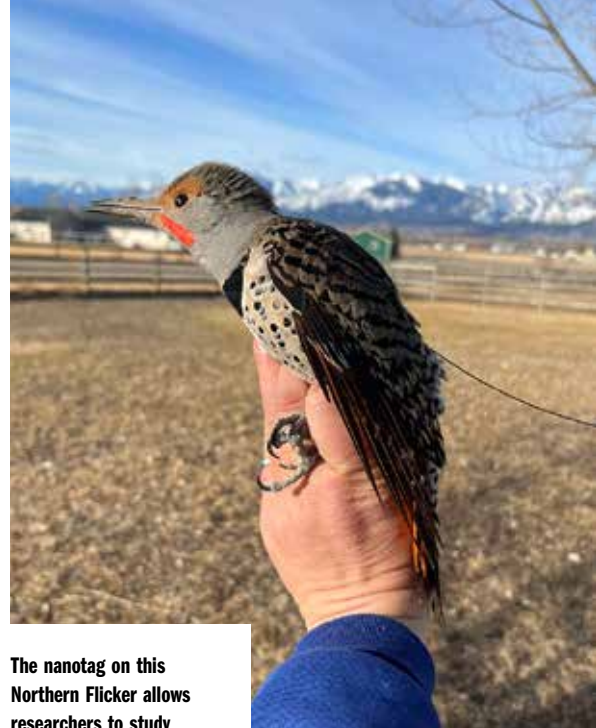
But let's rewind a bit. We didn't set out to study the intergrade zone, or even Northern Flickers, in our research at the MPG Ranch. Like many field biologists, our research paths diverge when least expected, and often germinate from incidental observations while intent on some other task. Such is the case with flickers: we really knew nothing about

the intergrade phenomena but simply started noting interesting flicker behavior and overall beauty while working with the Lewis's Woodpecker.

In the late summer and early fall we see Lewis's grouping into foraging flocks. These groups appear to make migratory movements together out of the valley, generally following the path of the Bitterroot River as they prepare to head to wintering grounds outside of Montana. We observed a similar behavior with flickers in the fall and early winter. Friends who knew we studied woodpeckers would text or call about large groups of flickers around feeders and in yards at the same time. After a few days of feeding, suddenly the birds would be gone. It made us wonder what these birds were doing. Were they year-round residents roving the valley? Migrants from farther north coming to overwinter here in Montana? A combination of both?

As we started reading available literature, we found all sorts of flicker information and flicker enthusiasts. We wondered if visible plumage characteristics might give us insights into the origin of our fall and winter birds. If we saw a high level of intergrade plumage, we might hypothesize that these birds migrated from breeding areas within the intergrade zone to overwinter in the Missoula and Bitterroot Valleys. We thought we might also use small tracking devices called nanotags (*see sidebar*) to

MPG RANCH PHOTO



The nanotag on this Northern Flicker allows researchers to study its movements, gaining insight into breeding habits and more.

Nanotags & the Motus Wildlife Tracking System

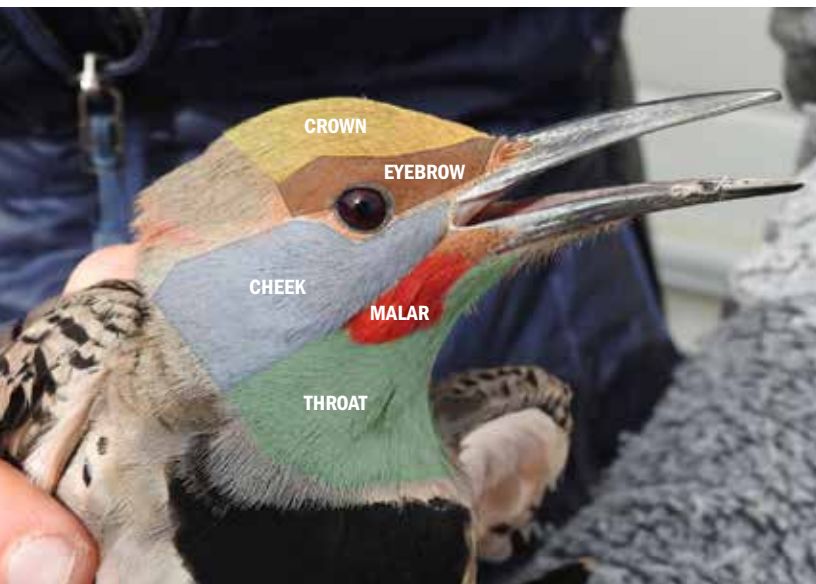
The Motus Wildlife Tracking System is a communal network of automated receiving stations that allows researchers to track tiny organisms over large distances. The system relies on a single radio frequency and identifies individuals by a unique pulse rate. Small tags that just transmit signals but don't store information can be used on everything from dragonflies and butterflies on up to birds too small for satellite transmitters. This network has revolutionized what we can learn about the movement of small organisms. MPG Ranch maintains 40 Motus stations, mostly in western Montana and Idaho.

see if we found evidence of flicker movements in and out of our region during the winter. The nanotags might give hints of breeding destinations if birds passed by passive receiving stations outside of the valley. If nothing else, the presence or absence of radio signals at the end of winter would at least let us know if birds remained in or left the area.

We used a drop-down trap set over a bird feeder to capture Northern Flickers, much like we do for Lewis's Woodpeckers and hummingbirds. Over two winters we captured and color banded 55 flickers, described the plumage characteristics of 54, and placed tracking tags on 52.

As we began capturing the birds, we went back to the literature to understand where we should look for intergrade plumage. On our side of the intergrade zone, we would be looking for birds with a majority of features matching "Red-shafted" status and one to five characteristics matching "Yellow-shafted" status. Most variable features occur on the head, so we defined head regions and looked at plumage coloration in

Extracting a flicker from a drop-down trap, after which it will be banded and given a tracking tag.



Discoveries from Citizen Science

Researcher Bryce W. Robinson from the Cornell Lab of Ornithology used media submitted to eBird and archived in the Macaulay Library to investigate the prevalence of nuchal crescents west of the known flicker intergrade zone during the breeding season. He found five percent of his samples showed evidence of a nuchal crescent and that the prevalence of this trait decreases with distance from the known intergrade zone. He still has questions about what these results mean for gene flow in and around the intergrade zone, but feels confident we shouldn't use this trait alone to define an individual as an intergrade. His work is a great example of how the observations of citizen scientists can help research at very high levels.



Just over half of the birds we captured had one intergrade characteristic and 11 percent had two. The most common feature we noticed was the "nuchal crescent." Yellow-shafted Flickers have a bright red crescent on their nape, and Red-shafted Flickers generally lack the feature...or so we thought. It turns out other folks have

noted the presence of nuchal crescents west of the intergrade zone even in the breeding season, which suggests we should look for more than just this crescent to put a bird into an intergrade category. However, we did see lots of variation in the extent of the crescent and scored them from zero to four based on their size. Most

crescents scored just a one and could be easily overlooked by casual observation or even study with binoculars or spotting scope. We also saw indications of Yellow-shafted Flicker plumage in the crown, throat, and feather shafts. All birds that had two or more intergrade characteristics had nuchal crescents.

these areas (see diagram opposite page). We also examined the colors of the feather shafts in the wings and tail. Birds that deviated from what we would expect from Red-shafted Flickers got a tally towards potential intergrade status.

We don't know how common intergrade features are in flickers breeding in western Montana. Preliminary data of our own and from collaborators at the University of Montana Bird Ecology Lab suggest locally breeding flickers largely lack these features, indicating we still lie well west of the intergrade zone. Observations from citizen scientists, additional summer field work, and examining museum specimens may all contribute to our understanding of breeding flickers.

MPG RANCH PHOTOS



The Philip L. Wright Zoological Museum at the University of Montana has over 60 Northern Flicker specimens from Montana and locations well to our east and west. Looking at these specimens helped us see the potential variation in flicker plumage.

northeast. We hope the placement of more receiving stations in the next year may help us understand where these tagged flickers breed; tags could transmit signals for two to three years. We also hope someone might see our color bands while watching flickers at their feeders or seeking them out for photography.

So, what comes next in our flicker research project? We're going to continue our work observing and capturing flickers for a third winter. And we'd love your help! We urge naturalists all over western Montana to consider paying more attention to flickers. Look a little closer at the heads of flickers you see. Do you see signs of a nuchal crescent? Black in the malar stripe? Gray crown or tan throat? Yellow flight or tail feathers? Consider photographing flickers throughout the year and submitting these observations to eBird or iNaturalist (see sidebar). The collective observations of people throughout the Intermountain West could help determine the identity of some of our winter visitors and define the current intergrade zone in the region. Has it changed or shifted since the 1960s? We look forward to finding out. 🐦

—Kate Stone and Mary Scofield study the lives and movements of Northern Flickers, Lewis's Woodpeckers, and several other Montana birds at the MPG Ranch in Florence, MT. They encourage you to look close, look often, and share what you observe.

Following the activity of our tagged birds gave us some insight on flicker breeding and movement—as well as more questions. In the months after capture, we tracked the flickers at receiving stations throughout the Bitterroot and Missoula valleys. As the winter passed, our number of daily detections decreased, suggesting the flickers ranged widely within the study area. Once spring arrived, our detections dropped to just a handful of birds, indicating almost all birds we captured in the winter ultimately traveled elsewhere to breed. Surprisingly, we have yet to detect one of these tagged flickers outside of our study area, though receiving station coverage is poor in areas to our north and

How You Can Help

Flickers are easy both to identify and photograph! Please consider including flicker pictures with eBird checklists or iNaturalist observations. Please include multiple angles of each individual such that researchers can see all aspects of the body, especially the head. Using these platforms will provide researchers with important details like the date and location of your observation and also gives researchers the opportunity to contact you if needed.

Pollinators in Winter:



Vespula alascensis

Death, Diet, and Diapause

BY ALYSSA ROGGOW



he wasps came in to die. First one, buzzing and bumping into the living room window, who was soon joined by a few sisters. Within an hour, there were more than 40 sinisterly striped yellow jackets (*Vespula alascensis*) zooming from one window to another in pursuit of light, and I was outnumbered.

We'd arrived at the house together, the wasps and I. In the smoky haze of early August, they set up shop in a homey crack in the exterior wooden siding while I unloaded a U-Haul and arranged the scrappy furniture that had seen one too many college apartments. Within a day, we'd come to the understanding that the west side of the house was theirs. Until this late September morning, bright but cold, the inside of the house was mine.

I left the wasps to their own devices. I'd read somewhere that when a yellow jacket is injured, it releases a pheromone to summon other yellow jackets to its aid, and I didn't want to provoke a swarm in my own living room. So, I warned my music students with sting allergies to stay away, and the rest had their lessons in the kitchen. In the lengthening twilight of autumn, I spent evenings in the half-dark, with a lamp on in the living room to draw the wasps while I worked in the narrow beam of light that leaked into the kitchen. The wasps' angry buzz filled the small house as they went from window to window to lamp and back, leaving trails of a clear, goopy substance wherever they landed.

A few days of furious Googling later, I learned that yellow jackets abandon their nests every year. In autumn, a pregnant queen ventures forth to find a safe place to overwinter, and in the spring she builds a small hive and raises the year's first brood of workers. Throughout the summer, the hive grows in numbers as adult yellow jackets eat sugary, carbohydrate-laden foods like plant nectar and fruits (and human-made sweets, hence their reputation for ruining picnics). Unlike adults, yellow jacket larvae require protein-rich foods such as aphids and grubs. Because of this, adult workers also forage for insects and other proteins, like human-prepared meats and fish (more ruined picnics). When the queen finally leaves the nest, her minions, leaderless, wander off in search of food. Unfortunately for them, food sources are diminishing in the cooler, shorter days, and they will not survive the winter.

The wasps in my living room weren't finding much in the way of food, and after a few days they began to weaken noticeably. The buzz from the living room was thinner; the yellow jackets were spending less time in the air. A few of them had begun to fall to the ground, and for some reason they were drawn to rugs. The wasps who were too weak to fly crawled in endless circles on the rugs. Not the carpet, not the linoleum—only the rugs.

I thought of killing them then, and probably could have done it without being stung, but a few days of accommodating their presence had stirred my sympathy. Their aimless, repetitive motions were anything but threatening, and in fact seemed darkly metaphorical of the human hordes. I kept the lights off and let them find a natural end.

Nearly two weeks after the yellow jackets appeared, I woke to find the first carcass on the living room rug, striped and inert as a discarded candy. The rest went quickly, and within a few days, the weak, intermittent buzzing was silent. When the wasps first came into my house, I was affronted and frightened and annoyed, and I knew nothing of their nesting habits or seasonal cycles. By the end of their stay, I was both humbled by the slow deaths of many creatures and newly attuned to the seasonal changes happening around me. The sweet flowers of summer had gone, the wasps were dead, and, as autumn rolled into winter, the living room was mine once more.



Though the yellow jackets had seized my attention with their proximity and dangerous reputation, they were not the only pollinators frequenting the yard since my August arrival. While I watched the wasps collapse from starvation, bees and butterflies were preparing for seasonal changes with a variety of less disruptive (to me) strategies.

While yellow jackets forage for just enough food to meet the day's demands, honeybees (*Apis mellifera*) gather far more nectar than their hive's immediate needs require, transform it into delicious and almost unbelievably shelf-stable honey, and store it away as sustenance to feed the colony through the winter.

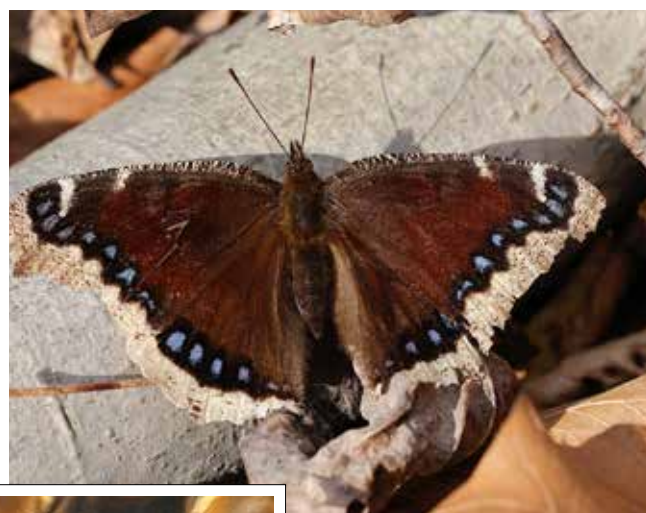
As food sources diminish and the nights lengthen, newly hatched worker honeybees begin to exhibit different physiological traits than early summer bees. These "winter bees," who were raised on the finest fare of summer, emerge plumper than previous generations of workers. This extra girth better equips them to contribute warmth to the hive in winter months, and they will live from four to six months, instead of the five- or six-week lifespan of summer worker bees.



Honeybees doing the shimmy to generate heat and keep the hive toasty warm, even on the coldest winter days.

If enough honey has been stored, enough winter bees have hatched into adults, and the colony is in a snug, weather-resistant hive, their prospects for surviving the winter are good. When temperatures fall below 50 degrees Fahrenheit, worker bees cluster around their queen and

begin to shiver. The vibrating and shaking and shimmying generates enough heat to keep the queen around her ideal temperature of 95 degrees. At the outer edge of the bee-cluster, temperatures hover around the 50-degree mark. Warm air rising from the center condenses at the cooler edge, providing moisture for the colony throughout the winter, and the cluster moves in a coordinated ball around the hive, feasting on stores of honey. At the first sign of spring, the colony is ready to resume its foraging activities.



Mourning cloak butterfly

Foraging and storing energy is an important strategy for another of Montana's pollinators, the state insect, the mourning cloak butterfly (*Nymphalis antiopa*). As nights lengthen, their diet shifts from nectar to sap flows and rotting fruits in order to build up fat stores for the winter. Mourning cloaks may head to lower elevations to overwinter, but they don't embark on an epic migration like their flashier cousins, the monarchs. Instead, they seek shelter in crevices and crannies between rocks, leaves, and leaf litter, and pass the cold months in a dormant state. Like honeybees, they're

ready to go at the first whiff of spring blossoms. Mourning cloaks are one of the first butterflies to be seen in spring, and one of the last species to be active in the fall.

Other non-migrating butterflies have different survival strategies for winter. Western tiger swallowtail (*Papilio*

rutulus) caterpillars that enter the chrysalis stage in the fall remain there throughout the winter in a state called diapause. As the name suggests, diapause is a “pause” in the normal functioning of an organism. Many insects enter into diapause in response to adverse environmental conditions, with triggers that include shorter day lengths, colder temperatures, and reduced food supply. For the tiger swallowtail, this state is marked by lowered growth hormones and the production of antifreeze chemicals to protect against cold temperatures—it’s basically the cryogenic sleep our favorite sci-fi authors have dreamt of for decades. Unlike hibernation, which is a seasonal state that primarily reduces metabolic activity of vertebrates, diapause is the interruption of an invertebrate’s developmental phase, and it can happen any time of year when environmental conditions for growth are unfavorable.

As the days begin to lengthen in spring and temperatures rise, the tiger swallowtail’s development resumes. Before long, they burst forth as adults to flutter, feed, and create the next generation of blazing yellow butterflies.

...it’s basically the cryogenic sleep our favorite sci-fi authors have dreamt of for decades.

The great spangled fritillary (*Speyeria cybele*), another vibrant butterfly found throughout Montana, enters diapause while still a caterpillar. It relies heavily on camouflage to remain hidden from hungry critters throughout the winter, although it may be hard to believe if you were to encounter this aggressively armored, black-and-orange caterpillar among the green foliage of summer. Its gladiatorial demeanor warns away daytime predators who happen to cross its path, and at night its dark coloring grants a measure of safety as the caterpillar munches on violets and other *Viola* species. As fall comes on, great spangled fritillary caterpillars find protection in curled leaves, seed pods, crevices between rocks, and the soil—dark nooks where their coloring once again hides them from view.

With autumn once again upon us, caterpillars are hitting pause, mourning

cloaks are feasting on the richest food sources they can find, honeybees are reaching winter proportions in hives filled with honey, and yellow jacket workers are zooming about on



Spangled fritillary caterpillar

a doomed hunt for sustenance. It has been a few years since the yellow jackets found their way into my home, but every now and then a carcass appears in some long-uncleaned corner of the house. Each time, the yellow stripes are less vibrant and the exoskeleton more fragile, and each time I experience an instinctive shudder of revulsion. But as I sweep it up and toss it outside, the small body becomes once again a potent reminder of the ever-unfolding cycle of life and the seasons that mark its passing. 🦋

—Alyssa Roggow is a musician, writer, Master Naturalist, and multifaceted educator. She can often be found incorporating her passions for the arts and the outdoors into interdisciplinary workshops for learners of all ages in venues such as Glacier National Park, Sculpture in the Wild, and the Paris Gibson Square Museum of Art.

Circadian Rhythms and Cryptochromes

Living with limited electricity for two weeks reminded me that humans are sensitive to seasonal changes, too—it was a bit of a shock to turn the lights back on! The body’s ability to regulate its functions and cycles according to daylight, called circadian rhythms, is driven by cryptochromes, photosensitive proteins in the eyes that measure blue light. Pollinators like wasps, bees, and butterflies also have cryptochromes (in fact, so do the plants they pollinate), but research into the mechanisms of circadian entrainment in insects is sparse and ongoing, and much remains to be learned. A recent study by Yifan Wang, et. al (2023) indicates that while hymenopterans like yellow jackets and honeybees do have cryptochromes, they appear to be light insensitive. Instead, the intensity of light signals on color photoreceptors and the interactions between them trigger circadian rhythm-related behaviors in jewel wasps (*Nasonia vitripennis*). The role cryptochromes may or may not play in this process is still unclear.

The Secret Lives of *Monarchs*

DOCUMENTED BY NATURALIST KELLY DIX IN LOLO, MT



The story begins on July 18th when I found seven (yes, seven!) monarch caterpillars in my milkweed patch and began observing them daily.

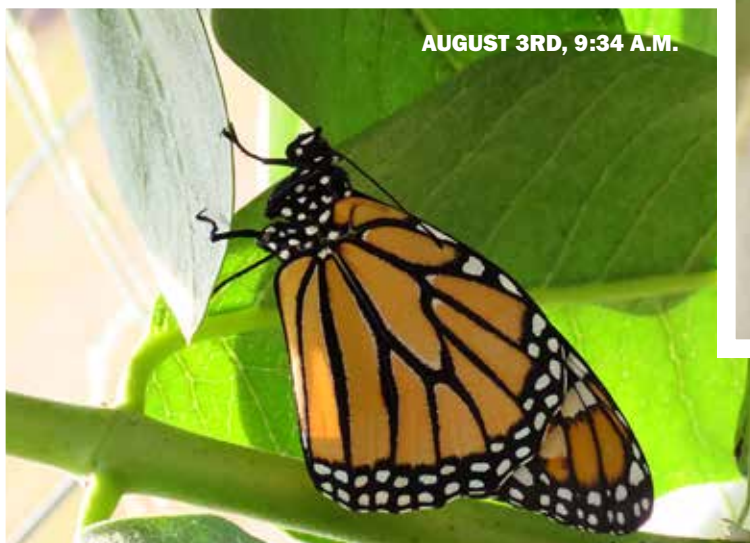
Over the next week, they began pupating. **On July 26th, the one I called Fred** was hanging upside down and wriggling. I went inside for less than 10 minutes. When I went back out I found Fred was almost finished wriggling out of his skin!

On August 2nd, the first chrysalis I found on July 23rd was getting darker in color.

August 3rd, 7:08 a.m.:

This one should eclose (that's geek-speak for emerge) today. The details on the butterfly are incredible!

August 3rd: I found the adult butterfly at 9:34 a.m. I missed the eclosure, but am still in awe of the process!

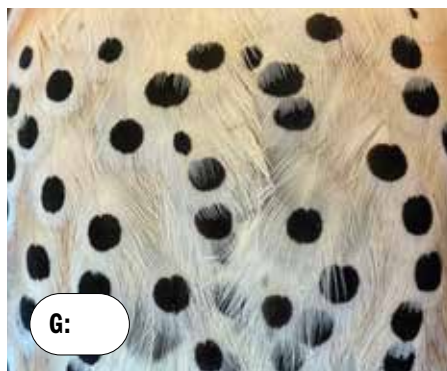
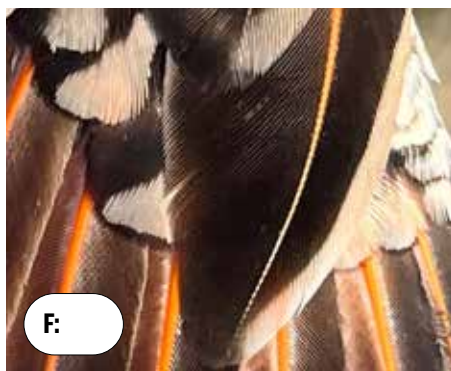
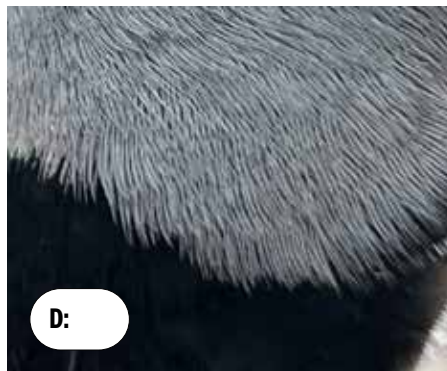
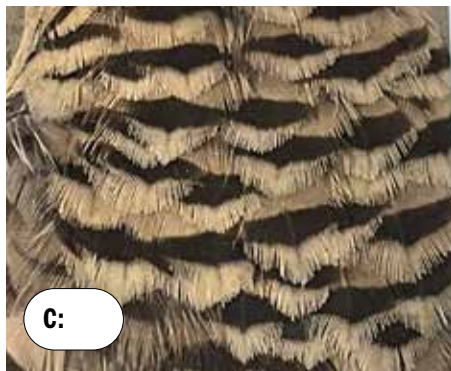
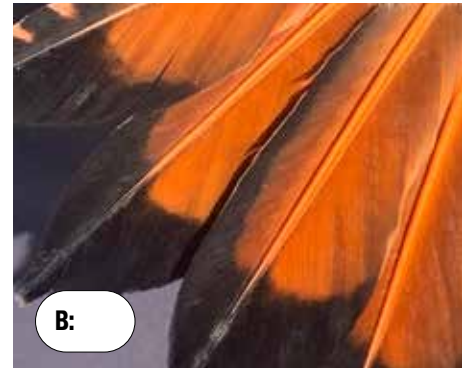


August 8: All six caterpillars that pupated survived to adulthood! Needless to say, I have been thoroughly enthralled by the secret lives of monarchs. ● ● ●

How well do you know your bird feathers?

Take our Northern Flicker Feather Quiz! (And be sure to read more about Northern Flickers and feather variation on pages 4-7 of this issue.)

1. Alula: specialty flight feather on the upper wing
2. Back feathers
3. Body feathers on chest
4. Malar: the moustache patch
5. Necklace: where the throat meets the chest
6. Retrices: the underside of the tail feathers
7. Uppertail coverts: feathers covering the top of the tail
8. Undertail coverts: feathers covering the underside of the tail



Answers: 1 = F Alula: specialty flight feather on the upper wing; 2 = C Back feathers; 3 = G Body feathers on chest; 4 = H Malar: the moustache patch; 5 = D Necklace: where the throat meets the chest; 6 = B Retrices: the underside of the tail feathers; 7 = E Uppertail coverts: feathers covering the top of the tail; 8 = A Undertail coverts: feathers covering the underside of the tail

Kids' Corner

We had another fabulous Creative Creatures camp collaboration with the Missoula Insectarium this year! At the end of the week, the campers displayed their work in an art show for their parents and friends.

Art by Ziggy Stillman.



get outside calendar



Programs for Kids



MNHC PHOTO

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. Check our website calendar for specific dates and topics—we offer the program most Saturdays. Free with membership or cost of admission.

Join us every Thursday from 10:00-11:00 a.m. for our miniNaturalist program! Best for ages 2-4, though kids of any age are welcome. The miniNaturalist program encourages curiosity for the natural world through exploration and play. We offer a guided outdoor activity and self-guided indoor activity each week. FREE!



Volunteer Opportunities

We have so many great ways to get involved with MNHC! Join us in the field and the classroom with our Visiting Naturalist in the Schools program. Or assist with kids' drop-in programs, help out at the front desk, join one of our event committees, write a Field Note, and so much more! Interested? Visit our website or sign up for our volunteer newsletter at MontanaNaturalist.org/volunteer/.

Join us for our Paleo Pub Talks this fall!

It's everything you wanted to know about dinosaurs in a four-part series. Join us for one, two, or all four fascinating conversations on dinosaurs with local paleontologist and paleo-artist Jason Poole. Each ticket purchase comes with admission for one plus your choice of two adult beverages (non-alcoholic options also provided).

COURTESY OF JASON POOLE



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 to register for programs and become a member. For more information, call MNHC at 406.327.0405.

PHENOLOGY FOR OCTOBER-MARCH

OCTOBER

Milkweed seed pods explode open and spread their parachute-like seeds for germination

The Big Dipper, Ursa Major, is at its lowest point in the sky



NOVEMBER

Chickadees grow their brains, helping them store & remember the location of their winter seed caches

White-tailed deer in rut



DECEMBER

Alpenglow paints snowy mountaintops with vivid colors at sunrise and sunset

Small mammals tunnel under snow in the subnivean zone in search of food and shelter.



JANUARY

Bison shovel snow with their heads to get to the grasses beneath

Great Horned Owls begin to mate



FEBRUARY

Musk rats forage underwater - look for lines of bubbles beneath the ice

Cottonwood buds exude a sticky resin

MARCH

Thousands of Snow Geese and other waterfowl stop at Freezeout Lake on their migration north

Listen for the striking "conk-la-ree" trill of Red-winged Blackbirds



RED-WINGED BLACKBIRD: JOY VIOLA, NORTHEASTERN UNIVERSITY, FLICKR.COM; BISON: NPS, JIM PEACOCK, FLICKR.COM; ALPENGLOW: NPS, JACOB W. FRANK, FLICKR.COM; CHICKADEE: KURABYA, FLICKR.COM; MILKWEED: PAUL VANDERWERF, FLICKR.COM

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



Adult Programs

Stay tuned for other fall and winter programming including naturalist presentations, First Fridays, field experiences, and more. Check our website and social media for the latest information, or sign up for our e-newsletter at MontanaNaturalist.org.

OCTOBER

October 5

Roadside Geology Field Trip with Bruce Baty,
9:00 a.m.-2:30 p.m. \$55;
\$50 MNHC members.
Registration required.

October 12

Paleo Pub Talks, 7:00 p.m.
Digging up Dinosaurs on
Three Continents. \$15;
\$10 MNHC members. Cost
for entire four-part series:
\$55; \$35 MNHC members.
Registration encouraged.

October 17 - November 21

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

October 19

Paleo Pub Talks, 7:00 p.m.
How I Spent My Summer.
\$15; \$10 MNHC members.
Cost for entire four-part
series: \$55; \$35 MNHC
members. Registration
encouraged.

October 26

How Streams & Rivers Change
the Landscape with Bruce
Baty, 12:00-1:00 p.m. Free
with admission.

October 26

Paleo Pub Talks, 7:00 p.m.
Chalk Talk: What Is a
Dinosaur? \$15; \$10 MNHC
members. Cost for entire
four-part series: \$55; \$35
MNHC members.
Registration encouraged.

NOVEMBER

November 2

Paleo Pub Talks, 7:00 p.m.
Dead on Arrival: A Dinosaur
Art Talk. \$15; \$10 MNHC
members. Cost for entire
four-part series: \$55; \$35
MNHC members.
Registration encouraged.

November 16

Geology of Glacier National
Park with Bruce Baty,
12:00-1:00 p.m. Free with
admission.

DECEMBER

December 2

Holiday Wreath Workshop
at Western Cider,
1:00-3:00 p.m. \$20;
\$15 MNHC members.
Registration required.

December 4

Holiday Wreath Workshop
at Western Cider, 6:00-
8:00 p.m. \$20; \$15 MNHC
members. Registration
required.

FEBRUARY

February 13 - May 7

Spring Montana Master
Naturalist Course,
Tuesdays, 4:00-7:00 p.m.,
plus two full-day Saturday
field trips on February 24
& April 3, and one half-day
Saturday field trip on March
30. \$450; \$425 MNHC
members. Registration
required.

MNHC's Holiday Bazaar!

December 1, 5:00-9:00 p.m.

Join us to celebrate the holiday season! During this first Friday event, MNHC will host a variety of local craftspeople and artisans selling their wares and art, free refreshments and finger food, and a curated auction filled with experiences, local art, outdoor gear, and more! This is a great opportunity to do your holiday shopping while supporting MNHC!



Hone your birding skills with MNHC's 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.

Dates & Locations:

October 15 & 31 at Kelly Island
November 2 & 26 at Lee Metcalf
December 1 & 17 at Council Grove



Fall and winter are a great time to read... join one of our naturalist book clubs!

MNHC's virtual naturalist book clubs started during the isolation of the pandemic and have proved so popular they continue to be in demand, running strong now for the fourth year in a row. Attended by readers and naturalists across the U.S., our two book clubs are run on the volunteer efforts of wonderful hosts: Sherry Staub, Cas, and Suzanne Hendrich. Sherry and Cas are going on their third year and Suzanne on her second. And the best thing about them? There's always room for more participants. Join one of these groups and expand your naturalist literary horizons! Email [Christine Morris](mailto:cmorris@MontanaNaturalist.org) at cmorris@MontanaNaturalist.org to sign up.

Looking for some new naturalist reads? Add these two excellent books to your list!

Campfire Stories, Volume II: Tales from America's National Parks and Trails, edited by Dave and Ilyssa Kyu
and **Eight Bears: Mythic Past and Imperiled Future** by Gloria Dickie

REVIEWED BY ALLISON DE JONG

Campfire Stories is a beautiful collection of stories, essays, and poems that celebrates the richness and complexity of our national parks and trails from a well of diverse voices. Editors Dave and Ilyssa Kyu made a point of seeking out BIPOC and LGBTQ+ writers, and that diversity of perspectives gives this book unusual depth and insight. Many of the stories acknowledge and name the Indigenous

peoples who lived on these lands long before they were designated as national parks, reminding us of their—and our—complicated history. From these stories we also learn that the present, with its challenges of climate change and habitat loss and overpopulation, is no less complicated.

And yet in spite of these complications, our national parks remain extraordinary places, places tens of millions of people visit each year. They could tell a hundred million stories. This book gives us a few dozen: enough to provide a tantalizing taste of seven of these magical places.

Pick up *Campfire Stories*, and before you know it, you're rafting the Colorado River in December, reveling in hundreds of millions of years of geologic history. Driving the rough road to Point Sublime on the Grand Canyon's North Rim. You are lost, hungry, parched in the unrelenting heat of Joshua Tree. You are biking Glacier's stunning Going to the Sun Road amidst lingering snow. You're dizzy from vertigo while climbing Dragon's Tooth on the Appalachian Trail. Surrounded by humid salt air, alligators, mangroves, and rainbow-shelled snails in the mesmerizing marshlands of the Everglades. You're following a narrow game trail, seeking out baby Roosevelt elk in the lush verdure of Olympic National Park. Craving enchiladas for days-turned-weeks while hiking the snowy Sierras on the Pacific Crest Trail. You are ecstatic, exhausted, awed, grieving, serene, challenged, renewed.

You can read this book in a cozy chair, in bed, at your kitchen table...but there's something powerful about reading it in a wild place, surrounded by birdsong, the murmur of water, the hum of insects. Read it beneath dappled sunlight, among the trees, or, yes, around a campfire, the stars bright overhead.

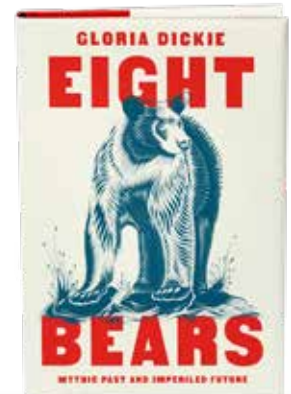


Award-winning journalist Gloria Dickie's **Eight Bears** is another book that takes you places—but this time, you're going on a world tour, visiting Peru and China, Vietnam and Ecuador, India and arctic Canada. And, in the U.S., Yosemite, Lake Tahoe, and a ranch in Montana. What connects these very different places is the eight species of bears that exist on our

planet: South America's spectacled bears, China's pandas, India's sloth bears, the sun bears and moon bears of southeast Asia, and the three on Montanans' home continent: black bears, brown bears, and polar bears.

As we learn from Gloria's expert, in-depth storytelling, each species has its own history and mythology, its own unique niche in its ecosystem, its own challenges. Gloria tracks down each bear, immersing herself in their landscapes and talking with the people who love, study, coexist with, and fear them (sometimes all at once). We learn that conservation of these species is tricky, especially in places where bear and human populations deeply overlap. Sloth bears are killed for their fierceness. Sun bears and moon bears are captured and caged to extract their medicinal bile. Pandas are universally beloved, but still their bamboo forests are sacrificed on the altar of agricultural expansion. And polar bears, which live far from dense human populations, are losing out to climate change in the rapidly warming Arctic.

As she tells the complex stories of the world's eight bears, Gloria keeps returning to one central question: can we learn to coexist with our ursine neighbors? There are no easy answers, but what we do come to understand throughout this lovingly researched account is how much will be lost if we can't.



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.

Volunteer Spotlight: Janet Cass

BY ALLISON DE JONG

Janet Cass moved from Minnesota to Missoula in June 2022, and has been volunteering at MNHC ever since. As a former working scientist—she has a master's degree in immunology and worked for many years as a biomedical researcher—she was drawn to MNHC and its focus on science and nature education. It took her less than a week after moving to sign up as a volunteer, and she began by soliciting donations for our 2022 auction, reaching out to regular donors as well as new businesses and organizations. She's also helped with MNHC clean-up days and, most recently, our inaugural summer block party, where she served on the planning committee, obtained sponsorships, and volunteered on the day of the event.

"Janet is amazing," says Kellen Beck, MNHC's Marketing & Events

Coordinator. "She has done so much for MNHC, she helps in so many ways...we love her!"

Janet also has experience as a freelance writer, magazine editor, and grant writer, so writing Field Notes for our program on Montana Public Radio was a perfect fit. So far she has researched, written, and recorded two excellent pieces which aired this summer, and she is looking forward to writing more. She has a fabulous voice—do yourself a favor and listen to her Field Notes, "The Dancing Loon" and "Please Don't Touch the Bison," online at MontanaNaturalist.org/field-notes/.

"I enjoy volunteering at MNHC because I know that, in some little way, I'm helping this organism thrive," Janet



Janet hiking among the arrowleaf balsamroot on a beautiful May day.

says. "I feel like I get back much more than I give."

We are so grateful for Janet's generosity, time, and dedication to MNHC. *Thank you, Janet!*

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imprints

Experience Stories on the Landscape

Our newest exhibit is officially finished and we couldn't be more excited! **Stories on the Landscape**, installed in August, is the latest addition to our expanding exhibit hall. Featuring captivating illustrations, hands-on rock specimens, and lots of local information, this is one you won't want to miss.

For billions of years, geologic processes have worked their magic on Montana's landscape. These forces act as timeless characters in an ancient, geologic story. When we unearth these stories, we can celebrate the landscape and our relationship with it. Stop by MNHC to learn more about these stories on the landscape!



Wings Over Water 2023: A Soaring Success

What happens when you combine eleven talented science teachers, lots of local experts, and a week of learning about Ospreys in the Clark Fork watershed? You get another edition of our educational and inspiring Wings Over Water teacher workshop!

This year's workshop was a smashing success from start to finish. Our eleven STEM teachers worked hard all week to learn about the history of our watershed and its impact on local Osprey populations. They worked with local experts from Raptor View Research and the Montana Osprey Project, attended an Osprey banding, explored the physics of flight, collected macroinvertebrates, toured Montana Resources mine in Butte, and worked their way through our extensive, standards-aligned Wings Over Water curriculum. They finished off the week with presentations demonstrating how they will integrate their new knowledge into their own classrooms across the country, from New Mexico to New Jersey. All in all, this year's workshop couldn't have gone better and we're already dreaming about Wings Over Water 2024!



Reflections from a STEEM Sister

“ I loved Limnology Camp! One of my favorite activities was when we caught and learned about aquatic macroinvertebrates. The fish hatchery was cool. We got to see fish at different stages of development and preserved, deformed fish.

The campout was a lot of fun! The walking tacos were a hit as we bonded overnight. I liked learning about the Flathead Lake Monster and the stories about it saving children and dogs. We had a great campsite and got to go paddleboarding. Overall, we spent a lot of time in the water. Emma and Caitlin were excellent camp counselors.

I thoroughly enjoyed Limnology Camp and look forward to returning next year. ”

—STEEM Sister Cassidy Parks

As To The Mission

THE ORGANISM THAT IS THE MONTANA NATURAL HISTORY CENTER

With the Montana Natural History Center's inaugural Summer Block Party in the rearview mirror, I've been thinking a lot about healthy organizations and organisms.

I've always liked the analogy of an organization as a living organism. Businesses, nonprofits, and public agencies all have different branches or arms. Within each, there are people and groups that act like organs that process different needs. Going further, an organization can, like an ant or bee colony, even be thought of as a superorganism, with people working together to carry out functions that individuals in the colony wouldn't be able to perform on their own. In our case, the board of directors, program and administrative staff, volunteers, donors, and more form this superorganism, along with schools, program participants, and museum visitors—all those whom we endeavor to reach through our work. The Montana Natural History Center simply couldn't exist without all these different groups engaged in their various activities.

Along those same lines, I can't help but think of microbiota and the human microbiome and how integral it is to human health. The notion that communities of microorganisms exist within larger macroorganisms has always set my hair on fire! And that these microscopic organisms can inhabit an environment such as our gastrointestinal system or skin means that they are pretty amazing creatures. This is made even more fascinating by the fact that macros need these micros to survive. It's not exactly the same thing as a superorganism, but when applied to organizational health, microbiota seems like another apt analogy. Consider the Missoula community. There's a need and desire to steward and conserve the place we inhabit and love. A cadre of different groups and organizations exist in symbiotic fashion with each other and the macroorganism, the Missoula community, to keep the community informed, protected, and healthy.

It's certainly a fun exercise to use biological concepts to frame how nonprofits, businesses, public entities, and citizens interact in healthy and incredible ways to form something greater. To this point, I want to extend a huge congratulations and thank you to all the fantastic businesses who support us, the volunteers and board members who give of their time, and the amazing nonprofits, schools, and other public entities with whom we work: we are making the greater Missoula area a super community!



Thurston Elfstrom, Executive Director

Support MNHC with a Distribution from Your IRA

Did you know that making a donation to MNHC from your IRA can have tax benefits? A Qualified Charitable Distribution (QCD) is a way to donate directly to MNHC from an IRA, rather than taking a distribution yourself and then donating from your own funds. As a result, you may avoid being pushed into a higher income tax bracket and steer clear of phaseouts of other tax deductions. With a QCD the gift can count towards your Minimum Required Distribution and will not increase your taxable income.

QCDs can be made starting at age 71½. If you are interested in supporting MNHC from your IRA, please contact Mark Schleicher at 406.541.8691 or mschleicher@MontanaNaturalist.org.



COURTESY OF SER ANDERSON

Ser Anderson

We bid a fond farewell to MNHC Teaching Naturalist **Ser Anderson** this summer. They have accepted an exciting new opportunity with Birds Connect Seattle as their Urban Conservation Educator, and are looking forward to learning more about community science and conservation in their new position. We are so grateful for Ser's years at MNHC, and all of us who know them will miss their thoughtfulness, deep natural history knowledge, humor, and kindness. And their wonderful monthly Saunters! **We wish Ser the best in their new adventure!**



COURTESY OF STEPHANIE MURPHY

Stephanie Murphy

Teaching Naturalist **Stephanie Murphy** also moved on to a new adventure this fall, as the Communications Coordinator for the Western Montana Conservation Commission with the DNRC. Stephanie is an amazing naturalist and educator and brought a deep knowledge and passion to her work. She added so much to MNHC during her years here, and we know she'll be wonderful in her new role as well. **We wish her the best!**

Alberton School Mountain Lion Project

From fall 2021 to spring 2023, junior high and high school students from Alberton School worked from start to finish on an exciting, hands-on STEAM project: articulating a mountain lion skeleton for museum-level display at MNHC. Their teacher, Nick Ehlers, connected the students with professionals at Montana Fish, Wildlife, and Parks, the University of Montana Zoological Museum (UMZM), Graves Creek Taxidermy, Heritage Timber, and MNHC to provide guidance along the way. Larry DePute, a volunteer at UMZM and expert skeleton articulator, also mentored the class throughout the process. The students installed the finished specimen at MNHC this past May—come by and check it out!



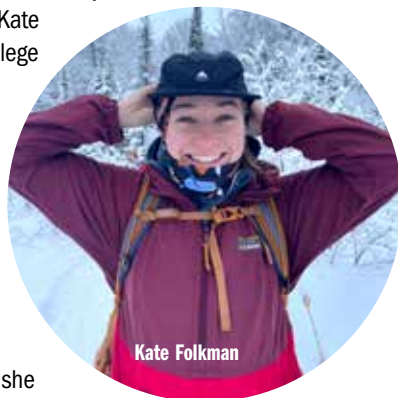
MNHC PHOTO

The mountain lion specimen was a two-year-old “problem cat” harvested by FWP officers in 2021. The bighorn sheep specimen with radio collar included in the mount died in the winter of 2022 and was later collected by Alberton students participating in the research and filming of the documentary *Out On A Ledge*. Both specimens are on permanent loan to MNHC from Montana Fish, Wildlife, and Parks.

WELCOME, NEW TEACHING NATURALISTS!

We are thrilled to welcome **Kate Folkman** and **Erin Vielbig** this fall as MNHC’s newest Teaching Naturalists. They’ll be teaching 4th-grade students in our Visiting Naturalist in the Schools Program as well as helping with programming at the Center.

Kate spent her childhood outside skiing, swimming in the lakes of Minnesota, and camping with her family throughout the western U.S. Kate then attended Concordia College in the Fargo-Moorhead Area and studied Environmental Science and Spanish. She was a part of the improv team and worked at her school’s Sustainability Office analyzing data for LEED certifications and as an intern at the organic garden. During the summers she spent her time working at various summer camps as a naturalist, lifeguard, and guide for canoeing and backpacking trips. Kate has spent the last two years on the North Shore of Minnesota at Wolf Ridge Environmental Learning Center teaching experiential, place-based education and doing graduate work in environmental education and sustainability. She spent her free time learning country swing dancing and fishing in the Superior National Forest. Kate is looking forward to continuing to explore and be curious about the natural world at MNHC!



Kate Folkman

Erin grew up on a family farm in the Lower Peninsula of Michigan. After attending Grand Valley State University, she set off to do trail work for Montana Conservation Corps. After finding value and purpose within the conservation field, she decided to return the following season as a Trail Crew Lead. Her crew cleared trails in the Selway Bitterroot and Frank Church Wilderness areas near Missoula, Montana. Between seasons, Erin worked for a community garden outside of Atlanta, Georgia, where she helped with volunteer days and nature camps for kids. Before spending this past summer as a seasonal naturalist with MNHC’s summer camps, Erin worked as a naturalist at Len Foote Hike Inn a few miles off the Appalachian Trail, where she developed her passion for education and natural landscapes. Erin enjoys floating the Clark Fork, playing euchre, and First Fridays.



Erin Vielbig

COURTESY OF KATE FOLKMAN

COURTESY OF ERIN VIELBIG

We're Redesigning Our VNS Curriculum!

The Visiting Naturalist in the Schools (VNS) program proudly celebrated its 20th anniversary of connecting students with nature last year. VNS currently serves 32 schools throughout northwestern Montana, ranging from Hamilton in the south to Hot Springs in the north.

The VNS team recently began work on a major redesign of the existing curriculum. The new curriculum will be designed from the Next Generation Science Standards, incorporate elements of NOAA's Climate Literacy Principles, and include components from Montana's Indian Education For All standards. These additions will strengthen the engagement, rigor, and relevance in the VNS program for all of the students that we serve. Pilot lessons will roll out this fall as we continue to foster curiosity, scientific inquiry, and sheer awe for the natural world in our 4th- and 5th-grade students.

Our VNS program is reaching more than 1600 students this year! Our naturalists connect these students to nature every month of the school year, including full-day field trips in October and May.



MINHC PHOTOS

Thanks for Partying with Us This Summer!

Our inaugural Block Party was a roaring success! The day was warm, but the turnout was great—around 750 people attended, based on the 500 ice cream cones and 350 beers served. And we loved seeing so many people dancing to the great bands who played throughout the day. Whether you joined us as a volunteer, sponsor, musician, artist, naturalist, fellow non-profit, or as a guest, thank you to every one of you! Our Block Party was only possible because our community is amazing and you all pulled together to make this beautiful day happen. We can't wait for next year!



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Hands-On History:

UM Students Take the Reins on MNHC Archives Project

STORY AND PHOTOS BY ALYSSA CORNELL

Museum collections can be an intriguing conundrum. At their core, collections are meant to be curated and maintained for the public. This can include use around research, interpretation, education, or just general enjoyment of the objects. But to ensure their longevity for future generations, museum professionals must sometimes limit how people can engage with them. There is an ongoing question within the field: how best to balance use and conservation? It was then quite exciting when MNHC was presented with an opportunity to both better conserve one of our collections and allow greater community access to it.

In the winter of 2022, Professor Eric Zimmer with the University of Montana's History Department contacted us about a potential collaboration. Eric presented the somewhat experimental idea of a course project immersing his students in public

history through hands-on work in the community. The students and the project would be scaffolded by course content on U.S. Environmental History. He wanted the final product to be beneficial both to his students and to the partnering institution.

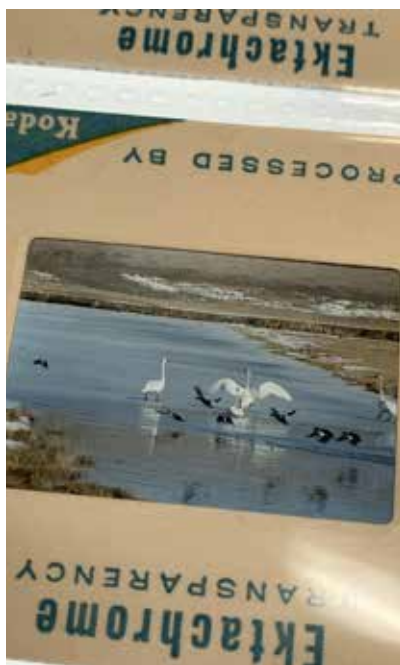
MNHC has worked with different departments at the University of Montana since our inception, but this concept of a semester-long project with an entire class was a first for us. Although new, it was immediately apparent this collaboration would have a positive impact on the students and our collections. One of my initial thoughts was how much I would have loved to take a course like this when I was a student!

Our project brainstorming phase did not take long. The Gabriel photography collection was a clear winner. Herman William "Bill" Gabriel III dedicated his life to the natural world through careers in forestry, wildlife biology, writing, and photography. After Bill's passing in April

2020, his estate donated a large portion of his photography to MNHC. The collection consists mostly of 35 mm color slides divided into 86 containers, or about 60,000-70,000 slides in total. Bill included maps, articles, notes, books, and personal correspondence, presumably to provide greater context for the photos. Despite our desire to fully process the donation, limited time and resources left it stagnant for two years. It needed to be inventoried to gain a better understanding of its content, as well as to inform our next steps for cataloging, rehousing, and potential digitization. The subject matter of the photos, Bill's background, and the scale of need for the collection made it a perfect fit for the class.

One goal was for the students to have ownership of the project while providing them with the necessary tools to accomplish it. In addition to myself and Drew Lefebvre, MNHC's Museum Programs Coordinator, Eric connected the students with other professionals in

The students used light boards and magnifying lenses to view, analyze, and sort the tens of thousands of slides in Bill Gabriel's collection.



"My students raved about this project. Several reached out after the class to tell me how much they learned about day-to-day work in the museum field. A few even said this project inspired them to pursue careers in archiving and collections management!"

the field. Professors Donna McCrea and Erin Baucom, archivists with the UM Mansfield Library Archives and Special Collections, helped mentor the class throughout the semester. Although we were present to help guide and answer questions, overall Eric organized the course so that students could act as project consultants for MNHC. This meant quite a few class planning sessions took place before the students even touched the photos in the collection.

After brainstorming, adapting the plan, adjusting timelines, and gathering our resources, the students came to MNHC for their first inventory day. The classroom was filled with all 86 containers, light boards, laptops, gloves, and magnifying lenses. Erin helped the students build a metadata element set and Google form which populated the students' responses into an organized spreadsheet. Container by container, the students generated a detailed inventory.

From the initial inventory phase, we brainstormed with the class about how to then make the spreadsheet functional for the collection's needs. We determined that one of the most important resources—and limitations—for MNHC's collection is space. The 86 containers take up a lot of it! The students determined that not everything was within the scope of MNHC's mission. By breaking the inventory into in-scope and out-of-scope, they could make recommendations for the out-of-scope photos to be removed or transferred to other facilities.

Determining the scope of the collection didn't require every student, so some groups worked on other components to support the collection, such as biographical research on Bill, and recommendations on how MNHC could best use the collection. One of the students is visually impaired, and brought to our attention that this archival photo project would be an obstacle for them. So they, later joined by others in phase two, worked in parallel with the inventory project to review MNHC's exhibit hall and recommend accessibility improvements that we plan to implement in the near future.

At the end of the semester, Eric and his students presented us with the project deliverables. These included a detailed

inventory spreadsheet color-coded to indicate in- and out-of-scope containers, a researched biography of Bill Gabriel, recommendations for MNHC's potential use, display, and storage of Bill's work, an accessibility audit, and informative project planning memos from each student group. The project culminated in a celebratory event at MNHC, where the students formally presented their accomplishments, results, and recommendations to colleagues, family, friends, and MNHC staff.

One important takeaway for the students was realizing that the management of this collection will not end with the semester. Projects like this often take multiple years to fully complete, and the need to actively care for a collection never ends. So as we look towards what's next for the Gabriel collection we'll utilize the student deliverables as a guide. We'll review and contact their recommended locations for out-of scope relocation, determine what resources we need to implement the accessibility recommendations, and use their biography of Bill and "how to use" notes to assist interpretation. Long-term project goals also include rehousing the collection into archival-grade materials and digitizing it to expand its accessibility to the public.

This was truly a beneficial and wonderful project for all involved. As a Collections Manager, I'm thrilled with the students' work in supporting the improvement of this collection. Eric was also pleased with the collaboration. "My students raved about this project," he said. "Several reached out after the class to tell me how much they learned about day-to-day work in the museum field. A few even said this project inspired them to pursue careers in archiving and collections management!" Others reaffirmed their passion for the field, and one even received a job offer thanks in part to the course. It was a privilege to observe the students learning, struggling, growing, and working together as they engaged with the Gabriel collection. This is a partnership we hope to continue! 🐾

—Alyssa Cornell's background is in public history and collections management and care. She loves the variety that every day brings in her role as Collections Manager at MNHC.

High-Tech Hunting Montana's Big Trees

STORY BY CARL SEIELSTAD

In a decidedly low-tech finish to a high-tech adventure, we struggled to wrap a diameter tape around the last tree's trunk, cursing the steep ground and the thorny thickets of devil's club. It measured almost six feet in diameter—a corky-barked Douglas-fir stretching 191 feet skyward.

This tree and hundreds like it had first appeared on a computer screen in the WA Franke College of Forestry and Conservation at University of Montana. We had been mapping the three-dimensional structure of forests in the Swan Valley of northwest Montana using Light Detection and Ranging (LiDAR) to better understand susceptibility to wildfire.

LiDAR uses rapidly pulsed lasers mounted on aircraft to measure distances to terrain and vegetation. GPS, motion tracking systems, and precise clocks work together to determine the location of each laser reflection, producing vast clouds of height measurements across the land surface.

Our Swan Valley study area contained 13.5 billion measurements across 670 square miles of forest.

A grad student working on the project noticed that many laser reflections were taller than the tallest known trees in

Montana. “Are those trees?” he wondered aloud, pointing at the images on the screen in our campus lab.

By examining clouds of laser measurements around each tall point and rotating perspective in a 3D visualizer, we found antennas, powerlines, flying birds, and, yes, trees—trees that easily surpassed the height of all but one of Montana's Tall Ten in its Big Tree Register. Was it possible we had discovered scores of new champion trees without ever setting foot in the woods?

Trees are scored by adding three measurements—distance around the trunk, height, and one-fourth of crown width. This form of scoring weights the girth of the tree considerably more than the other two measurements. We would need to meet our tall trees face-to-face to gather the other vitals. Armed with clinometers, measuring tapes, laser range-finders, cameras, and drones, we set out to visit the tallest twelve trees in the Swan Valley.

What started as a research project devolved into a personal quest, a tree fever of sorts. It was completed incrementally on weekends over two summers owing to the difficulty reaching each tree combined with an evolving resistance by spouses and



Foresters use a special kind of measuring tape called diameter tape, or D-tape, to quickly measure the diameter of a tree—in this case, a Douglas-fir.

CARL SEIELSTAD

children to sacrifice weekends thrashing in heavy brush and wading fast water to find those “silly” trees.

For reference, the tallest known tree in Montana is a 195-foot ponderosa pine growing near Fish Creek in Mineral County and second place is a 181-foot western white pine in Lincoln County.

Our field reconnaissance of the Tall Twelve in the Swan Valley revealed eleven standing trees ranging in height from 184 to 195 feet. A western white pine sprouts from a damp river terrace surrounded by fatter specimens of larch and Douglas-fir. A western larch grows from the bottom of a narrow, steep-walled seasonal stream channel. A Douglas-fir and its twin angle toward a river on a brushy escarpment to the modern floodplain. An Engelmann spruce springs from spongy ground in false huckleberry shrubs so thick that mosquitoes can only swarm harmlessly above.

One tree growing near a popular campground and evident in the LiDAR point cloud has vanished, likely a western larch felled by wind and cut for firewood.

Each tree is surrounded by neighbors of similar stature. They are perfect in form and health, straight, uniformly tapered, and defect-free. Their feet rest in water, either on

TIM WALLACE

Looking down at a 191-foot-tall Douglas-fir after a light dusting of snow.



a floodplain or in convergent terrain where groundwater flows late into the summer.


Although our Tall Eleven look down on all but one tree in Montana's record book, they will need an additional one to two feet of girth or about 65 feet of height and crown spread to become champions. The real champions are fatter and shorter, stretching seven to eight feet across at chest height and standing 153 to 181 feet tall.

A 200-foot tree is a mythical beast in Montana and we expect one might be found in a new LiDAR survey of Lincoln County. However, champion trees are rare and hard to find even with the help of technology. We identified 627 trees taller

The author's children embrace a 192-foot tall Engelmann spruce near Glacier Lake.



than 173 feet (the shortest tree in Montana's Tall Ten) across 670 square miles of forest, less than one per square mile. That's plenty of trees for tree hunters to find but represents only about 0.001 percent of all trees in the study area. Our findings suggest that most of them will be impressive but few will make the record books.

Ultimately, high-tech tree hunting can focus attention on tracts of forest with promising characteristics, but Montana's undiscovered champion trees will need to be found the old-fashioned way—by foresters, foragers, and hunters clamoring through the deep woods. 

—*Carl Seielstad is a professor in the Department of Forest Management at the University of Montana and scientist for the National Center for Landscape Fire Analysis (NCLFA). The big trees were discovered and measured in collaboration with researchers Valentijn Hoff and Chris Moran of the NCLFA.*

Tree scores are calculated by adding three measurements: circumference of the trunk in inches (calculated by multiplying the diameter at breast height by 3.14) + height (in feet) + one-fourth of crown width (in feet).



Measurements of the Tallest LiDAR-discovered Trees by Species vs. Champion Trees								
Species	LiDAR				Champions			
	Height (ft)	DBH ¹ (in)	CW ² (ft)	Tree Score	Height (ft)	DBH ¹ (in)	CW ² (ft)	Tree Score
Western Larch	195	38	30	321	153	84	34	426
Englemann Spruce	194	46	28	345	173	72	35	409
Douglas-fir	191	56	52	380	178	71	48	414
Western White Pine	187	45	41	338	181	74	19	417

¹Diameter at Breast Height; ²Crown Width

Three-dimensional visualization of a LiDAR point cloud of Highway 200 passing through the University of Montana's Lubrecht Experimental Forest.



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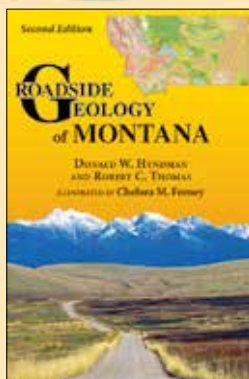
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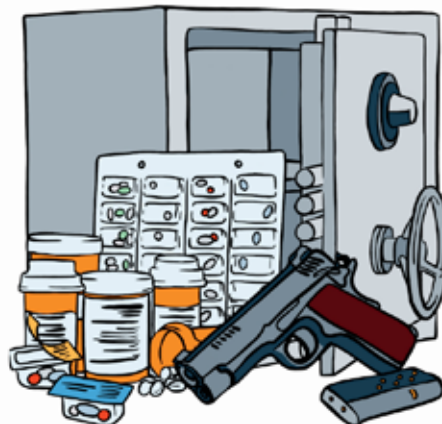
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I dreamed it was summer, but

Winter lives in cotton that flakes from wooden branches to drift and pile in the streets. Winter lives in the chap of my skin, the crack of my knuckles, and the wind-worn crease of my eyes. Winter lives in summer storms that snowball hail in the valley and return the caps to snow-capped peaks. Winter lives in the snowmelt that is runoff, that is stream, that is river. Winter lives in the collective energy of a town insistent on soaking up sunshine and green-up, and celebrations that linger late into the night. Winter lives in the press-press-press of summer, in the need to do-it-while-you-can, make-hay-while-the-sun-shines. Winter lives in a short growing season, in the question will my tomatoes beat first frost, in the often-answer: no. Winter lives in the summer solstice and the imperceptible drawing of the long night. Winter lives in the forage-gather-stock-up of fall, in chickadees storing seeds, squirrels stockpiling spruce cones, and rabbits nibbling diligently from dawn to dusk. Winter lives in the ricochet of chainsaw off canyon walls and the steady replenishment of backyard woodsheds. Winter lives in a wildfire season of smoke and haze so long that we yearn for days spent shoveling mounds of moisture, for dark, clear, quiet nights ablaze with only starlight. So that when winter comes, we welcome first flakes in relief. Because winter lives.

—Elizabeth Domenech is a writer, naturalist, and advocate for conservation and wildness. Her writing can be found published in The Sunlight Press, Eunoia Review, Amethyst Review, and Edible Bozeman. She lives in Bozeman, Montana.



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