MISSOURI CONSERVATIONIST

VOLUME 81, ISSUE 5, MAY 2020
SERVING NATURE & YOU

BIRDS *are* AWESOME

DO YOU KNOW THAT …

Birds control the insect population.
They consume over 400 million tons of insects per year.

Birds support your health.
Getting outside and listening to birds helps improve a person's mood and attention.

Birds are good for the economy.
Birdwatchers boost local spending on binoculars and other sporting goods, lodging, gas, food, and other local businesses.

BIRDS NEED OUR HELP

North American bird populations are declining. Here's what you can do to help:

Plant native plants, shrubs, and trees.
Native plants attract native insects, which provide the best food for birds and their young.

Make windows safer. Break up reflections and cut down on window strikes by installing stickers, film, or screens to the outside of windows.

Be a citizen scientist. Learn your birds by sight and sound, record sightings on eBird, or join monitoring efforts.

Not sure where to see and hear birds?
Check out the **GREAT MISSOURI BIRDING TRAIL**.
Visit **greatmissouribirdingtrail.com** to find locations near you.

Contents

MAY 2020
VOLUME 81, ISSUE 5

FEATURES

DEPARTMENTS


Jack-in-the-pulpit

MISSOURI CONSERVATIONIST

ON THE COVER
Three *Eusarca confusaria* moths pollinate a pale purple coneflower
DAN ZARLENGA
100mm lens, f/5.6
1 sec, ISO 800

Download this issue to your phone or tablet at **mdc.mo.gov/mocon**.

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Inbox

Letters to the Editor

Submissions reflect readers' opinions and may be edited for length and clarity. Email Magazine@mdc.mo.gov or write to us:

MISSOURI CONSERVATIONIST
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JEFFERSON CITY, MO 65102

WHAT LIES BENEATH

In 66 years, I had no idea there are burrowing crawdads [*Burrowing Crayfish*, March, Page 10]. I have seen these mud towers and thought they were built by wasps. I learn something every issue.

Rich Murray
St. Louis County

CRAYFISH KUDOS

Thoroughly enjoyed your article on burrowing crayfish. Growing up in Arnold, there was a small stream not far from the Meramec River. The stream emptied into a creek that flowed in the river. Along the stream, we would see gray clay chimneys.

June Kirk O'Fallon

NEONICS

I have a question about *Neonicotinoids and Wetlands* [*Nature Lab*, Page 4]. What I've read is that neonics are largely responsible for deaths in bees. I would think that farmers would want to preserve the pollinators. I realize that insects can also be disastrous to crops. Isn't there a solution that works for a better choice? And do these poisoned insects, or the contaminated waters, have an effect on bird populations?

Joyce Steinbuch Lathrop

Pesticides, including neonicotinoids, are one of the many pressures on pollinators and other invertebrates worldwide. And, since bugs are basically bird food, pesticides may indirectly affect bird populations. That said, we know our farming partners care very much about the important role pollinators play in agricultural systems. Many of them work hard to practice integrated pest management, which includes monitoring pest populations and establishing thresholds for control, as well as strategically applying pesticides like neonicotinoids. Additionally, many invest time and money to establish pollinator habitat in the form of flowering plants on their properties. Another aspect of our neonicotinoid research, not covered in this article, found that increased floral diversity buffered the effect of neonicotinoid concentrations on native bee abundance. Given the important role of native bees as pollinators, this results in a win-win situation. —THE EDITORS

BLOODROOT: BE AWARE

In March's *What Is It?* [Page 9], shouldn't there have been a warning about the bloodroot's sap?

David Stokely Republic

Bloodroot contains a reddish-orange sap that can irritate the skin. Care should be taken to avoid direct skin contact with the plant's sap. —THE EDITORS

FAMILY FUN

Our family enjoys the *Conservationist* and *Xplor* magazines. They are so informative and well designed. My 4.5-year-old son says, "Thank you for this magazine. It's so great." Keep up the good work.

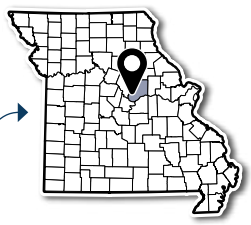
The O'Neal Family Smithville

A GOOD READ

Thank you for the high-quality magazine you put out month after month. I am a special education reading teacher in a middle school. I find your magazine to be a wealth of material for lesson plans. The photography is incredible, the topics well researched, and the articles well written. Thanks again for making this an excellent educational tool!

Rosa Hamilton via email

CORRECTION



In *Places to Go* [April, Page 31], we incorrectly stated Little Dixie Lake Conservation Area (CA) has camping available. The area is closed from 10 p.m. to 4 a.m., so camping is not allowed. For more information on Little Dixie Lake CA, visit **short.mdc.mo.gov/Zmo**.

BLOODROOT: JIM RATHERT

Connect With Us!

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Have a Question for a Commissioner?

Send a note using our online contact form at mdc.mo.gov/commissioners.

Want to see your photos in the Missouri Conservationist?

Share your photos on Flickr at flickr.com/groups/mdcreaderphotos–2020, email Readerphoto@mdc.mo.gov, or include the hashtag #mdcdiscovernature on your Instagram photos.

1

2

1 | Gray fox by Lisa McFadden, via email

2 | Crappie by midwesternwoman, via Instagram

3 | Missouri evening primrose by Kathy Bildner, via Flickr

3

Up Front

with Sara Parker Pauley

Recently, I participated in a woodland prescribed burn with my MDC colleagues. All was well orchestrated — burn lines prepared, conditions just right, checklist implemented, equipment ready. It was time. I watched the flames as they crept across the forest floor, sometimes catching downed logs that blazed hot and uttered sounds like roaring wind.

I couldn't help but think of the irony of this burn happening on Good Friday. The scorched earth, the scars left behind on bases of larger trees. All seemed lost for a time. Much like it may seem today amid this epic pandemic that we've not faced before — with fear and uncertainty casting dark shadows.

Anne Frank said, "The best remedy for those who are afraid, lonely, or unhappy is to go outside, somewhere where they can be quite alone with the heavens, nature, and God."

Missourians have taken to this remedy. Over the last weeks, as much of the world has shut down, so many more have sought solace and healing in nature. Our conservation areas, boat ramps, community lakes, parks, and other outdoor places have borne witness to our innate need for nature.

The forest floor will return — healthier for the burn — without the added burden of invasive shrubs and vines. And we, too, as Missouri families and communities will come through this dark time. There will be scars, yes. But may they remind us to care less about the unimportant things and more about those that matter — faith, family, community, nature. Restoration is near.

Sara Parker Pauley

SARA PARKER PAULEY, DIRECTOR
SARA.PAULEY@MDC.MO.GOV

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Nature LAB

by Bonnie Chasteen

Each month, we highlight research MDC uses to improve fish, forest, and wildlife management.

A trained volunteer conducts an exit survey with an unstaffed shooting range user. MDC seeks and uses public opinions to improve natural resource management and balance the needs of people and nature.

RESOURCE SCIENCE

Opinion Surveys

"Natural resource management is just as much about managing for people as it is for turkeys, trout, or trees," said Social Science Program Supervisor Ron Reitz. "The department considers how its management decisions affect you, the resource user, and your recreational opportunities."

Reitz's team of social scientists uses mail surveys, public meetings, focus groups, and web surveys to ask Missourians about their views. Last year, his team contacted nearly 200,000 Missourians to get their input on everything from deer and turkey regulations to elk viewing and unstaffed shooting range use.

You might say, "Nobody asked my opinion." It's true MDC can't contact everyone. But, through sampling, staff can learn what you likely think about a given topic.

This is because surveys assume that an opinion held by one person is also held by others. "If you ask enough of the right people, you get a pretty good idea of what a group of people, whether landowners, anglers, hikers, hunters, homeowners, farmers, or even all Missourians think about an issue," Reitz said.

Social science team tracks public opinions about Missouri's fish, forest, and wildlife

In fact, for simple survey questions, a sample size of about 1,000 can accurately represent the answers of Missouri's 6 million people. "The results are almost the same as if everyone had been asked and responded," Reitz said.

One survey that helped MDC learn more and do more for a group of Missouri recreationists occurred between 2013 and 2015. "This three-stage effort focused on unstaffed shooting range users," Reitz said. "The information we gained will help us better manage unstaffed ranges, meet public needs, and comply with federal guidelines."

User Survey of Unstaffed Ranges at a Glance

Info Needed

- Who uses MDC's 70 unstaffed shooting ranges?
- What are their needs, desires, and compliance with rules and regulations?

Methods

1. Create a map of all shooting ranges, regardless of ownership
2. Survey key area managers
3. Conduct user surveys at 39 unstaffed firearms ranges

Results

- Over **89%** of Missourians live within 30 minutes of a shooting range (of any ownership)
- About **51%** live within 30 minutes of an MDC shooting range
- Area managers reported three common rule violations: littering, improper firearm use, and vandalism
- An estimated **299,810 visitors** used the study's 39 unstaffed firearms ranges
- Missourians made up **95%** of the visitors
- MDC's unstaffed ranges provided users over **$1.8 million in recreation value**
- The estimated economic **impact on Missouri's economy is $7.3 million**

Using the Info

- Evaluate potential for staffing and prioritize maintenance and renovation/ construction projects
- Modify rules, encourage compliance, and improve customer service and safety

EXIT SURVEY: TOM TREIMAN

Browse public comment opportunities at **short.mdc.mo.gov/ZJx**

In Brief

AARON HILDRETH

FIRST ELK HUNTING SEASON THIS FALL

THE MISSOURI CONSERVATION COMMISSION HAS APPROVED FIVE PERMITS FOR HUNTING BULL ELK DURING MISSOURI'S FIRST ELK HUNTING SEASON IN MODERN HISTORY

Missouri's first elk season comes after years of restoration efforts of the once-native species by MDC, numerous partners including the Rocky Mountain Elk Foundation, and supporters including local communities and area landowners.

For this season, MDC has designated a nine-day archery portion running Oct. 17–25 and a nine-day firearms portion running Dec. 12–20. The five permits, awarded through a random draw, will be for bull elk and will be valid for both portions. Four permits will be for the general public and one permit will be reserved for qualifying area landowners.

MDC will require a $10 application fee for those applying for the general permits. Qualifying landowners applying for a landowner permit will not be required to pay the $10 application fee. Those selected for each of the five permits must pay a $50 permit fee.

MDC will limit the random draw to one application per-person, per-year with a 10-year "sit-out" period for those drawn for a general permit before they may apply again. If selected for a landowner elk permit, qualifying landowners will not be required to wait 10 years before again applying for a landowner elk permit. Qualifying landowners may apply once each year for a general elk hunting permit and for a landowner elk permit, but are eligible to receive only one permit annually.

Local landowners have been supportive of the reintroduction of elk to the area and many have worked hard to create habitat that benefits elk and many other wildlife species.

The landowner elk permit is limited to resident landowners with at least 20 contiguous acres within the "Landowner Elk Hunting Zone" of Carter, Reynolds, and Shannon counties. Zone boundaries are shown in the application. The landowner permit is nontransferable and may only be filled on the landowner's property.

General permits can be used in Carter, Reynolds, and Shannon counties, except the refuge portion of Peck Ranch Conservation Area, and are not transferable.

Allowed hunting methods for each season portion will be the same as for deer hunting. The permits will allow for the harvest of one bull elk with at least one antler no shorter than 6 inches in length. Successful hunters must Telecheck their harvested elk, similar to deer.

First Elk Hunting Season continued on Page 6 »

FIRST ELK HUNTING SEASON *(continued)*

To apply for an elk permit, applicants must be Missouri residents at least 11 years of age by the first day of the hunt. Those selected to receive a permit must have their hunter education certification or be exempt by age (born before Jan. 1, 1967) before they may purchase the permit.

Apply for the elk permit random draw May 1–31 online at **mdc.mo.gov/buypermits**, through MDC's free MO Hunting app, by visiting a permit vendor, or by calling 1-800-392-4115.

Qualifying landowners must submit their property information through MDC's Landowner Permit Application at **mdc.mo.gov/landownerpermits** before applying.

Starting July 1, applicants can check to see if they have been selected for an elk hunting permit online at **mdc.mo.gov/buypermits** after logging into *Manage Your Account* and selecting *View My Special Hunt History*.

For more information on elk hunting in Missouri, visit **short.mdc.mo.gov/Znd**.

Elk are a native species in Missouri but were hunted to extinction in the state through unregulated hunting during the late 1800s. With the help of numerous partners and supporters, MDC reintroduced about 100 elk to a remote area of the Missouri Ozarks in 2011, 2012, and 2013. Their numbers have grown to more than 200, and their range has expanded in recent years to cover portions of Carter, Reynolds, and Shannon counties. Learn more about elk restoration in Missouri at **short.mdc.mo.gov/ZYJ**.

HUNTERS GIVE TO SHARE THE HARVEST

MDC and the Conservation Federation of Missouri (CFM) thank the thousands of Missouri deer hunters who donated 348,535 pounds of venison to the state's Share the Harvest program this past deer season, including 6,795 whole deer. We also thank the more than 100 participating meat processors throughout the state who grind the donated deer meat into ready-to-use packages, and the many sponsors who financially support the program. The donated deer meat goes to local food banks and food pantries to help feed hungry Missourians all around the state. To get Share the Harvest venison, contact local food banks or food pantries. Share the Harvest is coordinated by MDC and CFM. Since the program was started in 1992, it has provided more than 4.3 million pounds of lean, healthy venison to help feed hungry Missourians, including this past season's donations. For more information on Share the Harvest, visit CFM online at **short.mdc.mo.gov/Zeu**.

Ask **MDC**

Got a Question for Ask MDC?
Send it to AskMDC@mdc.mo.gov
or call 573-522-4115, ext. 3848.

Q: I saw this moss that looked like it was "blooming." I've never seen this before. Can you tell me what this is?

Moss capsules

➔ This moss is at the "capsule" stage and is about to release spores. The capsules open when small, lidlike structures decay, allowing the spores to float in the wind and establish new life.

All mosses are bryophytes, meaning they reproduce via spores rather than flowers or seeds. Of the thousands of species of bryophytes identified, none show all the adaptations needed for a completely terrestrial existence. Unlike other plants, they lack the well-developed vascular structure needed to conduct water and nutrients. This limits their ability to grow very large and most are less than 4 inches tall.

Since they do depend on the existence of water to reproduce, they grow primarily in damp and shady environments — such as the floor of a Missouri forest or woodland.

Because mosses can survive without being rooted in soil, they grow where other plants cannot, such as on the surfaces of boulders, rocks, and stones. Many a hiker has enjoyed the soft respite offered by a moss-covered trail.

Q: I have some large elm trees in my yard that are succumbing to Dutch elm disease and need to be cut down. I've noticed squirrels, robins, wrens, bluebirds, and occasionally cardinals nest in them. Would fall be the best time to remove these elms, when the squirrels and birds are not raising young?

➔ From the perspective of the wildlife using these trees as habitat, September through October is the safest time to remove them. By September, most of the bird nesting activity will be concluded. And by getting the work done before Halloween, you would allow the squirrels to create nests elsewhere before very cold weather sets in.

As conservationists, we encourage people to preserve decaying trees when and where possible because they serve as excellent sources of food and shelter for a variety of animal species.

MOSS: HOLLY MARTIN; RED MILKSNAKE: COURTNEY BOLIN

Red milksnake

However, some trees simply cannot be saved or are not worth saving. If a tree has already been weakened by disease, the trunk is split, or more than 50 percent of the crown is gone, the tree should be removed.

Q: I noticed this red milksnake eating a skink. Can you tell me more about this snake?

→ Brightly colored and medium in size, red milksnakes occur throughout Missouri. They are generally active from April through late October, but they're secretive and seldom seen out in the open. They usually shelter under rocks and logs or in rodent burrows. During hot weather, they move even further underground. In Missouri, they prefer rocky, south-facing hillsides — especially on glades.

Red milksnakes feed on small snakes, mice, and lizards — particularly skinks. They kill their prey by constriction. In this photo, the snake you encountered is likely eating a five-lined skink.

What IS it?

Can you guess this month's natural wonder?

The answer is on Page 9.

Zachary Swindle
SHANNON COUNTY
CONSERVATION AGENT
offers this month's

AGENT ADVICE

Black bass season opens May 23 for streams south of the Missouri River. Opportunities abound across the state for anglers to catch smallmouth, largemouth, and spotted bass. Regardless of your preferred method, you will need a fishing permit. If you are fishing with others, keep your catch separate and identifiable. Be alert on the water and always have ample safety equipment. Check the *Wildlife Code of Missouri* or *A Summary of Missouri Fishing Regulations* for length and daily limits, which vary depending on your fishing location. Both are available where permits are sold or online at **short.mdc.mo.gov/ZUk**. Get your family together and head to your nearest fishing hole. What a great way to kick-off the summer!

WE ARE CONSERVATION

Spotlight on people and partners

by Madi Nolte

Terry Feil

Feil, a retired mail carrier, took conservation efforts into his own hands after reading an article about declining bee populations. With help from his wife, Robyn, and Private Land Conservationist Ryan Lueckenhoff, Feil converted 32 acres of his Audrain County farmland into pollinator- and quail-friendly habitat. In just three years, he has planted nearly 3,000 shrubs and more than 30 types of wildflowers.

Above and beyond

"There are basic requirements to these programs," Lueckenhoff said, referring to required numbers of shrubs and downed tree structures. "He went above and beyond and quadrupled the amount of stuff he had to do."

In his own words

"You can make a whole lot more money farming this land than doing what I'm doing," Feil said. "But there comes a time when you gotta ask yourself, 'How much is enough?'"

"Everything we've done seems like it's working," Feil said. "I have quail every day, all day long in my yard."

by **Cliff White**

What's your conservation superpower?

LEAVE WILDLIFE WILD


Eastern cottontail

As you head outdoors during this long-awaited spring season, you may encounter a variety of newborn wildlife. Young wildlife may appear to be abandoned, but that's usually not the case. MDC asks that you "leave wildlife wild" by not interfering with newborn or young animals as it can do more harm than good.

"Young animals are rarely orphaned," said MDC State Wildlife Veterinarian Sherri Russell. "If the young are left alone, the parent will usually return. Parents are normally out searching for food and cannot constantly attend to their offspring."

Russell added that baby birds are a common newborn people want to help.

"If you see a chick on the ground hopping around and it has feathers, leave it alone and bring pets inside because it is a fledgling and the parents are nearby keeping an eye on it," she said. "Fledglings can spend up to 10 days hopping on the ground while learning to fly. If you find one that is featherless, you can return it to the nesting area if possible, as it probably fell out of the nest."

Dogs catching baby rabbits and lawn mowers running over nests are other common issues.

"Rabbits seldom survive in captivity and can actually die of fright from being handled," Russell said. "Even if the animal is injured, return it to the nest because the mother will most likely return."

Despite what many think, wild mothers do not abandon their young because of a human scent, and most newborn animals do not survive in captivity.

"While people have good intentions, the care and rehabilitation of wild animals requires special training, knowledge, facilities — and permits," she explained. "Without such care, wild animals will remain in poor health and could eventually die. And it is illegal to possess many wild animals without a valid state or federal permit."

Russell also noted that wildlife can become dangerous as they mature, can carry parasites and disease, and can damage property.

"Native wildlife can carry mites, ticks, lice, fleas, flukes, roundworms, tapeworms, rabies, distemper, tuberculosis, respiratory diseases, and skin diseases," Russell said. "Some of these can be transmitted to humans."

Although tempting to take them into homes, the best help people can offer wild animals is to leave them alone.

FREE FISHING DAYS

Want some free fun that gets family and friends outside in nature? Get hooked on fishing with our Free Fishing Days June 6 and 7. During Free Fishing Days, anyone can fish in the Show-Me State without purchasing a fishing permit, trout permit, or trout park daily tag.

Other fishing regulations remain in effect, such as limits on size and number of fish an angler may keep. Special permits may still be required at some county, city, or private fishing areas. Trespass laws remain in effect on private property.

Conservation makes Missouri a great place to fish, and Free Fishing Days encourages people to sample the state's abundant fishing opportunities. Missouri has more than a million acres of surface water, and most of it provides great fishing. More than 200 different fish species are found in Missouri, with more than 20 of them being game fish for the state's more than 1.1 million anglers.

For information on Missouri fishing regulations, fish identification, and more, get a copy of *A Summary of Missouri Fishing Regulations* where permits are sold or online at **short.mdc.mo.gov/Zq3**.

WHAT IS IT?

VARIEGATED FRITILLARY CHRYSALIS

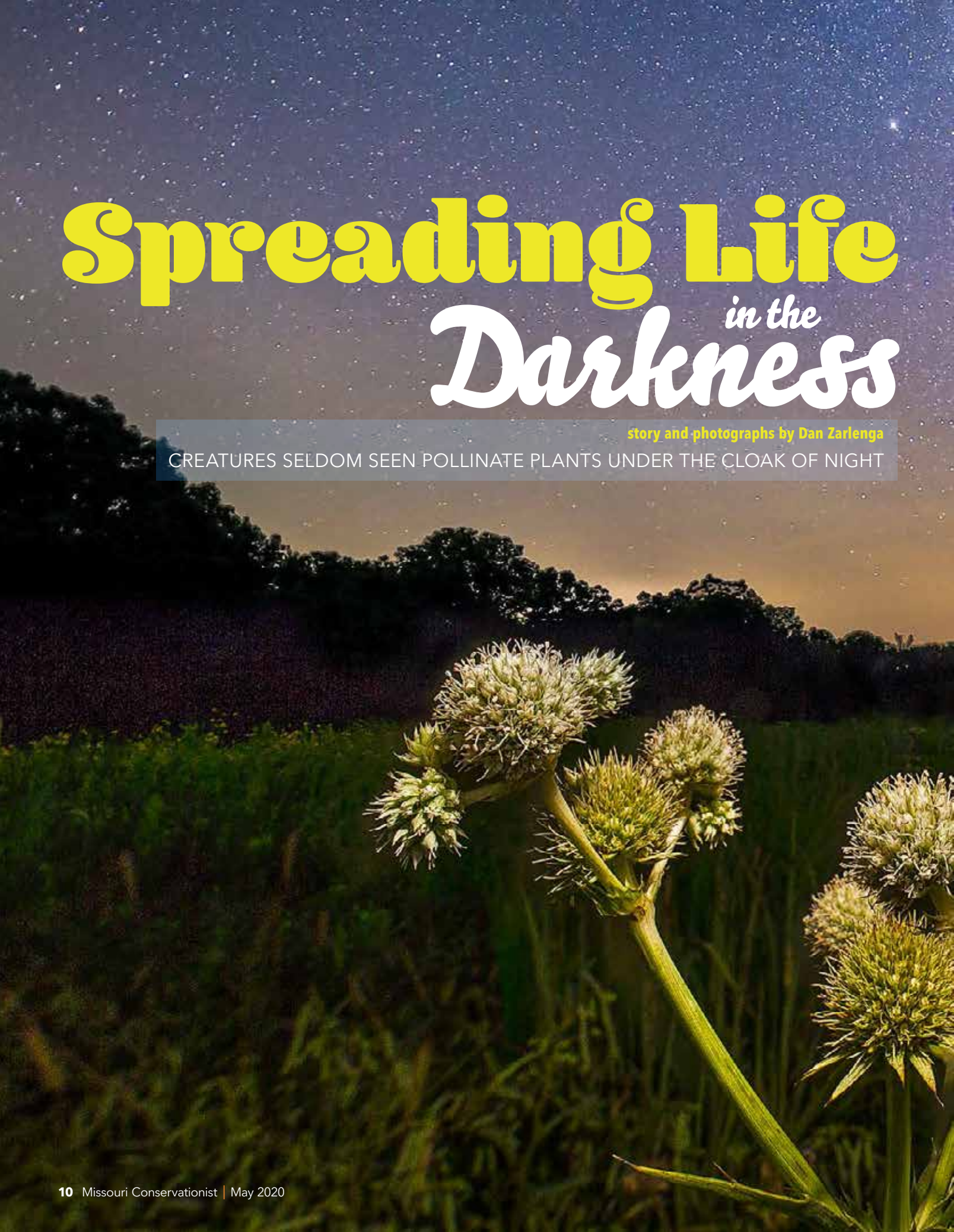
A variegated fritillary chrysalis is shimmery white, like a pearl, with black spots and bright orange to copper-gold nodules. It typically hangs from the front side of its host plant's leaves. A chrysalis can be found on a wide variety of plants, including mayapple, passionflowers, pansies, and violets. The emerging butterfly, which is primarily black and orange, is active between summer and early fall.

CHRYSALIS: NOPPADOL PAOTHONG

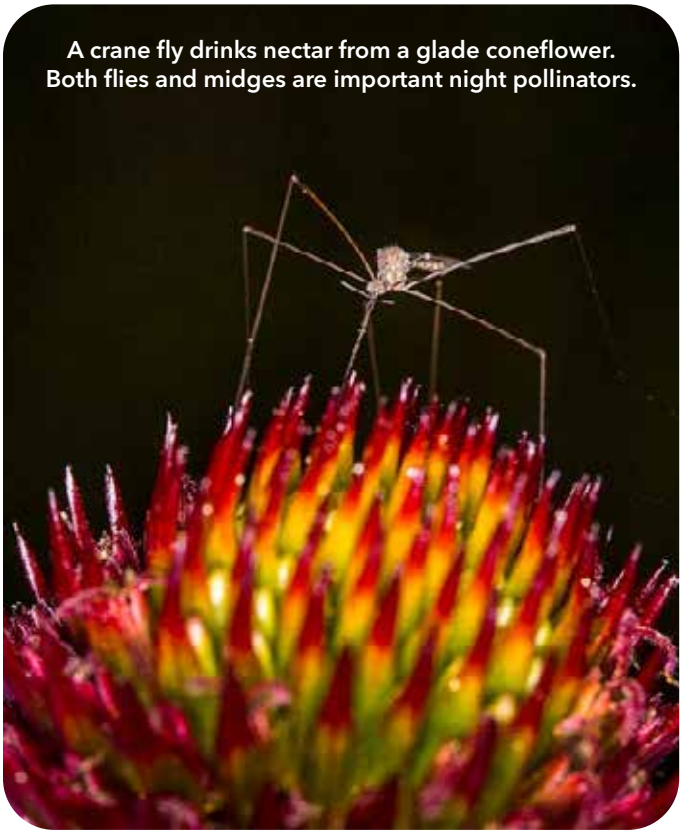
Spreading Life in the Darkness

story and photographs by Dan Zarlenga

CREATURES SELDOM SEEN POLLINATE PLANTS UNDER THE CLOAK OF NIGHT



A lot of plant pollination happens at night. Even nocturnal insects, like this bush katydid shown on rattlesnake master, might help spread pollen.



A crane fly drinks nectar from a glade coneflower. Both flies and midges are important night pollinators.

The sun's final rays have flickered below the horizon. Altair, Deneb, and Vega — a triad of jewels — sparkle from the dusky sky. A tiny leg brushes across a stamen, the male reproductive part of a flower. Golden specks with life-generating power adhere to its delicate hairs. Lured by nectar, an insect wings the grains of pollen through the darkness. An encounter occurs at another flower, this time with the female structure, the stigma. This nighttime transfer will propagate a species.

Many know of the essential pollination services our native bees provide. And who hasn't admired those most glamorous of pollinators, the butterflies? But when it comes to this all-important process, who takes over the night shift?

Scarcely little research has been done on pollination after dark, yet most naturalists and biologists agree that it occurs.

A 2011 experiment by researchers from Nova Scotia's Dalhousie University measured pollination conducted in enclosures of berry-producing plants. Using netting, researchers made some plants accessible to insects all day and night, some only during the day, and another set only at night. The results showed that nocturnally accessible plants produced about one-third as many ripe berries as the plants accessible by insects for the entire 24 hours. This suggested 33 percent of all pollination occurred after sundown.

"In most plants, pollination is a kind of partnership between plant and pollinator."

–CHRIS HARTLEY, ENTOMOLOGIST

Enter the Mighty Moths

When we explore the night pollinators in Missouri, it is the moths — cousins of butterflies — who emerge as the stars under the stars. There are about 160,000 varieties of moths in the world, and most of these are nocturnal. Twelve thousand moth species occur in North America, and they are an extremely diverse group of insects in size, shape, coloring, and habits. Turns out these little moths do the lion's share of the work.

"They outnumber the butterflies many times," according to Chris Hartley, entomologist with the Sophia M. Sachs Butterfly House in Chesterfield. "They're more significant pollinators without a doubt than butterflies because there are more of them."

A combined study carried out in 2018 by the Universities of York and Hull in the United Kingdom and Australia's University of Newcastle discovered that moths do indeed spread pollen over large distances during the night.

The research traced pollen carried by moths using cutting-edge pollen DNA detection methods. "Over half of the plant species we detected were not previously known to be visited by moths," wrote University of York's Dr. Callum Macgregor, lead author of the study. The research revealed that moths bore pollen from many of the same plant species as bees and butterflies. "Moths appear to complement the work of bees and can carry pollen over greater distances as they don't have the same ties to a particular part of the landscape," Macgregor concluded.

Of course, the plants have long-since figured this out for themselves, and some bloom after dark specifically to attract moths. One of the most conspicuous night flowers in this state is the Missouri evening primrose. They produce showy, yellow blossoms up to 5 inches in diameter and are often found on dolomite glades or dry, rocky prairies. This plant relies on moths for its propagation. Its light-colored petals are easier to see at night, and the flowers give off a strong scent in the evening that attracts moths.

"Primrose species we kind of think of being classic night-pollinated flowers," said MDC Natural History Biologist Steve Buback.

Eusarca moth

Stealing the Night Away

Nocturnal pollinators that depend on darkness to do their work are being robbed of the night. Growing evidence shows excessive artificial light has intrusive and negative effects on our natural ecosystems. Night creatures are being confused, distracted, and disoriented as nights grow ever brighter under manmade illumination. More than just a loss for astronomers and poets, the erasing of the night sky affects natural processes from bird migrations to night pollination.

Who hasn't seen a group of moths mesmerized around a street lamp? It is believed many night creatures use the moon and stars to help navigate. These distant light sources are relatively fixed visual references, providing constant bearings to follow. By contrast, the closeness of a porchlight mere inches or feet away makes the light's position appear to constantly change from the moth's point of view as it flies. The insect is forced to alter course continually trying to keep the light in the same orientation, which launches it into a confused, never-ending orbit.

"What do you think those moths would be doing if they weren't attracted to that light? They'd probably be out pollinating," said Hartley. "They're spending their whole night at these lights instead of out there visiting flowers."

Clockwise from left to right: celery leafeater moth, midge, Missouri evening primrose, Eusarca moth on a coneflower, master's dart moth on thistle, soldier fly, Eupithecia moth on white sweet clover, Helicoverpa moth on white snakeroot.

Buback has spent time on Missouri's northwestern prairies studying another wildflower which takes advantage of night pollinators — the prairie fringed orchid. Like the evening primroses, its flowers are light in color. This endangered grassland plant blooms day and night, but its fragrance becomes stronger after dark to draw in nocturnal hawk moths.

Hawk moths, also known as "hummingbird moths," come from the sphinx family of moths. Many species of this family inhabit Missouri and are excellent examples of night pollinating moths. They are characterized by thick, robust bodies and zippy flight patterns that mimic the hummingbird. Hawk moths have exceptionally long proboscises, structures they use to draw out nectar from flowers. Their stout, hairy forms are boxcars that transport large loads of pollen.

"In most plants, pollination is a kind of partnership between plant and pollinator," Hartley said. Numerous plants have structures evolved to get more pollen dusted onto their primary pollinating visitors. The more an insect interacts with a plant, the more pollen rubs off on it. "The plant has 'rigged' its nectar reward so that the insect has to run through the pollen to get to it," said Hartley.

The relationship is mutually beneficial, Hartley stressed. "The pollinator is coming away with a belly full of nectar, so it's getting a great reward."

Supporting Players

Moths aren't the only players in the night pollinating game. Hartley said there's a lot of compelling evidence that flies are also significant pollinators. "After bees, the consensus is that flies are the world's second most important pollinators, night and day both," he said. Flies visit flowers at night seeking nectar as well and spread pollen in the process. In fact, some plants can only be pollinated by flies. With over 150,000 species documented worldwide, flies interact with a tremendous number of plants in the dark of night.

Members of the largest order of insects in the world, the beetles, also participate in nocturnal pollination. For some plants, their services are essential, but for many others, pollination by beetles is more incidental. Yet, considering they make up around 40 percent of all insects worldwide, even when the pollination influence of beetles is accidental, it adds up. Scarab and soldier beetles spend a lot of time in flowers and are among the more effective, Hartley pointed out.

Humans may not appreciate mosquitoes, but nocturnal plants don't hesitate to court their pollinating favors. Female mosquitoes are the ones that suck blood, using the proteins to produce their eggs. Aside from that, adult mosquitoes are quite content to feast on the ambrosia of flowers during the night as they too carry pollen from plant to plant. It sure seems there are plenty of them out there to do the job.

Here are some things we can all do to help minimize the effects of light pollution:

- Don't leave porch and yard lights on all night; use lighting only when needed.
- Light just the areas with a real need for light; avoid decorative or landscape lighting.
- Choose lights that are no brighter than required, and try to avoid those with blue emissions.
- Where lights are used, employ fully-shielded fixtures that direct all the light downward where it is truly useful. Scattered light in other directions wastes energy and creates glare, making it harder to see.
- Employ motion-detection lights over constant ones where security is a concern.
- Urge friends and neighbors to do the same, and everyone will save energy costs, too.

With a little enlightenment, we can make it easier for our night shift pollinators to do their indispensable work. For more information, visit The International Dark-Sky Association at DarkSky.org.

Although dazzling to watch, fireflies do little to help pollinate.

"If insects are visiting and they're drinking nectar, then there's a chance they're going to transfer pollen from one plant to another," Buback said of the night pollinating crowd.

An encounter with other random night bugs could occasionally move pollen from plant to plant as well. This is less likely with insects that don't eat pollen or are not consistent in the plants they visit, such as katydids, but it is still conceivable. There's evidence to suggest katydids might play a bigger pollinating role in some other ecosystems. Bats perform vital pollination duties in parts of the world, too; however, none of the winged mammals found in the Show-Me-State do so.

Shift Workers

Not all nocturnal pollinating happens at the same time. During the night shift, different species split their duties into distinct "sub shifts." The nocturne begins an hour or so before and after sunset with the crescendo of the crepuscular crowd, or twilight insects, as they come out to play. While the night progresses, a variety of species bow in and out of the pollination performance; still others dance all night long. It's a complex symphony orchestrated by changing light levels and other influences yet unknown, all set to the mysterious music of evolution.

Where night pollinating is concerned, there are some insects who are all show and no go. The silk moths are among them, like the eye-catching polyphemus and luna moths. Same goes for the luminous fireflies, a species of beetle. These insects are all much too busy showing off to find mates during their short adult lives. They have little inclination to eat or pollinate and use plants merely as spots to rest from their amorous activities.

Still, that leaves plenty of pollinating to go on after the sun goes down.

Waste No Time

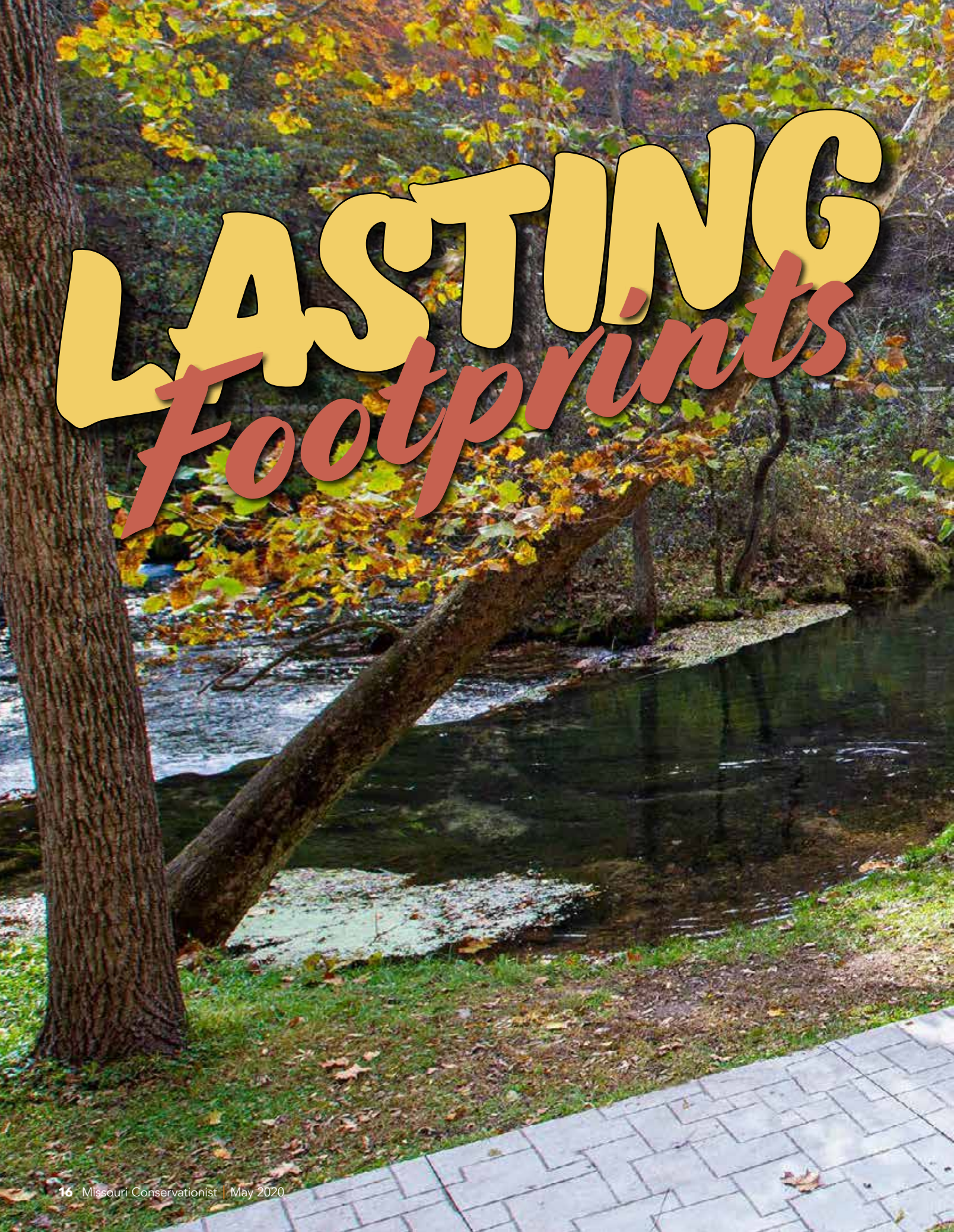
"We as human beings don't often think about what happens after we go to bed because we are diurnal animals," Hartley said. "Our biology is to be awake during the day, so we kind of forget about how important everything else is."

While bees remain the world's prime pollinators, Buback also feels the "night shift" should not be overlooked. "Some plants have adapted to night pollinators, so they've got to be doing some good work out there."

Think about it. Life on Earth spends half its existence under night. If nature didn't put all those hours to good use, wouldn't it be an awful waste of time? Thanks to an army of nocturnal pollinators, a lot can happen under the stars. ▲

Dan Zarlenga is the MDC media specialist for the St. Louis Region. He likes to discover nature mostly through hiking, backpacking, day and nighttime photography, and an occasional float trip.

This common Eupithecia moth larva will mature into an adult moth and join the army of nocturnal pollinators.



LASTING *Footprints*

DISCOVER NATURE SCHOOLS SETS A PATH FOR FUTURE CONSERVATIONISTS TO FOLLOW

by Stephanie Snyder McKinney | photographs by David Stonner

Leave nothing behind but footprints on the landscape," said Serena Hagler to her students prior to their departure for Maramac Springs. It was just one of the school's many outdoor field experiences with Discover Nature Schools (DNS). "And look for animal tracks or footprints to help us better understand their behavior and follow their movements."

With science notebooks in hand, the sixth graders of Licking Elementary School spent the day studying animal tracks and sign, testing water quality, collecting stream data, and studying human impact, both positive and negative. The students were elated to even carve out time for fishing. At the end of the day, just as Hagler had requested, the landscape at Meremac Springs showed no trace of the multitude of students exploring there, other than the muddy footprints the class left behind. In addition to physical footprints, Hagler left another set of lasting imprints behind, but not on the landscape.

Footprints of a different kind — a lasting kind — were clearly left for each student to follow. The footprints of stewardship, modeled by their teacher in each nature-based lesson, undoubtedly left an indelible set of tracks for the next generation of conservationists to follow.

Hagler, a science teacher at Licking School District, is one of the many hundreds of teachers across the state who take part in MDC's curricular program, Discover Nature Schools. Since 2007, Hagler has provided her classes with firsthand experience with glades, floodplains, forests, ponds, rivers, and prairie landscapes.

A student takes a water quality sample using a kit purchased through the DNS grant program.

"It's one of the few instructional units available that actually provides teachers with the tools necessary to help kids learn about Missouri plants and animals."

—KEVIN LOHRAFF, RUNGE CONSERVATION NATURE CENTER MANAGER

Blazing a Trail

First developed in 2006, DNS has created nature-based curricula for preschool through 12th grades. DNS units encourage inquiry-based exploration of science with a Missouri-specific appeal.

"It's one of the few instructional units available that actually provides teachers with the tools necessary to help kids learn about Missouri plants and animals," said Kevin Lohraff, Runge Conservation Nature Center manager. "It focuses on what's happening right outside their door."

Lohraff and the nature center staff see countless students annually visit the center as part of their DNS programming.

With a vast amount of nature-specific learning components to be completed outside, DNS students engage in hands-on learning in nearly every lesson. Beyond conveying conservation content, these units align with the most current Missouri Learning Standards set forth by the Missouri Department of Elementary and Secondary Education (DESE). Lesson and unit creation and revisions are done regularly to ensure relevance to those standards as well as other academic educational trends.

DNS units are outlined into five progressive, or scaffolding, instructional units, covering standards from preschool through grade 12. Complete teacher guides, full-color student texts, and scientific inquiry notebooks are available, free of charge, to all participating schools. Teacher training and professional development is offered by MDC's conservation educators, located regionally across the state. In addition to free materials and educator training, DNS offers a grant program to trained teachers and districts to allow for purchase of exploration equipment, field investigation tools, field guides, and other materials necessary to implement the units. The DNS grant also allows for transportation costs for school districts who conduct field experiences.

Students take classroom concepts to the field to engage in hands-on learning and to gain an appreciation for Missouri's resources.

More than Just Words in a Text

One of the most rewarding aspects of the DNS program, according to Hagler, is the ability for the text to come to life when students get to experience firsthand science concepts in their own communities and schoolyard.

"My kids become engaged in science content when it relates to their own frame of reference — what's in their backyard," she said. "Technical content that is sometimes difficult to get students engaged in, such as biomes and interactions between organisms and their environments, have them fully involved using DNS. Anytime learning objectives become more than just printed text, and become relevant to kids' daily lives and interests, that's when you have immediate student buy in."

One of Hagler's favorite units was a food web simulation. Students would role play an organism and interact with other organisms that they would either eat or get eaten by, physically connecting themselves with a string.

"Again, its hands-on learning," she said. "I then pose a disaster-type scenario, such as a drought that eliminates an organism, and we see how it affects the whole ecosystem. This becomes real when students do more than just read the terms on a page."

Another favorite of Hagler's class is an activity where students role play deer in a forest and find out what is needed for survival when resources are either scarce or abundant.

"Most of my students are either avid deer hunters or from a family that values deer, so this lesson really connects and teaches competition in a meaningful way."

Many teachers across the state use the DNS units in a versatile manner. One of the appeals is the flexibility of teacher implementation if their district already has a science text in place. This allows for teachers to use DNS as a standalone curriculum or supplement.

"I use the Nature Unleashed curriculum for teaching my unit on ecosystems rather than using the chapter from my school's purchased science textbook," Hagler said. "The Nature Unleashed curriculum is very well aligned with the DESE Learning Objectives for science, and uses the same vocabulary that I traditionally teach, just in a more hands-on way than our school text."

One of Hagler's science students, Elan, expressed the importance of this hands-on learning.

"It's kind of hard just to learn big things out of a book," Elan said. "Before we got to do a simulation to learn about trophic levels, I didn't know what they were. Once I could see it with my eyes, I finally knew about how energy is transferred in an ecosystem. We saw it by doing it. We figured out who eats who in nature and how plants and animals transfer energy."

Why Take It Outside?

Much study has been done regarding the benefits of outdoor exposure on childhood development and learning. Volumes of academic writings have touted the benefits of regularly scheduled outdoor learning components in a school setting, such as boosting concentration, increasing academic engagement, reducing stress and behavioral health concerns and patterns. Students with special needs and varying learning styles seem to thrive in an outdoor learning environment. These student-centered benefits of regular, nature-based educational opportunities are a driving force in updating and revising each DNS unit.

One of the greatest appeals to students is that most lessons contain an outdoor component that focuses on critical thinking and inquiry skills that allows for outdoor data collection, scientific record keeping, and hypothesis creation

STUDENT PORTRAITS: STEPHANIE MCKINNEY AND SERENA HAGLER

on many levels. DNS was founded on inquiry and place-based education that allows for experiential learning in a Missouri-specific way. Educational trends across the nation support this strategy amongst all curricular domains. Taking these lessons into the schoolyard opens a myriad of inquiry-based phenomena for students to explore. Lessons are geared to be cross-curricular, allowing for nontraditional students, as well as students across the academic continuum, to excel. Higher order thinking skills are engaged throughout the units, and many units end with an outdoor group activity that builds on previous lessons.

No Schoolyard, No Problem

Outdoor components can be carried out even in the smallest of playgrounds and courtyards. Rural and urban districts alike have utilized DNS in their districts and are frequently surprised at how small of a space is needed to conduct outdoor investigative lessons. In their DNS training, teachers learn even the smallest spaces are teeming with nature and are encouraged to utilize all types of schoolyard environments. Teachers are also trained in the "art of looking" to help foster a student's natural sense of wonder in the outdoor world, both on a large and small scale. DNS lessons facilitate this concept, in and outside of the classroom.

Getting children outdoors has many positive side effects including increased academic engagement, reduced stress and behavioral health concerns and patterns, and increased concentration.

Aiming for More Than Academics

While DNS is used in traditional classrooms across the state, homeschool groups, as well as private and parochial schools and student community groups, also have benefited. In addition, teachers of students with special needs have expressed support of the DNS curricula for the flexibility of use in accommodating various learner needs.

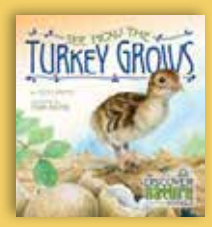
"I have used DNS with both regular education students and in years spent working with students with special needs," said Jennifer Scott, teacher with Success R-6 Elementary. "This program keeps all students actively engaged and lets students of all ability levels become active participants in the lessons."

Students with specific behavioral and emotionally specific needs seem to benefit from the program as well.

DISCOVER NATURE SCHOOLS

The program averages nearly 1,700 public and private schools in a given year. DNS reaches over 75,000 students per year, and over 400,000 students have gone through the program since its inception in 2006. MDC's conservation educators make DNS happen on the local level. They continually provide workshops and support for teachers in the DNS "train the trainer" model. For more information on DNS, including grants available for transportation and field experiences, workshops, and sample units, visit **short.mdc.mo.gov/Zxx**.

Nature Revealed (Pre-K) is a diverse collection of learning experiences that give Pre-K teachers and parents the planning tools, activities, and resources to stimulate children's sense of wonder of nature.



Nature Unfolds (K–2nd) introduces young students to the life cycles, seasons, weather, and basic needs of plants and animals through hands-on activities and a fully illustrated student book.

"This program helped my students with both emotional and behavioral special needs to engage, and it really helped them to focus as the lessons centered on their environment," Scott said. "It lessened behavioral issues. They loved the colorful text, and I, as their teacher, loved that these students could have the freedom to write, draw, or verbalize their answers. It made assessment an easier task for me. As a teacher, this is user friendly and easy to implement, but what I love the most, as a former special education teacher, is that all students in DNS can succeed, regardless of their learning style or academic ability level."

Stewards of Tomorrow

Perhaps the ultimate goal of the DNS program is to help Missouri students advance in the "continuum of stewardship," taking students from mere curiosity and a general interest in nature to a call to action that ignites their interest into a lifetime of stewardship.

Once back to their school in Licking Elementary, Serena Hagler's students recapped the day of DNS field experience by opening their science notebooks and studying their recorded data.

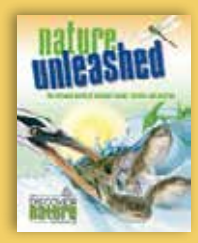
"I saw evidence of rodent tracks," one student stated.

Several others mentioned they had discovered evidence of human impact. Hagler summed up the experience by sharing with students "We can really learn a lot about behavior, simply by studying the tracks that are left behind."

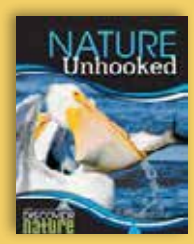
Thousands of Discover Nature Schools students are learning about human behavior as part of the program. More specifically, they are studying and taking mental note of the human behavior of stewardship and land ethics modeled by their conservation-minded teachers. DNS teachers are certainly making tracks, and their students are taking notes of the footprints left behind … and they are lasting footprints. ▲

Stephanie Snyder McKinney is the education program state coordinator for MDC and has enjoyed employment with the department for 13 years. She and her family reside in Texas County.

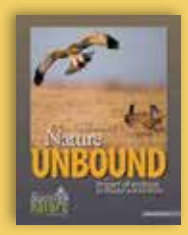
Discover Nature Schools (DNS) is built on five educational units, each consisting of age-appropriate content and aligned with Missouri Learning Standards. DNS is also available for homeschool groups.



Nature Unleashed (3rd–5th) helps elementary students understand ecosystem connections through exploring Missouri's ponds, forests, and prairies inside and outside the classroom.



Nature Unhooked (6th–8th) covers all elements of aquatic ecosystems, from the properties of water molecules to the diversity of aquatic life, and how we conserve and enjoy Missouri's aquatic ecosystems.



Nature Unbound (9th–12th) helps high school students understand the impact of ecology on Missouri and the world through activities that get students outdoors and exploring around their school.

Pond

This is the tale of two ponds. The pond on the left is in excellent condition with good quality aquatic plants and a healthy watershed. The pond on the right is suffering with excessive aquatic plant growth and trees on the dam. Learn how to maintain that high-quality pond or transform that pond that's suffering.

PHOTOGRAPHS BY SCOTT WILLIAMS

Management

WITH PROPER CARE, YOU CAN AVOID THE PITFALLS OF POND OWNERSHIP

by Scott Williams and Andrew Branson

Pond owners sometimes have a love-hate relationship with their ponds. People want a beautiful pond that looks nice, attracts wildlife, and provides great fishing. However, depending on the circumstances, these wants may be hard to achieve.

Ponds are very much like a living thing. They change with age, what you put into them can have a dramatic effect over time, and problems can be difficult and expensive to fix. Like a person's health, the health of a pond can be improved and maintained by taking steps to protect it.

Pond Turnover

Unless it is very shallow, all ponds in Missouri turn over twice a year. Turnovers occur in the spring and again in the fall as temperatures cool. Ponds in Missouri stratify, meaning they have layers of water at different temperatures that do not readily mix. In the summer, most ponds have a cool layer of water near the bottom and a warm layer of water near the surface. If you have ever enjoyed a summertime swim in a pond, you have probably felt this phenomenon as your feet were in much cooler water than the rest of you. As air temperatures cool in the fall, the temperature of the upper layer of water cools and as it nears the temperature of the lower layer of water, the two layers slowly mix. As long as this process occurs slowly, there are no problems for the pond. However, if the turnover happens quickly, due to severe weather, the gasses trapped in the lower layer are released too quickly and the dissolved oxygen in the pond can be used up, resulting in a fish kill.

As winter temperatures drop, the pond will form a cold layer of water on the surface, and a warmer layer of water near the bottom. As spring arrives and warms the upper layer of water to match the lower layer, the turnover process occurs again.

Water is a fascinating compound that does not follow the rules of most other compounds. Most things are their most dense in a solid state, but not water. Water is most dense at about 39 degrees, which is why water at or below 32 degrees turns into ice and floats. The density of cold water makes it very reluctant to mix with water of a warmer temperature, and this allows the process of stratification to occur. If water didn't behave differently than most compounds and was most dense at a solid state (ice), we would not enjoy all the fish that we have in areas that experience freezing temperatures. This is because as ice formed, it would sink to the bottom and slowly fill the entire water body with ice and there would be no place for fish to survive.

Good Quality Pond

Pond Location

The pond is located on an appropriate site. The soils are correct for holding water, the dam is constructed properly, and the pond received an adequate amount of water from its watershed to keep it full, but not so much as to constantly flush it out.

Fish Structure

Brush piles can be a great benefit to fish in a pond. Large piles of cedar trees or hardwood tree tops placed in 8 feet of water or less will attract and hold fish, give small fish a place to find cover, and attract aquatic insects and other food sources for your fish.

POND ILLUSTRATION: LES FORTENBERRY; POND TURNOVER: CLIFF WHITE; POND DAM: SCOTT WILLIAMS; KIDS FISHING, POND FENCING, FISH STRUCTURE: DAVID STONNER

Fishing

This may come as a surprise to some, but harvesting the appropriate amount of different types of fish is very important to maintaining the balance of the fish population and attaining maximum fish growth.

Well-Maintained Dam

A well-maintained dam will improve the lifespan and health of a pond. Good dam maintenance requires periodic mowing to prevent the establishment of woody vegetation, such as trees. Trees can root through a dam and can cause leaks or other structural problems. If your pond dam has trees on it, only remove the trees that have a trunk diameter of 4 inches or less. Cutting larger trees can increase the chances for leaks.

Quality Water Source

The watershed, or land area from which a pond gets its water, is covered with vegetation (trees are best, but grass works, too). The pond is fenced from livestock to reduce damage to its banks and direct inputs of nutrients through manure. If livestock are present in the watershed, the pond has at least a 100-foot border of vegetation to filter nutrients before they get to the pond.

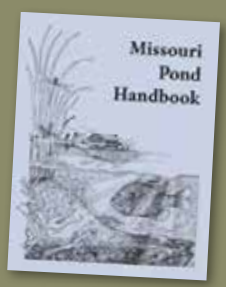
Aquatic Plants

Fifteen to 25 percent of the pond bottom has rooted aquatic plants. Not all types of aquatic plants are created equal. Plants like pickerel weed, spatterdock, and arrowhead provide cover and a place to find food for fish without taking over.

Fish Stocking

In small ponds, a combination of largemouth bass, bluegill, and channel catfish work well. If you stick to these types of fish, and stock according to the rates recommended for your area, you will have the best chance of producing a balanced, healthy fish population.

Missouri Pond Handbook is available free for Missouri residents. Order a copy from pubstaff@mdc.mo.gov or by calling 573-522-0108. Provide the publication title and your shipping address.



Poor Quality Pond

Too Many Nutrients

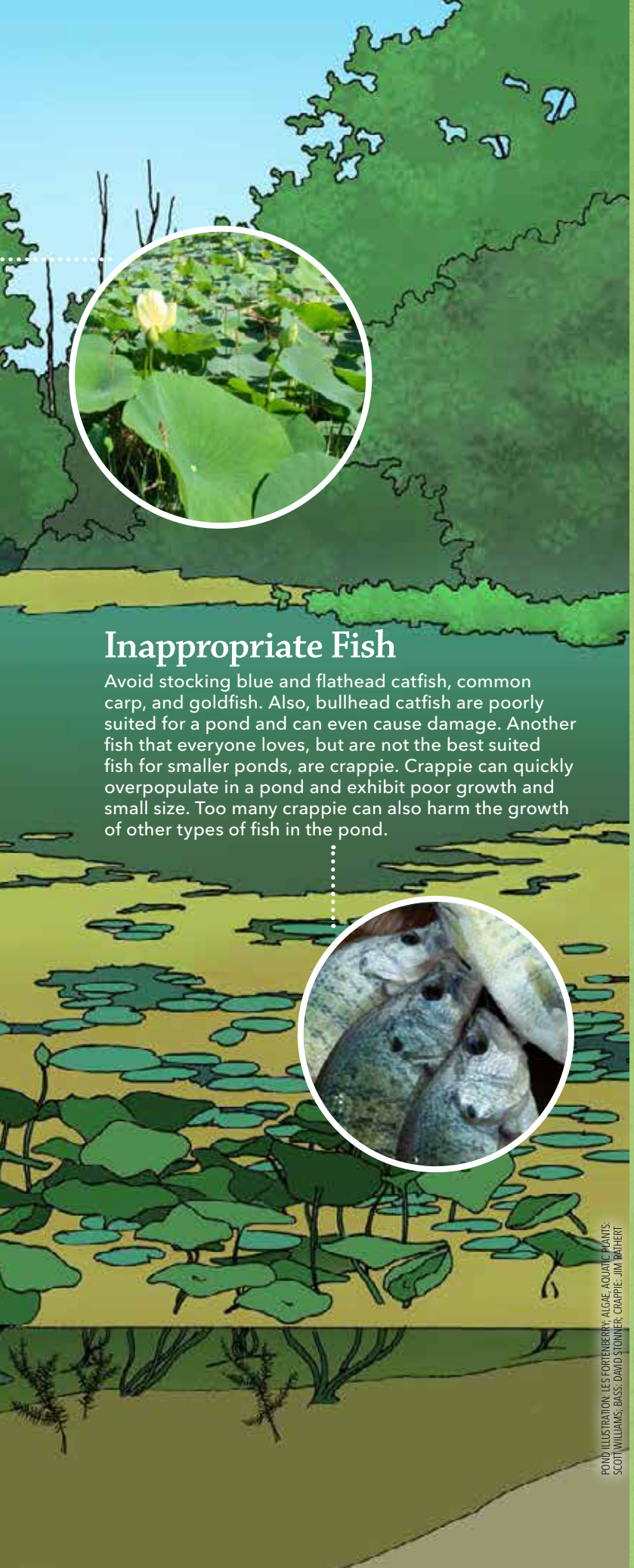
Nitrogen and phosphorus from livestock and lawn fertilizers can cause excessive growths of algae. Algal blooms in the summer can make your pond look uninviting and can even cause fish kills.

Nuisance Aquatic Plants

Aquatic plants are good, but too many are a problem. They make it impossible to fish, difficult for larger fish to get to smaller fish for food, and susceptible to fish kills. Control nuisance aquatic plants by removing them, using aquatic approved herbicides, or stocking grass carp. Identify the type of vegetation present to determine the best course of action to control it. Nuisance vegetation can be controlled in the long term by limiting nutrient inputs and planting good quality aquatic vegetation to use available nutrients.

Lots of Small Bass

Many pond owners complain that the largemouth bass in their pond are all small. This is normally caused by under harvest of bass. To get your bass under control and help increase their size, start harvesting the bass that are under 12 inches long at a rate of 35 bass/acre/year. While you are doing this, protect your bluegill from harvest for a couple years so they can spawn and provide more food for the bass. After a couple years, reduce your bass harvest to 25 bass/acre/year and maintain it at that level. Keeping harvest records makes this job easier. Bass may also exhibit poor growth if there is too much dense aquatic plants in the pond and they cannot catch an adequate amount of food. If this is the case, take steps to decrease the amount of vegetation in the pond.



Inappropriate Fish

Avoid stocking blue and flathead catfish, common carp, and goldfish. Also, bullhead catfish are poorly suited for a pond and can even cause damage. Another fish that everyone loves, but are not the best suited fish for smaller ponds, are crappie. Crappie can quickly overpopulate in a pond and exhibit poor growth and small size. Too many crappie can also harm the growth of other types of fish in the pond.

POND ILLUSTRATION: LES FORTENBERRY; ALGAE, AQUATIC PLANTS: SCOTT WILLIAMS; BASS: DAVID STONNER; CRAPPIE: JIM RATHERT

Grass Carp

Grass carp can be a good addition to a pond when needed and stocked appropriately. Grass carp should only be stocked in a pond that is having a problem with too much nuisance aquatic plants, and if those plants are the type that grass carp will eat.

Some common aquatic plants eaten by grass carp:

Common Name	Scientific Name
Pondweed	*Potemogeton, Najas*
Milfoil	*Myriophyllum*
Coontail	*Ceratophyllum*
Waterweed	*Elodea*
Muskgrass	*Chara*
Cattail	*Typha spp.*
Water lilies	*Nymphaea odorata*

Grass carp should not be stocked when a pond is not having plant problems. Grass carp are long-lived and difficult to remove once stocked, so only add them when necessary.

Consider other possible options to control aquatic plants such as shading, winter draw down of the pond water, or herbicide application. Many times, it helps to use a couple different methods of aquatic plant control.

Suggested grass carp stocking rates:

Percent of plant coverage in pond	Number of carp per acre of water
10–20 percent	mechanical or chemical spot treatment
20–40 percent	2–5 carp
40–60 percent	5–10 carp
over 60 percent	10–20 carp

Stock grass carp that are 8–12 inches in length to avoid being eaten by bass, and give the stocked fish at least two years to start getting ahead of the plant growth. Using a secondary control technique will help the grass carp be more effective at controlling vegetation in a shorter time frame.

Note: Grass carp can eat beneficial aquatic plants in addition to the nuisance ones. Do not add more than the recommended number for your situation.

Detailed descriptions of these control methods can be found at **mdc.mo.gov**, or by contacting your local MDC office.

Scott Williams has worked for MDC since 2003, assisting private landowners with pond and lake management issues and stream bank erosion. When not working, Scott enjoys pursuing waterfowl. Andrew Branson has been with MDC since 2005 and now works out of the headquarters in Jefferson City. Andrew spends his free time fishing Missouri streams.

Get Outside in MAY

Ways to connect with nature

Largemouth bass

Bag a Bass

Early spring is a great time to get in a float before the waters get too busy. Grab your pole and try black bass fishing. The season opens May 23. To find a fishing hole close to home, visit **short.mdc.mo.gov/Znx**.

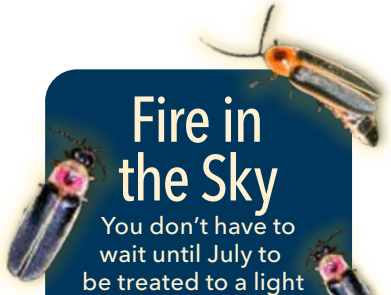
Birdwatchers: Behold the Bobolink

A new visitor flies in this month. **Bobolinks** visit from their southern haunts in Argentina. Train your binoculars on their nests in northern Missouri and see if you can catch a glimpse.

Ornate box turtle

Turtle Trot

Why did the turtle cross the road? More than likely, to search for food or a mate. As the weather warms and spring showers are ushered in, turtles emerge from their burrows. Sometimes their search for love and sustenance puts them in direct contact with busy roadways and vehicles. If you come across a turtle in peril and can safely assist it, carry it across the road in the direction it's heading.



Fire in the Sky

You don't have to wait until July to be treated to a light show set against the night sky. Head outside on a warm, clear night and wait patiently. Fireflies, also known as **lightning bugs**, will give you quite a show. They are a summertime favorite for all ages.

Natural Events to See This Month

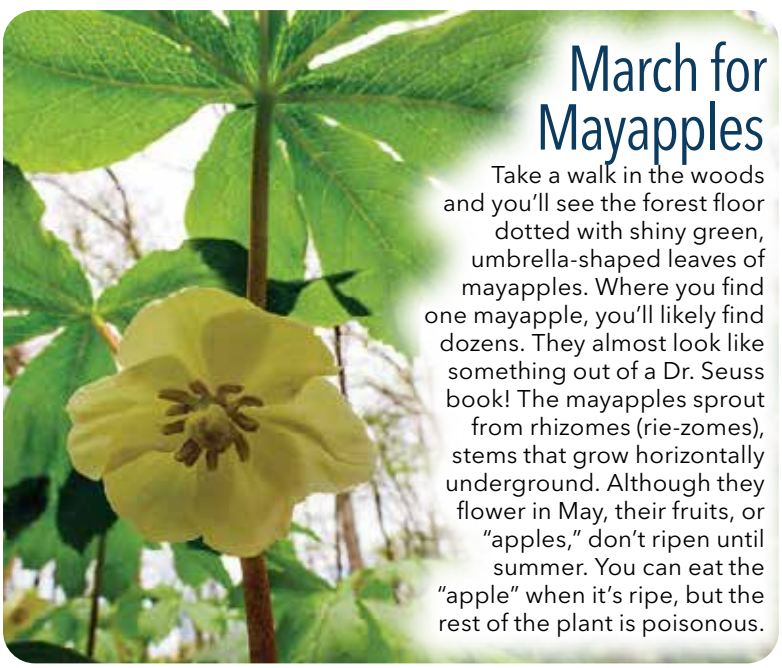
Here's what's going on in the natural world.

Listen for **cricket frogs** and **gray treefrogs**

Young woodchucks leave dens

Little Flowers on the Prairie

By late May, prairies are alive with the colors of wildflowers blooming. Some you might see include **Indian paintbrush**, **white wild indigo**, **field milkwort**, **orange puccoon**, and **celestial lily**.



March for Mayapples

Take a walk in the woods and you'll see the forest floor dotted with shiny green, umbrella-shaped leaves of mayapples. Where you find one mayapple, you'll likely find dozens. They almost look like something out of a Dr. Seuss book! The mayapples sprout from rhizomes (rie-zomes), stems that grow horizontally underground. Although they flower in May, their fruits, or "apples," don't ripen until summer. You can eat the "apple" when it's ripe, but the rest of the plant is poisonous.

Wild strawberries ripen in grasslands

Most purple finches have left Missouri

FIREFLIES: KANSAS DEPARTMENT OF AGRICULTURE; BUGWOOD.ORG; JESSICA LOUQUE, SMITHERS VISCIENT; BUGWOOD.ORG;
WILD STRAWBERRY: DAVE POWELL, USDA FOREST SERVICE (RETIRED); BUGWOOD.ORG; CELESTIAL LILY: KARAN A. RAWLINS, UNIVERSITY OF GEORGIA; BUGWOOD.ORG

Places to Go

OZARK REGION

Tingler Prairie Conservation Area

Prairie blooms and a sinkhole pond

by Larry Archer

Instead of buying your mother flowers for Mother's Day, take her somewhere wildflowers are abundant, like Howell County's Tingler Prairie Conservation Area (CA).

Located on 240 acres south of West Plains, Tingler Prairie CA's 127 acres of remnant and recreated native prairie puts on quite a show in May, according to Area Manager Susan Farrington.

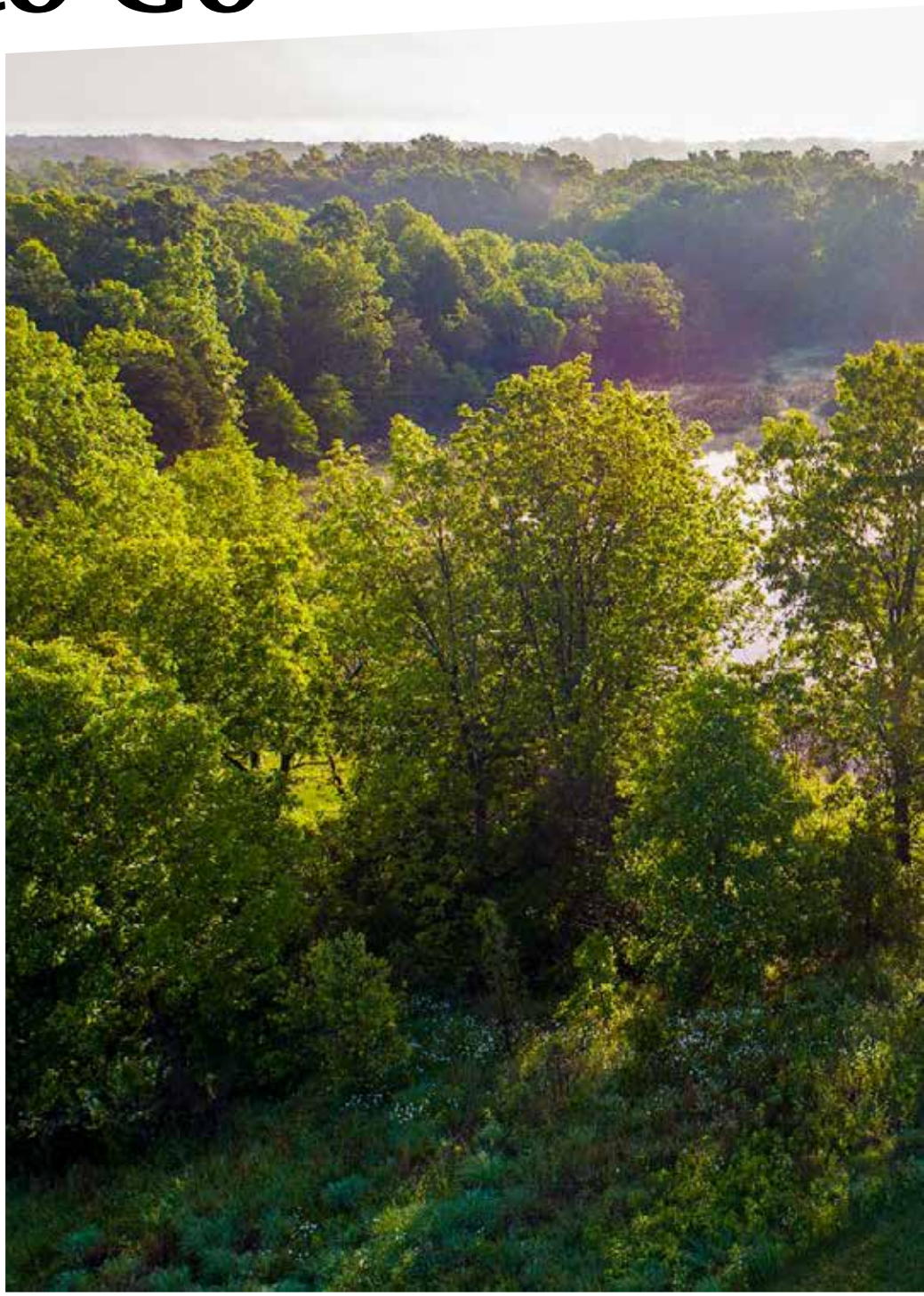
"The wildflowers in the prairie will be in full bloom — a lot of them — in mid-to-late May," Farrington said. "That's a really good time of year to go see it."

But as impressive as the prairie's spring bloom is, this area has a lot more to offer, she said.

"There's a large sinkhole pond, which is called Tingler Lake," she said. "Numerous rare species are found in and around this unusual natural pond."

The Nature Conservancy purchased the property for both the pond and the 27-acre original bottomland prairie remnant. MDC purchased the area from the The Nature Conservancy in 1987–1988.

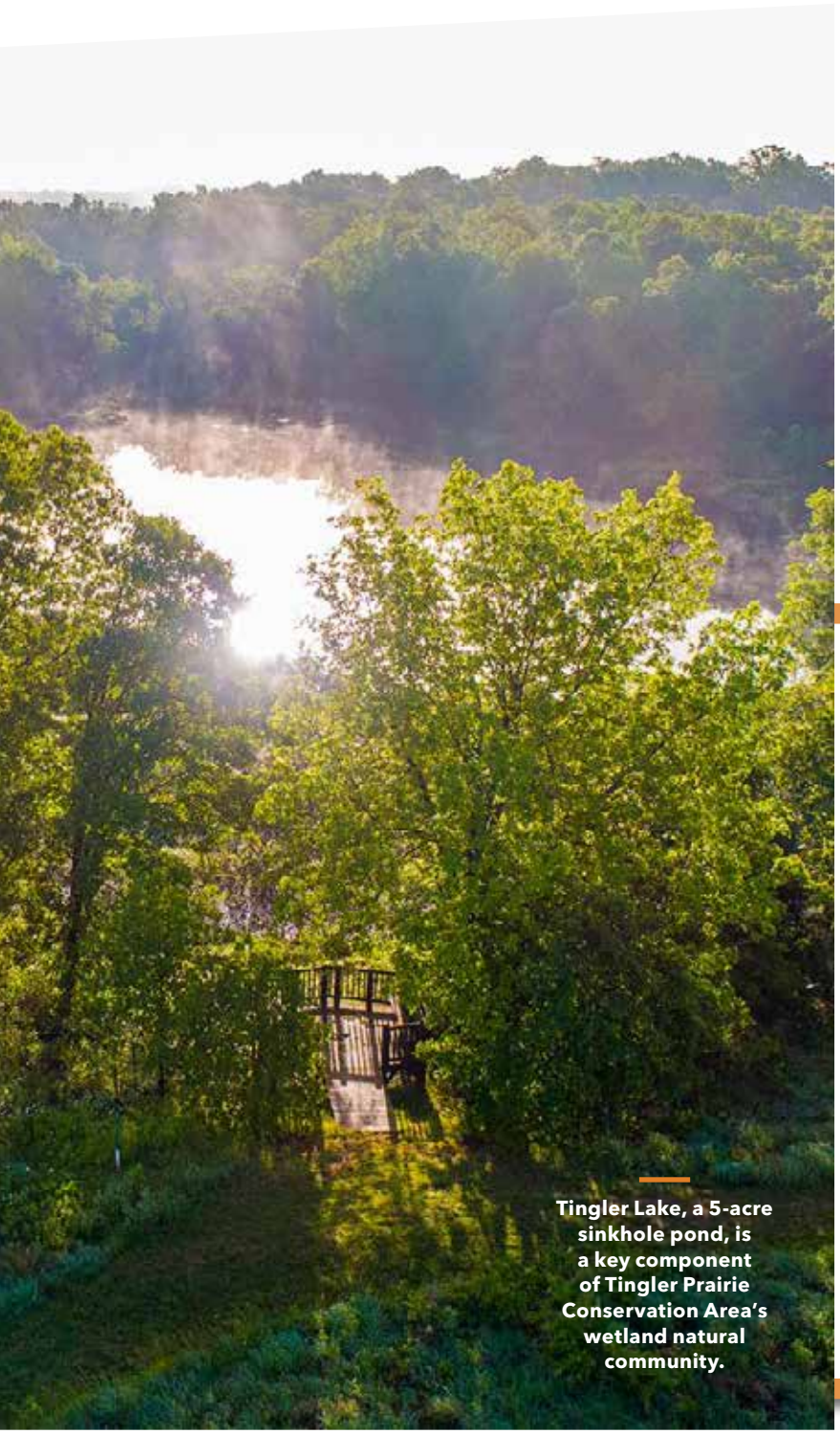
"The Nature Conservancy recognized it as a really important site because of the remnant wet mesic prairie swale that runs through it," she said. "While prairie once covered much of Missouri, less than 1 percent of remnant prairie remains, and wet prairie remnants are even more rare."



"A lot of birding goes on out there. There's some great birds, including the **dickcissel**, and we often have loggerhead shrikes using the property."

—Tingler Prairie CA Manager Susan Farrington

DAVID STONNER



Tingler Lake, a 5-acre sinkhole pond, is a key component of Tingler Prairie Conservation Area's wetland natural community.

TINGLER PRAIRIE CONSERVATION AREA

consists of 240 acres in Howell County. From West Plains, take Highway 17 south about 6 miles, then County Road 9100 west to County Road 8110 and go south 0.33 mile to the access.

36.6125, –91.8759

short.mdc.mo.gov/Zem 417-256-7161

WHAT TO DO WHEN YOU VISIT

Birdwatching Included in the Great Missouri Birding Trail (**short.mdc.mo.gov/Zes**). The eBird list of birds recorded at Tingler Prairie CA is available at **short.mdc.mo.gov/Zeh**.

Hiking Three hiking trails, totaling 2 miles, cover prairie, wetland, and woodland habitats.

Hunting **Deer** and **turkey**
Deer and turkey regulations are subject to annual changes. Please refer to the Spring Turkey or Fall Deer and Turkey booklets for current regulations.

Also **rabbit** and **squirrel**

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WHAT TO LOOK FOR WHEN YOU VISIT

White-tailed deer

Spring peepers

Loggerhead shrike

Scissor-tailed flycatcher

Wild Guide

May Beetles

Phyllophaga spp.

Status	Size	Distribution
Common	½–1 inch (adults); ¾–2 inches (larvae)	Statewide

Larva

Did You Know?
May beetles are named for the month they are most numerous. These light-loving creatures are clumsy walkers and fliers. There are more than 400 species of these beetles, which are difficult to distinguish.

It's hard to think of summer without immediately conjuring up the familiar sights and sounds of May beetles buzzing clumsily around porch lights, crashing onto the ground, lying helplessly on their backs, legs waving wildly. May beetles are nocturnal, and are drawn to light at night. They belong to a large family of beetles called scarabs. As with other scarabs, they are oval and stout and are usually brown, rusty, or black.

ECOSYSTEM CONNECTIONS

Many animals root out the grubs and eat them, including skunks, moles, and birds. Other animals, including birds and frogs, eat the adults. Several types of flies and wasps prey on the adults and larvae, laying eggs on them that hatch and devour the host.

FOODS

As adults, May beetles eat plant leaves and flowers. In their larval, or grub, stage, May beetles eat roots and decaying plant material in the soil.

LIFE CYCLE

Females deposit their eggs a few inches into the soil, often near trees. The grubs live underground for one to four years (depending on species), feeding on plant roots, and descend much lower into the soil to overwinter. They emerge as adults to fly, mate, and lay eggs.

HUMAN CONNECTIONS

When beetles are numerous, their feeding can cause serious damage to lawns and crops. The grubs serve as live fishing bait, one of the few types plentiful in spring.

MAIN: JOSEPH BERGER, BUGWOOD.ORG; INSET: STEVEN KATOVICH, BUGWOOD.ORG

Outdoor Calendar

MISSOURI DEPARTMENT OF CONSERVATION

Buy Permits and Permit Card

Buy Missouri hunting and fishing permits from numerous vendors around the state, online at **mdc.mo.gov/buypermits**, or through our free mobile apps, MO Hunting and MO Fishing. Permit cards are an additional way to show proof of most permits. Buy a new permit card for a one-time fee of $2 at **mdc.mo.gov/buypermits**. Buyers can select from four images: bass, buck, bluebird, or mallard duck.

FISHING

Black Bass
Impounded waters and non-Ozark streams:
Open all year

Most streams south of the Missouri River:
May 23, 2020–Feb. 28, 2021

Bullfrogs, Green Frogs
June 30 at sunset–Oct. 31, 2020

Nongame Fish Gigging
Impounded Waters, sunrise to sunset:
Feb. 16–Sept. 14, 2020

Streams and Impounded Waters, sunrise to midnight:
Sept. 15, 2020–Feb. 15, 2021

Paddlefish
Statewide:
March 15–April 30, 2020

On the Mississippi River:
March 15–May 15, 2020
Sept. 15–Dec. 15, 2020

Trout Parks
Catch-and-Keep:
March 1–Oct. 31, 2020

Catch-and-Release:
Nov. 13, 2020–Feb. 8, 2021

HUNTING

Bullfrogs, Green Frogs
June 30 at sunset–Oct. 31, 2020

Coyote
Restrictions apply during April, spring turkey season, and firearms deer season.

Open all year

Crow
Nov. 1, 2020–March 3, 2021

Deer
Archery:
Sept. 15–Nov. 13, 2020
Nov. 25, 2020–Jan. 15, 2021

Firearms:
- Early Youth Portion (ages 6–15): Oct. 31–Nov. 1, 2020
- November Portion: Nov. 14–24, 2020
- Late Youth Portion (ages 6–15): Nov. 27–29, 2020
- Antlerless Portion (open areas only): Dec. 4–6, 2020
- Alternative Methods Portion: Dec. 26, 2020–Jan. 5, 2021

Groundhog (woodchuck)
May 11–Dec. 15, 2020

Pheasant
Youth (ages 6–15):
Oct. 24–25, 2020

Regular:
Nov. 1, 2020–Jan. 15, 2021

Quail
Youth (ages 6–15):
Oct. 24–25, 2020

Regular:
Nov. 1, 2020–Jan. 15, 2021

Rabbit
Oct. 1, 2020–Feb. 15, 2021

Squirrel
May 23, 2020–Feb. 15, 2021

Turkey
Archery:
Sept. 15–Nov. 13, 2020
Nov. 25, 2020–Jan. 15, 2021

Firearms:
- Spring: April 20–May 10, 2020
- Fall: Oct. 1–31, 2020

Waterfowl
See the Migratory Bird and Waterfowl Hunting Digest *or visit short.mdc.mo.gov/ZZx for more information.*

For complete information about seasons, limits, methods, and restrictions, consult the *Wildlife Code of Missouri* at **short.mdc.mo.gov/Zib**. Current hunting, trapping, and fishing regulation booklets are available from local permit vendors or online at **short.mdc.mo.gov/ZZf**.

Free MO Hunting and MO Fishing Apps

MO Hunting makes it easy to buy permits, electronically notch them, and Telecheck your harvest. MO Fishing lets you buy permits, find great places to fish, and ID your catch. Get both in Android or iPhone platforms at **short.mdc.mo.gov/Zi2**.

ILLUSTRATION: MARK RAITHEL

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Take a walk through Missouri's woods, prairies, or glades on an early summer day. You might just find the red, orange, and yellow blooms of Indian paintbrush. What other wildflowers will you discover today? For help identifying your discoveries, visit **short.mdc.mo.gov/ZeC**.

by **Noppadol Paothong**