Spring has sprung, HabiChatters! And like the noble mushroom, we emerge from our winter dormancy ready to transform our world. A guest writer joins us this spring to show off some hard work for native plants in a schoolyard garden - check out Wild Acres In Action. Plus, our regular authors have provided a Native Animal Profile on red-winged blackbirds, a deep delve into plant communication, and an article featuring our state entomologist.

If you read one thing in this issue, keep this Habitat Tip in mind: despite our mammalian urge to cleanse away the detritus of the winter, let's remember this year *not* to purge our garden beds right away. Wait until daytime temperatures are 50* F for several days in a row so that our native insects may complete their winter dormancy in peace.

Sarah Witcher

Mushrooms by Zaphir Shamma, DNR Photo Contest 2020

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Natural Heritage Program Spotlight: Max Ferlauto, State Entomologist
The arrival of spring for many wild animals and plants means emerging from a period of quiet and slumber - but that is not true for the small staff of the Natural Heritage Program. Max Ferlauto, state entomologist with the Maryland Department of Natural Resources, provides some insights into his work with insects and spiders, which like the creatures themselves is interwoven with (and often dependent upon) the native plants and backyard habitats we encourage in the Wild Acres program.

How Plants Communicate

The human world is so fraught with communication it can feel overwhelming at times. Getting out into nature can be a relief for those of us looking for some peace and quiet. Although the forests, rivers, mountains, or dunes may feel tranquil and devoid of chatter, a barely perceived symphony of plant communication lies just on the edge of human understanding.

Red-winged Blackbird

Agelaius phoeniceus

Red-winged blackbirds are not rare, but they certainly are beautiful! Chances are you have spotted them many times or heard their call, “Conk-la-REE!” Their scientific name is *Agelaius phoeniceus,* which comes from a Greek origin. “Agelaios” means “flocking” in Greek, indicating these birds flock together in large groups, while “phoeniceus” comes from the Greek word "phoinikeos," due to the fact that ancient Phoenicians brought to Greece crimson dyes that they made using shellfish. The latter part of their scientific name describes their colorful wing patches. The first known painting of a red-winged blackbird was created by English naturalist Mark Catesby somewhere between 1727-1731. Carolus Linnaeus, the famous Swedish scientist who formalised binomial nomenclature, the modern system of naming organisms, gave the red-winged blackbird its scientific name in 1766, based on Catesby's painting.

Mark Catesby, *The red Wing'd Starling. 1727-1731*

In the 1914 book *Myths and Legends of the Mississippi Valley and the Great Lakes,* author Katharine Berry Judson writes of a Native American Chitimacha folktale that describes how the Red-Winged Blackbird got its wing coloration. The tale tells of a man setting a marsh on fire while the bird warns everyone, the man throws a shell at the bird hitting it and causing it to bleed which in turn causes the red coloration on the wings. At the end the red-winged blackbird saved the marsh.

They are one of our most abundant and widespread species throughout Maryland and most of the continent, and can be found in all of the lower 48 states, parts of Alaska, and parts of Canada, Mexico, Cuba, Guatemala, Belize, Honduras, El Salvador, and Costa Rica. In late spring and summer you are most likely to find them perched on cattails, reeds, and other tall plants in wetlands where they breed. The remainder of the year they gather in flocks and can be found foraging in agricultural fields and pastures. They sometimes travel up to 50 miles between feeding and roosting sites.

Red-winged blackbirds are omnivorous; they vary their diet when opportunities arise. However, their diet consists mainly of seeds and grains, like corn and rice, as well as small berries.They

will also eat a variety of insects and arachnids during the breeding season to increase their caloric intake and meet their dietary needs, allowing them to be in peak reproductive form. If needed they can also eat various other small invertebrates and carrion as well. Red-winged Blackbirds will visit backyard bird feeders, especially when food is limited in the winter months. Their predators include owls, raptors, snakes, and some mammals, such as raccoons.

Male coloration is shiny black with red, or more often red and yellow, patches on the upper parts of their wings. These are called epaulettes, which is the same word used to describe the shoulder decorations on military and royal uniforms. Resembling large sparrows, female Red-winged Blackbirds are brown and heavily streaked, with a yellowish area around their beak. The juveniles look more like the females in coloration, as seen in the photo above. This species is polygynous, and males mate with up to 15 females. The better the territory that the male controls, the more females that come to his harem.

Males are very territorial and spend a large portion of their time defending their turf, using a combination of showy behavior and swooping. Displaying their epaulettes has the dual purpose of attracting females and showing off for other males. If another male enters their territory, they may swoop towards them to deliver a smack. However, in defending their territory, they may also try to attack other animals wearing red!

Map of red-winged blackbird range from Cornell Lab's All About Bird website:
https://www.allaboutbirds.org/guide/Red-winged_Blackbird/maps-range

Wild Acres In Action: A Local Outdoor Classroom

Recently we received this correspondence from a Master Naturalist working in Silver Spring at a Middle School, and we wanted to share his **inspiring words of wisdom**. Thanks Mitch Greene, and keep up the great work caring for Maryland's wildlife!

"I am the Outdoor Classroom Coordinator at Silver Spring International Middle School and Sligo Creek Elementary School; I am supported by two incredible principals, PTSAs, and a nonprofit organization. The space I manage is located at the Old Blair High School site in a shared courtyard. The Outdoor Classroom is where teachers and students gather for formal and informal education.

"One of my roles is to manage and maintain the ecosystems we have there. In that capacity, I have begun converting about 700 square feet of weedy, non-native grass and invasive cinquefoil into a native-plant meadow! Despite skipping the step of killing the weeds before I planted the first phase, I'm pleased to say that almost 100% of the new plants thrived; many have reproduced in just two growing seasons. That is not a testament to my skill but **a reminder of how well-suited native plants are to the environment in which they evolved**.

"Having native grasses, herbs, shrubs and trees in the Outdoor Classroom has provided opportunities for students to observe native wildlife. We have watched American goldfinches devour the seeds of native sunflowers, seen green lacewing adults (hoping to find a camouflaged juvenile), found the easy-to-miss eggs of native true bugs, and even come across a polyphemus moth cocoon! We've got potter wasps and garden spiders, grey squirrels, mockingbirds and catbirds. We've seen juncos and, soaring overhead, a pair of American bald eagles. There is a pair of red-shouldered hawks who visit in the fall, and cardinals have nested in the chokeberry shrubs at the bottom of the meadow. Moss, lichens, fungi…there is **a sense of wonder restored**.

"About half of the Outdoor Classroom can be planted, the size of a large suburban yard. Here in the eastern half of the United States, where most land is privately owned, **every square foot of potential habitat is important**. Ideally, every yard would have oak or hickory trees and the plants that associate with those genera, but in situations where we have a postage stamp or balcony, even a small patch of native grasses and perennial flowers will help other native organisms. I want students and other visitors to learn that life on earth is unique–possibly in the universe!–and every opportunity we have to choose to support it, in all its incredible forms, we must no matter how insignificant the effort may be. Whether we put a pot of native grasses and asters out on the balcony or turn an abandoned farm back into a hardwood forest, habitat is essential.

"As an informal educator I have benefited greatly from the HabiChat Newsletter; thank you for providing accurate information, fun games and engaging ideas for young naturalists! I get inspiration from and frequently cite and link to HabiChat in emails and letters to parents and teachers. I hope that sharing my successes (and failures!) will help others realize that **it doesn't**

have to be perfect, expensive, or complex to be effective. A handful of native plant seeds or a few plugs from a reputable source will go a long way."

Love what you see here and want to get started with your own project? Check out our article on how to get started with native plants!

Don't forget to certify your garden; signs that explain why you've planted native species can go a long way, helping educate the public about the importance of biodiversity. Check out our list of free resources at the bottom of the Wild Acres page.

Do YOU want your garden to be featured in an upcoming issue of HabiChat? We love to hear from you! Email sarah.witcher1@maryland.gov.

All photos by R.M. Greene.

Outdoor classroom meadow site, before planting.

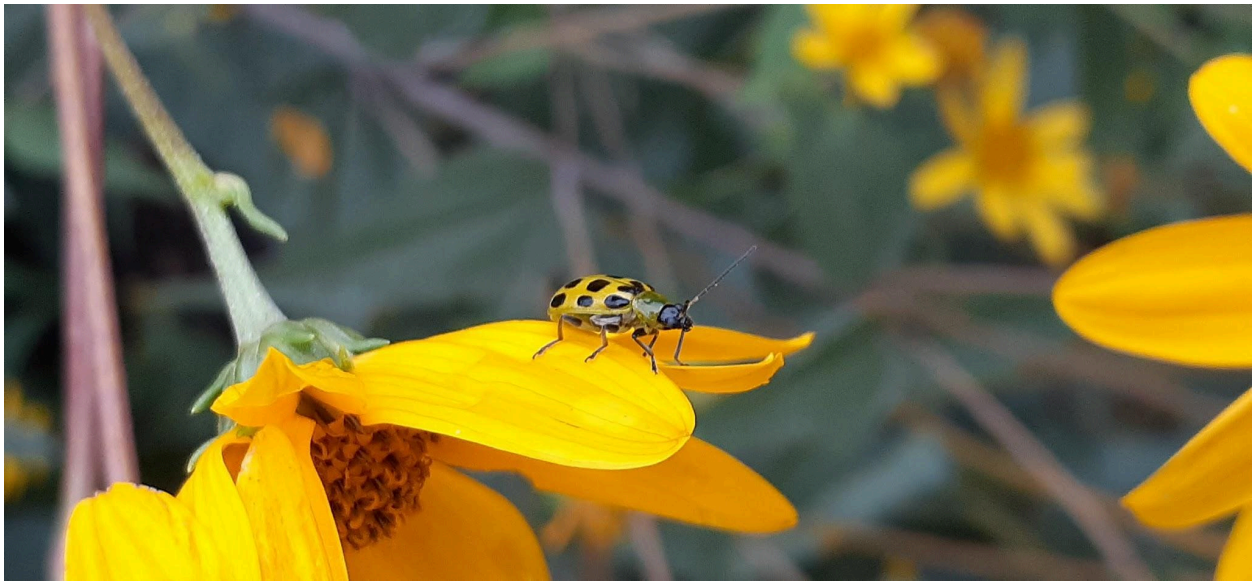
Wellness garden, in planting progress

Meadow corner with established plantings; *Helianthus* are planted in this corner in honor of the memory of a previous coordinator's daughter. Her favorite flowers were sunflowers.

Fifth-graders after helping plant six new spice bush and witch hazels (*Lindera benzoin* and *Hamamelis virginiana*)

A welcome visitor to the outdoor classroom, a fraternal potter wasp (*Eumenes fraternus*)

Black and yellow garden spider (*Argiope aurantia*), a beneficial arachnid that preys on many insects considered pests to humans.



Eleven-spotted cucumber beetle (*Diabrotica undecimpunctata*) on sunflower (*Helianthus sp.*); Maryland's native flowers and plants are uniquely adapted to coexist with this local insect.

Natural Heritage Program Spotlight- Max Ferlauto, Entomologist

Bumblebee. Photo courtesy of USGS-PWRC

The arrival of spring for many wild animals and plants means emerging from a period of quiet and slumber - but that is not true for the small staff of the Natural Heritage Program. Our biologists have a big responsibility: protecting and managing the nongame, rare, threatened and endangered species and their unique habitats in Maryland. While field work does increase in the warmer months, the cool season provides time we need to provide important services to Maryland residents. Max Ferlauto, state entomologist with the Maryland Department of Natural Resources, provides some insights into his work with insects and spiders, which like the creatures themselves is interwoven with (and often dependent upon) the native plants and backyard habitats we encourage in the Wild Acres program.

Do you know what's in your SWAP? The acronym in this case stands for State Wildlife Action Plan, a document the Natural Heritage Program publishes every ten years with input from all the experts and stakeholders in Maryland, outlining conservation approaches for wildlife and wildlife habitat. All 50 states have SWAPs, mandated by the U.S. Fish and Wildlife Service as a condition of receiving funding to research and

conserve rare and declining species. Coming up with this plan is a task full of complexity; imagine getting everybody who cares about wildlife to agree on one written plan that includes every living thing in Maryland! Ferlauto contributes to this effort by updating rare species lists using the results of surveys our staff completes, as well as contributions from local naturalists and occasionally community science applications (like iNaturalist and the Maryland Biodiversity Project).”This isn’t just counting bugs,” he says. “The more we study insects, the more we can understand their ecological and economic benefits.”

Firefly by Adrienne van den Beemt

For example, Max is focusing particularly on statewide firefly surveys. Many Marylanders report that they have noticed a large reduction in the number of fireflies they remember from their childhood - and they aren't wrong. Firefly population numbers have decreased due to a number of reasons, including habitat loss, use of pesticides, and too many outdoor lights. Firefly larvae are beneficial predators, eating garden and agricultural pests like slugs and contributing to overall soil health and aeration. Species of firefly can be tricky to identify, with differences often only limited to the pattern of flashing light they use in their glowing mating displays. Through field surveys, Max and his team aim to produce a truly comprehensive list of what species are here right now, with additional time spent improving our understanding of their life histories so we know the best ways to conserve them. He's also working with college students to better understand other species and our impacts upon them, like the Baltimore Checkerspot, our state insect. Collaborating closely with communities, Max hopes to eventually produce an easily-accessible online resource for homeowners to access insect and plant information that may help them make conservation-minded decisions. One such homeowner management decision is leaving fallen leaves in garden beds, which host the larvae of fireflies, butterflies, and other species throughout the winter.

Speaking of communities, much of Max's work supports larger projects like pollinator-friendly maintenance of public roads and park land development. He's currently working with local municipalities to develop roadside mowing plans by identifying road stretches that are important to rare pollinator species, like the rusty-patched bumblebee. Many of these species pollinate agricultural crops, and populations are in steep decline; the rusty-patched bumblebee has declined by 87% of its historic range in recent years. Understanding the reasons for these declines could help us conserve valuable biodiversity before it's too late. If no other argument for protecting biodiversity speaks to your heart, think of the biomedical implications of permanently losing entire species; the cure for cancer could be buried in a rare insect! In many cases, Natural Heritage Program goals align well with community financial and economic goals as well. Planting native plants, which also benefit local insects, and effectively managing our roadside areas can save taxpayer funds in fuel and mowing costs.


Max Farlauto with a waved sphinx moth (left), and a leaf litter study (right). DNR Staff photos.

Along with other Natural Heritage Program staff, Max is also engaged in surveying Wills Mountain State Park in Allegany County, which is set to open to the public following a recent land purchase. In the time since Maryland purchased this property, park management and biologists have worked closely together to understand what resources it holds, including rare species and ecological communities. By carefully documenting what's there, the Department can achieve its goals of allowing public access as soon as possible while also protecting the resource for future generations.

Bugs may seem tiny and insignificant, but the truth is quite the opposite. They often tie together layers of environmental functioning that are pivotal to soil (like decomposition and fertility), plants (like pollinators), other animals (like predators that eat invertebrates), and humans (like pest control, fishing and boating industries). With possible changes at the federal level, state laws and programs that promote endangered species conservation could be the last line of defense for some of our regionally rare species. While our square footage may not be large, Maryland's lands and waterways hold immense ecological importance. We are fortunate to house some very rare habitats in a crucial watershed like the Chesapeake Bay, often due to unique geological areas and the range overlap between southern and northern species. We

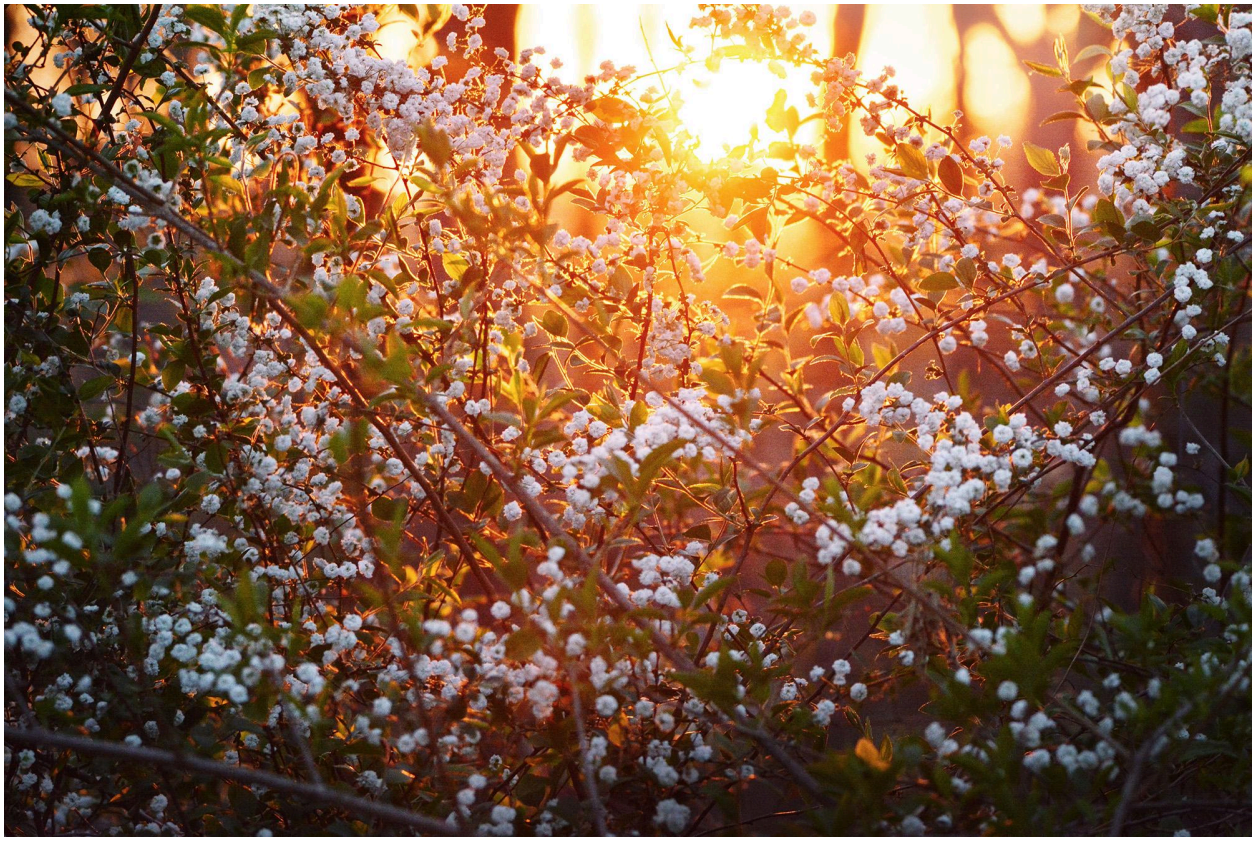
also have one of the most wildlife-savvy, educated, and motivated populations in the nation, allowing us to historically enact- and hopefully continue to prioritize- conservation in a way that should truly make us proud.

Want to hear more about Max's work with leaf-loving insects? Check out this podcast: In Defense of Plants - Leave the Dang Leaves
https://www.indefenseofplants.com/podcast/2024/12/3/ep-505-leave-the-dang-leaves

Check out this new research about leaving the leaves!
https://www.sciencedirect.com/science/article/pii/S0048969725004565

For more on beneficial insects, visit:
https://dnr.maryland.gov/wildlife/pages/habitat/wabugs.aspx

Leaf Language and Root Words: How Plants Communicate



Evening Sun by Pamela Brumbley, DNR Photo Contest 2016

The human world is so fraught with communication it can feel overwhelming at times. Getting out into nature can be a relief for those of us looking for some peace and quiet. Although the forests, rivers, mountains, or dunes may feel tranquil and devoid of chatter, a barely perceived symphony of plant communication lies just on the edge of human understanding.

The concept that plants may “speak” has been a recurring theme in folklore and mythology throughout human history. In English folklore, willows are said to follow travellers, muttering to themselves as they walk. Herodotus, the ancient Greek historian, wrote in the fifth century BCE of a tree in Dodona that spoke with the voice of Zeus, interpreted by priestesses from the rustling of leaves. Sophocles references Herakles (better known to English-speakers by his Roman name, Hercules) pondering a prophecy from the same sacred oak.

Humans have long used plants and plant symbols as a means to communicate with each other. One of the oldest symbols in written speech is a hieroglyph of the papyrus stem, and any historic overview of ancient Egypt would be incomplete without

mentioning the use of papyrus to make the first paper in recorded human history. In fact the word “paper” derives from the plant name!

Outside of the written word, humans have found innumerable ways to have plants speak for us. One of the better known examples is that of Victorian flower language. Floriography, the art of using flowers to communicate, burst into popularity during the 1800s, as Victorian society dictated strict lines around expressing emotion. While plants have always held symbolic meaning in different cultures throughout time, many of the modern meanings of flowers in Western culture were solidified in this era.

With these longstanding historic connections, it may surprise many that the study of plant-to-plant communication is itself relatively new. And much of the modern era of research began with the ephemeral smell of maple and poplar trees in the early 1980s.

Smelling the Flowers by Duane Tucker, DNR Photo Contest 2016

A Yell via Smell, A Wink via Stink

Chemical forms of communication are perhaps the most easily perceived ways plants communicate with each other and with the world around them. While we as humans

cannot hear plants (more on that later) or see the ultraviolet colors they employ to signal to pollinators, we can detect and measure the chemistry plants use.

One important element of chemical communication is the use of aroma compounds by plants to attract pollinators and defend against predators. Humans have long enjoyed the scent of flowers and other plants; the history of perfumes would be a terribly short one without them! But even as we find joy in the various smells of plants, many of those scents have a specific message not meant for us.

In 1983, the first study linking scent to plant communication was published. The researchers found that despite no contact via root system or touching, maple and poplar tree saplings would respond to others of their same species receiving damage to their leaves. The conclusion, now supported by decades of research, was that the plants were communicating via air; in short, through smell. Since these early days, 30-some species of plants have been shown to be able to communicate with others of their same species, or even different species, through the release of scent molecules in the air.

Plant VOCs (volatile organic compounds) are chemicals that plants release into the air to communicate danger to each other, attract pollinators, repel herbivores, or even attract third parties with no interest in the plant for its own sake. One commonly used example many of us have experienced is the smell of freshly-mown grass, a plant VOC released in response to leaf damage. Some plants, like petunias, have such a highly attuned ability to recognize specific VOCs that they will reject ones that are identical, but "backwards": even replicating the VOCs as their mirror image will not confuse the plant. In this regard, petunias have much in common with humans, as seeing a reversed photo of ourselves may come with some degree of confusion and discomfort as well.

In one clever example of plants using VOCs as defense against those that would munch upon them, several species of economically important plants (corn, cotton, and tobacco) were found to release VOCs that attracted parasitic wasps to them. These wasps prey upon one of two closely-related species of caterpillar who would otherwise eat these specific plants, and it was found that the plants seemed to be releasing a distinct scent to let the wasps know their favorite dish was on the menu.

In an exciting turn for those of us interested in plant communication and willing to read studies heavy on chemistry, researchers from Saitama University in Japan have recently been the first to visually document the way plant VOCs are emitted and received. The experiment, done in real time between mustard plants, showed the mechanics of how such communication occurs. Researchers tracked the movement and increase of calcium ions in plant tissue in an undamaged plant following exposure to VOCs

released by a damaged one, using high-resolution imaging. This finding suggested that the leaves took in these chemical signals via stomata, tiny openings on the leaf surface used for gas exchange. While we're far from knowing all the intricacies of these conversations, this marks a major milestone in our understanding.

Mushrooms by Zaphir Shamma, DNR Photo Contest 2020

Root Words

Right on the heels of scent as one of the most discussed methods of plant communication is that of the mycorrhizal network. Mycorrhizae is the term used to describe the intricate networks of fungus and plant roots that stretch beneath the surface of the ground. An estimated 80-90% of terrestrial plants have relationships with one or more types of fungus, some of which are never seen on the surface.

The field of mycorrhiza ecology is divided into general categories based on the kind of plants and fungi involved. They often include: orchid mycorrhiza, ericoid mycorrhiza, ectomycorrhiza, and arbuscular mycorrhiza. Orchid mycorrhiza refers *just* to the relationships between orchids and fungi (read more on Maryland's native orchids!) In the same vein, "ericoid" refers solely to the members of the Ericaceae family of plants, which includes heathers, blueberries, and rhododendrons, among others. Ectomycorrhiza includes relationships in which the fungus does not penetrate the cell walls of its symbiotic plant partner. These relationships are largely the ones between fungi and flowering plants (called "angiosperms") or pines. By far the most common type

of mycorrhiza is arbuscular, which accounts for the some 200,000 species of plant and the relationships they form with fungi. Arbuscular mycorrhiza accounts for those between fungi and grasses, herbs, and many trees.

Mycorrhizal relationships provide a great many functions to both the plant and fungi involved, including transport of nutrients, increased plant productivity, protection from disease and drought, and nourishment of seedlings. The mechanics are complicated, to say the least, but researchers have found that the results of the mycorrhizal networks below forests encourage biodiversity. Beyond that, or perhaps as part of it, is the fact that the mycorrhizal network passes along communication from plant to plant.

“Common mycorrhizal networks” are localized fungi networks that connect plants of both the same and different species. Signals relating to disease or herbivore attacks on the connected plants have shown to be communicated via these networks, allowing plants in the area a heads-up so they may strengthen their immune defenses against potential attack themselves. Unlike human news networks, these mycorrhizal communications happen without the use of helicopter footage of local traffic, which is perhaps an area for improvement for the future.

Sound the Alarm

As quiet as the plant kingdom may seem to humans, our limited hearing filters out a positive cacophony of sound! The field of studying the sounds produced by plants is known as “plant bioacoustics.” Researchers in this field must use instruments able to pick up sounds that are typically of exceptionally high frequency and thus unheard by the human ear.

The field of plant bioacoustics is actually a century old, with documentation of the more audible noises made by plant sap in capillary tubes (a “click”) first made in 1914. The 1960s saw several studies of “audible acoustic emissions” of plants, and the first recordings thereof.

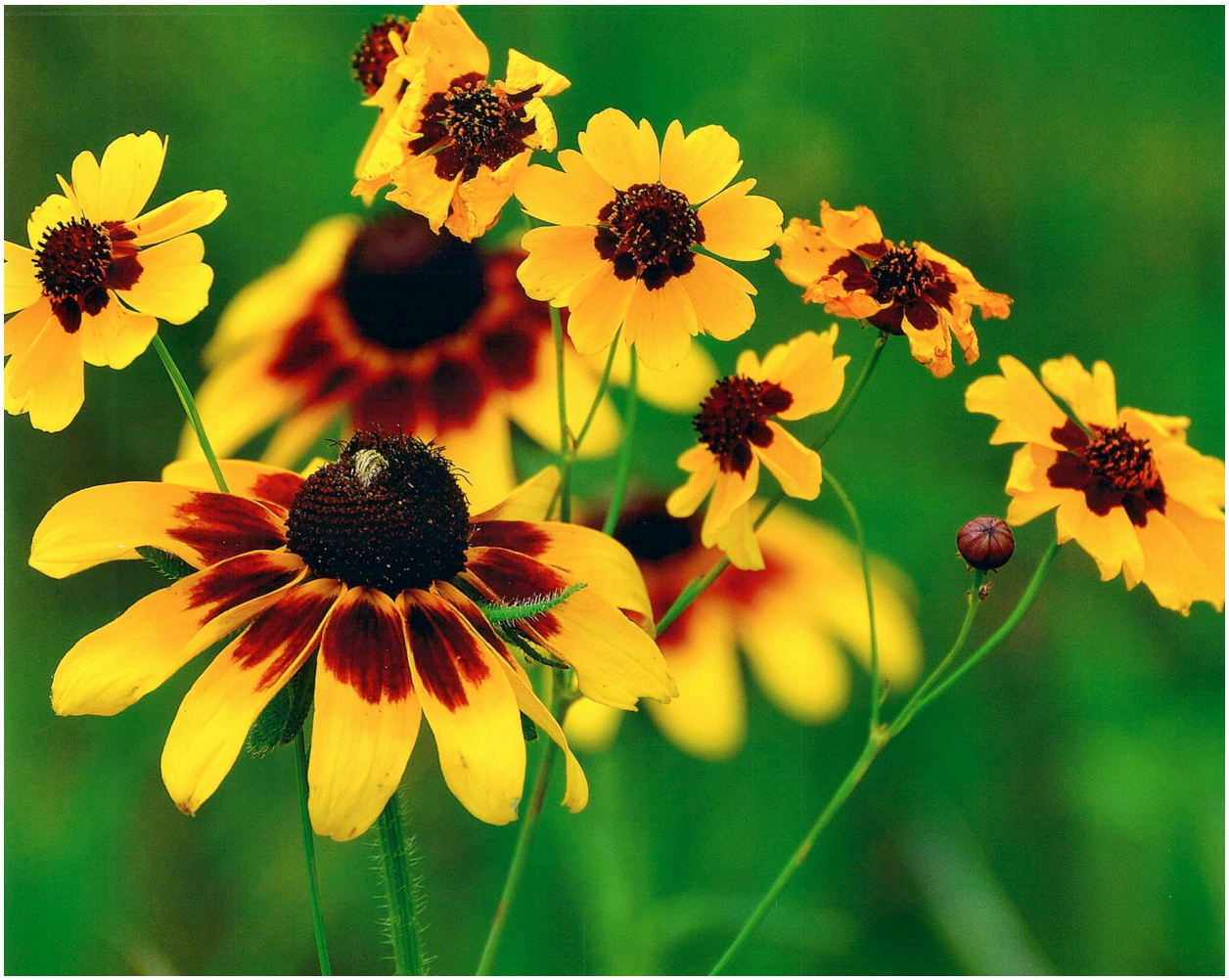
A recent study showed that tomato and tobacco plants make a popping sound when stressed by damage to their leaves and dehydration. While the sound itself was noted to be as loud as human conversation in volume, the frequency is far above what we can hear as humans. The researchers also recorded a handful of other plant species, including grapes and wheat, and found that they too emitted stress sounds.

Milkweed Munching Monarch by Annette Conniff, DNR Photo Contest 2015

So if plants can produce sound, does that mean they can “hear” sound as well? In a sense, yes! While plants do not have organs dedicated to the vibration of airwaves that we call sound, they do respond to vibrations that travel through the air. In 2014, researchers at the University of Missouri found that plants responded to the sound of caterpillars eating by mounting chemical defences. Not only did the study confirm the plants responding, but also that the plants seemed to retain the memory of the sound; the plants were played the noise, then later exposed to the caterpillars. The plants behaved as if they had been warned of the possibility- mounting a defense by producing mustard oils once the caterpillars arrived. The same study found that the plants did not respond similarly to the sounds of other, non-predatory insects, or of the wind, meaning the plants were able to distinguish between sounds that implied danger and sounds that did not.

Similarly, a species of evening primrose native to Mexico and the southeastern United States has been shown to respond to vibration recordings that mimic bee and moth wingbeats. The primrose was found to have produced sweeter nectar when it perceived a pollinator was nearby. In this case, the flower of the plant seemed to act as the “ear,” because when the flower was covered, no change in sugar content was found.

Studies of sound and its impact on vegetation have shown discovery after discovery. Sound travels well underground, and corn roots have been shown to grow towards sources of vibrations, while peas have been shown to use vibrations in the soil to locate water. Further, certain frequencies have shown to delay the ripening of tomatoes, while others have shown the ability to stimulate growth in plants. While we ourselves can't hear all the sounds of the plant kingdom, we would still encourage them to rock on!



Roadside Flowers by Lori R. Bramble, DNR Photo Contest 2013

Showing Their True Colors

By now, it is probably not surprising to learn that, like plants producing sounds we can't hear and communicating with scents that we don't understand, they also display colors we cannot see. (It's always something new with these guys, isn't it?)

In fact, many flowers display colors outside of our normal range of light vision. Pollinators (and herbivores, and many other animals besides) see a greater range of colors on the ultraviolet end of the spectrum of light, making some of the flowers they

visit vibrantly bright. Many flowers display “landing strips” or highlight exactly where to find nectar (and coincidentally, pollen) so bees and butterflies, and some birds and bats, find exactly what they’re looking for while also pollinating the flower in question.

“False color” techniques have been developed to assist us with visualizing just how differently bees see color. What these, and other imaging techniques, including UV light, have shown is just how much plants are saying with colors that we can’t see.

Hold My Calls

When you’re in your garden this spring, or simply enjoying a mild day in the great outdoors, consider the chatter going on all around you in a vast unknown conversation. Even more methods of communication are utilized by plants than what we have covered here, from electrical signaling to fluorescence and beyond; some researchers are even attempting to communicate with plants in their own language.

As we learn more about the world we can barely perceive with human senses, it throws into stark relief how little we really know about the ecosystems we inhabit. Even as science develops, our lantern of knowledge held forward to light the way, we find more delights and puzzles emerging from the darkness. A vast world of beautiful secrets surrounds us- how are we to find our way?

Aldo Leopold wrote, “to keep every cog and wheel is the first precaution of intelligent tinkering,” and what better advice could we have for an ecosystem we are just now beginning to see as a full and complicated network. And how can we save what we have before we damage it, or lose it altogether?

When you’re digging your hands into the warming earth, consider what you’re planting there. Native plants, besides being easier to care for in our climate, provide habitat to all the beneficial insects we love to watch flit through our gardens. The mycorrhizal fungi in the soil seek plants they know to form partnerships with, and the bees and butterflies seek colors only they can see on flowers they evolved alongside for thousands of years. Sounds we can’t hear travel through the earth, reaching ears we don’t understand, and if we want to save that symphony for a time when we may hear it, then please consider using your space to make a wildlife oasis in an increasingly cacophonous world.

And cool it with the pesticides, y’all.

For more on how to introduce native plants to your yard or garden, see our Wild Acres site.
If you’d like to throw off the shackles of manicured grass and embrace the beauty of natural lawns, see our explainer on lawn alternatives.

by Katy Gorsuch