Marilandica

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Marilandica
A Publication of the
Maryland Native Plant Society

www.mdflora.org
P.O. Box 4877 Silver Spring, MD 20914

Our Mission
Promote awareness, appreciation and conservation of Maryland's native plants and their habitats. We pursue our mission through education, research, advocacy, and service activities.

Letter from the President

Dear Friends,
Have you tried iNaturalist? My introduction to it was the City Nature Challenge, an international contest where cities worldwide compete for the most observations of nature during a 4-day period. You record your observations photographically on the iNaturalist app. The app itself can suggest an ID; and these are surprising accurate for common and easy-to-ID plants. The ID can be confirmed or disputed by others, and it's recorded at the location where you took the photo. It's a lot of fun, and like other social media, you can 'follow' others who share your natural science interests.

But. I've had a hard time persuading field trip participants that the ID iNaturalist gave them wasn't correct. "Just look at the plant!" I plead. I'm sure iNaturalist's software will improve over time, to the point where it won't be necessary to know anything at all about plant structure or habitat in order to get an accurate ID. You won't need to examine plants yourself. Just show them to your phone! Wait. . . What?

What fun is a field trip where most of the participants spend their time fooling with their phones and their cameras? With regard to the camera, I stand guilty as charged. Yet. Last week in West Virginia, it rained on and off so I left my camera in the car. As a result, I rediscovered the joy of NOT thinking about setting up the shot or searching a patch for the one perfect flower to preserve electronically.

I don't have any particular conclusion for these rambling thoughts. I've always believed field trips were the Society's most important activity. No other organization conducts numerous field trips, all over Maryland, free and open to the public. All accomplished by dedicated field trip leaders and our busy field trip coordinator, Anne DeNovo. Thank you!

~ Kirsten Johnson, President

MNPS Needs You

We are an all-volunteer organization with a lot of activities.
Dedicated members of our Board of Directors put in a lot of time and
we can always use help.

Field Trips. We are always looking for new places and leaders for field trips, especially in western Maryland, northeastern Maryland (Harford and Cecil Cos), and the eastern shore. If you have an idea, and would like someone to join you to scout out the area, please contact Anne DeNovo, fieldtrips@mdflora.org.

Website. Are you interested in website updating and design? We can use your help. Please contact Karyn Molines, info@mdflora.org.

Board. Do you want to serve on the Board of Directors? Please contact Nominating Committee Chair, Beth Johnson, info@mdflora.org. If you would like to attend a board meeting, please email info@mdflora.org for the time and location. (Ideally the Board meetings would be regularly announced on the website, but see above.)

Montgomery County Programs. Can you help with program logistics? Please contact Marney Bruce, either at a program, or at info@mdflora.org.

Field Trip Plant Lists. Do you love working with data? Do you have a basic working knowledge of the common Maryland plants? We have many plant lists from field trips posted on the website, but also a substantial backlog that need editing. Please contact Kirsten Johnson, kh.johnson@ymail.com if you can help.

On the cover: *Conopholis americana.* Photo: Ed Boyd. Ed and the other photographers featured in this issue are contributors to the Maryland Biodiversity Project and the Maryland Plant Atlas. See marylandbiodiversity.com.

Wildflower in Focus – Squawroot

Conopholis americana (Linneaeus) Wallroth
Squawroot, American Cancer-root, Bearcorn

Walking in the woods, you can easily overlook the holoparasites—plants with no chlorophyll—or mistake them for fungi. They're short and they're not green. But as Ed Boyd's lovely cover photo shows, if you look closely, these peculiar plants possess a distinctive beauty and interest.

Squawroot's erect stems have numerous scale-like flowers that make the plant look a bit like a pinecone. "Conos" means "cone" and "pholos" means "scale" in ancient Greek, hence the name "Conopholis."

Keep your eyes open in an oak forest and you're likely to see one of these fascinating plants. Squawroot parasitizes the roots of red oak species that are associated with mycorrhizal fungi. It does this by penetrating first the fungal sheath surrounding the root, and then the root itself with structures called "haustoria" that enable the transfer of nutrients from the oak root to the squawroot. Once the seedling establishes that connection, it grows underground for about four years before a flowering stalk emerges. Most of the biomass remains underground.

There is debate about whether the squawroot weakens the tree, but oak trees can certainly live a long time while supporting a population of squawroots. Squawroot is more common in older forests and may be an indicator of forest age and stability. In areas where oaks are being replaced by beeches, maples and other species, squawroot is an increasingly uncommon plant. I've seen claims that squawroot also parasitizes beech, but I could find no primary sources. The confusion could arise because oak and beech are often found together.

Squawroot reproduces by self-pollination. Bumble bees visit occasionally, but they are unlikely to return because squawroot produces no nectar. In one study, plants were covered with bags to prevent insect visitation. They still set seed at the same high rate as unbagged plants. In fact, even the underground part of the stalk will flower and set viable seed. Seed dispersal seems to be accomplished by mammals, especially deer and bears (hence the common name "bear corn").

Squawroot in fruit.

USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols.* Charles Scribner's Sons, New York. Vol. 3: 235.

Squawroot displays structural characteristics typical of self-fertilizing species: reduced amounts of pollen, small corollas and corolla lobes, small stigmatic lobes, and stigmas and anthers located close to each other. They don't need to invest in the fancy corollas and delicious nectars that other plants use to attract pollinators. Self-pollination may evolve as a strategy for reproduction when opportunities for cross-pollination decline, perhaps due to the disappearance of animal pollinators, or perhaps to the low density of the squawroot populations. And individuals that self-pollinate have a competitive advantage because they transmit their genes simultaneously through both their pollen and their ovules, whereas an individual cross-pollinator contributes only half its genes to the offspring.

But wait. If self-pollination is so advantageous, why isn't it more common? Why haven't more plant species evolved this way? Are there disadvantages too? Indeed, self-pollination reduces genetic variation and the potential for adaptation. Not surprisingly, self-pollinating lineages have greater rates of extinction, and reversion to cross-pollination occurs extremely rarely or not at all. This is why self-pollinating plants like squawroot are hypothesized to be evolutionary "dead-ends." This doesn't mean they're destined for extinction anytime soon, but it does mean they have a very limited ability to adapt in response to changing conditions.

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Maryland Native Plant Society Conference 2019
Co-sponsored by Frostburg State University Department of Biology

Ancient Forests & Peatlands
of Western Maryland

Frostburg State University, Frostburg, MD.

SATURDAY August 24

MORNING 8:30 Registration

9:00 Welcome and Opening Remarks

Speakers:

- Sunshine Brosi, Assoc Professor of Biology & Ethnobotany Director, Frostburg State U
- Kevin Dodge, Director of Natural Resources & Wildlife Technology, Garrett College
- Joan Maloof, Founder & Executive Director of the Old-Growth Forest Network
- Poster Session

AFTERNOON 12:00 Announcements followed by lunch

1:00 – 5:00 Field trips. Carpool from the University

EVENING 5:00 Evening Social — Cash Bar, Appetizers, Posters, Treasure Table

6:00 Buffet Dinner

7:00 Film: *A Force for Nature: Lucy Braun*

SUNDAY August 25

DAY LONG Field trips. Meet at the location. Directions provided on Saturday
Water, hiking boots, sunscreen, hat, and bug repellent are highly recommended for all trips.

Register On-line at www.mdflora.org

REGISTRATION FEE: Includes morning program, lunch, afternoon field trips and Sunday field trips. Members: $80; Nonmembers $90. Saturday Social with dinner: Add $50. Fees increase by $10 after July 1. Information on accommodations in the area can be found at www.mdflora.org

Proceeds from the conference will support our scientific research grant program.

Ancient Forests & Peatlands of Western Maryland

FIELD TRIPS: Saturday, August 24

4-H Camp
Leaders: Zach Fowler & Austin Persons. This out-and-back hike will start and end at Cunningham Lake at the MD 4-H Environmental Education & Camping Center. We will walk along the lake, then upstream through the woods to a wetland with beaver dams. Moderate to difficult due to rough trails & approx. 4-mi distance; optional walk in wetland.

Elk Ridge Native Plant Preserve
Leaders: Liz McDowell & Ron Boyer. This forested ridge adjacent to the Savage River State Forest lies within the Mid-Atlantic Highlands, the largest interior hardwood forest in the world's temperate latitudes. Landowner efforts have helped protect several uncommon plants and animals. Easy to moderate walk.

Fifteen Mile Creek
Leaders: Chris Frye & Kirsten Johnson. Western MD's rain shadow effect, eastern Allegany County's hilly topography, and the microclimates of Fifteen Mill Creek combine to produce a variety of plant species on floodplains, shale beds, and bluffs. We will explore wetland seeps, riparian zones, shale barrens, and deep mesic valleys in Green Ridge State Forest. Multiple stops at easy to access sites. Easy to moderate walk.

Finzel Swamp
Leaders: Donnelle Keech & Donna Gates. The Nature Conservancy's Finzel Swamp, a Pleistocene boreal remnant, is a biodiversity treasure with over thirty rare and uncommon species, and five globally and locally significant wetland habitat types. This is one of the few refuges in MD where boreal species persist since the last Ice Age. Easy to moderate walk.

FSU Arboretum Exploration
Leaders: Karyn Molines & Olivia Shaffer. Explore the arboretum and practice tree identification skills. This arboretum provides a growing, sustainable resource for campus and regional communities, while maintaining the natural setting of the mountains of Appalachia. Easy walk.

New Germany State Park.
Leaders: Joe Metzger & Christine Campe-Price. This mountain gem lies along Meadow Mountain, the eastern Continental Divide. Its many trails pass through a variety of habitats: hemlock and mixed hardwood forests, rhododendron covered streams, old field, and lakeshore. Easy to moderate walk.

North Cherry Creek Bog
Leaders: Kevin Dodge & Ed Gates. Mile-long complex of seeps and wetlands with excellent examples of mountain peatland communities, including oligotrophic peatland, minerotrophic acidic fen, forested acidic seep, and acidic conifer swamp forest. The high-quality open sphagnum bogs are significant plant communities. Moderate to difficult; wet, muddy, with sketchy bridge crossings.

Old-Growth Dedication Site
Leaders: Sunshine Brosi & Joan Maloof. An old-growth site in Allegany County will be dedicated as part of the 'Old-Growth Forest Network', celebrated, and explored.

Paw Paw Tunnel & Hill Trail.
Leaders: Champ Zumbrun & Kerry Wixted. Discover the plants and animals along the Tunnel Hill Trail with outstanding views of Green Ridge St Forest, Paw Paw Bend, and tunnel gorge. Then explore the 3,118-foot-long Paw Paw Tunnel, the engineering marvel of the C&O Canal Nat'l Historical Park. Bring a flashlight. Moderate to difficult walk due to switchbacks and total distance (~ 4 miles).

FIELD TRIPS: Sunday, August 25

4H Camp
Leaders: Zach Fowler & Austin Persons. Out-and-back hike will starting and ending at Cunningham Lake at the MD 4-H Environmental Education & Camping Center. We will walk along the lake, then upstream to a high-elevation wetland with beaver dams. Moderate to difficult due to rough trails & approx. 4-mi distance; optional walk in wetland.

Asa Durst Homestead Trails
Leaders: Scott Campbell & Dwight Johnson. Enjoyable 4.5 mile hike through rolling forest on old logging roads and single track trails. Explore homestead remnants, stands of pine, spruce, and larch, vestiges of fruit orchards, stream valleys rimmed in rhododendron, and upland hardwood forests that have reclaimed former farmlands. Easy to moderate: two stream crossings & small section of trail crosses a wetland.

C & O Canal at Spring Gap
Leaders: Joe Metzger & Karyn Molines. Before the canal existed, Spring Gap provided a shallow river-crossing of the Potomac River. Years later, Spring Gap was the start of Chief Justice William Douglas's historic walk to Washington, DC to promote the canal as a national park. Expect giant sycamores and oaks, as well as cut-leaf coneflower, asters, and goldenrods. Easy walk.

Crabtree Slopes
Leaders: Dan Boone & Sunshine Brosi. This hike is to an old-growth stand on steep slopes along Backbone Mountain in Potomac State Forest. Moderate to difficult due to distance and hill.

Cranesville Swamp.
Leaders: Jim Howell & Liz Matthews.
Cranesville Swamp is a boreal peat bog relic from the Pleistocene Epoch. Nestled in a mountain valley bowl known as a frost pocket, cold conditions still permit boreal plants to survive. This Nature Conservancy gem is a National Natural Landmark. Easy to moderate on boardwalk and short loop trails.

The Glades
Leaders: Kevin Dodge & Jil Swearingen. One of MD's oldest peatlands, dating back 18,000 years, this is the state's largest and most open peatland. Several species of sphagnum moss are restricted in MD to this and nearby peatlands. The Glades is home to large mammals such as black bears and bobcats. Its unusual ecology creates the necessary habitat for at least ten other state-rare plant and animal species. Moderate; wet & muddy areas.

Parasitic Plants – What are they?

For MNPS, this is the Year of the Parasitic Plant, in which we emphasize these peculiar species in our programs and field trips. But what do we mean by parasitism in plants?

Most plants are "autotrophs", meaning that they feed themselves. Through the process of photosynthesis, autotrophs use energy from the sun, collected by chlorophyll and other pigments, to take carbon dioxide from the air and turn it into carbohydrates (sugars and starches), the building blocks of life. It's a neat trick. Autotrophs make carbohydrates literally out of thin air and use them to fuel their own cellular processes and growth. We then take some of this growth and turn it into houses, clothes, and food. But not all plants work this way. Evolution has shifted about 1% of the plant kingdom off this self-feeding pathway. These plants are called "heterotrophs," meaning they get their energy from consuming other things.

Left: Bastard toad flax, Comandra umbellata. *Photo: Ed Boyd. Right: Bigseed alfalfa dodder,* Cuscuta indecora*, on marsh elder,* Iva frutescens. *Photo: Jim Stasz.*

Ecologically speaking, a parasite is an organism that feeds off a host without providing any benefit in return. Within the plant kingdom there are about 4,500 parasitic species belonging to 28 families. These parasitic species come from 12 or 13 independent evolutionary events, resulting in large variation among them. The one commonality is that they all produce a haustorium, which is a specialized root used to attach to the host, invade its vascular tissue, and transfer nutrients. The word haustorium comes from the Latin haustor, which means "water drawer", and indeed, parasitic plants have higher rates of transpiration than their host plants, allowing them to siphon water and sugar, vampire-like, from their hosts.

The flora of Maryland has four families that contain parasitic plants: The closely related Sandalwood (Santalaceae) and Mistletoe (Viscaceae) Families; and the Morning Glory (Convolvulaceae) and Broomrape (Orobanchaceae) Families.

Most will be familiar with mistletoe (*Phoradendron leucarpum*) in the Viscaceae and dodder (*Cuscuta spp.*), in the Convolvulaceae. Both are obligate stem parasites, as their haustoria penetrate the stems of their hosts, rather than the roots, and they must live attached to hosts; they cannot live independently. Dodders are also "holoparasites" meaning that they completely lack chlorophyll and cannot photosynthesize at all. Mistletoe is one of a number of parasitic plants that still produce chlorophyll and are capable of some photosynthesis, making them "hemiparasites."

In Maryland, bastard toadflax (*Comandra umbellata*) is in a class by itself as our only member of the Santalaceae. All members of the Sandalwood family are parasitic to some degree. The champion of this family is the Death Tree (*Okoubaka aubrevillei*), which is native to tropical Africa and the largest parasitic plant that we know of. Death Trees can grow to 40 m tall and can drain enough nutrients through root parasitism on the surrounding vegetation to create large gaps in the forest, ensuring itself a ready supply of sunlight and a competitive advantage in an otherwise crowded environment. Although not as impressive as the Death Tree, bastard toadflax parasitizes over 200 woody and herbaceous species, giving it the most diverse and largest natural range of any parasitic plant. In botany, the word "bastard" refers not to parentage but means "false" or "of unusual shape or size". In this case, the narrow leaves of this species closely resemble those of true toadflax (*Linaria*), but true toadflax and bastard toadflax are not close relatives.

The Orobanchaceae contains the largest group of parasitic plants in Maryland. This family recently underwent a reorganization to include many hemiparasic members previously placed in the Figwort Family (Scrophulariaceae). The Orobanchaceae now includes plants with all levels of parasitic ability ranging from nonparasitic (*Lindenbergia*) to obligate holoparasites. Among the Maryland Orobanchaceae are squawroot, *Conopholis americana*, the feature plant of this issue, and the familiar beechdrops (*Epifagus virginiana*). Hemiparasitic members of the Scrophulariaceae that were transferred into the Orobanchaceae include members of the false foxglove (*Aureolaria and Agalinis*), Indian paintbrush (*Castilleja*), lousewort (*Pedicularis*), and cow-wheat (*Melampyrum*) genera. These plants all produce chlorophyll, so that casual observer would never suspect they were subterranean thieves. Some members of this group are obligate parasites, but others are facultative and can be grown without attachment to a host; however they are rarely found growing this way in nature.

Host specificity is quite varied among the haustorial parasites. Some species such as dodder can associate with hundreds of hosts in diverse families, while other species, such as squawroot, associate with a small, taxonomically related group of plants, in this case members of the red oak group. Other parasitic plants have just one host. Beech drops associate only with the roots of the American beech (*Fagus grandifolia*). Overall, it appears that the generalist strategy has the greatest chance for survival over evolutionary time, and most parasitic plants are generalists. Interestingly, although many species of parasitic plants can associate with a wide variety of host plants, field studies show that the majority of hosts actually used are from a subset of those possible. Thus, some species may be better hosts than others and the parasite is can discriminate between them. Overall, the best hosts are those that are longer lived (woody), high in nitrogen

(legumes), have easily accessible vascular systems, low defenses, and better access to limiting resources such as deep water during drought.

A third group of plant heterotrophs can also be considered parasitic, although the mechanism these plants use to obtain their nutrition is more convoluted than that of the haustorial parasites. The discovery of this group started two centuries ago with an investigation of yellow pinesap (*Hypopitys monotropa*), a Maryland native. Pinesap has no chlorophyll, and so researchers knew it must be a holoparasite. But researchers in 1821 could not find physical connections to other plant species. Further research through 1885 led to the discovery of mycorrhizal fungi, a group of soil fungi that form mutualistic relationships via the roots of host plant species. These fungi provide nitrogen and phosphorus to their hosts in exchange for carbohydrates. Mycoheterotrophs can subvert this mutualism by tapping into these fungi and using them as conduits to steal water and sugars from the other plants. It wasn't until the 1960's that researchers used radioactive isotope labeling to track the flow of carbohydrates from spruce trees through their mycorrhizal symbionts into pinesap plants. The word "mycoheterotroph" to describe this phenomenon wasn't coined until 1994. Mycoheterotrophy has evolved independently many times, and it occurs in many thousands of species within the liverworts, ferns, fern allies, monocots and eudicots. Many of these species depend on mycoheterotrophy only at the seedling stage, but about 500 species associate with mycorrhizal fungi at all stages of their life cycle.

Wood betony, Pedicularis canadensis.
Photo: Ed Boyd

Indian pipe, Monotropa uniflora
Photo: Jim Stasz

As with the haustorial parasites, mycoheterophs can be holoparasites or hemiparasites, and the hemiparasites can be obligate or facultative. Obligate mycoheterotrophs native to Maryland include the orchid genus *Corallorhiza* and several species of the Heath Family (Ericaceae), including Indian pipe (*Monotropa uniflora*), yellow pinesap (*Hypopitys monotropa*), and pygmy pipes (*Monotropsis odorata*). Mycheterotrophy enables those species to succeed in the low light of understory habitats. Most, if not all, obligate mycoheterotrophs are understory woodland inhabitants.

Hemiparasitic mycoheterophs native to Maryland include spotted wintergreen (*Chimaphila maculata*), American wintergreen (*Pyrola americana*), and Virginia pennywort (*Obolaria virginica*). These species produce tiny dust-like seeds with minimal nutrient reserves, so that, although they can produce some of their own carbon as adults, they rely on parasitism for nutrients as seedlings, making them obligate mycoheterotrophs.

Fungal host specificity among the mycoheterotrophs has a very different pattern than fungal specificity with autotrophic mycorrhizal plants. Mutualistic mycorrhizal symbioses are typically very non-specific, with one species of plant being able to associate with many species of fungi, and one species of fungi able to associate with many different plant species. The pattern in the mycoheterotrophs is much the opposite, with exceptionally high specificity towards fungi, while the fungi remain generalists. Mycorrhizal specificity in mycoheterotrophs is often so extreme that many of these plants will not germinate or develop in the absence of their target fungal symbiont. The driver of these tight evolutionary relationships is thought to be two-fold: the plant must find, among the available fungi, the best match for its nutrient demands, and it also must find a fungus that is either unable to detect it or unable to evict it once its parasitic tendencies are clear. Once a viable fungal candidate has been found, there is extreme selection pressure for the plant to fine-tune its physiology to that particular fungal species, eventually making it incapable of switching to a more distantly related fungal host.

In most years the plant group MNPS highlights is a taxonomically distinct group such as ferns, roses, or milkweeds. This year we've gone a different route and selected parasitic plants, a collection of species that spans multiple plant families and multiple modes of extracting resources from other plants. Now that you've been introduced to this group, enjoy looking for these unique and special components of the Maryland Flora.

~ Vanessa Beauchamp

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2019 Research Grants Awarded

We received a dozen applications this year, and all of them had substantial merit.
Following are the abstracts from the successful applications.

***Parthenocissus quinquefolia:* a potential "workhorse plant" for coastal restoration.**
Amy Gage, graduate student, Rutgers University.
I will plant *Parthenocissus quinquefolia* vines sourced from a variety of habitats into test plots on coastal sand dunes. This experiment will determine if *P. quinquefolia* vines should be included in coastal restoration plantings. It may also result in the discovery of rare coastal *P. quinquefolia* ecotypes.

Fungal interactions as drivers of evolution and speciation in Maryland orchids.
Ida Hartvig, Smithsonian Postdoctoral Fellow, Smithsonian Environmental Research Center
The ecology and evolution of orchids are affected by their obligate dependency on specific fungi for germination. This project investigates the evolutionary patterns of fungal use in native species in the orchid genus *Platanthera* and it will improve our understanding of orchid biology of benefit to conservation of Maryland orchids.

The hidden half of nitrogen fixation: Are the ecological impacts of nitrogen-fixing plants driven by the diversity of their symbiotic bacteria?
Benton Taylor, Smithsonian Postdoctoral Fellow, Smithsonian Environmental Research Center
Maryland's nitrogen-fixing plants and their bacterial symbionts can dramatically alter the fertility of the surrounding ecosystem, but what drives nitrogen fixation rates in these plants is poorly understood. This project will investigate whether the diversity or identity of nitrogen fixers' bacterial symbionts determines the amount of nitrogen these plant bring into Maryland's ecosystems.

The genomics of beech tree defense and the spread of beech bark disease in Maryland.
Samantha Worthy, graduate student, University of Maryland
Fagus grandifolia, a staple tree in Maryland forest, is threatened by Beech bark disease (BBD). The conferring defense gene against BBD has been identified, but not assayed broadly in natural populations. Here, I quantify defense gene genotypes across ontogeny to understand the impact of BBD on Maryland forests.

The effects of lead on leaf traits, distribution, and population genetics of native and introduced *Plantago spp*.
Eric Yee, graduate student, Johns Hopkins University
Industrialization has caused heavy metal contamination in cities like Baltimore, MD, which is highly toxic to most organisms. Introduced plantain species (*Plantago spp.*) hyperaccumulate heavy metals like lead in their tissues. Morphological, reproductive, and genetic trade-offs from hyperaccumulation could have allowed them to outcompete native plantains in cities.

The MNPS research grant program, started in 2013, relies for funds on member contributions and dues. Our website allows donors to specify that their contributions will be used for research. The members of the Research Grant Committee are Vanessa Beauchamp, PhD and Brett McMillan, PhD (co-chairs); Bill Hilgartner, PhD; Kerrie Kyde, MS; Marla McIntosh, PhD; and Kirsten Johnson, MNPS President.

Help DNR Track Watchlist Plants

The Department of Natural Resources monitors and ranks rare and uncommon species. But they don't have the resources to monitor "watchlist" species – those ranked S3. We can help. Pictured here are some that bloom or fruit in mid-summer to autumn. Keep your eyes open!

If you see any ranked plant – Please note the exact location and try to take a photo. Then either contribute the record to the Maryland Biodiversity Project, marylandbiodiversity.com, or send an email to info@mdflora.org. We'll take it from there. Locations of species on private property or likely to be poached will not be shared publicly. You can find the complete list of Maryland's Rare Threatened and Endangered Plants on DNR's website.

Right top: Brown-eyed susan, Rudbeckia triloba. *Right bottom: Wand lespedeza,* Lespedeza violacea.
Left vertical: Short's aster, Symphyotrichum shortii. *Left top: Catberry,* Ilex mucronata. *Left bottom: Common cow-parsnip,* Heracleum maximum.

Invasive Plants and Indirect Interactions – MNPS Research Grant Project

Due in part to a long history of habitat fragmentation and human development throughout Maryland, non-native, invasive plant species are prevalent in many of our forests.

Conservationists and botanists alike are familiar with the wide-ranging negative effects that these plant species may have on native vegetation. Such species modify native plant communities and can cause decreases in native plant diversity, growth rates, and seedling recruitment. Herbivores may preferentially eat the more palatable native plants, and the attractive inflorescences of many non-native plants can also alter plant-pollinator relationships, reducing successful pollination and seed production. Beyond reducing available food for native herbivores, invasive plant species can also cause cascading effects on important predators like spiders by changing prey densities, resulting in a reduced predatory community. Spider communities also depend upon the structure of vegetation in the understory, which can be heavily modified by invasive plants, particularly as several of our resident invasive plants form dense mats or thick stands. Think about forest structure in the presence of lesser celandine or Japanese knotweed! Many people either ignore or abhor spiders; however, these species play critical roles in both the regulation of insect populations and in the transfer of nutrients and energy from insects to higher-level predators.

Experimental patch of Japanese stiltgrass.

Interestingly, there exist a few examples of invading plant species providing potentially beneficial impacts to spiders. For example, spotted knapweed (*Centaurea maculosa*), a forb that invades fields and edge habitats, increased mesh web spider populations more than 40-fold when compared to native grassy habitats in the western United States. Within the knapweed, spider webs were larger and individuals were able to capture more food than in the native vegetation. Closer to home in the East, Japanese stiltgrass (*Microstegium vimineum*) allowed for greater population densities of a predatory wolf spider when compared to uninvaded areas. The higher grass cover created a favorable, moist habitat for juvenile toads, which, in turn, were feasted upon by the spiders. These two brief examples indicate the complex ecological interactions present in systems with invasive plant species.

With funding from Maryland Native Plant Society's Research Grant, I was able to take a closer look into the effects of Japanese stiltgrass on invertebrate communities. Through this project, I hope to better understand the secondary and tertiary impacts of this annual invasive grass on the herbivorous insect and primary predator communities. I hypothesized that reduced availability of native vegetation in stands of stiltgrass would reduce abundance of herbivorous insects, which in turn, coupled with a loss of structural complexity for webs, would reduce abundance and diversity of spider species.

I studied deciduous forests on National Park Service lands in Washington, Frederick, and Montgomery Counties in Maryland. The forests contained multiple invasive plant species and scant understory vegetation, in part due to dense white-tailed deer populations, and they were reasonably representative of forests in surrounding, private lands. Dominant trees included native maple (*Acer spp*), hickory (*Carya spp*), American beech (*Fagus grandifolia*), and yellow poplar (*Liriodendron tulipifera*) while the understory consisted of mostly northern spicebush (*Lindera benzoin*), paw-paw (*Asimina triloba*), and exotic plants such as garlic mustard (*Alliaria petiolata*) and multiflora rose (*Rosa multiflora*), in addition to Japanese stiltgrass. Within each study area, I located patches of Japanese stiltgrass at least 100 square meters in size in the forest interior. Sites were selected with 100% ground cover of stiltgrass. I established a plot in the center of each stiltgrass patch and paired it with a control plot of the same size located outside of the stiltgrass. I used a commercially available leaf blower and vacuum to collect invertebrates on vegetative surfaces, in spider webs, and in other spaces between vegetation in each plot.

Contrary to my hypothesis, my preliminary results show that the abundance of invertebrate taxa, including flies and true bugs, is much higher within patches of stiltgrass as opposed to other areas of the forest. As a direct result of the increase in prey availability, the biodiversity, the species richness, and the abundance of spiders were also much higher in patches of stiltgrass than in control plots. I had predicted that the structural complexity of understory vegetation would play a more prominent role in determining spider diversity and abundance but it was not a significant factor. While vegetation complexity above the forest floor was extremely limited in the presence of Japanese stiltgrass, adjacent forest areas were similarly devoid of understory structure: in spite of limited vegetation, web-building spiders and species that hunt on vegetative surfaces still manage to find suitable habitat.

At first glance, it seems as though Japanese stiltgrass may provide a great benefit for some insects and their predators. However, a further look into subsequent consequences from the changes in invertebrate communities is necessary to fully understand the ecological implications. Will a more abundant spider community negatively affect the survival of other invertebrate species? Does a change in diet to include more flies affect spider physiology? Or subsequently, the health of the birds that need those spiders to raise their young? More research is surely necessary to clear up some of these questions, but these preliminary results point to the complexities of understanding the impacts of invasive species in natural ecosystems. The results of this research will help guide management of invertebrate biodiversity and the prioritization of invasive plant species control in these national parks and potentially other public lands in Maryland.

~ Andrew P. Landsman, PhD

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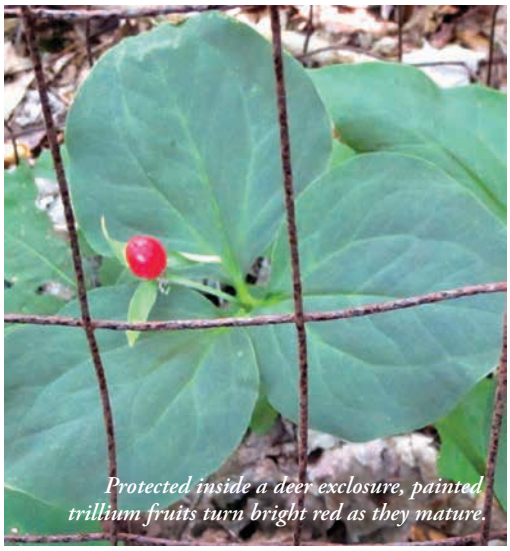
The views expressed herein are those of the author and do not represent the United States Department of the Interior or the National Park Service.

Mountain Maryland Notes

It's May in Garrett County and time to look for a special wildflower that grows on a north-facing slope under a mixed deciduous-conifer canopy on our property. In past years we've counted as many as 100 individuals, though never all in flower. Unfortunately it seems that we're not the only ones searching for this plant. White-tailed deer apparently enjoy the blooms as much as we do. So to give the plants a fighting chance to flower and produce fruit, we place deer exclosures around them. It may seem like a lot of effort, but anyone who has happened upon this wildflower knows that it's worth it. Considered the most strikingly beautiful of all the trilliums in the eastern United States, *Trillium undulatum* is a true jewel of the forest.

Painted trillium's distinctive color makes it easy to identify.

Painted trillium fruit begins to form after pollination.



Protected inside a deer exclosure, painted trillium fruits turn bright red as they mature.

Photos: Boyer & McDowell

Commonly called painted trillium or painted wake-robin, *Trillium undulatum* is a northern species found from Quebec and Ontario south through New England. At lower latitudes it grows only at higher elevations, reaching its southern limit along the spine of the Appalachian Mountains in Georgia. A woodland species that grows well in a cool, rich, acid soil that is moist and well-drained, it also grows in full sun at high elevations further north and along the edge of bogs. In Maryland painted trillium is a true mountain species growing only in Garrett County.

Depending on the taxonomist, painted trillium is placed in one of three families: Liliaceae (lily), Melanthiaceae (bunchflower), or Trilliaceae (trillium). Its genus name 'trillium' simply seems to reflect its whorl of three green leaves and three distinctive petals. But if you take a closer look, you'll see that it also has three sepals, a three-lobed ovary, three styles, and six (three times two) stamens. Its specific epithet 'undulatum' refers to the wavy margins of the petals.

When it's in flower, painted trillium is easily identified by the red to red-purplish marks at the base of the white petals, described as an 'inverted V-shape' by some botanists. But even after the petals have disappeared, the distinctly stalked leaves provide an important clue to its identity. The only other trillium in Garrett County with such petioled leaves is *T. nivale*, a MD endangered species which is a much smaller plant with narrow leaves. In our region, most of the bright red fruits of painted trillium have ripened by late August. Each fruit produces many hard, deep-brown seeds, each with a fatty, protein-rich appendage called an elaiosome. Ants carry the seeds to their colony; feed their larvae the elaiosomes; and remove the 'waste' (seeds). This behavior serves to disperse the trillium seeds throughout the forest.

Speaking of seeds, it is a very slow and extremely difficult process to propagate any trillium species from seed. If you're lucky enough to have a large population of wake-robin, *Trillium erectum*, on your property and manage to beat the ants to a ripe seed pod, you can give it a try. Keep in mind that the seeds are hydrophilic, so they should not be allowed to dry out before being planted. As soon as you collect them, remove the elaiosome (rub it off by hand), plant the seed, and wait. Several years later, you may be fortunate to have a flowering plant. Painted trillium however is a totally different matter. Attempts to propagate this species from seed or division almost always end in failure. If you see *Trillium undulatum* for sale, immediately question the plant's provenance. In all likelihood it was stolen from the wild and 'nursery grown' for a brief time before being sold. So please don't add this incredible northern species to your garden. Instead, treasure and protect this incredible wildflower and its habitat wherever you encounter it.

~ Liz McDowell

References:
Blanchan, N. 1926. Wild Flowers [adapted by A.D.Dickinson from "Nature's Garden"]. Garden City, NY: Doubleday, Page & Company.
Cullina, W. 2000. New England Wildflower Society: Guide to Growing and Propagating Wildflowers of the United States and Canada. Boston: Houghton Mifflin Company.
Hemmerly, T.E. 2000. Appalachian Wildflowers. Athens, GA: University of Georgia Press.
Newcomb, L. 1977. Newcomb's Wildflower Guide. Boston: Little, Brown and Company.
Spira, T.P. 2011. Wildflowers & Plant Communities of the Southern Appalachian Mountains & Piedmont. Chapel Hill: University of North Carolina Press.

Websites:
Ladybird Johnson Wildflower Center wildflower.org
Maryland Biodiversity Project marylandbiodiversity.com
USDA National Plant Database plants.usda.gov

Upcoming Events

All MNPS sponsored events are free and open to the public unless otherwise noted. Pre-registration is required for many field trips, and early registration is usually offered to members. Unless otherwise indicated, MNPS field trips are generally geared to adults. New field trips and programs are continually being scheduled. See our website, mdflora.org, for up to date listings and details.

Field Trips & Other Outdoor Events

May 29, Wednesday, 9:00 – 11:00
St Luke's Restoration of Nature
St Luke's Church, Annapolis, Anne Arundel Co
Leader: Ellie Chetalat

June 9, Sunday, 10:00 – 2:00
Ferns on the Gunpowder
Gunpowder St Park, Kingsville area, Baltimore Co
Leader: Dwight Johnson

June 12, Wednesday, 9:00 – 10:30
June 25, Tuesday, 9:00 – 10:30
Weed or Wildflower?
New Germany St Park, Garrett Co
Co-sponsored with Friends of New Germany St Park
Leaders: Christine Campe-Price and Liz McDowell

Date and Time TBA
Baltimore Botany by Bike
Leader: Brett McMillan

FIELD TRIPS!

As of May 19, MNPS had sponsored 37 field trips in 2019! So we're well on track to break our record. Thanks to all our field trip leaders, and especially Marney Bruce, who has already led 10 field trips this year in Montgomery County's special natural areas.

Programs

May 28, Tuesday, 7:30 PM, doors open at 7:00
The Mushroom Chronicles: Why Plants Need Fungi
Kensington Library, Kensington, MD
Speaker: William Needham, President, Mycological Ass'n of Washington, DC

June 25, Tuesday, 7:30 PM, doors open at 7:00
How to Recognize Old Growth Forests & What Makes Them So Special
Kensington Library, Kensington, MD
Speaker: Joan Maloof, Executive Director, Old Growth Forest Network

July 30, Tuesday, 7:30 PM, doors open at 7:00
Dark Secrets on the Forest Floor: Parasitic and Hemiparasitic Plants of Maryland
Kensington Library, Kensington, MD
Speaker: Margaret Chatham, Virginia Native Plant Society

August 27, Tuesday, 7:30 PM, doors open at 7:00
Area-Wide Tick Control in Suburban Communities
Kensington Library, Kensington, MD
Speaker: Patrick Roden-Reynolds, UMD Graduate Student

September 24, Tuesday, 7:30 PM, doors open at 7:00
From Mountains to Saltmarsh: Rediscovering MD Ornithological Soc'y Sanctuaries
Kensington Library, Kensington, MD
Speaker: Martha Watson, PhD

One of our sponsored field trips in 2019 — Gillis Falls Park, Frederick Co in April.

Become a member. Join online: www.mdflora.org.

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A Publication of the Maryland Native Plant Society

In this Issue

Maryland Native Plant Society
PO Box 4877
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Maryland Native Plant Society Conference 2019
Co-sponsored by Frostburg State University Department of Biology

Ancient Forests & Peatlands
of Western Maryland

SATURDAY August 24th & SUNDAY August 25th
Frostburg State University, Frostburg, MD.

Register On-line at www.mdflora.org