Sempervirens

Spring 2017 | The Quarterly of the Virginia Native Plant Society

'Nature Knows No Boundaries'

Save Sept. 29–Oct. 1 for the Tri-State Native Plant Conference, Shepherdstown, W.Va. • By Suzanne Dingwell

When is the Annual Meeting not the Annual Meeting? When it's the Tri-State Native Plant Conference, that's when! This year the native plant societies of Virginia, Maryland, and West Virginia will convene in Shepherdstown, W.Va., for what promises to be a memorable event. The conference, titled "Nature Knows No Boundaries," kicks off the afternoon of Sept. 29 and runs through Sunday, Oct 1.

The Potowmack Chapter, host of the Virginia Native Plant Society's Annual Meeting this year, began planning for a tri-state event in 2011, when discussions turned to the hard fact that Metro D.C. is not really conducive to convening large groups. Though we have some rare and wonderful locations for walks, the traffic and costs are generally discouraging to many.

On the other hand, a number of our chapter members remembered with fondness the 2003 Conference, put on by the Maryland Native Plant Society, when the confluence of all three organizations provided a lively synergy and an unparalleled opportunity for networking. Part of the success of that gathering was the setting: the National Conservation Training Center of the U.S. Fish and Wildlife Service, in Shepherdstown, a venue with its own well-deserved reputation. The Tri-State Conference will be held there again this year.

Cindy Gustafson stands alongside an ancient Tulip-tree (*Liriodendron tulipifera*) at Ferry Hill. Below: The HQ of the Tri-State Conference. (All photographs by R.H. Simmons)

The grounds at the NCTC are secluded and lovely; the buildings are modern, convenient, and comfortable. You can walk from your room in the lodge buildings to your meal in the dining hall without having to think about your car at all! We will be offering a wide variety of field trips both on and off campus, as well as workshops, talks, and roundtable discussions.

Field trips will be offered at many locations, including Ferry Hill, Snavely's Ford, several locations on the C&O canal towpath, Stauffer's Marsh, Yankeur Preserve, Ice Mountain, Catoctin Mountain, Greenbrier State Park, Cool Spring Preserve, Shannondale Wildlife Man-

agement Area, Eidelon Preserve, the Blue Ridge Center for Environmental Stewardship, Snyders Landing, and Cranesville Swamp. There will be tours, both historical and botanical, at Antietam. There will be walks on the NCTC grounds, each with its own focus, such as grasses, trees, and native plant communities.

Near-vertical, north-facing limestone cliffs with an overhanging American Arborvitae (*Thuja occidentalis*) are among the sights to be discovered at Ferry Hill.

And there will be workshops! We have Lara Call Gastinger, chief illustrator of the *Flora of Virginia*, coming to do a workshop titled "Maintaining a Field Sketchbook." She promises to teach us how to observe and document plants, and how to successfully maintain a record of our work. Vincent Viza-chero, owner of the native plant design and consulting firm NativEcology, will give a workshop on designing your home garden using plants that grow harmoniously in their own native plant communities. Rodney Dever and Mark Lesser, from Shepherd University, will give a tree walk combined with a session on tree identification in a laboratory at the university. We will have workshops on how to use iNaturalist, the Citizen Science project using crowdsourcing of photos for data gathering; on learning the meaning of botanical names; and, if there is enough interest, on GIS mapping.

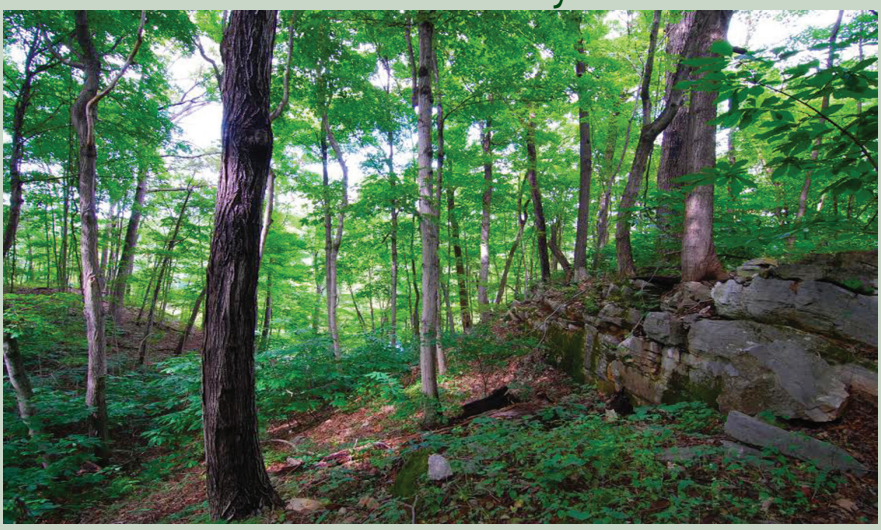
Students from Shepherd will present poster sessions, too; and Bland Crowder will be on hand with the latest on news of the new Flora App. He tells us he is hoping to demonstrate an advanced prototype.

Wesley Knapp, a 15-year veteran of the Maryland Natural Heritage Program and now mountains botanist and ecologist with the North Carolina Natural Heritage Program, will be one of our keynote speakers. Rodney Bartgis, who was a botanist with both the Maryland and the West Virginia Natural Heritage programs before serving 12 years as the West Virginia state director for The Nature Conservancy, will also give a keynote address. The wealth of knowledge brought to the conference by these two gentlemen will certainly enrich the experience of all who come to hear them speak.

You can let us know about your interest in any of these workshops or topics and suggest other idea for trips or workshops. Registration opened June 1 at VNPS.org; click on Tri-State Native Plant Conference under Events. Get ready. It's going to be great! ❖

Prime Cove and Slope Forests Will Be Visited at Ferry Hill

Ferry Hill, part of the C&O Canal National Historical Park, will be the site of several field trips on offer at the Tri-State Native Plant Conference this fall. Perched majestically on a bluff overlooking the Potomac, the site is cherished for its historic and ecological value. Home to nearly pristine old-age rich cove and slope forests, it is one of Maryland's finest examples of this community type. A diversity of evergreen ferns and bryophytes is found at the base of the cliffs, along with many other native plants. ❖

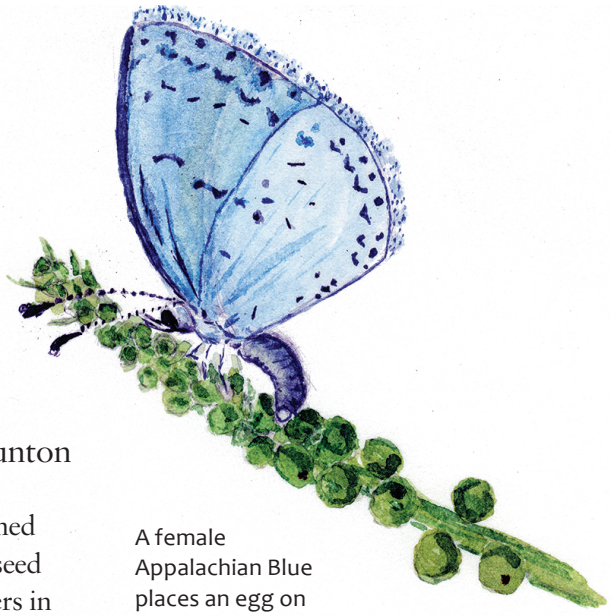


Among the plants to look for along the limestone cliffs at Ferry Hill is American Wall-rue (*Asplenium ruta-muraria*).

Black Bugbane & The Blues

Interactions Between our Wildflower of the Year and the Insect World

By W. John Hayden, Botany Chair. Illustrations by Nicky Staunton



A female Appalachian Blue places an egg on *Actaea racemosa.*

No, this article has nothing to do with American Roots music. Black Bugbane is one of several common names for the 2017 VNPS Wildflower of the Year, *Actaea racemosa*. And Blues refers to a subfamily of lycaenid butterflies, commonly referred to as Blues or Azures. The interactions between Black Bugbane, a.k.a., Black Cohosh, Appalachian Azure butterflies (*Celastrina neglectamajor*), and ants was recently summarized by VNPS charter member and past president Nicky Staunton (2015). In brief, Black Bugbane is the sole food source for caterpillars of Appalachian Azure butterflies, a situation that, superficially, might seem like any other caterpillar and host plant association. As is so often the case, however, it is the details that make this story exceptional. First, these gray, sluglike caterpillars feed preferentially on flowers and flower buds of Black Bugbane. Further, as they feed, they create minute vibrations that summon the attention of ants, who, in turn, feed on secretions produced by the caterpillars. In essence, the caterpillars process plant flowers and buds into food that ants readily consume. In return, ants will aggressively defend both plant and caterpillars from other animals. As long as there are not too many caterpillars per plant, unconsumed flowers will complete fruit and seed production, and all three partners in the relationship benefit: caterpillars become butterflies, Black Bugbanes make seeds, and ants get fed for their efforts.

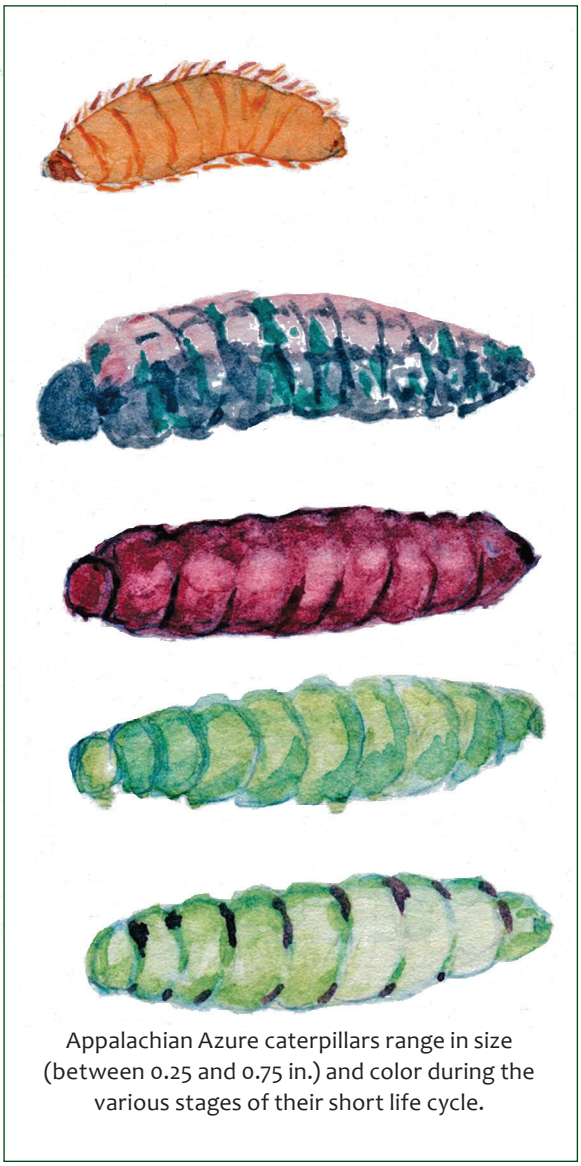
While learning about Black Bugbanes and their Blue/Azure butterflies, I started reading about related butterflies and their host plants, and I was struck, on the one hand, by the broad parallels in the relationships between these other Blues and their host plants. On the other hand, the small differences in their natural histories were intriguing.

One of the first things that I learned was that there are several similar and, evidently, closely related Azure butterflies in eastern North America that use flowers as larval food plants. In addition to the Appalachian Azure, a specialist restricted to flowers and buds of Black Bugbane, we have: the Spring Azure, whose primary food plant is Flowering Dogwood (*Cornus florida*), but it is also known to use Blueberry and Viburnum flowers; the Summer Azure, whose primary flood plants are summer-flowering shrubby Dogwoods (e.g., *Cornus ammomum*) as well as a variety of other plants; and the Cherry Gall Azure, also known to consume flowers of various plants but, as the name implies, it feeds mainly on the finger galls commonly found on the upper leaf surface of Black Cherry (*Prunus serotina*)—which is flat-out, mind-bendingly bizarre. Tiny little mites form minute finger galls on the leaf and the caterpillars eat the finger galls, mites and all!

Dorsal views of Appalachian Blues, female, left, and male. This is the largest Azure butterfly.

Though morphologically similar, and evidently closely related, these butterflies exploit different food resources. As such, these caterpillars and their food preferences illustrate the general ecological principle known as niche differentiation; because food is the distinguishing environmental factor involved, this appears to be a special case of niche

differentiation called resource partitioning. What's interesting is that specializing on flowers (or other highly seasonal food items like finger galls on cherry leaves) has profound effects on other aspects of the natural history of these butterflies. For example, seasonal emergence, mating, and egg-laying by adult butterflies are necessarily closely tied to host plant flowering season (or gall formation). Of the species discussed here, the Spring Azure is active in early spring, and because the flowering period of Flowering Dogwood is relatively brief, this butterfly is univoltine—adults have to emerge and mate and females have to lay their eggs to initiate the next generation at just the right time for those hungry little caterpillars to have access to buds and flowers of Flowering Dogwood. Consequently, there is just a single generation of Spring Azures per year, which is the definition of univoltine. In contrast, food plants for the Summer Azure bloom all summer long; these butterflies can be active from June to October and may progress through two or three generations per season—i.e., it is multivoltine. Wedged between the flight periods of Spring and Summer Azures, we have flights of the Appalachian Azure and the Cherry Gall Azure; these are both univoltine species for which the establishment of their new generation coincides with flowering time of Black Bugbane and the emergence of cherry leaf finger galls, respectively.



Appalachian Azure caterpillars range in size (between 0.25 and 0.75 in.) and color during the various stages of their short life cycle.

For these Azure/Blue species, host food plant preference exerts profound influence on other aspects of the natural history of these closely related butterflies. We have seen how food preference influences time of breeding season and number of broods per year. Because breeding seasons are separated in time, it is unlikely that Spring Azures will have an opportunity to mate with Summer Azures, and the same can be said of other combinations of butterflies within this group. These Azure/Blue butterflies appear to be reproductively (genetically) isolated from one another—at least to a large extent. As reproductively isolated entities, each species occupies a different evolutionary trajectory.

Another consequence of specializing to a host plant is the acquisition of some sort of biochemical strategy for dealing with the different protective compounds produced by these plants. Black Bugbane makes steroidlike molecules, dogwoods protect themselves with iridoids, and cherries defend themselves with molecules that release cyanide. To some extent, feeding preferentially on buds and flowers might be part of the toxin-avoidance strategy that three of these species of caterpillar employ, because flowers and buds are likely to contain lower concentrations of protective compounds than leaves or mature fruits and seeds. Nevertheless, some facility in overcoming a host plant's toxins is essential. An anecdotal observation illustrates the importance of adapting to particular plant toxins. Appalachian Azure caterpillars can eat toxic Black Bugbane leaves if the host plant has been depleted of buds and flowers; Summer Azure caterpillars will also eat Black Bugbane buds and flowers, but they will die if forced by necessity to eat leaves of the same plant.

It may be common to think of plants as hapless victims of herbivores, and perhaps to some extent they are. But plants do fight back with chemistry and, over time, the diverse molecules they deploy have profound impacts on their herbivores. If you are an Appalachian Azure caterpillar, you are what you eat, and what you eat is Black Bugbane. Black Bugbane not only made the physical substance of every Appalachian Azure flitting in the forest, it also determined profoundly important aspects of their natural history.

WORK CITED

Staunton, N. 2015. Fairy candles, butterflies and ants. Blazing Star 16(2): 13–15. [Reprinted in Wild News (04): 3–4.]

From the President

Plants Need More Advocates

Recently I had the honor of representing the Society on a conference call held by the Native Plant Conservation Campaign (NPCC), which is led by Emily Roberson out in California. The NPCC is a network of 46 affiliate native plant societies and other native plant conservation organizations throughout the United States representing about 150,000 native plant advocates. Its mission is to promote the conservation of native plants and their habitats through collaboration, education, and advocacy. The VNPS has been an affiliate since 2002. The original NPCC action plan for 2017 had been to focus on funding at the federal level, but, given the current political climate, its emphasis has shifted to advocacy at the local level.

Our two-hour conference call did not allow for much in-depth discussion, but each of about 20 participants shared successes and challenges. The NPCC's Roberson noted that she had recently joined the advisory board for the 12th annual Endangered Species Day, which was observed on May 19. An advocate for curing plant blindness, she is a voice for the recognition of endangered plants, which are all too often overlooked in favor of charismatic animals. Learn more about the efforts of the NPCC online at www.plantsocieties.cnps.org.

Many of the affiliates mentioned successes relating to forming partnerships, using citizen science, and capitalizing on the interest in plant–pollinator relationships. A number of native plant societies, including the VNPS, offer some research grants of varying levels. The small Alabama Native Plant Society awards a $5,000 scholarship to a student studying botany. The Arkansas Native Plant Society partners with the Arkansas Natural Heritage Program in a seed-collection initiative through which they provide farmers with native-seed mixes. The California Native Plant Society enjoys 10,000 members, a budget of nearly $2.5 million, and more than 25 employees. Its budget base is one-third membership dues, one-third grants, and one-third fees for services, such as scientific surveys. Colorado has created a YouTube channel and has capitalized on the monarch–milkweed connection. It also hosted a virtual plant sale with pickup sites scattered around the state, which turned out to be a successful fundraiser.

A number of our fellow organizations mentioned the challenge of developing more ways of reaching out to people. Other difficult issues mentioned included the engagement of more young people and the development of members at the leadership level, matters of particular concern to the VNPS as well.

The VNPS is at a crossroads now. We have nearly 2,000 members, but some chapters are in danger of folding. We closed the Fredericksburg Area Chapter a few years ago for lack of leaders, and now the Shenandoah Chapter has requested to fold for the same reason. Plants need us as advocates! Please consider stepping up and taking a turn on the board of directors of your chapter or the state organization. You will help the Society and native plant communities—and maybe make some friends as well.

Neither a plant nor a field guide is in sight, but these folks engaged in important advocacy work for Virginia's native plants and ecosystems during a recent state board meeting. The Society needs more people willing to be leaders and advocates for Virginia's natural world. If you'd like to volunteer your talents and interests in such ways, please write nvehrs1@yahoo.com, and we'll get right back with you. (Nancy Vehrs photo)

SOLD-OUT WINTER WORKSHOP

'Under Stories, Small Communities, and Secret Agents'

By Peggy Troyer
South Hampton Roads Chapter

Crowded house: Attendees were captivated by four excellent presenters at Winter Workshop 2017. (Jonathan Stevens photo)

It was a full house at the auditorium of the University of Richmond, for the VNPS's Winter Workshop 2017 on March 4. The theme was "Under Stories: Small Communities and Secret Agents."

Opening speaker **John Townsend** shared with us his new passion for mosses and liverworts. Staff botanist with the Virginia Natural Heritage Program and a coauthor of the *Flora of Virginia*, he had focused almost solely on vascular plants until last year when he attended a class at Highlands Biological Station in North Carolina. When we watched his video on identifying the mosses in a sample, there was groaning from the audience, as he was using two microscopes in addition to his loupe. If you can't see the cell structure, well, just forget it! Just kidding, you'll at least be in the ballpark. Waterfalls are prime collecting sites, as the humid air promotes all kinds of bryophytes. He estimates that Virginia has 580 species.

We got to see some interesting species. *Campylopsis carolinae* likes to grow under Longleaf Pines (*Pinus palustris*). This moss is often mostly hidden in sandy soil, with a few little hairs sticking out. Where else is this species found? Why, in Brazil, of course! Some species are quite localized, others have an amazing range.

If you find a dry specimen, whatever the moss, add water and voilà! In seconds the leaves plump out and become easier to identify.

Because identification involves magnification, John gave us some photography tips—like getting a bracket to connect your cell phone's camera to the eyepiece of your scope. To get clearer, more descriptive photos of the moss in question, John recommends photo stacking. This is how a CT scan works, by the way. You take multiple pictures, adjusting the focus one or two clicks between shots, then stack the pictures for one 3-D photo. There are apps for this. My husband the pathologist was very interested in this approach.

At the suggestion of Tom Wieboldt, John dragged his moss mentor from Highlands to the Pinnacles of Dan and other spots, where they identified some moss species never recorded for Virginia. John loves his new pursuit of smaller plant life that "forces" him to visit stunning waterfalls and other sites across the state. Interest in bryophytes is relatively new! Get those magnifiers out and check your surroundings!

We moved on to a marvelous presentation on lichens by **Manuela Dal Forno,** a National Science Foundation postdoctoral research fellow with the Smithsonian Institution. Lichens are the result of wonderful symbiotic relationships, with fungi providing structure and protection and algae or cyanobacteria (blue-green algae) providing the photosynthesis, in other words, the mycobiont and the photobiont, depending on how classy you feel. And by the way, Manuela had a photo of a car covered in lichens. and says to just move your car periodically to avoid this. Lichens come in multiple forms—crustose, foliose, fruticose, gelatinous, dimorphic, filamentous, and squamulose. They grow on multiple substrates because, thanks to the photobiont portion, they are self-sufficient. They produce some crazy chemicals. Sunscreen! Water control! Inhibition of competing

species for the space! One variety is poisonous to foxes and wolves! They are used in creating the dyes that color Harris tweeds, in perfumes, and in litmus paper.

Lichens are considered lichenized fungi and they are named by the fungus involved. These fungi no longer exist separately from their photobiont, and some lichens are tripartite—they include one fungus species and two photobionts. By DNA studies, which is how they definitively identify various lichens, they have also found lichens with additional bacteria outside the fungal structure, and yeasts in the cortex, or fungal sections. These lichens are considered hyperlichenized fungi. More than 19,000 fungi are lichenized, and they did not come from a single ancestor.

When you're identifying a specimen of lichen, how the underside looks is very important. Don't just note the top, flip it over.

Reproduction is sexual (by spores), in which case the fungus has to find its little algal or bacterial buddy after reproducing, or asexual, which involves the whole package's reproducing. The fungus gets a bit of its alga or cyanobacterium to get things going. Multiple species can be found in close proximity, as in the mosses.

Mary Jane Epps's presentation was titled "Lifting the Veil: A Hidden World of Plant–Fungal Interactions." Good thing she was so interesting, because she spoke right after lunch! She discussed fungi that are present in leaves, roots, and flowers of vascular plants. (They're even on mosses and liverworts!)

Fungi living inside of leaves are said to inhabit the *phyllosphere*. Many of these are endophytes, that is, they get nutrition from the plant, though they don't cause disease. They can have various effects on host plant ecology, including some interesting effects on the herbivores that might happen to ingest the host plants.

Tall Fescue (*Schedonorus arundinaceus*), if infested with a certain fungus, can cause fescue toxicosis when ingested. In cattle this results in weight loss, heat stress, and foot rot. In voles, it reduces reproductive capacity. (Can I put some on the leaves of my garden plants?) Juncos and Canada Geese suffer weight loss when eating endophyte-infected fescue seeds.

In Panama, says Mary Jane, one pioneering study treated cacao trees, from which we get chocolate, with a pathogen in the genus *Phytophthora*, which also includes the species that caused the Irish potato famine. Cacao plants exposed to the disease, but hosting their friendly endophytes, experience only a quarter of the leaf drop that afflicts untreated plants. Some farmers are already using this technique.

On the down side, spotted knapweed, an invasive, has endophytes that make it stronger. They increase levels of a chemical in the soil that inhibits other species' growth, increase its drought resistance, and manufacture growth hormone to bolster host plant growth. *Boo*.

In the *rhizosphere*—the realm of plant roots and surrounding soil—mycorrhizal fungi colonize root tips of almost all land plants. They enhance nutrient and water uptake, receive sugars from the plant, and greatly increase the absorptive area around the host plant's roots.

They come in two forms. *Arbuscular mycorrhizal* fungi (AMF) form a treelike structure within root cells of the host plants. These fungi are so ancient they have been found in fossil roots more than 400 million years old. They are thought to have facilitated the move of plants from aquatic to shoreline to dry-land locations. The fungus is on the inside, the photosynthesizing plant around it in the root cells. In our flora Jack-in-the-pulpit, Columbines, Trout Lilies, Trilliums, Wild Ginger, and Ladies'-tresses have AMF, as do a few trees, including Maples, Walnuts, Tulip-tree, and Ashes. In the tropics, most trees have AMF.

Hayden Honored with Surprise Award

At the Winter Workshop we surprised John Hayden with a special distinguished service award in gratitude for his contributions to the Virginia Native Plant Society. John has served as our board's Botany Chair since 2003 and has written the Wildflower of the Year brochures and regularly contributes scientific articles for *Sempervirens*.

A professor of biology at the University of Richmond, John has been our liaison there for the Workshop. In addition, he has sat on the Research Grants Review Committee since its inception in 2015 and led the Seeds of Success effort in 2005. John participates on social media and patiently answers plant identification queries posted there. He is an active member of the Pocahontas Chapter, frequently presents chapter programs, and teaches botany to Master Naturalists.


John Hayden

In recognition of his accomplishments, VNPS presented John with the framed award as well as a gift. John is an active gardener and lives on several acres in Powhatan County. With the aid of his family in the gift selection, we presented him with a weed wrench that he can use to tackle invasives on his property. Thank you for your continued service, John! ***—Nancy Vehrs***

The rest of the party has *ectomycorrhizal fungi*, or EMF. Here, such trees include Pines, Oaks, Beech, Birches, Spruces, Firs, and Chestnut. The fungi provide or assist in uptake of nitrogen, phosphorus, and water. They grow between the root cells and form shaggy sheaths around the roots. Many of the mushrooms we see in the yard are the fruiting bodies of EMF fungi.

In British Columbia, an interesting symbiosis was found between Douglas Fir and Paper Birch, facilitated by fungi that link trees together underground via a mycorrhizal network. During the summer, when the birch leaves are out and shading the younger Douglas Firs, sugar produced by the birches flows through their mycorrhizal fungi and into the firs. In the fall, when the birch have dropped their leaves and the firs have more sun exposure, the flow is reversed as the firs feed sugar to the birches.

Parasitic plants like Indian Pipe and Pinesap trick the mycorrhizal network to feed them the sugars they normally collect for themselves.

Black Walnut and Garlic Mustard produce chemicals that in the soil can destroy the mycorrhizae of surrounding plants. This is likely how garlic mustard can establish itself even within a well-established native plant population. We don't yet know how long, after removal of those stinkers, the poison remains active in the soil.

Also awaiting research is fungi in flowers. While nectar is thought to be sterile until the flower opens, very soon afterward it is commonly infected with yeast. These yeasts serve to alter sugar content, amino acids, and even the aroma of the flower, which can have various implications for pollination. This is hot-off-the-press research. In fact all of this fungal research is pretty new, Mary Jane said, and has been done primarily in the western United States, Europe, and Canada. Get out your grant applications—the field is wide open for Virginia and the East Coast!

On their lunch break, workshop participants peruse publications at the Blue Ridge PRISM exhibit. PRISM stands for Partnership for Regional Invasive Species Management. (Nancy Vehrs photo.)

Jason Davis, a neurophysiologist at Radford University and a *Virginia Wildlife* contributor, wrapped up the workshop with a lively discussion of plants that produce chemicals that are neurologically active in animals. Mostly this serves to ensure that they are eaten by the species that are most useful to their propagation.

Capsaicin, the zinger in chili peppers, affects mammals but not birds. Birds neither chew up the seeds nor deposit them close to the adult plant, so they are the beneficial consumers. Jason noted that we humans foil this system, because we can anticipate a secondary gain. Once the pain receptors are tingling from the capsaicin, we release endorphins to cope with the pain, and they feel good. So we, or certain ones of us anyway, are willing to endure the pain for the soothing response that comes next.

Cucurbitacin, from the cucumber, is a steroid blocker. It stops insects from molting, so they can't mature.

Legumes produce phytoestrogens, known as isoflavinoids. These act as birth control for smaller mammals and birds. Production is increased during times of drought. Keep your furry paws off!

Alkaloids are produced by 20 percent of plants studied. These include caffeine, nicotine, strychnine, and morphine. Caffeine blocks adenosine, which is a neurotransmitter of sleepiness or fatigue. Nicotine stimulates acetylcholine, another neurotransmitter. When at toxic levels, nicotine can produce seizures and heart failure. Insects are more sensitive than vertebrates, so they are affected first. This is why putting tobacco in your garden reduces insect invasion.

Urushiol—from our friends Poison Ivy, Poison Oak, and Poison Sumac—actually causes an autoimmune reaction: the body turns on itself.

Insects fight back, in the form of galls, in which the plant produces a lot more of what the insect wants to eat. Plants go after each other, roo, with sunflowers reducing germination rates in surrounding plants; rice's "foolish seedling disease" causing tall but weak seedlings; and sorghum and Black Walnut making it difficult for competing plants to grow near them.

Our membership's interest in the smaller plants is clearly on the rise and presents exciting opportunities. And areas where more study would be welcome became apparent. Our thanks to the Pocahontas Chapter for hosting the workshop and the Piedmont Chapter for offering books for sale. ❖

Mosses and Their Kin: New Avenues for Virginia Botanists

From Your Natural Heritage Program
By John Townsend

In the last issue you heard about a new foray into the world of pollinators, particularly bees, being made by zoologists with the Virginia Natural Heritage Program. While our zoologists have been digging into the world of invertebrates for many years, our botanical efforts have focused almost entirely on vascular plants—until now.

These cryptic species seem to be experiencing an upswing in popularity with the public, but they have always been a focus of the scientific community worldwide. This combination of ready scientific expertise and a heightened level of interest among amateur naturalists has spawned specialized field guides, numerous classes, and restoration projects, as well as works of nonfiction, novels, and poetry. Thankfully, Virginia Natural Heritage has benefited from related training opportunities and now has enough experience to include these plants as inventory and protection targets.

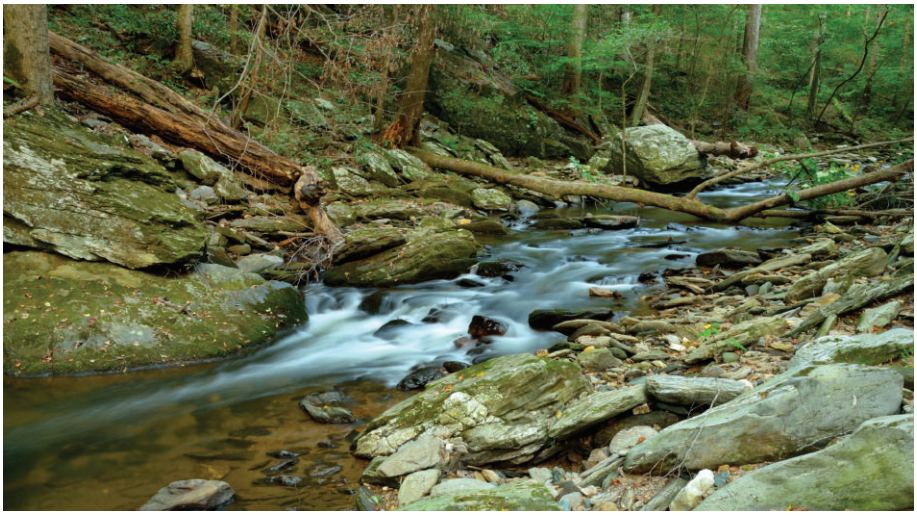
Two challenges faced when delving into any poorly known and highly technical group are 1) how to identify the organisms and 2) of the species you identify, how to know what is rare and what is common. All of our inventory efforts at Heritage are works in progress, but the obstacles presented by these technical groups mean we must be cautious with notions of rarity. Luckily, the advent of large museum databases has made the process of winnowing down a list of conservation targets much easier.

Recent field work has already uncovered regionally and globally rare species, some found in areas previously unexplored by Heritage botanists. The liverwort Appalachian Threadwort (*Drepanolejeunea appalachiana*), a globally rare species with tropical affinities, was discovered recently in the Dan River Gorge, a dramatic landscape feature with very little inventory history. This Appalachian escarpment gorge also yielded Virginia's first records for two other species, one of which—*Lejeunea blomquistii*, or Blomquist's Leafy Liverwort—is endemic to the southern Appalachians and globally rare. Our newfound ability to survey for such species has finally enabled us to recognize this spectacular gorge for its biological significance, in addition to its famously dramatic topography.

Many rediscoveries of rare bryophytes have been made on our Natural Area Preserves and other public lands. These efforts often follow on the heels of other scientists' generalized collecting, allowing us to refine what is known about these populations. Successes include rediscovering several rare mosses and liverworts from the high elevations of Mount Rogers, relocating a rare moss known from the calcareous forests of Natural Bridge, documenting the rare Keever's Bristle Moss (*Orthotrichum keeverae*) at Bald Knob Natural Area Preserve, and locating populations of a globally rare moss at the Blackwater Ecological Preserve and South Quay Sandhills Natural Area Preserve, properties known for numerous Longleaf Pine–associated rarities. Deeper understanding of our preserves has already been gained through this renewed inventory effort.

Any foray into the biological unknown is invigorating and rewarding. With this new effort, we continue a long tradition of pushing the boundaries of what is known and putting that knowledge to work in a very practical manner. Recalling Aldo Leopold's admonishment to "keep every cog and wheel …" of the natural apparatus, we are again pushing ourselves to learn the many parts that make it all work.

—John Townsend has been staff botanist with the Virginia Department of Conservation and Recreation's Division of Natural Heritage since 2001. He conducts rare-plant inventories across the state as well as learning and documenting the flora more broadly, including being coauthor of the Flora of Virginia.



The Dan River Gorge is a showcase habitat for cryptic species. (John Townsend photo)

VNPS Awards 3 Research Grants for 2017

The Board of the Virginia Native Plant Society has announced three recipients of the Society's Research Grants for 2017. The grants total $15,000, and 11 applications were received. The projects we funded for 2017 are described below.

The Research Grant Program awards funds for well-defined projects whose results can be evaluated and which address the Society's goals and mission. VNPS research grants should advance our understanding of the biology of native plants and their relationship to their ecosystems; teach students about the importance of native plants and habitat preservation; measure the benefits of native plant habitats to the economic and environmental health of the commonwealth; or address similar topics.

This is the program's third year. A call for proposals will go out this fall for next year's grant cycle. Check our site, vnps.org, for information.

—Joyce Wenger, Publicity Chair

Four evolutionary species in Early Violet (*Viola subsinuata*) in Va.

Under the leadership of Harvey Ballard, an associate professor of biology at Ohio University, this project will complete critical studies on multiple undescribed violet species lurking in Virginia. Opinions on the taxonomy of North American violets have diverged widely over the past century, especially with regard to delineations and taxonomic status of species in the acaulescent blue violets (*Viola* subsection *Boreali-Americanae*).

The team has been studying acaulescent blue violets in Virginia, including *Viola subsinuata*, using intensive field methods, herbarium collections, and evidence from macromorphology, micromorphology, reproductive behavior, genetic diversity based on microsatellite variation, and ecological niche to detect and delineate evolutionary species.

They have applied the unified species concept as an objective filter for inferring which sets of populations deserve species recognition. Their preliminary studies have confirmed at least seven distinctive phenotypes probably representing distinct species, including four in western Virginia.

This project will complete these studies to document the geographic distribution of all four phenotypes in Virginia, provide a detailed analysis of niche differentiation among them, and permit the objective evaluation of the taxonomic and evolutionary status of these phenotypes based on morphological traits, reproductive behavior, genetic differentiation and microhabitat preference. The results will be presented at a regional and a national conference in 2018, and will be published as two journal articles. A full set of voucher specimens will be submitted to the Massey Herbarium at Virginia Tech, and the final report will be given to VNPS and the Virginia Natural Heritage Program. This project will enhance the knowledge of Virginia's incredible plant diversity.

Biotic Disturbances and Tree Mortality in Va. Blue Ridge

This project will be led by Kristina J. Anderson-Teixeira of the Smithsonian Conservation Biology Institute (SCBI), in Front Royal, and Alan J. Tepley of the Smithsonian Institution. It focuses on the effects of biotic disturbances—insect pests and pathogens—on forests of Virginia's Blue Ridge ecoregion. Insect pests and pathogens are a leading cause of mortality in the region, yet their impacts have yet to be quantified.

A student intern will conduct an annual tree-mortality census of a large (26 ha) forest-dynamics plot at the SCBI this summer. The project team will use data from this plot and more than 200 forest monitoring plots at SCBI and in Shenandoah National Park to quantify the impacts of biotic disturbances on forest mortality, biodiversity, productivity and biomass. They will test the hypotheses 1) that biotic disturbances are the largest driver of mature-tree mortality and have substantially reduced the abundance and biomass of host tree species throughout the Blue Ridge ecoregion; and 2) that, over the past three decades, biotic disturbances have reduced biodiversity and caused modest reductions in forest productivity and biomass.

As these hypotheses are novel, not only for the Blue Ridge ecoregion but also for forests anywhere in the world, this study will help improve general scientific understanding of the net impact of biotic disturbances on forest diversity, structure, and function. Beyond the scientific advances that it will achieve, this project will yield several additional benefits. The 2017 mortality census will bridge a critical gap between the previous census, in 2016, and the next scheduled full-plot census, in 2018, and it will also push the data record past the threshold required to use it as a basis for application for long-term funding from the National Science Foundation.

The majority of funds will support an intern, who will learn about

the flora of Virginia, threats to native tree species, and scientific analysis and writing. VNPS members will be invited to SCBI for a plot tour and citizen-science opportunity to learn about tree mortality in forests of the region.

Beneficial Effects of Native Plants and Pollinators in Ashland

This project will be performed under the direction of Assistant Professor Nicholas Ruppel of Randolph-Macon College. A recent focus on the importance of native plants and pollinators has highlighted the critical interactions among local species in natural ecosystems. As urban encroachment continues to threaten native habitats, it is increasingly important to promote the use of local green spaces as refuges for native plants and their pollinators. Educating the public on the value of native plant–pollinator relationships is one way to accomplish this. The aim of this project, therefore, is to assess the diversity of insect pollinators on native plants in Ashland.

This project will involve undergraduate students and faculty from Randolph-Macon, as well as students from John M. Gandy Elementary School. This summer and fall, several modes of insect identification (e.g., digital photography, trapping) will be used to assess pollinator abundance and diversity at the Moores Native Plant Garden. From these collections, the team will assess the diversity of insect types and the nature of the insects (i.e., native vs. nonnative). The ultimate goals are to expand the educational utilization of Randolph-Macon's Moore Native Plant garden by undergraduate students, school children, and community members, and to increase knowledge of plant–pollinator interactions and the importance of native plant gardening. ❖

Leader Tom Wieboldt and participants on Goshen Pass field trip. (Karen Sheffield photo)

Goshen Pass Trip Offers Up Mosses, Time Travel

"What does this rock say to you?" asks Tom Wieboldt on a recent Virginia Native Plant Society geology and botany trek through the Goshen Pass Natural Area Preserve in Rockbridge County. The pass was formed by the Maury River, a tributary of the James.

Maybe you're drawn in hoping to see the details of the lichen Tom is describing. Perhaps your eye catches the beautiful limestone rock in the bright sunshine or the fantastic dolomite striations caused by years gone by shallow sea events. As VNPS enthusiasts, we're often attracted to the greener side of life, and several different mosses shared this rock along with many species of lichen. We could have stayed at the rock all day, but we had millions of years of geologic time to cover, so off we went to our next location. David Spears led our journey back in time, taking us to special places with outstanding sandstone, shale, and limestone outcroppings, each representing a different geologic era. Many lichens, mosses, and liverworts enjoy life on the rocks, and Tom identified many for us, but he also shared his microscope photography of them so we could see the identifying characteristics and their exquisite design. For me, the trip was a reminder that so many things are right in front us if we would only take the time to settle in and observe them.

Many thanks to David Spears, Tom Wieboldt, the Upper James River Chapter, and the Rockbridge Baths Firehouse for a fantastic journey fexploring the smaller side of life. ***—Karen Sheffield***

VIRGINIA NATIVE PLANT SOCIETY

Sempervirens (ISSN 1085-9632) is the quarterly newsletter of the Virginia Native Plant Society, Blandy Experimental Farm, 400 Blandy Farm Lane, Unit 2, Boyce, Va. 22620, 540-837-1600, info@vnps.org. Nancy Vehrs, President; Nancy Sorrells, Editor; Karen York, Office Manager. Original material in *Sempervirens* may be reprinted if credit is given to the Virginia Native Plant Society, to *Sempervirens,* and to the author of the material, if named. Readers are invited to send letters, news items, and queries for consideration. E-mail items to Nancy Sorrells at lotswife@comcast.net.

Next submission deadline: June 15, 2017

Crow's Nest Natural Area Preserve Opens

Trailing Arbutus, left, at Crow's Nest. At right, Tom Smith and Mike Lott explore a trail carpeted with Dutchman's Breeches. (Nancy Vehrs photos)

At long last Crow's Nest Natural Area Preserve in Stafford County is open! With Preserve Steward Mike Lott as emcee and Gov. Terry McAuliffe as one of the many honored guests, the preserve opened April 1 with a ceremony and sign unveiling.

A 1.5-mile access road on an easement through private property allows the Raven Road Access Point to serve as the entrance to the main preserve. (A boat launch on the Accokeek Creek side was already open.) A partnership between Stafford County and the Commonwealth of Virginia beginning in 2008 led to the preservation of the nearly 3,000-acre Crow's Nest.

Following the ceremony, Mike Lott led a short hike on one of the recently developed trails. We enjoyed views of the wetlands and Accokeek Creek and saw a number of early spring wildflowers on the hilly trails including Trailing Arbutus (*Epigaea repens*), Early Saxifrage (*Micranthes virginiensis*), Spring Beauty (*Claytonia virginica*), and carpets of Dutchman's Breeches (*Dicentra cucullaria*). I look forward to seeing the abundant Mountain Laurel (*Kalmia latifolia*) in bloom later this spring and visiting in all seasons. For more information about Crow's Nest, visit the Department of Conservation and Recreation website at www.dcr.virginia.gov/natural-heritage/natural-area-preserves/crowsnest. ***—Nancy Vehrs***

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