Sempervirens

Spring 2021 The Quarterly of the Virginia Native Plant Society

Pandemic year brought surprises from the field

It should come as no surprise that pandemic year 2020 also brought its fair share of challenges to field work for Natural Heritage staff. Nevertheless, dedication and drive overcame, and some nice surprises did come from the field. Natural Heritage Botanists and Ecologists had a rich and productive year of inventory, including several special discoveries worth highlighting.

From Your Natural Heritage Program

By Jason Bulluck

Ecologists Gary Fleming, Karen Patterson, and Kristin Taverna put feet, eyes, and survey plots on the ground across the Commonwealth, documenting 28 new natural community occurrences, half of which were globally rare, and five that are endemic to Virginia. Three special natural community finds in Augusta County were thanks to VNPS members.

An amazing example of a Central Appalachian Mountain Pond (Buttonbush – Threeway Sedge Type) community was documented with a global conservation status ranking of "Critically Imperiled," due greatly to its large size and pristine condition. This sinkhole pond, semipermanently flooded, is dominated by Golden Club (*Ornotium aquaticum*), and considered one of the finest individual ponds in the Shenandoah Valley. Two additional globally rare wetlands also occur on the property, which is currently owned by a dedicated conservationist and VNPS member.

Coastal Plain Calcareous Seepage Swamp, Surry County. Photo Gary Fleming.

Also noteworthy are two discoveries on the tract most recently added to Mt. Joy Pond Natural Area Preserve. This addition, made possible via the key role of two VNPS members, first surprised us with an impressive and robust population of Small Whorled Pogonia (*Isotria medeloides*).

In 2020, two state imperiled natural communities were documented on this tract as well: a Central Appalachian Low-Elevation Acidic Seepage Swamp and a Central Appalachian Depression Forest.

Davis' Sedge (*Carex davisii*). Photo Gary Fleming.

Mention a native prairie community in Lee County and visions of woodland openings with limestone glades come to mind. But, how about a Riverside Prairie? In The Cedars region, along a 10-mile stretch of the Powell River, this rare and understudied natural community was found, dominated by native tall grass species and forbs. The site is quite species rich; more than 80 vascular plant species can be found in a 100-square meter area. These small-patch, prairie-like grasslands develop on periodically scoured limestone ledges and slopes, and can cover areas as large as half an acre. Some of the patches border tracts protected by The Cedars Natural Area Preserve.

In Surry County, on a private property site visit, two occurrences of a globally rare seepage wetland, the Coastal Plain Calcareous Seepage Swamp, were documented along the James River. This community type, which occurs where ravines cut in calcium-rich Tertiary shell deposits,

(See 2020 highlights, next page)

2020 brought plant highlights

(Continued from page 1)

is endemic to Virginia's Coastal Plain and is considered imperiled at global and state levels.

On the same property, a critically imperiled and extremely rare Coastal Plain Dry Calcareous Forest was observed. This community, relatively upland to the associated seepage swamp community, occurs on drier slopes of ravines where calcium from shells and shell-marl influence the soil.

There were some special botanical highlights in 2020 as well. *Carex davisii*, a western sedge, rare and disjunct in and east of the Appalachians, was found in old, high-quality bottomland hardwoods at a site, on both sides of the Appomattox River. This is the second population discovered on the Appomattox and all other known Virginia populations are along the Potomac River.

Virginia Natural Heritage Botanist Johnny Townsend documented new populations of Virginia critically imperiled bryophytes and lichens including the second Virginia location for Sullivant's bark moss (*Forsstroemia producta*) and the largest known subpopulation of Rock Gnome Lichen (*Cetradonia linearis*), known only from Whitetop Mountain, and one of only two federally listed lichens in the United States.

Appalachian Witch Grass (*Dicanthelium appalachiensis*). Photo Johnny Townsend.

Two new populations of the recently-described *Dicanthelium appalachiensis* were documented in 2020. This species, with the common name of Appalachian Witch Grass on the Virginia rare plants list, will almost certainly receive the highest of conservation status rankings, with only six locations known. Five of these are in Virginia.

Lastly, 2020 brought discovery of new populations of an undescribed *Monarda* from Bath County, which may be a new taxon, endemic to the shale region. Virginia Natural Heritage Program is working with the Missouri Botanical Garden toward naming and classification of this species.

Rock Gnome Lichen (*Cetradonia linearis*). Photo Johnny Townsend.

This just scratches the surface of an incredibly productive 2020 for your Virginia Natural Heritage Program in biological inventory, data management, environmental review, land protection and Natural Areas stewardship. We look forward to the field months of 2021, and sharing more highlights with our Virginia Native Plant Society friends, partners, and supporters. ❖

Riverside Prairie community along the Powell River in The Cedars area, Lee County. Photo Karen Patterson.

An undescribed *Monarda* sp., Bath County. Photo Johnny Townsend.

Celebrate Native Plant Month with Congress

From the President, Nancy Vehrs

By the time you read this, our earliest spring ephemerals will be a distant memory as spring proceeds at a rapid pace in Virginia. Did you know that the U.S. Senate recently adopted a resolution designating April "National Native Plant Month?" In Senator Rob Portman's (R-OH) March 26 press release, he and Senator Mazie K. Hirono (D-HI) extolled the unanimous Senate passage of the bipartisan resolution they introduced designating April 2021 as "National Native Plant Month." This resolution recognizes the importance of native plants to environmental conservation and restoration, as well as in supporting a diversity of wildlife. Sen. Portman said, "From stabilizing soil and filtering air and water to providing shelter and food for wildlife, native plants play an indispensable role in supporting resilient ecosystems as well as in our everyday lives. This bipartisan resolution highlights the importance of native plants and celebrates our rich ecological heritage here in Ohio and across the nation."

Senator Hirono went on to say, "Hawaii is home to nearly half of our country's threatened and endangered plant species. Now that the Senate has passed this bipartisan resolution, during April we can celebrate and highlight how native plant species support ecosystems all across America."

In both the 115th and 116th sessions of Congress, legislators introduced the "Botany Bill" in the Senate and House. The bill was designed to promote botanical research and sciences capacity, generate demand for native plant materials, and authorize related federal activities. It had some bi-partisan support, but it was not co-sponsored by any legislators from Virginia. It has not been reintroduced in the current 117th Congress – yet. Perhaps this National Native Plant Month can serve as the impetus for the resurrection of the Botany Bill.

Here in Virginia, we are proud of the diversity of our species where north meets south and the topography ranges from the Coastal Plain to the mountains. Our Commonwealth has five endemic vascular plants. We have a topnotch Natural Heritage Program to protect our best natural habitats and rare plants. Celebrating our native plants is not a one-month affair, but I hope that this designation brings a little more attention to our native treasures and leads to a more substantive botany bill. Our native plants deserve a continual celebration. Native plants are patriotic; spread the word!

IN THE SENATE OF THE UNITED STATES

RESOLUTION

Designating April 2021 as "National Native Plant Month"

Whereas native plants are indigenous species that have evolved and occur naturally in a particular region, ecosystem, and habitat;

Whereas there are more than 17,000 native plant species in the United States, which include trees, shrubs, vines, grasses, and wildflowers; Whereas native plants help prevent flooding, drought, and erosion and can help restore damaged ecosystems;

Whereas native plants provide shelter as well as nectar, pollen, and seeds that serve as food for native butterflies, insects, birds, and other wildlife in ways that non-native plants cannot;

Whereas more than 200 of the native plant species in the United States are estimated to have been lost since the early 19th century;

Whereas habitat loss and degradation, extreme weather events, and invasive species have contributed to the decline of native plants in the United States; and

Whereas native plants are essential components of resilient ecosystems and our natural heritage: Now, therefore, be it

Resolved, That the Senate –
(1) designates April 2021 as "National Native Plant Month"; and
(2) recognizes the benefits of native plants to the environment and economy of the United States

2021 WOY

Tell me why the *Wisteria* twines

Article and illustrations by W. John Hayden, Botany Chair

Rather than support themselves, vines and lianas take advantage of pre-existing structures in their immediate vicinity in order to climb towards the canopy. As a group, these plants use a variety of strategies to climb. Some, like Grapes and Greenbriers, grasp their support via special modified stems or leaves called tendrils; others, for example Trumpet Creeper, attach themselves to their support via adventitious rootlets; and some, like Morning Glories, and Japanese Honeysuckle, twine tightly around their supports. Please note that the line from the old song has it dead wrong. Familiar ivies, such as Poison Ivy and English Ivy, do not twine; these plants climb by inserting small adventitious rootlets into cracks and crevices of their support. Ivies simply do not twine, but *Wisteria* species do **(Figure 1),** and it is the physiology of twining stems that forms the subject of this article, the first of this year's series dedicated to the VNPS 2021 Wildflower of the Year, *Wisteria frutescens*.

The why of *Wisteria* twining is not difficult to understand. One driving force in the physiological ecology of plants is competition for sunlight to support photosynthesis—in short, for lianas like *Wisteria,* twining is how these plants quickly climb through the shady understory to gain a position in the sunny forest canopy. How *Wisteria* species and other twining plants accomplish this biological imperative is a complicated interaction of two distinct physiological processes, circumnutation and thigmotropism.

When telling a complicated story, it is always good to start at the beginning and, as is often the case in plant biology, the logical starting point for this story is the shoot apical meristem **(Figure 2)**, aka the actively growing terminal bud. This meristem is a self-perpetuating structure that generates, successively, leaves of the shoot system and their intervening stem segments (internodes). At the extreme tip of the stem, there is a dome of cells actively engaged in mitotic cell division, generating cells that form new leaf and new stem tissues. Just below the apical dome or promeristem, there may still be some lingering mitotic cell division, but here the future stem cells begin to enlarge in both length and width, which accounts for how stems become wider and longer than the little meristems from which they arise. On the flanks of the apical dome, localized bursts of mitotic cell division give rise to leaf primordia **(Figure 2)**—the little clumps of cells that eventually become leaves. For plants with alternate leaves, the location of new leaf primordia rotates successively, around the apical dome, progressing either in a clockwise or counterclockwise direction. Empirical observation suggests that the direction of successive leaf primordium initiation is a genetically fixed characteristic.

We must also acknowledge that hormones regulate the growth processes described in the previous paragraph. For the story told here, the hormone auxin (chemically, indole-3-acetic acid) plays a major role. It is widely acknowledged that cells of actively growing apical meristems and growing leaf primordia produce auxin that is then transported toward the base of the plant. As it passes through the region directly below the apical meristematic dome, this auxin flow triggers the cell enlargement/elongation that we observe as stem growth.

But growing stems do not simply stretch upward in a straight line. As seen

Figure 1. Old twinning stems of *Wisteria floribunda*.

in time-lapse photography, growing plant stems actually dance! They sway back and forth, tracing more or less circular patterns in the air. In the parlance of plant physiology, these slow-dancing stem tips are performing the process of circumnutation. It is only the upper, elongating, portion of the stem that circumnutates. The amplitude of circumnutation is greatest at the tip, decreases gradually at successively lower levels, and finally, where there is no more stem elongation, there is no more circumnutation. In three dimensions, circumnutating shoots trace a spiral of decreasing radius from the tip down **(Figure 3)**. It is a well-established fact that circumnutating vines and lianas trace much wider arcs than non-lianous plants. The functional advantage for a liana, like *Wisteria*, is obvious: highly exaggerated circumnutation increases the probability of intercepting a potential support that will provide an upward pathway to life in the sun.

The functional, evolutionary, advantage of circumnutation for a liana is an example of an explanation that addresses ultimate cause. Plant

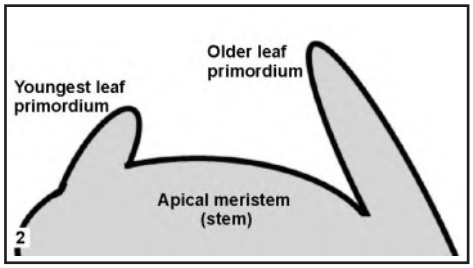


Figure 2. A generic apical meristem as seen in longitudinal section, with two leaf primordia.

biochemists and physiologists are also interested in what might be called proximal causes, the small-scale mechanisms that explain large scale phenomena.

Though long-studied and long-speculated upon, the proximal cause of circumnutation is not fully understood. One current explanation goes something like this: If meristems generated perfectly symmetrical downward flows of auxin, we would expect stems to grow upward, straight as an arrow. But plants do not live in an ideal and perfectly symmetrical world. The suggestion has been made that some unknown, perhaps random, influence causes auxin flow to become asymmetrical, resulting in cells along one vertical sector of the stem to elongate more than cells in other sectors. Asymmetrical elongation would result in bending of the stem from vertical. Once the stem is bent, specialized cells perceive their misalignment from the truly vertical force of gravity and respond by redistributing auxin to cells on the lower side of the bend. But, as this explanation goes, the compensating cell elongation is greater than necessary, causing the stem to bend in a slightly different direction, and the sequence of events repeats itself, over and over. In short, a random fluctuation in stem growth is perpetuated by repeated overcompensation by the plant's response to gravity. This explanation of circumnutation reminds me of a wobbly out-of-balance motor.

I think there may be a simpler explanation, at least for circumnutating stems with alternate leaves. Let's call it

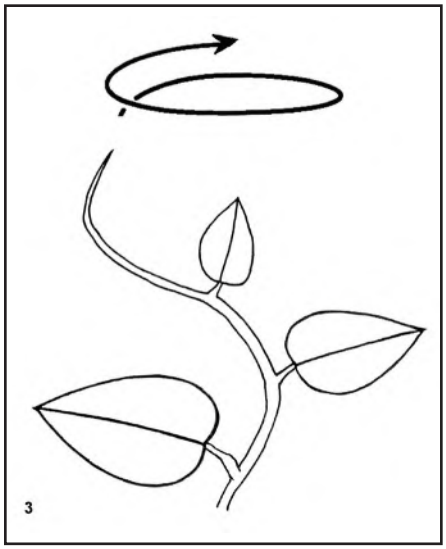


Figure 3. Circumnutation, the dance-like sway of growing stem tips.

Hayden's Hypothesis. It is well known that growing leaf primordia are potent sources of auxin production. At any given point in time, there will be a series of leaves at various developmental stages below a growing shoot tip; there will be one leaf primordium at a very early stage of initiation near the apical meristem itself, there will be later stages of development at successive positions below the apical dome, and further down the stem, mature, fully formed, leaves will be found.

There is no reason to expect that all these different stages of leaf development would release exactly equal amounts of auxin—one stage (and I do not know which one!) would likely secrete the most auxin and stem cells directly below that leaf would, consequently, elongate the most. Continuous growth and development of the whole shoot system means that, over time, the position of leaves secreting the greatest amount of auxin would shift continuously, following the same sequence by which the leaf primordia form in the first place. In other words, stem sectors receiving the greatest amount of auxin would follow a spiral path down the stem, fully explaining, I think, circumnutation. [I have not researched in detail the extensive literature on circumnutation,

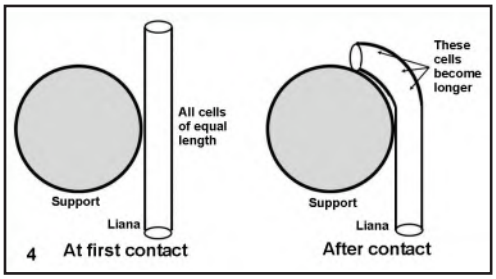


Figure 4. Thigmotropism, the growth process by which twining vines (and tendrils) wrap around a support.

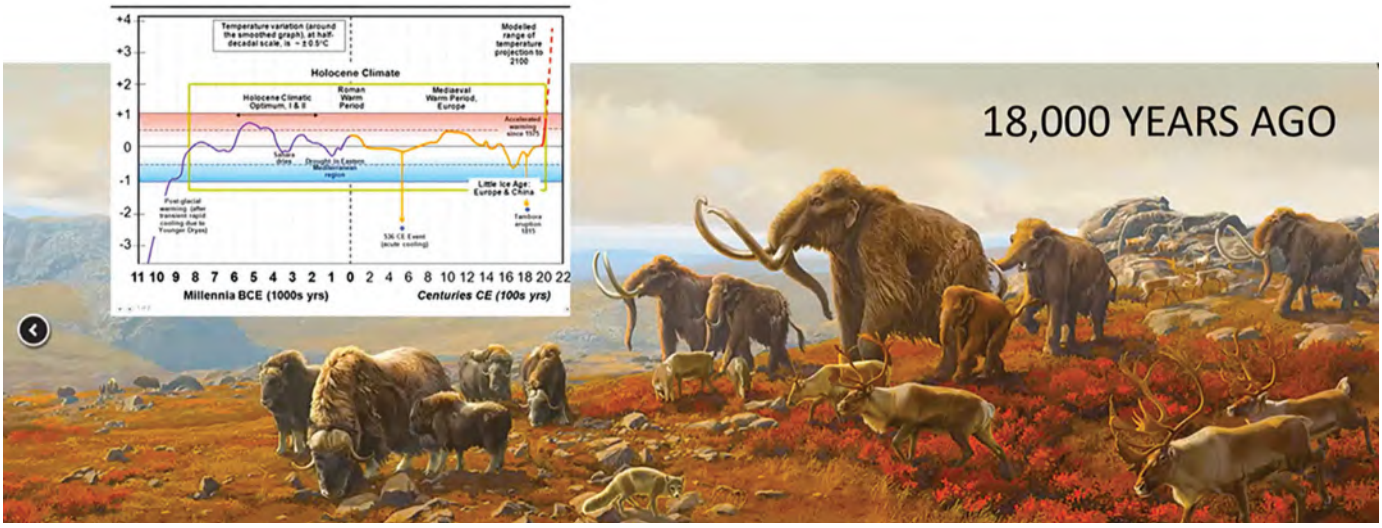
so if this idea has been proposed by others or, if it has been tested and thoroughly refuted, I will meekly bow to the ways of science and wistfully acknowledge that Hayden's Hypothesis should be tossed into the trash bin of failed and/or redundant ideas.]

What about thigmotropism? Although there are similarities, plant physiologists make a distinction between circumnutation and thigmotropism. Circumnutating stems are in contact with nothing but air. Thigmotropism is a growth response to physical contact (touch) that is initiated when a circumnutating stem contacts a firm support. Like circumnutation, thigmotropism is possible only for stems (or tendrils) that have not yet reached their full potential for elongation. Mechanistically, the proximal cause of thigmotropism is also under active investigation. Auxins may be involved; however, induced, localized, insensitivity to auxin may be involved, as well. Regardless of the mechanistic details, the result of thigmotropism is that portions of lianous stems in direct contact with a support grow less, while the opposite side of the stem grows more, resulting in a self-perpetuating, helical pattern of growth around the supporting structure **(Figure 4)**.

Why do Wisterias twine? To prosper photosynthetically in the higher reaches of the forest canopy. And how do Wisterias twine? Oh, that's easy, too: via the intricate interplay of circumnutation and thigmotropism. ❖

2021 Annual Workshop

Deep dive into past offers lessons for today



The 2021 Annual Workshop was a dive into deep time with speakers that discussed the Earth's climate from as long ago as 56 million years, up to present day. For being the first-ever virtual annual workshop, registration and attendance suggest a wide audience was reached!

The speakers for the Annual Workshop were none other than top notch. They were ordered chronologically, and first up was Dr. Scott Wing of the Smithsonian Museum. Scott spoke about the Paleocene-Eocene Thermal Maximum, or PETM. The PETM was a global warming event that occurred about 56 million years ago. At this time, Colorado (the location of his field sites) had a tropical climate, inhabited by palm trees and alligators. What appears on the record as a "minor blip" in global temperatures, was actually a 200,000-year long warming event.

Scott told a narrative of ancient survival, extinction, and evolution. Among other things, he studied a single hillslope that contained fossils from before, during, and after the PETM. Scott explained with great clarity how they were able to make a rough reconstruction of species that endured the PETM, species that were pushed to extinction, and new species that evolved afterward. The events that occurred during this "minor blip" in earth's history evidently had wide-ranging implications. Scott concluded with a sobering message. Climate change today is of extreme severity in power and rate of increase, especially compared to the PETM and other past global climate events. The world was radically changed in the past by these events, and we can be sure the same will happen in the Earth's near future.

Rodney Bartgis, former West Virginia state director for The Nature Conservancy and life-long conservation advocate, was our next speaker. Rodney's timeline focused on earth during the past million years. Rodney shared explanations for many plants whose distributions have perplexed botanists. Contrary to a belief that certain species were extirpated from entire ranges as glaciers expanded and retreated, Rodney presented evidence that some of these species and communities may have found refugia in places scattered across the continent. These refugia may have, in turn, had a critical role in repopulating the greater landscape post-glaciation. The evidence, on which the finer points Rodney admitted were not widely accepted, was thought provoking and may answer many questions botanists have to this day.

Our very own Dr. Emily Southgate, President of the Piedmont Chapter, spoke about her studies in historical ecology. A blend of ecology and history, with special attention to human impacts on the land, historical ecology is a field that Emily practically invented (or rather, discovered!), and for which she is a primary resource. Her research has shed light on countless

(See Lessons Learned, next page)

Lessons Learned

(Continued from previous page)

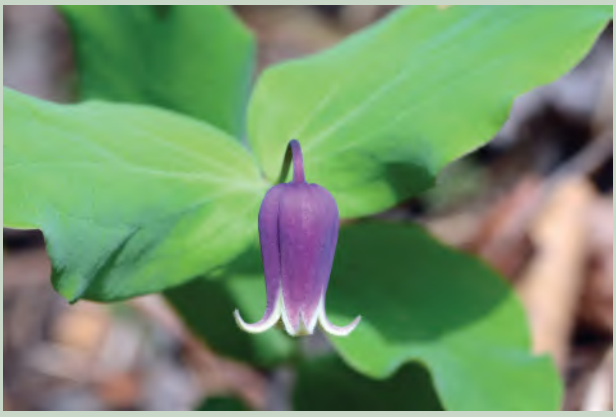
ecological process that have been less understood due to the lack of historical context in which they were studied. Humans have had lasting impacts on the earth, not just in the last several hundred years, but for well over 10,000 years. Our natural habitats continue to be influenced by recent and prehistoric human developments. An important part of Emily's message was that collaboration among different fields could greatly improve understanding of greater processes.

Dr. Molly Mitchell, from the Virginia Institute of Marine Science, capped off our Annual Workshop with her fascinating data on recent trends in the Chesapeake Bay. Molly is an expert wetland scientist, who has sampled vegetation in thousands of marsh plots across the Bay. Her research, among other things, focused on the effect of sea level rise on marsh communities. One of the greatest threats related to current sea level rise is the elimination of freshwater marshes, as the oceans rise and kill salt-intolerant species. In the lower reaches of Virginia's major rivers, Molly has found that many freshwater marshes, supplied only by minor tributaries, are being eliminated at a frightening pace. These marshes have a great diversity of life and functions for the ecosystem and neighboring land. Over her career, Molly has observed that these findings have implications for much more than just the freshwater marshes.

If you were unable to see any of these talks, please watch them at our very own Vimeo page: (**Vimeo.com/VNPS**).

The two photographs with this article are two slides used during the virtual presentations by the workshop speakers. If you were unable to attend the conference virtually or would simply like to watch the programs again, visit the Society's Vimeo page at Vimeo.com/VNPS.

—Joey Thompson is the VNPS Education Chair and a botanist at an engineering firm, VHB. Joey conducts rare plant surveys, plant species inventories, and natural community evaluations in addition to other natural resource surveys.



Celebrate National Native Plants Month in April!

Whether in April or all year, take the time to get to know Virginia's native plants. Five species are found nowhere else on Earth. One of those five endemic plants is Addison's Leatherflower (*Clematis addisonii* Britt.) seen here. Photo Gary Fleming.

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, 2021

Society adopts statement on use of cultivars

On March 17 of this year, the Society's Board of Directors adopted the following statement on cultivars.

The cultivar: *Kalmia latifolia*, 'Elf'

The wild-type: *Kalmia latifolia*

A tale of two plants: Both of these plants are Mountain Laurel (*Kalmia latifolia*), a Virginia native. However, the plant on the left is a nursery cultivar, 'Elf', while the one on the right is a wild-type plant that has evolved in the natural landscape over millennia. The wild-type plant on the right is the healthier of the two plant examples.

The Virginia Native Plant Society (VNPS) encourages communities and individuals to incorporate native plants into managed landscapes and, when doing so, to maximize the use of wild-type plants. Such an approach provides the most reliable way to support the flora and fauna with which these plant species have coevolved over millennia, to maintain genetic diversity and to minimize the risks inherent in introducing plants to an ecosystem. This is particularly important in ecological restoration projects, mass plantings in parks and on private grounds and in any landscaping in proximity to natural areas.

VNPS recognizes that wild-type plants may be difficult to find in the marketplace, and that cultivars and hybrids of native plant species can offer distinctive characteristics which increase their effectiveness in landscape design. However, due to documented cases where the introduction of cultivated plants has negatively impacted natural populations, and because the ecological implications of such plants have not yet been adequately evaluated, we recommend avoiding hybrids and using cultivars only in locations distant from natural areas (e.g., urban gardens) and to exercise caution in the selection of plants that vary significantly from the wild type (e.g., in flower structure, flower color, fruit size and leaf color).

VNPS encourages the horticulture industry to provide more wild-type plants and to clearly label cultivars to assist the public in distinguishing between the two.

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