



A publication of the Friends of the National Arboretum

ARBOR FRIENDS

SUMMER 2020



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FROM THE EXECUTIVE DIRECTOR



DEAR FRIENDS OF THE NATIONAL ARBORETUM:

What an exciting and challenging time to be joining FONA! And what an honor it is to be working alongside the incredible FONA team at the historic U.S. National Arboretum. I have been coming here since my days as a Capitol Hill staffer in the 1990s, but I'm now seeing the Arboretum through much different eyes, and I've developed a greater appreciation for the integral role FONA plays in supporting the Arboretum. As Executive Director, I plan to work hard to continue to grow this support, while looking for opportunities to make our members feel welcome and valued each time they visit.

Since 1982, FONA has helped the Arboretum pursue important mission-related activities like research, but we can also point to unique accomplishments like securing the original Capitol Columns and restoring Springhouse Run. FONA continues to offer very popular programming at the Washington Youth Garden where close to 6,500 kids each year visit and learn important lessons about healthy food and how it grows—see page 10 for updates on how we're adapting Youth Garden programs this year. None of this would be possible without a committed federal partner, a hard-working team, a strong board, selfless volunteers and, most importantly, supporters like you.

Even though we are in the midst of uncertain times, our work doesn't stop. We will continue to identify opportunities to enhance the profile of the Arboretum and improve our visitors' experience. Countless people have told me how much they love coming here, but there are too many people who have not yet experienced this special place. You can count on FONA to spread the word and welcome new audiences to the Arboretum.

On behalf of the entire Arboretum family, I want to thank you for all you do to support our work. It is so important that as members, you feel like we're providing a return on your investment in FONA, so please let us hear from you! You can share your opinions and ideas through our various social media channels and by email. Or just pick up the phone and give us a call! 🌱

Craven Rand, Executive Director
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ON THE COVER: Stokes' aster (*Stokesia laevis* 'Klaus Jelitto')

LETTER FROM THE DIRECTOR

On continuity...



EVERY spring since 1949, the U.S. National Arboretum has borne throngs of visitors, the crowds growing with every expansion of the gardens and collections. Technically, there is something in bloom every day of the year at the National Arboretum—and that's not counting greenhouses. But spring becomes something more than flowers, reflecting our innate need for beauty, warmth, and comfort beyond that of home and technology. It transcends cultures and language, and when we are sequestered, it

becomes all the more valuable and poignant. But the season continues nevertheless, and so will we. Spring becomes summer, and we grow.

The Arboretum's federal funding has increased for the third time in five years! This spring, the National Arboretum saw another budget increase in the form of an addition to our turf genetics program, which will allow us to hire a scientist focused on studying the ecosystem functions of turf. This a direct product and capstone achievement of the GrassRoots exhibit. The exhibit served as a new model of collaboration between gardens, research, and industry—largely supported by donations and contributions—that celebrated the importance of grasses and turf to cultivated landscapes and agriculture in general. Like all exhibits, it will come to an end, and we are pondering the next iteration.

Our hiring continues at an accelerated pace. We are shooting for 20 in 2020. That's right, 20 new hires by the end of this year, filling vacancies across the board, some of which have been empty for years. By the end of 2020, we will essentially be fully staffed, an accomplishment not seen in many years. In this issue of Arbor Friends, we have highlighted several of our newest hires, the first of many new faces you'll be seeing around the Arboretum. As we rebuild our team, we will be looking at our operations to identify new opportunities for enhancing mission delivery through synergistic relationships with our stakeholders, like the Friends of the National Arboretum.

One of our continuing efforts resulted in the release (this year) of our first hybrid hemlock, *Tsuga chinensis* 'Traveler', a result of nearly thirty years of breeding and research. Traveler is a controlled cross between the woolly adelgid-resistant Chinese hemlock and our native Carolina hemlock. It represents the very essence of what we do at the National Arboretum and the Agricultural Research Service: long-term research aimed at solving problems that face American agriculture. A vital role of ever-increasing importance not only to the United States, but also to an increasingly connected world with shared challenges.

The work continues. 🌲

Richard T. Olsen, Director
The U.S. National Arboretum



GARDEN FAIR

As you know, FONA's 2020 Garden Fair had to be cancelled. We missed seeing friends like you, plant enthusiasts, and excited Arboretum visitors.



ARBOR FRIENDS SPRING ISSUE

Our Spring issue of Arbor Friends about the Garden Fair was ready to go to the printers when we made the call to cancel the Garden Fair. Instead, we've added a few articles from the Spring issue to this one for a special Summer Issue. We hope you enjoy it!



EMAIL NEWSLETTER

Sign up for the FONA Field Notes email newsletters at [FONA.org](https://fona.org) to get details from the Washington Youth Garden, behind-the-scenes stories, pictures of the Arboretum, and the latest updates.



REMOTE WORK

FONA staff have been working remotely since mid March (except for a few essential staff in the Youth Garden). Although we're able to collect our mail, we do not have regular access to our office. If you have any questions about your FONA membership, tax receipts, etc., please reach out to us. Email info@fona.org or call 202.544.8733. We'd love to hear from you.

Meet the New USNA Staff

Over the last year, the U.S. National Arboretum (USNA) has hired several new staff members—all wonderful additions to the team. The Arboretum team (and we at FONA) are thrilled to have them on board and to see the work they are doing in the labs, the office, and the gardens. The hiring continues, and the Arboretum expects to be fully staffed, filling recent and longtime vacancies by the end of 2020.



DR. FRED GOUKER

Location: Primarily in Beltsville, MD, but I also travel between Beltsville and Washington, DC to work at the Arboretum.

New position title: Research Geneticist

When did you join USNA? April 2019

What are you working on at USNA?

My main duty as a research geneticist at the USNA is to serve as a tree and shrub breeder to create, evaluate, select, and release landscape trees and shrubs that have been improved to be more tolerant to various environmental stresses, pests, and pathogens and that also have superior ornamental value. To accomplish this, my work involves both basic and applied research on breeding and genetics. I authenticate molecular markers that help identify hybrids and assess genetic diversity, and I use traditional breeding methods to develop new cultivated hybrids. At this time, we are focusing on boxwood, redbud, crapemyrtle, flowering cherry, hemlock, and elm. My current primary research involves breeding new boxwood cultivars with improved ornamental traits, with the specific objective of breeding for resistance to the invasive pathogenic fungus known as boxwood blight, a devastating pathogen that can cause browning and complete defoliation and is a problem throughout public and private gardens and in the nursery industry worldwide. Very little is known about inherent genetic resistance to boxwood blight, if there is any. So I am using advanced genomic tools to help identify genetic loci or genes responsible for resistance to help breed for long-term durable resistance to boxwood blight. I am also using artificial intelligence to develop a visual diagnostic tool that will help identify and quantify plants infected by boxwood blight and that will help more accurately and efficiently screen and select large quantities of plants for disease resistance.

What are your favorite plants and why?

One of my favorite plants is the lilac—a beautiful and fragrant shrub. I grew up with two very large purple and white lilacs (*Syringa vulgaris*) in my backyard which have been kept alive through propagation since my great-grandmother's time. Another favorite is the eastern hemlock (*Tsuga canadensis*), the state tree of Pennsylvania, which is where I'm from. It always brings back a sense of nostalgia for the places where I loved to hike and camp in the state forests and where I developed an appreciation for the outdoors.



JULIA DA SILVA

Location: Washington, DC

New position title: Interpretive Specialist

When did you join USNA? May 2019—It's my first anniversary!

What are you working on at USNA?

I oversee all of our interpretive materials. If it's educational and it's something you're reading, hearing, or viewing, it's part of my job. Since we can't welcome visitors to the grounds right now, I'm currently working on some ways for folks to interact with us digitally—updating content for our free app and developing a remote “mission” for Agents of Discovery, an educational app that lets families explore the natural world. Normally, our mission is here on the grounds. The new mission allows families to discover all kinds of things right from their own homes.

What are you looking forward to doing at USNA?

I am very much looking forward to being back on the grounds! This is my first spring at the Arboretum, and I hate to be missing the beauty of flowering trees and bushes. When you work in such a lovely setting every day, it's easy to take it for granted. Once I'm able to be there again, I won't be so complacent! Walks at lunch, runs after work—I can't wait to be back among the collections.

TONY LINFORTH

Location: Washington, DC

New position title: Volunteer and Program Manager

When did you join USNA? April 2019

What are you working on at USNA?

I manage the public programs, volunteers, and interns.

What are you looking forward to doing at USNA?

I am excited to be working with the volunteers. It is important to me that the volunteers have a sense of accomplishment. I want to see the program expand over time. The fresh energy and ideas of volunteers are essential to the continuing success of the Arboretum.

YOUR SUPPORT MATTERS!



TODD ROUNSAVILLE

Location: Beltsville, MD

New position title: Lead Scientist, Woody Landscape Plant Germplasm Repository

When did you join USNA? April 2020

What are you working on at USNA?

Broadly speaking, I work on protecting, expanding, and enhancing the genetic resource base of woody plants and collaborate with other researchers to increase scientific knowledge on crop genetics and biological processes. More specifically, I help ensure the relevance, integrity, and coordination of the Arboretum's germplasm collections within Agricultural Research Service (ARS) and with our broader stakeholder base, including other botanic gardens and the public.

What are you looking forward to doing at USNA?

In 2004, I was a summer intern in the dogwood collection, and I have many fond memories of that time at the Arboretum, but in the summer I didn't get to see the majority of the collection bloom. With the grounds now closed, I will look forward to spring 2021 to see the dogwoods in bloom. I'm also excited to start working in the office and meet my ARS and USNA colleagues in person.

MARKITA BROOKS

Location: Washington, DC

New position title:
Event Coordinator

When did you join USNA?
January 2020



What are you working on at USNA?

I am responsible for coordinating and executing internal events in addition to handling logistics for all events and activities at the Arboretum.

What are you looking forward to doing at USNA?

I am looking forward to working with colleagues and visitors on events and programs so that everyone can enjoy all of our beautiful offerings here at the Arboretum. 🌳

FONA'S VALUE

With your support, FONA collaborates with the Arboretum to:

- 1 EDUCATE YOUTH:**
Expand education for underserved youth through the Washington Youth Garden
- 2 IMPROVE PUBLIC PROGRAMS AND VISITOR SERVICES:**
Encourage exploration and connection with plants, science, and nature at the Arboretum
- 3 RESTORE THE ENVIRONMENT:**
Support Springhouse Run restoration
- 4 BUILD COMMUNITY:**
Engage a diverse community and build support for the Arboretum
- 5 PROVIDE FINANCIAL SUPPORT:**
Invest directly in Arboretum horticultural and research interns, and more
- 6 TELL THE STORY OF THE ARBORETUM:**
Bring the Arboretum to life through Arbor Friends, online publications, and social media.
- 7 PLAN FOR THE FUTURE:**
Embark on future plans and important capital improvements as we approach the Arboretum's 100th anniversary in 2027
- 8 ADVOCATE:**
FONA advocates on behalf of the Arboretum to ensure its long-term success.



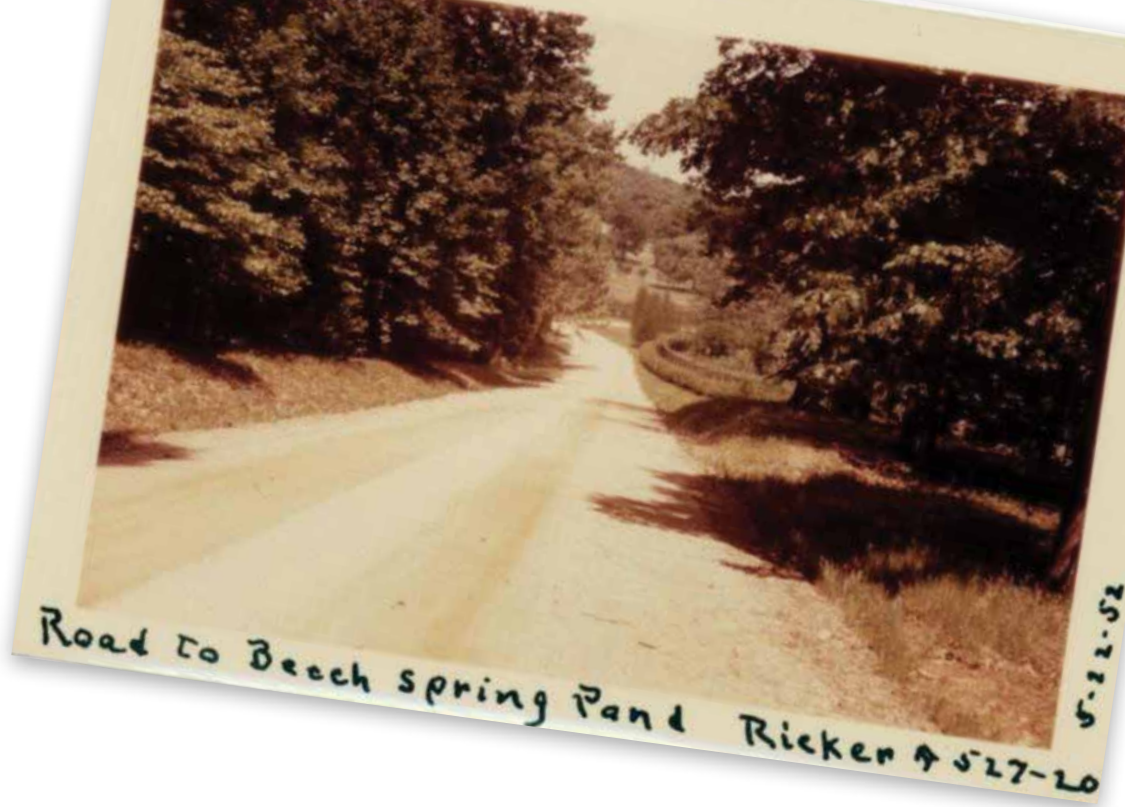
Hundreds of volunteers were required to create the Fern Valley collection. The caption written on this photo is "The Original Valley Girls" 1959. Photo credit: NCAGC

Opposite, top: The road to Beech Spring Pond in 1952 before Fern Valley was established. Photo credit: NCAGC.

Opposite, bottom: Edith Bittinger visiting the Fern Valley Collection. Photo credit: USNA.



Cherie Lejeune



Edith Bittinger: Retracing the Steps of a USNA Pioneer

Imagine the U.S. National Arboretum of 1957; picture only a few roads and a shack for the skeleton staff of USDA researchers. Travel back to this time to channel Edith Bittinger who, at age 80, with her pencil and tablet in hand (and most likely wearing sensible rubber boots to protect her shoes), was walking around documenting trees for an arbor course with her fellow Georgetown Garden Club members. She happened upon Arboretum Director Dr. de Vos that afternoon and asked him if the Arboretum had a fern collection. Edith's childhood garden in New England had many varieties of ferns.



Bittinger coordinated with engineers and excavation and landscape contractors to add the infrastructure elements like bridges and a limestone wall. Photo credit: NCAGC.



Left: Today, the Fern Valley Collection is a delight to explore in all seasons.
Right: Edith Bittinger at the ribbon cutting ceremony in May 1960. Photo credit: USNA.

Opposite page, top: Fern Valley committee circa 1963, meeting in Fern Valley, outdoors. Bittinger is seated at the far right. Photo credit: USNA.



Dr. de Vos stated that discussions about a special fern area were ongoing and a pilot planting had been done. This conversation would prove fateful. It ignited an idea, which (coupled with Edith's sheer determination) would bring about the first official garden at the US National Arboretum: Fern Valley. This special four-acre garden created on the USDA research property suddenly became immensely appealing to the public.

Today (some 60 years later), Edith Bittinger's name is not well known, but Fern Valley continues to thrive as an exceptional space that embodies the basic tenants of woodland gardening. It is a delight in all seasons. Color and texture abound among thousands of shade-happy species and, of course, there are lovely trees all year round.

Who was Edith Bittinger? A Google search doesn't yield much information. The few available photos of her bring up the image of a 1950s grandmother, with lovely day dresses, laced squat-heeled shoes, always a hat, and aluminum winged frame glasses. Edith Gay was born in Michigan, spent summers in Duxbury, Massachusetts, graduated from Radcliffe College in 1899, and married Charles Bittinger shortly thereafter. The story goes that they met in Paris where she was a singer (many claimed she sang opera, but stage performances rather than productions is more likely). Charles won numerous awards for his many contributions to science and art, notably for his role in the development of naval camouflage. Together, Edith and Charles were a social force in the DC scene, choosing Georgetown as their home in 1929.

Edith had seen many gardens during her extensive world travels, so she had big ideas in taking on this project. She corresponded with horticulturists and the fern experts queued up for the project, as well as the engineers and excavation and landscape contractors. It was a huge undertaking to remediate what had been land for dumping farm refuse. In the end, they created attractive infrastructure by installing bridges, steps, rustic benches, and even a 60-ton limestone wall. Her meticulous timeline with details of the project and the names involved can be explored in the article she wrote for the Fern Journal (Volume 51, No. 3, October-December 1961, pp 113-160).

Edith, along with Margaret Donnell, a fellow garden club member, led a core team of 70 garden club volunteers from a

total of 20 garden clubs in DC, Maryland, and Northern Virginia. This team recruited several hundred other volunteers including white-shirts-by-day husbands. Edith's vision was apparently, a successful "sell."

By the time of the official dedication in May 1960, the inventory showed that 4,000 ferns of 47 species and 2,000 native herbaceous plants representing 90 species were in the ground. Some of the original plants came from the volunteers' own gardens, and Edith brought ferns from her family home in Duxbury. At the time of the dedication, Bittinger was 83 years old. She would live to be 90, and when she died, she was buried in a simple grave in Oak Hill Cemetery in the District of Columbia alongside her husband, Charles.

This project earned the group the reward of having the Arboretum appointed (by a Congressional Act in 1964) the official home of what today is known as National Capital Area Garden Clubs, Inc. (NCAGC).

As a stakeholder of the U.S. National Arboretum, NCAGC is proud of this original garden connection. NCAGC (along with their parent organization, National Garden Clubs) also backed the Friendship Garden at the Arboretum—the original and the recent replanting.

Adopting more of Edith's can-do spirit has helped my own energy as I execute my duties as NCAGC's current president. Sharing Edith's efforts, which led to our home at the Arboretum for NCAGC's current 66 clubs and 2,200 members was, and is, a very special gift. 🌿

CHERIE LEJEUNE is the president of the National Capital Area Garden Clubs, Inc.

WASHINGTON YOUTH GARDEN

Adapting Our Programs

Christin Riddick

TO SAY THAT THE WASHINGTON

Youth Garden has had to shift its work during the COVID-19 pandemic is an understatement. With schools closed, our SPROUT field trips have been canceled for the spring, and our Garden Science team shifted from in-person lessons to supporting the distance learning efforts of our partner schools. In spite of all that, the Washington Youth Garden is working hard to support families in DC.

In the garden, we're using the land we have available (the Demonstration Garden at the Arboretum, and four partner school gardens) to grow food with an emphasis on maximum food production rather than growing food for educational purposes. This means more greens, potatoes, cucurbits, tomatoes, and okra will be harvested this summer for donation. Our goal is to donate more than 2,000 pounds of produce—that is more than double our 2019 donation. We're also using space in the greenhouse at the Arboretum to grow more seedlings and sharing hundreds of extras with school gardens across the city so they can continue to grow food in their neighborhoods.

On the program side, our teams have been working together to develop several new resources:

- The Grow At Home Activity Guide is now available on our website. This booklet guides students through experiments with seed starting and seed-based recipes at home. The

Our goal is to donate more than 2,000 pounds of produce—that is more than double our 2019 donation.



Above: Our programs team now meets virtually. **Bottom:** Our new Grow At Home Activity Guide is available to everyone on our website.



Opposite page, top: Garden coordinator Emilia and FoodCorps service member Dwayne mulched the KIPP Webb school garden to protect the new irrigation system. **Bottom left:** We're growing food at our partner school gardens to donate; **Bottom right:** Xavier and Jake prepare baskets of food harvested from the Demonstration Garden for donation.

physical kits, which include growing medium and seeds, have been distributed at our Garden Science partner schools and several long-time SPROUT participant schools as well. Our goal is to share more than 1,000 kits by September.

- Several of our most popular resources, recipes, and activities are now available on our website on our Distance Learning and Garden Resources page: www.washingtonyouthgarden.org/distancelearning
- Follow us on Instagram @WashYouthGarden to see daily posts of garden activities, growing tips, recipes, and more. We are working with several other organizations to create a series of short videos from DC farms and gardens like City Blossoms and Common Good City Farm. Check out the YouTube Playlist by searching for DC Virtual Farm Field Trip.
- The Summer Institute for Garden-Based Teaching is shifting to an online model, and the training will be open to more participants.
- Our Green Ambassadors high school internship program is pivoting, too. Details are still in the works, but they will focus on more direct support for our community through gardening.

It is certainly different to engage with young people and families online instead of in person, but it is amazing to see the information people are interested in now. For example, I created a video on the WYG Instagram page for a DIY potting



mix tutorial and one of our followers replied, “With all the garden centers closed, I have been searching online for potting soil. Almost dropped \$30 on a 40-pound bag. Thank you, thank you.” Moments like these really reaffirm that the work we are doing is still important.

As a team, we will continue to serve our community during these difficult times. Connecting people to food is more important now than ever before. If I have learned anything these past few months,

it’s that if you have the heart to grow and learn, there are opportunities out there for you, and I’m proud to be part of a team of people seeking to use those opportunities to make a difference. 🌱

CHRISTIN RIDDICK is the On-Site Program Manager at Washington Youth Garden. Formerly a 2nd-grade educator at Miner Elementary School, Christin is an alum of WYG teacher training (Summer Institute for Garden-Based Training). He is taking his experiences from the classroom and implementing them in the garden.



Bradley Evans

Learning from Bonsai

In these unprecedented times, a small number of Arboretum staff are meeting the challenges and tending to essential duties on site, such as watering the plant collections. One “Small Team” staff member is Bradley Evans who normally manages the Introduction Garden and is now also assigned to the Bonsai care team. While he has a wealth of knowledge about plant culture and maintenance, Bradley is enjoying this foray into a new realm of plant care.



I am a horticulturist at the Arboretum and my primary work for the past 15 years has been managing the Introduction Garden that surrounds the Visitor Center and pool, growing plants and designing landscapes, both seasonal and permanent. I focus on myriad different plants, from orchids to cacti, tropical plants to succulents, along with perennials, trees, and shrubs. Even though I work with a variety of plants and have to contend with all of their different seasonal needs, I was beginning to get a bit complacent, maybe a little too comfortable, since their needs are fairly predictable.

Being chosen to help out in the Bonsai & Penjing Museum piqued my interest and inspired me to learn as much as possible about these small, mysterious old trees in pots. I had some of my own bonsai in high school and college, but now I realize that I was never fully invested in maintaining them nor had I researched the intricacies of pot media, care, and plant training for bonsai. At that time, I was infatuated with orchids and their care and maintaining a saltwater reef tank filled with fish, coral, and various other invertebrates. Bonsai was merely a side interest.



My journey to the world of bonsai has been one of learning and appreciation, of being much closer to these ancient and revered plants than I had ever been before.

WATERING

Being immersed in bonsai and helping to water them on a daily basis has been a real eye opener. For the first week, I mostly followed Michael James, the Museum Curator, around and watched him do his work. Bonsai may need to be watered two or three times a day, depending on the season, which initially seemed crazy to me. For the plants in the Introduction Garden, I water them heavily in the morning and move on. But as I learned with the bonsai, the aim is to have them start the morning thirsty and give them a heavy watering early in the day. That watering can involve up to 10 passes of the hose to see water coming out of all the holes in the bottom of the pot. In the afternoon, usually around 2:00 p.m., a touch-up watering is necessary to carry them through the rest of the day until the following morning. If the bonsai are dry at 2:00 p.m. and they don't get a touch-up watering to carry them through, they could lose branches over time. Having that knowledge was important, as was knowing when certain recently repotted bonsai just need a morning touch-up of water since their roots are just beginning to grow into the fresh *akadama*, a very specialized porous bonsai potting medium.

PRUNING

Along with helping to keep the bonsai properly watered, I have also been learning how to prune them. It's fascinating and a bit stressful to prune a tree that has been in training for 200 or 300 years. Each new sprout has to be cut back to the first internode. From what I've learned so far, if the fresh spring growth isn't pruned back sufficiently, the shape and training of the tree can be lost. And since the bonsai are planted in pots with limited root space, trimming back the sometimes vigorous branches helps achieve a delicate balance between branch growth and the very limited amount of roots in the small soil volume to support that growth. I am very lucky that Michael has been close by and open to questions. To immeasurably ruin the form of a bonsai is a burden I could not easily live with.

BRADLEY EVANS normally manages the gardens surrounding the Administration Building and parking areas, collectively known as the Introduction Garden. This spring, he is also assigned to the Bonsai care team.

MOVING FORWARD

It's hard to believe there's so much to learn about watering and pruning and the eccentricities of each bonsai plant, since care can vary greatly among individual plants. What I have learned about watering, I want to apply to the plants I grow for the Introduction Garden. For the bonsai, a lot of times, the potting media may be wet, but the plant would benefit from having just its leaves watered. I found this to be especially true in the tropical greenhouse portion of the bonsai collection. Watering only the leaves can help get rid of pests like mites and knock out old dead leaves.

As for pruning, I never really paid attention to the direction of dormant buds on plants unless I was pruning roses. Pruning branches back to dormant buds in specific directions can really help with the long-term shape and evolution of the form of all sorts of plants. In the future, I will not be afraid to severely or more frequently prune back plants with especially vigorous growth. Some tropical plants can benefit from relatively hard pruning more than once a year. In general, bonsai are heavily pruned to maintain their shape.

I have learned about potting media, too. Bonsai are often potted in mixes of *akadama*, granite grit, or *kanuma*. They really benefit from having the additional aeration these ingredients provide. I thought it was particularly interesting that the majority of our azalea bonsai are potted in mostly *kanuma*, which is a soft, highly acidic, crumbly media that's ideal for azaleas because of its moisture retention and drainage properties. I'm thinking this media might make a good soil amendment for growing healthy azaleas or any other acid-loving plants before they are planted in any collection.

My journey into the world of bonsai has been one of learning and appreciation, of being much closer to these ancient and revered plants than I had ever been before. Being a temporary caregiver has led to a certain feeling of bliss and the joy of quiet contemplation while doing my work and thinking about all the other people who previously engaged with these plants with such passion and care. I plan to use the experience and knowledge I've gained from working with Michael James to better and more thoughtfully care for my Introduction Garden plants. 🌳



This year FONA's signature event, Dinner Under the Stars, honoring Barbara Shea, was cancelled due to the coronavirus. While we are disappointed, the good news is that we are close to meeting our fundraising goal! As our most important fundraising event of the year, proceeds support the mission of the U.S. National Arboretum, including our award-winning youth education program, the Washington Youth Garden. Thank you for sticking by us in these tough times! Your support makes a difference and will enable FONA to continue its work to support the U.S. National Arboretum.



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Tremendous thanks also go to our Dinner Co-Chairs, Chandler Goule, Anne MacMillan, Melissa Pflieger, and Lucy S. Rhame, and to our 2020 Dinner Committee members.

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RESEARCH

Closing the Door to Destructive Diseases

Anne McGarvey

AS PRODUCE, PLANTS, AND PEOPLE move around the world, diseases sometimes travel with them. When the bacteria that cause these diseases are introduced into new environments, they frequently evolve and adapt in whatever way they need to in order to thrive in their new location. Emerging diseases pose a serious threat to the agricultural and horticultural industries in the United States, because they can spread rapidly and cause widespread damage to critical industries before being detected.

At the U.S. National Arboretum in the Floral and Nursery Plants Research Unit, a team of scientists led by Dr. Qi Huang, is studying emerging and existing diseases caused by two bacteria in particular: *Ralstonia solanacearum* and *Xylella fastidiosa*. Diseases caused by these two bacteria devastate plants and threaten food production throughout the United States. By using cutting-edge research that dives deep into the genomes of these bacteria, Dr. Huang and her team have created vital tests that state and federal agencies can use to fight these diseases.

From geraniums to grapes, destruction is evident

According to Dr. Huang, *R. solanacearum* “is arguably one of the most economically important bacterial diseases in the world.” By infecting the vascular system of plants and surviving in the soil, it causes bacterial wilt in more than 200 plant species in 44 families, including ornamentals such as geranium (*Pelargonium* spp.) and agricul-



Top: Leaf scorch symptoms of Japanese beech caused by *Xylella fastidiosa*, photo credit: Dr. Qi Huang; **Middle:** *Ralstonia solanacearum* under a microscope, photo credit: Kelman & Hruschka, 1973; **Bottom:** A geranium plant showing symptoms caused by *R. solanacearum*, photo: Dr. Qi Huang

tural crops such as potatoes, tomatoes, and bananas. Although these bacteria typically infect plants in tropical climates, a particular strain known as r3b2 has adapted particularly well to temperate environments through cool virulence, allowing bacteria to survive and infect plants in locations with cooler-than-tropical temperatures.

The r3b2 strain of *R. solanacearum* was accidentally introduced to the United States in 2003 through infected geranium cuttings from abroad. Since then, losses in the ornamental plants industry have mounted to more than \$10 million and resulted in the dissolution of a major supplier of geraniums. The same bacteria were again found in April 2020

in another shipment of geraniums from abroad. Dr. Huang notes that the economic impact of this re-introduction of *R. solanacearum* r3b2 to the United States is not yet known.

As a soil-borne pathogen that can withstand cool temperatures, *R. solanacearum* r3b2 also threatens the agriculture industry, especially in the cooler climates of Idaho, Montana, and North Dakota where seed potatoes are produced. It can easily spread throughout the country via distribution of those seed potatoes.

Another bacteria that has had a devastating impact on both agricultural and horticultural industries is *X. fastidiosa*, which lives in the xylem (a type of tissue for transporting food and water) in vascular plants. *X. fastidiosa* requires insects for transmission from plant to plant. Among its victims, it causes Pierce's disease in grapevines, quick decline syndrome in olives, and leaf scorch in elm, sycamore, oak, mulberry, and oleander. It has already wreaked widespread havoc on elm, oak, and sycamore trees throughout the mid-Atlantic and southeastern United States, and it threatens street and landscape trees across the country.

A closer look at the invaders

Bacteria are microscopic organisms that live on every surface around us. If plant pathogens are so dangerous, how do we prevent them from coming here in the first place? Dr. Huang says it all comes down to rapid, sensitive, accurate, and reliable testing, so that inspection agencies can make quick, informed decisions that prevent the entry and establishment of these diseases in the United States. Her work puts her and her team of scientists at the Arboretum on the front lines of the battle. So far, they have created highly specific tests that can determine whether *R. solanacearum* and *X. fastidiosa* are present and how harmful their particular strains might be to plants in this country. They have increased the reliability and accuracy of existing tests and, in partnership with Rutgers University and the USDA's

Animal and Plant Health Inspection Service, they have created a new portable detection system known as POKKIT™. Inspection agencies can use POKKIT™ to rapidly perform highly accurate genetic tests in field settings to determine whether *R. solanacearum* is present in one of its harmful variations.

Dr. Huang's research and the tests she and her team have developed for emerging diseases help safeguard the U.S. agriculture and horticulture industries against certain diseases. Inspection agents, by using her accurate and economical tests, can quickly determine whether those diseases are present in shipments from foreign countries and stop any potential invasions. Dr. Huang hopes to do more than just stop disease-causing bacteria from entering the country; she hopes to stop them from spreading if they're already here. Trying to imagine how viruses that specifically infect bacteria like *R. solanacearum* can somehow be re-engineered to work against them as a form of control is one current project; another is developing an integrated disease and pest management strategy to help the ornamental plants industry control *X. fastidiosa*.

The results of Dr. Huang's research at the Arboretum will have a far-reaching impact on plant production across the country. From grapevines snaking along misty valleys in California to elm trees lining main streets in North Carolina, from geraniums blooming in Tennessee backyards to the potato crop in Idaho fields, Dr. Huang's research into emerging diseases reaches all corners of the United States. Through the new and updated tests Dr. Huang and her team have created, we can better safeguard the U.S. horticulture and agriculture industries from diseases that might devastate many of our most beloved plants. 🌱

ANNE MCGARVEY supports fundraising, marketing, and communication efforts at FONA. She is an avid crossfitter, baker, and outdoorswoman whose passion this past gardening season was growing and pickling chili peppers.



STAFF SPOTLIGHT: DR. QI HUANG

What was it that inspired Qi Huang to devote her life to studying agriculture? At a young age, she decided to follow in her father's footsteps: he was a professor at an agricultural university in China. The first steps included an MS degree in Plant Pathology from the University of Kentucky and a PhD in Plant Pathology from the University of Wisconsin-Madison, after which she began work as a researcher in the Fruit Laboratory at the USDA Agricultural Research Service in Beltsville, Maryland. She stayed there for nearly two years, but when a position opened at the Arboretum's Floral and Nursery Plants Research Unit in May 2001, she jumped at the chance because she "loved the beauty of horticultural plants."

Dr. Huang has spent the last 19 years diving deep into the subject of bacterial genomes to better understand what makes bacterial diseases so pervasive and to find ways to better distinguish destructive bacteria from benign bacteria. Because she focuses on microscopic entities, Dr. Huang conducts the majority of her research in a laboratory at the National Arboretum's Beltsville campus, which has an array of state-of-the-art equipment close at hand to help extract and analyze bacterial characteristics at the molecular level. Among her tools are shakers and incubators, which are critical for growing bacteria cells, polymerase chain reaction (PCR) and quantitative PCR analyzers to detect and amplify specific genes, and computers and special bioinformatic software to help her make sense of all that genetic information. She makes use of a symphony of tools that work in concert to help unravel the mysteries of how these bacteria impact horticulture. 🌱



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Wildlife at the National Arboretum

The Arboretum is home to a variety of animals. This is just a very small sampling of the diverse wildlife we have on site. Other animals seen at the Arboretum are otters, deer, red bats, groundhogs, eastern cottontails, turkey hens, wood ducks, frogs, salamanders; the list goes on and on. Department of Energy and Environment (DOEE) Wildlife Biologists, USNA trail cams, and Arboretum staff keep an eye on the wildlife and monitor their presence.



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1 FOWLER'S TOAD

Photo credit: Lindsay Rohrbaugh, DOEE

2 GREAT BLUE HERON

Photo credit: Dan Rauch, DOEE

3 HERMIT THRUSH

Photo credit: Dan Rauch, DOEE

4 RED-EARED AND PAINTED TURTLES

Photo credit: USNA

5 COYOTE

Photo credit: USNA Trail Cam

6 RED-SHOULDERED HAWK

Photo credit: Dan Rauch, DOEE

7 GRAY FOX

Photo credit: USNA Trail Cam

8 EASTERN PHOEBE

Photo credit: Dan Rauch, DOEE

9 BEAVER

Photo credit: USNA Trail Cam 🌿



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Large candles on
a young *Pinus
thunbergii*
'Thunderhead'.
Photo credit:
Joe Meny, USNA.

Opposite page:
Erin Holden trims
pine candles from
atop a tall ladder.
Photo credit: USNA.

CANDLING THE PINES

Karen Zill



WHAT IS CANDLING AND WHY IS IT DONE?

In spring, the buds formed on pine trees in the previous year expand into what are called candles—long, new growth that will turn into the current year’s branches. “Candling” is the process of removing or shortening this new growth to control the size and shape of the tree. It’s done when the candles have finished growing but before the new needles start to form. Candling also helps to balance the energy of the tree, and when it is done correctly, it can slow the growth on vigorous parts of the tree while strengthening weaker areas.

HOW IS CANDLING DONE?

It’s a relatively simple process. Whether you use fingers or pruners depends on how much candle you’re removing, which in turn can depend on which species you’re candling. Completely removing a candle at its base eliminates that future branch, but also stimulates new bud development. I use thin pruning snips when completely removing a candle because this gives a nice clean

cut and doesn’t leave any extra tissue. To keep that future branch, but control its length, the top of the candles can easily be pinched back with your fingers. You don’t usually want to cut through a candle with pruners because that can damage future needles.

Not all candles on a tree will necessarily be pruned, but they all need to be assessed. The tree puts energy into its new candles, so we leave candles on weaker areas to strengthen those spots. Stronger, healthier areas on a tree can be more heavily candled. Getting to each branch can be a challenge, depending on the size, shape, and location of the tree. Orchard ladders come in handy for outer branches, but to reach inner branches and the apex of a tall tree, sometimes the best option is to climb up in there. For certain trees I climb with a tree saddle, the sort that professional arborists use. This allows me to stay safely tied to the tree while still being able to candle hard-to-reach branches. Some of the pines I candle at the Arboretum are fifteen to twenty feet tall.

IS CANDLING DONE WITH ALL VARIETIES OF PINE TREES OR ONLY CERTAIN ONES?

Candling can be done to any type of pine tree. Personally, I’ve worked on Japanese black pines (*Pinus thunbergii*), Japanese white pines (*Pinus parviflora*), and Japanese red pines (*Pinus densiflora*). But candling is necessary only when you want to control the size and

One of the sights a spring visitor to the National Bonsai & Penjing Museum might chance upon is someone up in a pine tree. That would be one of the Arboretum’s horticulturists, engaged in trimming the “candles” at the ends of the branches. In a recent interview, Erin Holden explained the process.

the shape of the tree. You wouldn't candle that fifty-foot pine in your backyard, for example, or a tree that you want to grow out naturally. And the pines in the Gotelli Collection certainly wouldn't get candled. Candling is reserved for special garden trees that the Japanese call *niwaki*. The pruning principles are basically the same as for bonsai. Other conifers, like fir and spruce, don't produce candles as new growth in the way that pines do, and so they don't get candled in the spring. I haven't seen these trees pruned as *niwaki*.

HOW MANY TREES AT THE ARBORETUM ARE CANDLED, AND HOW MANY GARDENERS ARE INVOLVED IN THE WORK?

Most of the pines are in the Bonsai & Penjing Museum, the notable exception being the beautiful Japanese black pine in front of the Administration Building. The trees let you know when they're ready to be candled, usually late April to early June. After that, the candles start to harden off, needles start to expand, and you won't get the new bud formation that you're looking for.

I candle about thirteen trees, mostly Japanese black pines. We have nine tall pines in the Stroll Garden of the Bonsai Museum, and they require at least five gardeners. Most of the work can be done in a day with that many people, and I'll spend a few more days by myself finishing up.

WHAT IF CANDLING ISN'T DONE? HOW DOES THAT AFFECT THE PINE TREE'S GROWTH?

Candling doesn't have to be done every year. If a tree is weak, then skipping a year will help it gain strength and grow in size. If you're trying to maintain a certain shape, then skipping candling can result in the tree losing that shape. However, the health of the tree should always come first.

DOES CANDLING HAVE ANY BEARING ON CONE FORMATION?

Yes. Female cones (what we consider the actual "pine cones") are produced at branch tips on the current year's growth. Candling removes that portion, and therefore the possibility of cones for that year. Cone and seed production require lots of energy from the tree, and when we remove the candles, all that energy can be directed into vegetative growth instead of reproductive growth.



Erin uses a tree saddle to keep her secure when climbing the pines that line the entrance to the Bonsai Museum. Photo credit: USNA.



ERIN HOLDEN

Gardener in the Bonsai & Penjing Museum

Erin grew up playing in the woods near her home in the suburbs of Richmond, Virginia, curious about all the different kinds of plants she saw there. From an early age, she helped her grandfather pick the vegetables from his garden, and as a child, she spent long hours poring over her mother's Rodale Encyclopedia of Indoor Gardening. At Radford University, Erin majored in biology and minored in chemistry, planning to become a veterinarian. However, her love of plants stayed with her, and once she began learning about their medicinal uses, she decided to pursue a degree in herbal medicine at Maryland University of Integrative Health. But she wasn't interested in clinical work. "I wanted to be outside with my hands in the dirt, not in an office," she says.

Starting as an intern in the National Herb Garden, Erin moved to the Bonsai Museum as an Agricultural Science Research Technician when an opportunity opened there six years ago. This gave her a chance to learn about Japanese gardening. With the help of long-time Bonsai garden volunteers and books on Japanese gardens, along with a two-week hands-on training seminar at the Portland Japanese Garden in Oregon, she learned how to create the aesthetic of a Japanese garden. Spring candling is one of the techniques used in this type of gardening, and Erin finds it very soothing and meditative. "Time seems to disappear when I'm in a tree," she says.

A self-described die-hard plant nerd, Erin still loves spending time in the woods and finding new plants to identify. She's currently completing a minor in horticulture at Oregon State University and when she's not outdoors, she uses her time for music lessons, jewelry making, and other crafts.

IS CANDLING RELATED TO CLOUD PRUNING?

Cloud pruning is basically training the branches to form separate pads, or "clouds." The term "cloud" can refer to roundish balls of foliage or flatter pads. The pine in front of the Administration Building is a great example. Candling is an essential part of the process. A good cloud won't have any branches or needles sticking out of the silhouette, the bottom of the pads will be smooth and sharp, and the overall appearance will be neat and tight. Skipping candling will result in untidy, misshapen pads that eventually blur into one another. If candling is skipped for too many years in a row, it can be difficult to get the tree back in shape and will take even longer to correct. You're always thinking long term when pruning pines. 🌲

KAREN ZILL is a DC-based freelance writer. Her work includes discussion guides for film and public television programs, memoirs, essays, and nature writing.



Summer Garden Tips: Be Proactive!

Nancy and Pierre Moitrier

No matter your level of gardening knowledge, your garden's size, or your garden's style, weeding is an obligatory task that will make your established garden healthier and more beautiful. Weeds not only compete with desirable plants for light, water, and nutrients, they can also host pests and diseases. Follow these easy, organic approaches to annual and perennial weed control:

KNOW THE SEASONAL CYCLE OF WEEDS. Soil temperature dictates when specific weed seeds will germinate. Different weeds will grow in January than will grow in July. With each different season—winter, spring, summer, fall—different weeds thrive.

KNOW THE LIFE CYCLE OF THE WEEDS. Annual weeds will die after they flower and set seed. Perennial weeds will persist year after year and continue to produce flowers and disperse seeds until their roots are killed.

KNOW THY ROOTS. Does the weed have a tap root (dandelion), a fibrous root (chickweed), or adventitious roots (English ivy)? Is it a bulb (*Ornithogalum*)?

KNOW EFFECTIVE CONTROL STRATEGIES.

- With all weeds, the most important point is to prevent seeds from dispersing. Remember, one year seedin', seven years weedin'!
- Spend 30 minutes weeding once a week as opposed to 2 hours weeding once a month to regularly remove weeds before they form seeds.
- Soils are more friable after a rainfall, which makes removing weeds much easier.
- Select the appropriate tool. A flat shovel can be used to remove large areas of fibrous rooted weeds. A hoe can be used to remove seedling weeds, while a digging knife can be used to remove bulbs, tap-rooted weeds, and individual weeds.

- With annual weeds, once seeds are set, the plant is dying. Application of an herbicide will be pointless at this stage of the plant's life. No need to grub out the root, just discard plants and seeds in yard waste, not in compost.
- With perennial weeds, it is critical to extract the entire root.
- Minimize soil disturbance which will expose latent weed seeds to light, causing them to germinate and create a new infestation. Follow up with a mulch application in disturbed areas.
- A 2-inch layer of shredded mulch will minimize germination of undesirable weed seeds.
- Armed with these proactive tips you will be able to suppress weed populations, which will eventually lead to weed-free-garden nirvana, and isn't that what we all strive for? 🌱



NANCY AND PIERRE MOITRIER operate *Designs for Greener Gardens*, a boutique gardening company that specializes in designing, creating, developing, and maintaining distinctive gardens of all styles. Pierre hails from France and brings the charm of the Old World to their garden creations. Nancy's 40 years of gardening experience combined with her design knowledge and innate artistic eye add a superior dimension to their garden projects. Follow *Designs for Greener Gardens* on Facebook.

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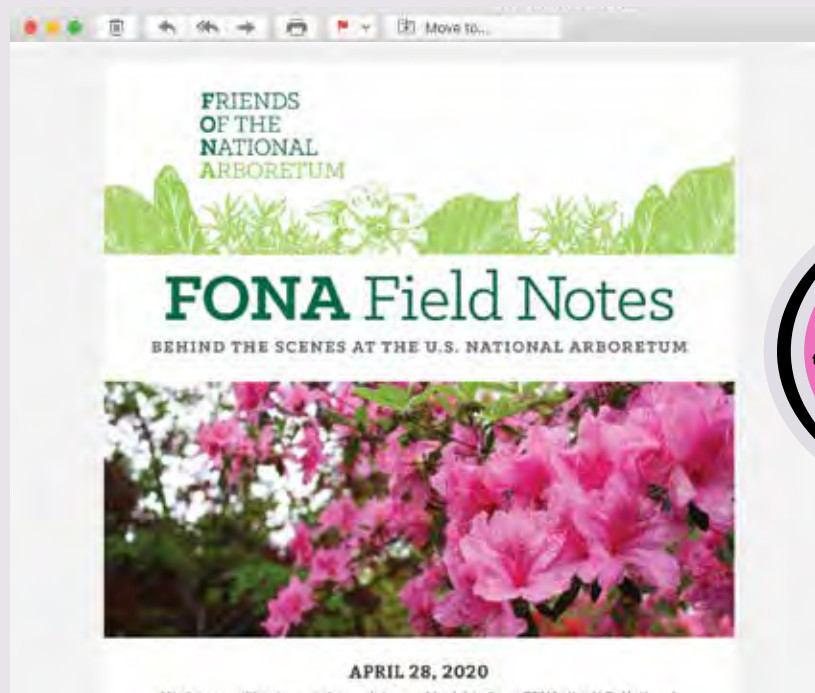
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HAPPENINGS *For more information, visit usna.usda.gov or fona.org*

GETTING UPDATES BY EMAIL AND ONLINE

Sign up for the FONA Field Notes email newsletters at FONA.org to get regular updates from the Washington Youth Garden, behind-the-scenes stories, pictures of the Arboretum, and the latest information.



REOPENING

The Arboretum will update the operating status of the grounds and public facilities on its website when it changes.
Visit usna.usda.gov for more info.

EVENTS

Like everyone else, our plans have been upended. The calendar of events is paused for now, but we will keep **FONA.org** updated.

FOLLOW

@FONArboretum and @WashYouthGarden on Instagram and Facebook to see what's blooming, the food donations harvested from the garden, recipes, gardening advice, education activities, and "plant yoga" videos!

