Dear Friends of Holden Forests & Gardens,

My first anniversary as president and CEO of Holden Forests & Gardens is just around the corner. This year has been one of listening, learning and building. And, then listening and learning some more. I’ve had the chance to meet, talk and get feedback from many of you. I want these conversations to continue. Your stories, comments and questions have been invaluable to me and the entire team as we plan for the future of Holden Forests & Gardens.

The Volunteer Recognition Event this past September was themed, “Volunteers Make Holden Forests & Gardens Sing.” I was lucky enough to have the chance to express my gratitude to the volunteer force that is 1,700 people strong, and the theme called my attention to an observation noted by Daniel H. Pink in his recent book, When: The Science of Perfect Timing. “Choirs are peculiar. A lone voice can sing a song. But combine a few voices, sometimes lots of voices, and the results transcend the sum of the parts.”

Not only was this statement fitting to describe the impact of volunteers at the Arboretum and Botanical Garden campuses, but I also think it describes the conclusion that has surfaced time and again as we build vision for the future of Holden Forests & Gardens:

“The sum of Holden Forests & Gardens, formerly the Holden Arboretum and Cleveland Botanical Garden as separate organizations, transcends the sum of the parts, and promises so much more mission impact in Cleveland and Northeast Ohio.”

In this issue, members of the newly shaped leadership team will share a bit about their roles and the reasons they choose to work at HF&G. The team is enthusiastic, creative, knowledgeable and ready to roll their sleeves advance the mission. I’m proud to have them as partners and look forward to introducing them to all of you.

The development of a new five-year strategic plan is a top priority during the coming year. We look forward to engaging you in this process. We want to know how you see the Botanical Garden and Arboretum working to benefit the needs of your neighborhood and Northeast Ohio.

In the meantime, I’m excited to give you a preview of our plans for the coming months following extensive planning work over the summer. We will be advancing initiatives that focus both internally and externally to grow attendance, build a sustainable financial model, position HF&G as a relevant and impactful nonprofit, lead regional urban and community forestry efforts; and implement new professional standards and practices for the organization.

All our initiatives have the same desired outcome to serve our community and to inspire a deeper understanding and connection to plants and the natural world around us. The Botanical Garden and Arboretum campuses are grounded in rich legacies of horticulture, science, learning, and beauty. As destinations, they are tremendous assets to our region. We will continue to invest in making our campuses inspiring and engaging places to visit.

You will see enhanced programming and exhibitions that make visits fun and worth coming back for; plus, programs for all ages will grow in variety and connection to the plants and natural world around us.

We will build on traditions like Goblins and GLIDW, and new ideas such as more active winter programming at the Arboretum. Our programs will be designed to reach audiences of all ages, but we are committed to ensuring a robust program schedule for children and young families to help advance the next generation of plant enthusiasts.

You will also see Holden Forests & Gardens out in the community and maybe even your neighborhood. We are putting great emphasis on work that expands our impact beyond the borders of the Arboretum and Botanical Garden campuses.

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Here is just a sampling of work that will continue and grow in the community:

**Sprouting Young Scientists (SPYS).** a new preschool multi–season outreach program encouraging hands on exploration of the world of plants using live plant materials. This year, 40 classrooms will take part in the second round of field testing.

The Cleveland Learning Experience for Science Collaborative, better known as CLEASC, is a group composed of Holden Forests & Gardens, the Cleveland Museum of Natural History, Shaker Lakes Nature Center, Great Lakes Science Center, Greater Cleveland Aquarium and Cleveland Metro Parks Zoo. Each organization provides hands-on science programming for a particular grade level in the Cleveland Metropolitan School District. We are field testing a new third grade program on the life cycle of plants and butterflies to 50 classrooms. Generous funding from several sources allows us to provide this outreach program encouraging hands on exploration of the world of plants using live plant materials. This year, 40 classrooms will take part in the second round of field testing.

Green Corps, an urban agricultural, work-study program for high school students can make a connection with science and the world around them.

For the past decade, the Scientist Lecture Series has been showcasing the work of researchers from around the country as they unravel the mysteries of nature and search for solutions to the challenges facing Earth’s diverse ecosystems. Introduced in 2008, the lecture series at the Holden Arboretum focused on providing our members and guests the opportunity to learn more about the work taking place in the Arboretum’s research labs and collections. Presented by members of the Arboretum’s research staff, the first lecture focused on sugar maple decline in the northeastern United States and the role air pollution may be playing in that process. The second explored research conducted at the David G. Leach Research Station on plant diseases affecting rhododendrons. In its second year, the scope of the series expanded, with researchers from partner institutions invited to share their work with Arboretum audiences. The first, Tom Rooney, from Wright State University, presented research on the ecological impact of the white tail deer on Ohio’s ecosystems. Since then, Holden Forests & Gardens audiences have welcomed scientists from botanical gardens and universities around the country.

**Academic Research,** which is often a program area little known to the general public and even our members. We are focused on raising the prominence and awareness of our science and research program housed at the Long Science Center. The team conducts original research in our collections and natural areas and publishes research in peer-reviewed international scientific journals to advance knowledge. We have partnerships with regional and national universities and our staff hold faculty appointments at Case Western Reserve, Hest State and Ohio State universities. This work benefits from access to our plant collections and natural areas. We hope to encourage more people to attend staff led hikes and public talks, including the Scientist Lecture Series and better conservation practices.

The lectures have been a hit with Holden Forests & Gardens audience, with 60 to 50 people attending each talk to learn more about science. The audience is diverse, with HF&G members mingling with college and high school students and faculty members from area universities. Holden Forests & Gardens kicked off the 10th anniversary year of the talks in October, when Jennifer Ison, PhD, from the College of Wooster, shared her work on plant-pollinator mutualisms. Presentations planned for the winter months include from Missouri to Mountains, Exploring Environments in a World of Change and Exploring Environments in a World of Change.

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Finally, the lecture series helps to showcase Holden Forests & Gardens’ research program and facilities, leading to new collaborations between the HF&G scientists and researchers from outside agencies. Burke said. These collaborations are fundamental to advancing our understanding of how forest ecosystems function and finding new and better conservation practices.

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Leading the Way
Team of New Hires and Seasoned Veterans Guide Holden Forests & Gardens
By Cait Anastis, Editor

Alpern's Education and Guest Experience team will be key player in realizing HFSG's mission to advance and inspire a deeper understanding of plants to enhance life. "My team's role is to bring understanding of plants to enhance life," he said. "My team's role is to bring..."

The newest member of the leadership team, Alpern joined the staff in August. Describing himself as a lifelong "museum geek", Alpern previously served as director of exhibitions at the Cleveland Museum of Natural History where he oversaw the museum's permanent and temporary exhibition programs. Prior to joining the staff at the Cleveland Museum of Natural History in 2006, he worked in exhibitions at the Peggy Notebaert Natural Museum in Chicago. The chance to be a part of Holden Forests & Gardens was an opportunity Alpern didn't want to pass up. "Having spent nearly my entire career in service to environmental science focused cultural institutions, the opportunity to lead and transform programs and experiences at HFSG's two incredible campuses was the chance of a lifetime," he said. "On meeting Jill and the team, I found their passion and drive was contagious - I was all in!"

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To help propel those efforts forward, Koski has built a new leadership time that is a dynamic mix of seasoned Holden Forests & Gardens veterans and talented newcomers, drawn from the non-profit and business world.

JOEL ALPERN, CHIEF OF EDUCATION AND GUEST EXPERIENCE

The past year has brought a number of changes to Holden Forests & Gardens as President and CEO Jill Koski has worked to move the organization forward in pursuit of the vision to help support greener communities in the Northeast Ohio.

To help propel those efforts forward, Koski has built a new leadership team that includes HF&G's research department. Burke earned his doctorate in biology from Rutgers University in New Jersey with an emphasis in ecology and evolution. His research focuses on plants and beneficial soil microbes. In 2012 he was named chairman of the research department. Burke says he works advances HF&G's outreach efforts. "All life depends on the conservation of nature and the natural resources nature provides. The science programs are dedicated to growing our understanding of plants and environmental science so that we may be effective stewards of the natural world and enhance the life-and-well-being of all our communities," Burke said. "Clean air, clean water - these are essential for the maintenance of all life and the well-being of our society. And plant conservation is the foundation upon which all our other efforts rely." Burke and his team are committed to preserving and promoting the beauty and value of plants in the natural world. "My team's role is to bring understand..."

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American Tree Sparrow

Spizelloides arborea

By Rebecca Thompson, Manager of Academic Programs

Strictly winter visitors, American tree sparrows, can be commonly seen nesting on the ground. Their nests are composed of twigs, grasses, and leaves, which they weave together to form a structure that blends into the surroundings. These sparrows are known for their distinctive song, a series of trills and whistles that can be heard during the breeding season. They are commonly found in open habitats, including edges of forests, gardens, and fields. Despite their small size, American tree sparrows are quite resilient and can adapt to various environments, making them a popular bird for bird watchers and nature enthusiasts. Their presence in the area indicates a healthy ecosystem, as they play a crucial role in the food chain by feeding on insects and seeds.
Volunteers 
During this season of giving, we especially appreciate the gift of our many volunteers who share their time and talent, their energy and creativity, their passion and commitment to supporting the mission of Holden Forests & Gardens. In September, we honored their collective contribution at our 2018 Volunteer Recognition events with the theme of Volunteers Make Holden Forests & Gardens Sing! In her opening remarks to volunteers attending the Arboretum campus event, President and CEO Jill Koski noted the inestimable value of having dedicated volunteers working together on behalf of our organization. “I know that you are far more than the specific roles and work you provide while directly fulfilling your volunteer commitment. You are community leaders, ambassadors, cheerleaders, members, donors and friends. We are grateful. Thank you for being a part of the choir that makes Holden Forests & Gardens sing!”

In addition to acknowledging the vital support of all our volunteers, several volunteers at both campuses received special recognition. At the Cleveland Botanical Garden Recognition Brunch, Sally Hanrahan was presented with the 2018 Botanical Garden Volunteer of the Year Award by last year’s recipient, Rodrick “Rod” Chima. Nominated by Kate Nickley, coordinator of the Hershey Children’s Garden, Hanrahan has been a familiar and frequent face in any volunteer activity involving children for the past 10 years. Be it at a special event such as Glow, Boo-tanical Bash, or Egg Hunt or through her weekly efforts in the Children’s Garden, she can be seen engaging, exciting and educating our youngest guests about the magical wonders found in our gardens. Hanrahan was also singled out for her “hard work, creativity and kindness” and the many ways in which she goes “above and beyond” to provide support and encouragement to staff and other volunteers. Hanrahan was congratulated on her award by Holden Forests & Gardens Chief of External Affairs Ellen Grevey, Board Chairman Bradley E. Turner, and Volunteer Coordinators Tracee Patterson and Sarah Hartley. Joining her at the podium were the 2018 Botanical Garden campus Lantern Award winners, Hollis Hamilton, Yvonne Morbitzer and Marianne Stern; and Birdhouse Award winners, Sharon Skora, Debbie Smith and Lor Whittington.

At the popular Holden Arboretum Recognition Clambake, Yvette Slusarski received the R. Henry Norweb Jr. Volunteer of the Year Award from 2017 winner Maria Stannek. A volunteer since 2011, Slusarski was recognized for her significant contributions to the education department. Nominating staff member Vanessa Pierce, manager of family engagement, shared that in addition to her work as a school guide and on special events and projects, “Yvette took over the difficult and time-consuming job of coordinating our Tree Tale Tellers program last spring. She was able to improve the program by making new bags and materials, as well as coordinating the training session and library visits. She handled everything with a professional demeanor and friendly smile. Her hard work paid off as we were able to reach 24 libraries, and 644 people were served in just two months.” Slusarski was thanked for her service by Koski, Turner, Hartley and Patterson. Also recognized were the 2018 Arboretum campus Lantern Award winners, which included Jane Brockway, Tish Collier and Amy Golzé, as well as Birdhouse Award winners, Jennifer Ault, Richard Beck and Al Cowger.

Volunteers with a lifetime achievement of contributing 1,000 hours or more to Holden Forests & Gardens were also presented with certificates at this year’s events, and included volunteers Hank Andrews, Marilyn White, Joyce Smith, Susan Lombardo, Hap Howle, End Haas and Sister Pat McHale.

Both individual and group volunteers share the gift of their time in a variety of activities and programs at both our campuses. If you are interested in joining our volunteer community, please contact Sarah Hartley, Arboretum volunteer coordinator, at 440.602.8003 or Tracee Patterson, Botanical Garden volunteer coordinator, at 216.707.2822 for more information.

The Gift of a Holden Forests & Gardens Volunteer

By Tracee Patterson, Volunteer Coordinator, Botanical Garden campus

Ed and Yvette Slusarski with Jill Koski and Brad Turner.

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Holden Forests & Gardens hosted 40 researchers from universities around the country at Phys-Fest2 last July at the Holden Arboretum. During the training for plant eco-physiologists, participants had the opportunity to learn new research and communication skills while conducting research using the Arboretum’s laboratories and the Murch Canopy Walk and Kalberer Tower. As part of the communications training, some of the participants were asked to write articles for Holden Forests & Gardens magazine about the research techniques they were using.

What happens when sunlight interacts with leaves? Some of the light passes through the foliage, some is reflected and some is given off in the form of heat. We are able to see the color of the leaves because our eyes can detect a portion of the reflected light. But how do leaves interact with the light that our eyes cannot see, including ultraviolet (UV), which is the light that causes us to get tan at the beach; or near-infrared (NIR), which is the light used to create heat in a space heater?

Scientists use a highly sensitive camera to measure the reflected sunlight from a material, such as a leaf, which splits light into hundreds of wavelengths (spectra), including many that humans cannot see, such as UV and NIR. Because different materials have different properties, they react with light differently, each has a unique spectral signature in the same way that every person has a unique fingerprint. This spectral signature describes how intensely each wavelength of sunlight is reflected and can be used to answer questions about what we cannot see with our eyes alone.

During Phys-Fest, attending scientists used a hyperspectral camera to image leaves to determine if it is possible to predict if the American beech leaves are infected by beech leaf disease based on their spectral signatures using a hyperspectral camera. Although the process only takes a few minutes the resulting images unlock an immense amount of detail about how sunlight interacts with these leaves. In the same amount of time it takes to microwave a bag of popcorn, the hyperspectral camera was able to capture 270 narrow wavelengths of reflected light from the target leaf. For comparison, a digital camera can capture an image of the leaf in only three broad color wavelengths: red, green, and blue, matching the colors detectable by the human eye.

The images from the hyperspectral camera reveal subtle differences in the intensity of reflected wavelengths of light, which in turn allow scientists to determine from the leaf if the plant is under stress from overheating or displaying lower photosynthetic activity as a result of disease. Researchers can then use these measurements to detect differences between vigorous, healthy leaves and those showing symptoms of disease or stress. Likewise, scientists can observe how individual leaves on a tree differ (e.g. photosynthetic rate and water usage) depending on whether they are exposed to consistent sunlight at the top of the canopy or are well-shaded closer to the ground.

During PhysFest2, scientists were able to differentiate leaves from American beech trees infected by beech bark disease, even when symptoms of the disease were not visible to the naked eye. We found that infected leaves seem to reflect less light in the visible wavelengths, while reflecting more light in the NIR when compared to uninfected leaves. These differences in the NIR could potentially be used in future research to examine the degree of infection in these trees or to understand how the infection spreads. It is amazing that these powerful cameras can detect differences that are invisible to us!

Editor’s note: Kinzie Bailey, University of Arizona; Aaron Kamoske, Michigan State University; and Luiza Aparecido, Arizona State University contributed to this story.
On a hot summer day, you may notice the leaves on your plants or backyard trees looking a tad thirsty. The hotter and drier it gets outside, the more water these plants use and lose. The leaves may even begin to wilt in response to overly hot conditions. Our observations tell us that this phenomenon often affects some plants to a greater degree than others, but what triggers the wilting to occur in the first place? Most plants are anchored to one location by their roots and cannot escape rising temperatures. They have no choice but to adapt to the stress they are undergoing. If they are not already adapted to withstand these conditions, sometimes trees within the same species might vary their response when growing in a hot environment. Plant physiologists have aptly dubbed this plant response "heat stress." When the temperature heats up, plants may simply lose more water to maintain functionality, and consume more water later to compensate.

In studying how heat stress affects plants, scientists have found that many plant species experience adverse consequences. These unfavorable conditions can affect plant growth in many ways, such as reducing photosynthesis. Scientists have also discovered that some species, and even sometimes certain individuals within a species, can resist heat stress quite well. This is great news because we want strong, healthy plants that can survive the unpredictable weather! Holden Forests & Gardens is an excellent place to study how plants tolerate prolonged heat waves and which trees need a cooler climate, as participants will explore the limitless potential of this medium using their own unique artistic vision.

What can all of this tell us about heat stress in plants? These studies help us gain insight about species habitat preference and how they adapt their leaf structure to cope with environmental stress. We can also make some inferences about which trees are more likely to tolerate prolonged heat waves and which trees need a cooler climate. Information that will help horticulturists and property owners select plants better suited to survive and thrive in changing climate conditions. Similarly, we see that trees with different leaf shapes (short leaf versus longleaf, twisted versus flat needles) respond differently to the environment even though they were grown in the same location.

Editor’s note: Phys-Fest 2 scientists Laura Ladwig, University of Wisconsin; Kinsie Bailey, Montana State University; and Jamie Mosel, University of Minnesota, contributed to this story.
Orchid Mania at Cleveland Botanical Garden, Saturday, January 26 through Sunday, March 10.

Holdenfg.org

Forests & Gardens is the member magazine for Holden Forests & Gardens, which includes the Holden Arboretum in Kirtland and the Cleveland Botanical Garden in Cleveland.

Our Mission: Advance and inspire a deeper understanding of plants to enhance life.

Our Vision: Vibrant green communities and diverse native forests of the Great Lakes region will flourish and sustain life.

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