Summary and Key Findings
from
Plants on the Move:
How Public Gardens Can Help Control Invasive Plants

November 10-11, 2016

Compiled by Theresa Culley[1], Kurt Dreisilker[2], Megan Dunning[3], & Clair Ryan[4]

1. theresa.culley@uc.edu, Ohio Invasive Plants Council, % Dept. of Biological Sciences at University of Cincinnati, 312 College Drive, PO Box 210006, Cincinnati, OH 45221
2. kdreisilker@mortonarb.org, The Morton Arboretum, 4100 Illinois Route 53, Lisle, IL 60532
3. mdunning@mortonarb.org, The Morton Arboretum, 4100 Illinois Route 53, Lisle, IL 60532
4. mipn@mortonarb.org, Midwest Invasive Plant Network, % The Morton Arboretum, 4100 Illinois Route 53, Lisle, IL 60532

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Participants of *Plants on the Move* discussing how public gardens can help prevent plant species from becoming invasive by collecting and synthesizing records of plants escaping cultivation and then disseminating this knowledge to wider audiences.

Introduction

Public botanical gardens and arboreta are living museums and as such, their core missions include the collection and display of herbaceous and woody plants from their local region or from around the world. To fulfil this mission, gardens and arboreta continually research, test, and accession new plants to build diverse collections. A small percentage of exotic plant species accessioned for ornamental display reproduce and spread outside of cultivation and, if left unchecked, can spread to natural areas and become invasive. The Morton Arboretum, in partnership with the Midwest Invasive Plant Network and the Ohio Invasive Plants Council, sought to explore the role of gardens and arboreta in monitoring the spread behavior of plants and in sharing data collected.

Towards this end, these partners convened the symposium and working group meeting Plants on the Move: How Public Gardens Can Help Control Invasive Plants on November 10-11, 2016 at The Morton Arboretum. Prior to the conference, a survey to better understand the current role of public gardens in identifying and controlling undesirable plants that spread from cultivation was circulated through American Public Gardens Association and ArbNet. At the conference, representatives from 23 public gardens from 17 states and from Canada shared their expertise through presentations, and discussed how we can monitor, manage, and share information on plants escaping from cultivation. This summary includes the key findings of this working group, and the survey results, presentations shared at the conference (and speaker biographies), and working group discussion that informed these findings.

Overall, the meeting and the working group discussion reinforced that the potential introduction of new invasive plants through plants that escape cultivation is a critical issue for public gardens and arboreta. These institutions collect valuable information on plant movement that is not always available through other sources, or that corroborates information from other sources or regions. Public gardens and arboreta have the opportunity to take a leadership role in identifying and responding to plants escaping from cultivation by collaborating to share information and develop solutions. The next steps for this project include: pursuing development of a tool for documenting and sharing data among public gardens and their relevant audiences, development of a space for sharing resources related to invasive species for these groups, and engaging more gardens in the conversation and with these resources.

Key Findings and Next Steps

Findings:

- Potential introduction of new invasive plants through plants that escape cultivation is an important issue that public gardens and arboreta should engage in, discuss, and develop solutions for.
    - There is currently a wide variety of current practices, capacity, and interest in approaching this issue in the public garden and arboreta community.
    - Public gardens and arboreta have the potential to become leaders on this issue.
        - Public gardens and arboreta often have the resources and expertise to observe and document the movement of plants on the landscape.
        - Public gardens and arboreta can detect new invasives during the critical lag time between introduction and significant spread and population growth, enabling rapid response and minimizing impacts to natural areas.
- Gardens and arboreta should not hesitate to openly discuss the fact that plants do move beyond the bounds of cultivation.
    - Such openness to discussion was readily exhibited at the meeting.
- Escaping from cultivation and invasiveness are not the same thing.
    - Not all plants that escape cultivation cause the ecological, economic, or human health harm required to be considered invasive.
    - A potential threshold for invasiveness requiring removal from collections is when a species spreads to natural areas and exhibits the ability to form self-sustaining populations that grow over time.
- It is desirable to develop a tool for public gardens and arboreta to contribute and share observations about plants ‘on the move’.
    - The information contained in the tool should be accessible to an audience beyond just garden and arboreta staff/managers.
    - The tool should capture regional differences - a plant that escapes or shows invasive potential in one region may not show those characteristics in another.
- It is desirable to develop an information hub for gardens to share resources related to identifying and managing species that are potentially escaping from cultivation or invasive, including policies, monitoring guidelines, reporting tools, and more.
- It is important to garner input and participation from a broader audience of gardens and arboreta than those that attended the meeting.

Next Steps

- Pursue development of a tool for documenting and sharing data.
    - Answer important questions such as:
        - How will tool development and maintenance be funded?
        - Where will the tool be housed?
        - Who takes the lead on development?
        - Who has input into development?

        - With whom shall information be shared (gardens or larger community?)
- Pursue development of a space for sharing resources related to invasive species, including policy documents, useful websites and watch-lists, and other tools related to identifying and taking action on potentially aggressive species.
- Engage more gardens in the conversation to garner diverse input and support
    - Share the summary of the Plants on the Move Summit widely with other gardens and solicit feedback.
    - Present poster on Plants on the Move Summit at APGA 2017 Conference, June 19-23, 2017 (completed).
- Assemble a working group/committee in 2018 to mobilize next steps. Please contact Kurt Dreisilker (kdreisilker@mortonarb.org) for more information or if you are interested in joining the conversation.

Survey and Results

Prior to hosting the Plants on the Move Summit, The Morton Arboretum and the Ohio Invasive Plants Council composed a survey for public gardens and arboreta to collect some background information about if and how plant spread issues are considered and addressed at these institutions. The survey was distributed via email to all APGA members and also via ArbNet. The survey received responses from 35 institutions primarily from the United States, although two responses were from international institutions (one each in Canada and Australia).

A primary finding of the survey was that many public gardens and arboreta have seen plants moving to, from, and around their properties, are concerned about those movements, and have taken action in response. Of our 35 respondents, 32 (91.4%) observed plants spreading from cultivation, 30 (85.7%) expressed concern about observed or potential plant movement, and 31 (88.5%) reported existing programs to control spreading plants. Of the institutions with control programs, most said that they would deaccession species from their collections if they were spreading beyond an institution-specific threshold. Twenty-three respondents (65.7%) said that their collections policy contains provisions regarding the accessioning of taxa known to be invasive.

Our respondents generally demonstrated a high level of awareness and concern about plant spread, and as a result, many have established control programs. However, responses regarding whether the results of this work are currently shared outside of the institution were mixed. Only about half of our respondents currently share information about plant spread and prevention efforts. Thirty-one (88.6%) of our respondents indicated that they believe they could benefit from sharing information on this topic with other public gardens, particularly other institutions in the same region or climatic zone. Twenty-six (74.3%) also said that their institution would share information about plant movement to some sort of network, even if that network were viewable by the public. Six others (17.1%) were willing to share information with certain restrictions on who would have access to the data and how they would be used. Only one respondent (2.8%) expressed no interest in sharing. Similarly, all but one respondent expressed interest in joining a program or network to share information assuming minimal out-of-pocket costs.

Our key conclusions from this survey and the chief driver for coordinating the meeting was that public gardens and arboreta widely tackle plant spread issues but don’t necessarily share their outcomes or lessons learned along the way. Both the public garden community and the general public could potentially benefit and learn from gardens sharing and publicizing this information more broadly.

Summit Presentations

DAY 1

The Role of Public Gardens in Addressing the Problem of Invasive Plants: Honoring Sarah Reichard's Legacy – *Kayri Havens, Chicago Botanic Garden*

Many invasive species were originally introduced for horticultural purposes, and several continue to be both utilized as landscape plants and profitable for the green industry. This issue was brought to the forefront for public gardens in a series of workshops designed to link experts in ecology and horticulture to prevent plant invasions organized by Sarah Reichard in the early 2000s. These workshops developed voluntary codes of conduct for a variety of stakeholders designed to curb the use and distribution of invasive plant species through self-governance. This presentation demonstrates how these codes have been implemented at the Chicago Botanic Garden and how they have shaped research and curatorial efforts. For instance, deciding how to treat cultivars of invasive plants led to a research project to address how fecundity of cultivars affects potential invasiveness. The garden modeled the effect of reducing fecundity on population growth rates of invasive species and used the results to determine the garden's cultivar policy. Finally, this presentation reflected on how Dr. Reichard's leadership has raised awareness about, and curbed the use of, invasive plants in public gardens and beyond.

Beyond the Blame Game: From Innocence to Influence – *Kurt Dreisilker, The Morton Arboretum*

Long before the term 'invasive species' was coined, The Morton Arboretum was planting thousands of trees, shrubs, and other plants from around the world. For almost 100 years the mission has remained the same, but our perspective has changed. Today the Arboretum has numerous resources to help inform invasive plant management, such as herbarium specimens, collections plant records, numerous staff members studying the local flora, and 1700 acres of living collections and natural areas to discover plants escaping cultivation. After decades of accumulating data and knowledge, we can leverage these resources and help transition the Arboretum from a period of innocence to influence.

Formation and Context of the St. Louis Declaration – *Kimberlie McCue, Desert Botanical Garden*

In 2001, a landmark workshop was convened at Missouri Botanical Garden that brought together a diverse set of stakeholders to learn from each other and work cooperatively to address the challenge of invasive plants. Scientists, nurserymen, garden club members, government, landscape architects, and botanical gardens all came to the table and over three days found common ground. The result is the St. Louis Declaration On Invasive Plant Species, a statement of findings and principles that 15 years forward still hold true. Coupled with draft voluntary codes of conduct the St. Louis Declaration can provide a springboard for action moving forward.

A Framework for Conservation in North American Public Gardens – *Murphy Westwood, The Morton Arboretum*

In the past few decades, significant advances have been made across the botanic garden and arboretum community to evolve missions and focus priorities towards conservation of the natural world, involving activities such as habitat restoration, species conservation, rare plant propagation, and germplasm collecting for genetic diversity conservation. Gardens have also become increasingly vigilant to prevent the escape of potentially invasive cultivated plants into the wild. The North American Botanic Garden Strategy for Plant Conservation provides a framework and road-map for local and regional plant conservation efforts in public gardens and arboreta. It outlines 17 specific plant conservation targets for the garden community to achieve by the year 2020. Target B5 of the North American Strategy states that all botanic gardens will increase their roles in the management and control of invasive species. Sub-targets include the development of invasive species policies and the adoption of codes of conduct such as the St. Louis Declaration on Invasive Plant Species. This presentation introduced the North American Strategy, highlighted model case studies and tools for successful invasive species management by gardens, and provided garden staff with the international policy mandate to support efforts to implement invasive species policies and practices.

Stopping the Invasion at Chicago Botanic Gardens – *Jacob Burns, Chicago Botanic Garden*

With an increased awareness about the environmental and economic threats posed by invasive species, the Chicago Botanic Garden developed a proactive invasive plant policy. Jacob Burns explained how the Garden adheres to this policy without compromising its horticultural mission or the beauty of its landscapes. He also provided examples of problematic plants that have been recently removed from the Garden's collections.

What Public Gardens Can Contribute to Research on Invasive Species – *Theresa Culley, University of Cincinnati*

With an ever-growing concern about invasive plants in society today, public gardens now have an unprecedented opportunity to take on a leading role in working with researchers to address this issue. Because botanical gardens and arboreta across the country carefully monitor their collections of introduced plants, they are ideally positioned to be the first to detect species that may escape cultivation and thus have the potential to become invasive on a larger scale. Gardens often also maintain multiple cultivars of a given taxon, often planted in close proximity to one another - a condition that will maximize the likelihood of hybridization, which has been recognized as a trigger for plant invasions of some species. Far from being blamed for past introductions of plants that later became invasive, gardens can now be recognized for their proactive role in the early detection of invasive plants and their work with researchers to reduce the negative impact of these species in natural areas.

Public Garden Management of the Unwanteds: Great Plants of Yesteryear Now Termed Illegals – *Craig Morell, The Kampong of the National Tropical Botanical Garden*

When the wrong plants get into the wrong places, both natives and exotics can get out of hand. This presentation focused on how good plants go bad, how they got there, and why the problems won't go away anytime soon. Mr. Morell discussed a Floridian's perspective on the reasons why so many plants get out of hand and the vectors of weed plants.

Restoring an Old Growth Urban Forest in the Heart of The New York Botanical Garden – *Jessica Schuler, The New York Botanical Garden*

Since 2008, The New York Botanical Garden has been actively managing the 50 acre Thain Family Forest with the goal of reducing invasive species and promoting natural regeneration. This presentation highlighted the forest inventory process, lessons learned from managing priority invasive species, monitoring the establishment of non-native plants, and restoration techniques including native plant production, species selection, and planting strategies.

DAY 2

Development of a Weed Risk Assessment for Botanical Gardens: Utilizing Database Technology to Evaluate Species for Invasive Potential – *Brittany North, Missouri Botanical Garden*

The Missouri Botanical Garden (MBG) in St. Louis is continuing the work begun by the *St. Louis Declaration on Invasive Plant Species* by implementing technologies that evaluate the Garden's accessions for invasive potential. Since the St. Louis Declaration, MBG has made an intentional effort to remove known invasive plants from its living collections and to monitor potential invasive plants using mapping and database technologies. Over the last few years, MBG has renewed its focus on increasing collections diversity to support conservation of threatened species while realizing the need to reduce the risk of introducing non-native plants of potential invasiveness. Beginning in 2012, MBG began to research and develop a formal Weed Risk Assessment (WRA). In 2016, MBG applied for and received funding from the United States Department of Agriculture to integrate the WRA framework into its Living Collection Management System (LCMS). This new WRA tool consists of three phases ranging from literature review to field observations. Once fully integrated into the LCMS, the WRA methodology will be shared with other botanical gardens.

Meet PlantRight PRE Tool & Database (aka What's in PRE for Me?) – *Jan Merryweather, PlantRight*

PlantRight is one of several programs of the California non-profit (501c3), Sustainable Conservation, which has spent over twenty years advancing environmentally friendly practices that are also good for business. Not your typical San Francisco environmental group…Sustainable Conservation business partners are diverse and include the: auto industry,

commercial agriculture, dairy industry, and horticulture industry. All Sustainable Conservation programs base decisions on science and make decisions by consensus.

American Public Gardens Association as a Potential Central Point of Communication and Available Platforms – *Pam Allenstein, American Public Gardens Association*
Ms. Allenstein provided an overview of communication methods utilized by American Public Gardens Association including electronic and print media, as well as online and in-person professional development programs. Details were provided on the Association's professional sections, their online discussion forums, and specialized resources.

ArbNet as a Potential Platform for Communication – *Sue Paist, ArbNet*
ArbNet was presented as a potential communication platform for the community of gardens focused on preventing the escape and spread of invasive cultivated plant species. ArbNet is the interactive, collaborative community of arboreta and tree-focused professionals. ArbNet facilitates the sharing of knowledge, experience and other resources to help arboreta meet their institutional goals and to strengthen the network of arboreta around the world. ArbNet has the capacity to host a dedicated information hub for resources, guidelines, and policy documents related to preventing invasive cultivated plants. ArbNet currently offers related resources on its website, including the Invasive Plant Species Voluntary Codes of Conduct for Botanic Gardens & Arboreta and templates for collections policies that include specific language relating to invasive species management and prevention. The discussion forum on the ArbNet website can also be utilized to increase communications among gardens and other sectors, providing a platform for a broad audience of stakeholders to ask and answer questions, report on invasive management activities, flag new potential invasives on a regional basis, and share observations. In addition to the resource hub and discussion forum, ArbNet also provides a quarterly newsletter and social media outreach as additional channels for active communication around the subject of invasive cultivated plants.

Working Group Discussions

Discussion Question: How do you define "escape from cultivation" at your garden?

The following potential definitions were developed through small group discussions:

- Escape from cultivation is the unassisted sexual or asexual reproduction of plants that allows offspring individuals to grow and continue reproducing outside of the spatial area where they were intended to grow (the question of spatial threshold is discussed below).
- Escape from cultivation is plant spread or growth that exceeds management capacity.

It was noted that plants that escape from cultivation may exhibit one or more of the characteristics commonly seen in invasive plants including aggressive/rapid spread through sexual and/or asexual reproduction, vector-assisted dispersal over considerable distances, hardiness/favorable phenology, rapid growth of individuals, allelopathy, and a propensity to cause ecological and/or economic harm.

Not all plants that escape cultivation will become invasive (i.e. certain plants may spread beyond the boundaries intended for cultivation, but without posing significant ecological, economic and/or human health threats that generally characterize invasive plants). Unassisted plant spread can be conceived on a continuum from "unable to grow/reproduce and spread in any setting without human assistance" on one end and "highly invasive with a propensity to spread aggressively in natural areas" on the other end.

Discussion Question: What is the threshold for when concern and possible action is warranted about an escapee at your garden?

This threshold can be construed in a number of ways: as a threshold regarding the physical distance of travel of the escapee from the parent plant, as a threshold regarding the cultural settings into which the offspring are able to establish and then successfully reproduce, and as a threshold regarding the quantity of escapee offspring observed. Many attendees stated that the movement of a cultivated plant into open/green space either on or off of the garden's property would be a trigger for concern. The area of new colonization does not necessarily have to be a high quality natural area to trigger concern (e.g. spread to adjacent road or utility right-of-ways may be a problem). The number of viable seeds produced by the species, mechanism of dispersal, and other key biological traits of the species in question may need to be considered to determine an appropriate threshold.

Discussion Question: When does your garden make the decision that something is escaping?

Generally, institutions make this decision after evidence is presented showing escapees exceeding one or more of the thresholds described above. Standards of evidence required for a

decision and action vary from garden to garden. Examples of forms of evidence include anecdotal observations from staff or volunteers, voucher records and other hard-copy documentation, and secondary research about how the taxa and species has behaved in other settings, including its native range and other places where it has been cultivated.

Discussion Question: What do you do with accessioned plants when they escape?

The response to escaped plants varies by institution. As a first step, many collect evidence of the escape, such as documenting or flagging plants outside of their intended area of cultivation. The collected evidence is then presented to a person or body that would ultimately make a decision about what to do with the parent plant. This might be the director of collections or an invasive plant workgroup or advisory board. The decision may depend on the strength of the evidence against the accessioned plant, including monitoring data demonstrating movement/spread and the strength of conclusions from secondary research (e.g.. if the plant can be characterized as a known invasive, deaccessioning it may be a relatively uncontroversial decision). The decision may also depend on the philosophy of the particular garden. Some will deaccession any non-native plant with evidence of escape. Some gardens feel a desire or sense of responsibility to be trendsetters, leaders, or influencers in terms of taking a precautionary stance against potential new invaders. Some institutions maintain invasive/spreading species watch lists, which characterize species on a case-by-case basis.

Discussion Question: How do you get buy-in about escapees within your garden?

Discussion revealed that the degree of buy-in necessary can vary widely depending on garden size, structure, staffing, etc. Directors at smaller gardens may be able to make executive decisions about deaccessioning without significant buy-in. Others may have invasive plant workgroups that would be engaged in the decision-making.

Obtaining buy-in may involve presenting the collected evidence of escape to staff with multiple perspectives including curators, directors, natural area staff, horticulturalists, and landscape architects. Alerting a variety of staff about potential escapees early can help with collecting observations. It may also be important to get buy-in from volunteers, especially if they are helping to remove the escapees or performing an early detection role in natural areas. Depending on the situation and capacity of the garden, it may be desirable to seek buy-in and/or participation from outside parties including neighboring property owners and the nursery industry if the species or taxa is widely available as an ornamental. It was generally agreed that obtaining buy-in can be a lengthy process. Using effective education and outreach techniques can be important for garnering public support.

Another observation was that buy-in can be easier to obtain when conclusions regarding the invasiveness of the species or taxa in question are supported by third parties such as the American Public Garden Association (APGA) and/or other state and regional groups.

Additionally, some felt that it is important for gardens to have formal policies and/or strategic plans addressing invasive plant issues.

Discussion Question: What data have you been collecting, and who is collecting it?

Types of data collected by various institutions include: GPS/GIS location of escaped plants and supporting info (e.g. date observed, distance from parent plant), herbarium vouchers, photographs, deaccession records/tags, and databases. Documentation protocols may be different for escapees versus known invaders and for plants versus insect pests. Some gardens maintain or utilize ranked invasive/escapee watch lists. Data can be collected by multiple people including natural areas and horticultural field staff, volunteers, curators, science and research staff, and visitors.

Discussion Question: How is data recorded?

Formats for recording data included paper records, herbarium voucher specimens, databases (e.g. GIS, Microsoft Access, BG-BASE, web-based systems), web platforms (e.g. iNaturalist, iMapInvasives, EDDMapS), spreadsheets, and through institutional memory (i.e. via staff awareness from conversations but not through formal record keeping). Institutional invasive species workgroups sometimes document their lists and risk assessments, as well as ranking species within their collections. Additionally, meeting minutes and white papers also record some data.

Discussion Question: What information is not currently being collected that would assist in verifying that a plant is escaping?

Data and knowledge gaps identified through discussion included: access to comprehensive lists of invasive or watch plants; defined protocols for risk assessment and ranking; evidence of adverse impacts on native plant communities; population change over time for escaped species (the rate, distance, and extent of spread); understanding how an escaped species behaves in its native range; characteristics of colonized areas (level of disturbance, native plant diversity before invasion, soil types, etc.); negative observations (i.e. records of where the plant is not found); impacts of climate change on plant movement; landscape/land use history; predictive models of plant movement; phenological data; understanding vectors of spread; relative fecundity of cultivars; tolerance of escapee species to environmental hardship (e.g. drought, soil compaction, high salt levels, flooding, etc.); and successes and challenges regarding the control of escaped and invasive plants.

These gaps may be more indicative of information that is not being shared effectively between partners than information that is not being collected at all.

Discussion Question: How can we store and easily access information to help close the gaps described above?

The group discussed the need for consistent terminology and discussed when is more appropriate to characterize a plant as “spreading” versus when is it appropriate to characterize it as “invasive.” Participants discussed a desire for a master list (either national or regional) of invasive and/or spreading plants. Ideally, public gardens would contribute to the development of these lists. Some felt that there may be value in standardizing how data about plants on the move are recorded and shared.

Discussion Question: What do we need our information sharing system to do?

Participants identified the following as important characteristics for an information sharing system: easily accessible; user-friendly; able to store both quantitative and qualitative data; able to facilitate discussion and sharing of experiences; should acknowledge and accommodate differences between different methods and protocols; should include searchable plant lists, databases, maps; should accommodate ranking; database should be taxonomically structured, georeferenced and sortable by region; should function on an international scale; should be mobile device compatible; and, there should be a dedicated staff person responsible for coordinating the database and information sharing network.

The group discussed whether the system should be open to input from the public (e.g. citizen science) or closed to garden affiliated users only. When a citizen science approach is utilized, verification is important to ensure overall quality of data.

Discussion Question: How can we use existing tools?

The Plant Risk Evaluator (PRE - http://www.plantright.org/pre) was identified as having been helpful to smaller gardens with fewer resources. It may be a good model or platform for collecting and sharing data, though it was not clear if it can incorporate geospatial data in its current form. The Sentinel Plant Network was discussed as a useful model for sharing information about plant pests. Perhaps it could be adapted to share information on spreading and invasive plants. Professional email listservs and/ web forums were identified as being useful for comparing qualitative and anecdotal information. APGA or ArbNet could potentially host this type of discussion. A listserv or forum would also be useful for disseminating information about and tools produced by this initiative.

Discussion Question: What other tools should be considered?

The following additional tools were mentioned by participants: annual written reports where each garden briefly documents updates regarding movement of spreading or invasive plants observed that year; facilitated discussion coordinated by APGA; citizen science platforms like EDDMapS and iMapInvasives (though it was unclear if those platforms would allow data

reporting for specific cultivars); mobile data entry tools similar to the Great Lakes Early Detection Network (GLEDN) app; and the Plant Collections Network.

Discussion Question: Who needs access to the data?

The primary audience was thought to be horticulturalists, nursery professionals, plant propagators, and landscape architects, while the secondary audience (perhaps engaged at a later stage) would be invasive plant councils, regulatory agencies, and the general public. Specific groups identified that might benefit from access/involvement included: large and prominent public gardens such as the New York Botanical Garden and Missouri Botanical Garden; national professional associations (e.g. APGA); university research programs; state cooperative extension offices including master gardeners and master naturalists; arborists; the green industry including trade organizations; landscape architects; Botanic Gardens Conservation International; AmericanHort and the Cultivate Conference; Association of Zoological Horticulture and the Association of Zoos and Aquariums; International Plant Propagators' Society; Ecological Landscape Alliance; Perennial Plant Association; Garden Club of America; Garden Writers of America; Arbor Day Foundation.

It was noted that if plant watch lists are generated, they would need to be shared with caveats (i.e. that plants appearing on the list may not be invasive or even spreading in all planting situations).

Speaker Biographies

Kayri Havens holds a B.S. and an M.A. in Botany from Southern Illinois University and a Ph.D. in Biology from Indiana University. She spent three years as the Conservation Biologist at Missouri Botanical Garden before joining the Chicago Botanic Garden in April 1997. She is currently the Garden's Director of the Division of Plant Science and Conservation and Senior Scientist. Her research interests include the effects of climate change on plant species, restoration genetics, the biology of plant rarity and invasiveness. She is on the adjunct faculty of Loyola University, Northwestern University, and the University of Illinois-Chicago and collaborates with a variety of academic institutions and stewardship organizations to help improve conservation efforts for plants.

Kurt Dreisilker has a B.S. in Plant Biology and M.S. in Natural Resources and Environmental Sciences from University of Illinois at Urbana-Champaign. His first three years of service working at The Morton Arboretum began in 2001 to maintain the Arboretum's Living Collections, and in 2004 he began managing the Arboretum's 900 acres of natural areas. Now, as the Head of Natural Resources, he utilizes his unique perspective from these two roles to help inform various audiences about invasive species. He was a founding steering committee member of Northeastern Illinois Invasive Plant Partnership and is currently the treasurer for the Midwest Invasive Plant Network.

Kimberlie McCue hails from the Midwest, and completed her undergraduate degree at Missouri Western State College and her graduate degree at the University of Missouri-Columbia. Kimberlie worked as Conservation Biologist for Missouri Botanical Garden from 1997-2005 and participated in development of the St. Louis Declaration and draft voluntary codes of conduct for botanic gardens and arboreta. She then chaired a multi-stakeholder committee that used the draft codes to guide development of MBG's first invasive species policy. Today, Kimberlie works for the Desert Botanical Garden in Phoenix, Arizona, focusing on both threatened species and habitats, and invasive species.

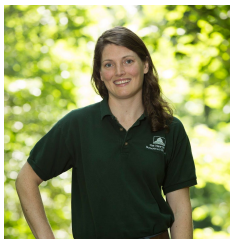
Murphy Westwood is the Tree Conservation Specialist at The Morton Arboretum in Lisle, IL (USA) and a Global Tree Conservation Officer for Botanic Gardens Conservation International in London (UK). Murphy is responsible for developing and implementing the strategy and projects of the Global Tree Conservation Program at The Morton Arboretum. The Program advances tree conservation efforts through global collaborations, with specific focus areas in China, Mexico and the genus *Quercus* (oaks). Murphy also manages ArbNet (www.arbnet.org), the interactive community of arboreta, and administers the ArbNet Arboretum Accreditation Program. Murphy obtained her PhD from the University of Cambridge (UK), her MS from Imperial College (UK) and her BS from the University of Michigan (USA). In addition to participating in various professional and botanical

societies, Murphy is a member of the IUCN/SSC Global Tree Specialist Group and Vice Chair of the Plant Conservation Professional Section for the American Public Gardens Association.

Jacob Burns works as the curator of herbaceous perennial plants at the Chicago Botanic Garden, where perennials, bulbs, herbaceous vines and groundcovers make up the most extensive part of the Gardens' collection. His responsibilities entail increasing the size and diversity of the collection, conducting collections-based research, and sharing information about herbaceous perennials with the public and professionals alike. Jacob has been with the Garden since 2008 where he formerly worked as a horticulturist in the Waterfall and Dwarf Conifer Gardens and coordinated the horticulture intern program. Previously, he worked for Pawling Properties and interned at Garden in the Woods and North Carolina Botanic Garden. Jacob's passion for perennials began at an early age when he started sketching wildflowers for his local nature center and assisting botanist and Trillium expert Fredrick W. Case with his home gardening.

Theresa Culley is a Professor of Biological Science at the University of Cincinnati, where her research focuses on invasive species, especially those of ornamental origin (most notably the Callery pear, *Pyrus calleryana*). She is a board member of the Midwest Invasive Plant Network and also a past-president of the Ohio Invasive Plants Council where she currently serves as Chair of their Invasive Plant Assessment Team. In this capacity, Theresa has worked directly with the nursery industry, land managers, researchers, and government to help craft the invasive plant assessment protocol for Ohio, which is now used to identify invasive plants on the state level. As an avid gardener, Theresa is also keenly interested in identifying practical solutions when some ornamental plants become weedy and to help communicate science to the general public.

Currently the Director at the Kampong Botanical Garden in Miami, **Craig Morell** is a lifelong plantsman. Growing tropical plants and orchids since 15, he has a B.S. degree in Ornamental Horticulture from the Univ. of Florida, has worked as resort horticulturist,State Government nursery Regulation, private orchid nursery manager, municipal horticulturist, and now as a public garden director for an NPO. He tries to limit his plant interests to angiosperms, gymnosperms, monocots and dicots. Hailing originally from Milwaukee, he has lived in South Florida for almost 30 years.



Jessica A. Schuler, Director of the Thain Family Forest at The New York Botanical Garden, is responsible for the management of the 50 acre, old growth urban forest including ecological restoration and the development of education and research programs. She teaches about urban forest restoration, invasive species, and native plants. Jessica earned a BS in plant science with distinction in research from Cornell University and is an

ISA-certified arborist. Jessica is an advocate for native plant conservation and ecological restoration.

Brittany North joined Missouri Botanical Garden in 2013 after completing her Master of Science in Environmental Science and Policy at George Mason University (Fairfax, Virginia). She currently works in Plant Records where she collects, enters, and maintains data for the Garden's living collections, processes plant label requests, and coordinates weather and phenology-related projects. She is currently working to develop, test and implement a Weed Risk Assessment for MBG. Her previous work has involved restoring native ecosystems to previous natural states in McHenry County, Illinois, researching the mycobiome of the invasive *Microstegium vimineum,* and managing noxious weeds for the Bureau of Land Management in Nevada.

Jan Merryweather, Senior Project Manager at Sustainable Conservation, leads the PlantRight program with invaluable support from her team and plant scientists and nursery professionals across the nation. We're serious about "invaluable," because most of Jan's career has been in the consumer product and energy efficiency sectors. Jan joined Sustainable Conservation in 2013, and graduated from Stanford University at a time when palm and eucalyptus trees were revered by the community.

Pamela Allenstein has worked at American Public Gardens Association since 2000. She manages the Plant Collections Network, a program facilitating a continent-wide approach to plant collections preservation at public gardens and promoting high curatorial standards in collections management. The Network includes 130+ Nationally Accredited Plant Collections and works in collaboration with the USDA-Agricultural Research Service. Allenstein leads the Association's tree gene conservation partnership with the US Forest Service, and represents public gardens on the National Clean Plant Network for Roses board. Previous experience includes 15 years working in curatorial and horticultural roles at public gardens and within the green industry. She holds a B.S. in ornamental horticulture and M.S. in public gardens administration.

Sue Paist, ArbNet Coordinator, has been managing the network since 2011. In Sue's role as ArbNet Coordinator she works with the arboretum community worldwide developing communication channels, facilitating information exchange, collaboration and dialogue. Sue also coordinates the ArbNet Arboretum Accreditation Program that focuses on quality, standards and thresholds providing guidelines, models, expertise, and inspiration so that the entire arboretum network is stronger, more connected, and together is advancing the quality and capacity of tree-focused gardens.