Conservation Horticulture Expertise at Botanic Gardens

BOTANIC GARDENS CONSERVATION INTERNATIONAL

UNITED STATES BOTANIC GARDEN

Conservation Horticulture Expertise at Botanic Gardens

Abby Meyer, Emily Bruns, Jeremy Foster, Ray Mims, and Raakel Toppila

October 2024

Acknowledgments: BGCI-US gratefully acknowledges those who responded to the 2022 Conservation Horticulture Survey, and the United States Botanic Garden for making this project possible. Special thanks to Emily Coffey at the Atlanta Botanical Garden for providing advice on conservation horticulture, and to Emily Hestness at the United States Botanic Garden for advising on the design of the survey tool for this study.

Recommended citation: Meyer, A., Bruns, E., Foster, J., Mims, R., and Toppila, R. (2024) Conservation Horticulture Expertise at Botanic Gardens. BGCI-US, San Marino USA.

Cover photos: Top: DNA sampling for GGI-Gardens at Desert Botanical Garden (photo credit: Desert Botanical Garden). Middle: Tony Gurnoe collecting *Romneya trichocalyx* herbarium voucher from Monardella Gulch (photo credit: San Diego Botanic Garden). Bottom: Participants from Mauritius, Rodrigues, the Seychelles and Reunion, learning how to collect good quality seed from threatened species to establish conservation collections and prepare for species recovery programs (photo credit: BGCI).

BOTANIC GARDENS CONSERVATION INTERNATIONAL

UNITED STATES BOTANIC GARDEN

Table of Contents

What is conservation horticulture?

Conservation horticulture is a term first published in the late 1990s to highlight the specialised knowledge and practical skills required in horticulture intended for the conservation of rare and threatened plants (Affolter 1997). Specifically, conservation horticulture supports training and knowledge sharing, uses best practices and protocols, generates knowledge, and connects people to plants and information (Gratzfeld, 2017). This often happens within the context of development and management of *ex situ* collections that:

- are genetically diverse and representative of the target populations in the wild;
- provide plant material for *in situ* conservation, including population reinforcement and reintroduction programmes; and
- support conservation education and environmental sensitization.

In general, conservation horticulture is often practiced by botanic garden staff along a spectrum of intensity and with varying degrees of formality, and conservation horticulture can also be manifested among a team of people working together.

Taking the pulse

An online survey was launched in June 2022 by BGCI-US, in collaboration with the United States Botanic Garden (Appendix 1). The survey was widely distributed through emails to botanic garden staff, BGCI's global newsletter and social media accounts, and through regional botanic garden networks and online discussion forums and listservs. The survey was offered and promoted in the English language. Botanic garden staff were given one month to complete the survey, and reminders were sent out throughout the month. The invitation to participate in the survey was directed at a wide variety of botanic garden staff including those specializing in horticulture, curation, conservation, education, and research, since a wide variety of skills and knowledge applies to the work of conservation horticulture. Survey invitations attempted to use approachable wording to invite input from anyone curating, growing, studying, or communicating about threatened plants in any way, as we assumed awareness of "conservation horticulture" as a specific area of expertise was relatively low.

The 20-question survey was designed to characterize botanic garden engagement in conservation horticulture and identify ways to broadly support this critical area of expertise. Questions were aimed at identifying respondents' current experience with and awareness of conservation horticulture. We also wanted to identify any past education or experiences that provided the skills and knowledge for respondents working in conservation horticulture, as well as any additional training or support desired by respondents. There were also questions focused on respondents' perceived recognition of their conservation horticulture expertise within their institutions, as well as across the botanic garden community.

A total of 238 individuals from 54 countries responded to the 2022 BGCI-USBG Conservation Horticulture Survey (Figure 1). Respondents were globally distributed, though 41% reported that they work in the United States. By continent, 48% of respondents were from North America, 20% Europe, 17% Asia, 8% Oceania, 5% Africa, and 2% South America.

Figure 1. Respondents to the BGCI-USBG Conservation Horticulture Survey (2022), by country. Dot size represents the number of respondents, with the smallest dots showing countries with one respondent. Countries with five or more respondents are labelled. Dots are placed in the geographic centre of each country.

Respondents had an overall average of 16.5 years of work experience related to conservation horticulture. There was a wide diversity in years of experience reported by respondents, from less than one year to 50 years, with most respondents falling in the middle, at 20-24 years of experience (Figure 2).

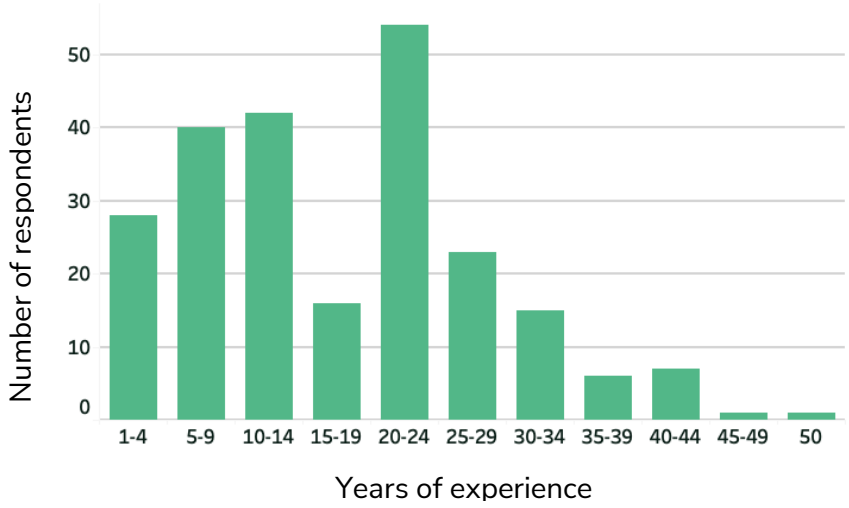

Figure 2. Respondents to the BGCI-USBG Conservation Horticulture Survey (2022), by years of experience.

The most common organization type selected by respondents was 'Botanic Garden or Arboretum with a scientific focus', which was chosen by 172 (72%) of respondents (Figure 3); the second most common was 'Conservation Organization' with 63 (26%) of respondents. Of the 238 respondents, 77 – nearly one-third – selected more than one category to describe their organization, reflecting the diversity of work within individual organizations.

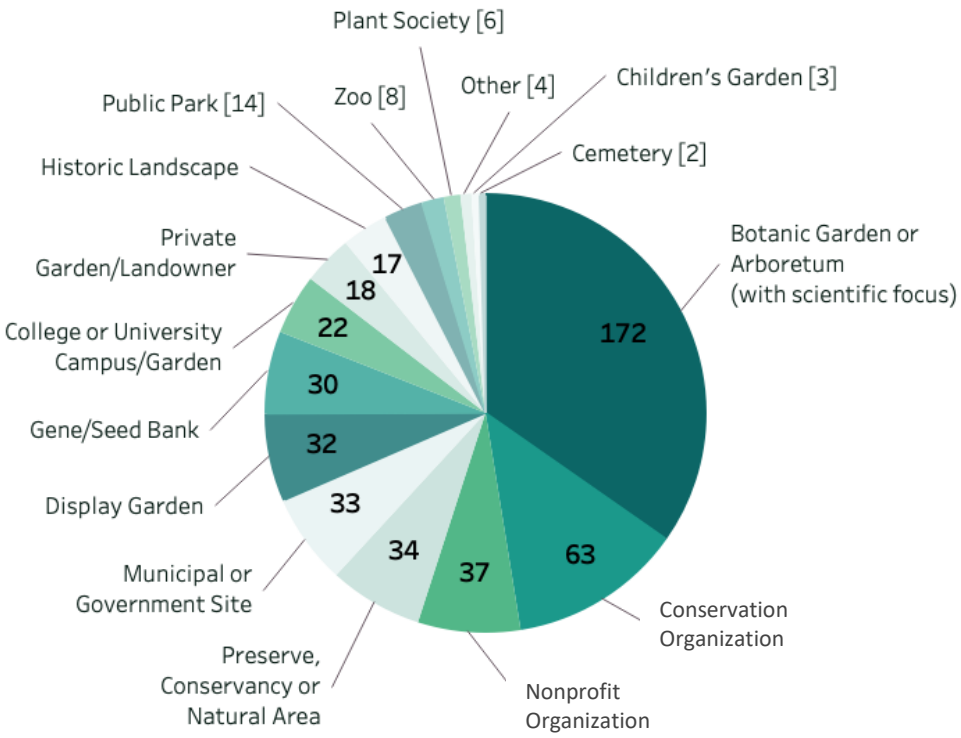

Figure 3. Respondents to the BGCI-USBG Conservation Horticulture Survey (2022), by type of organization. Respondents had the option to select all categories they felt represented their organization, so the total is greater than the number of respondents.

We also asked respondents if their organization has a plant conservation program and/or if they grow species of conservation concern to directly support species survival. Of the 238 respondents, 215 (90%) responded 'Yes', 13 (6%) responded 'Unsure', and the remaining 10 (4%) responded 'No' (Figure 4).

Does your organization have a plant conservation program and/or grow species of conservation concern to directly support species survival?

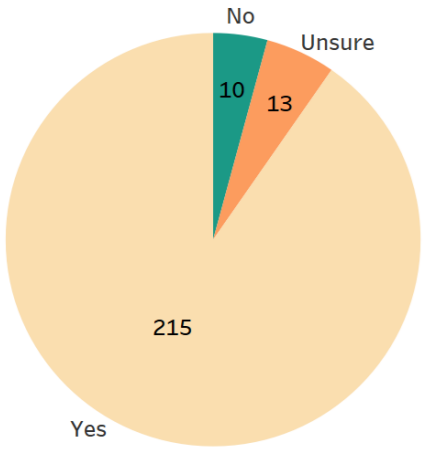

Figure 4. Responses to the BGCI-USBG Conservation Horticulture Survey (2022) when asked if their organization had a plant conservation program and/or if they grow species of conservation concern to directly support species survival.

Are you a conservation horticulturist?

Because we estimated that the use of 'conservation horticulture' as an expertise is not ubiquitous across the botanic garden community, we were curious if respondents' views of themselves as conservation horticulturists might change after being presented with information about conservation horticulture. At the start of the survey, respondents were asked 'Do you consider yourself a conservation horticulturist?'; we call this their 'pre-survey response'. Following the first question, respondents were given a definition of conservation horticulture and asked a series of questions about how conservation horticulture is part of their work. At the close of the survey, respondents were again asked if they consider themselves a conservation horticulturist, in light of what they learned during the survey; we call this their 'post-survey response'.

We saw a significant positive shift to respondents that answered 'Yes' pre-survey (141 respondents; 63%) and 'Yes' post-survey (170 respondents; 76%; Figure 5). A total of 38

respondents switched from ‘No’ or ‘Unsure’ pre-survey to 'Yes' post-survey. Only one respondent switched from 'Yes' pre-survey to 'No' post-survey and four switched from 'Unsure' to 'No'.
It seems that by providing the definition and examples of conservation horticulture, the views of those doing relevant work changed, making them more likely to identify themselves as conservation horticulturists.

Before considering the official definition, do you consider yourself a "conservation horticulturist"?

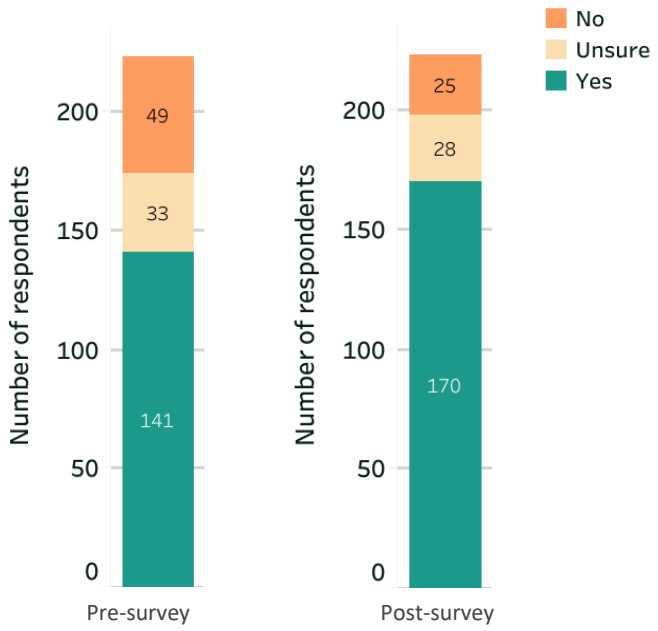

Figure 5. View of self as a 'conservation horticulturist' pre-survey (left) and post-survey (right) taking the BGCI-USBG Conservation Horticulture Survey (2022).

In addition to the post-survey question asking respondents if they consider themselves a conservation horticulturist, we asked whether they realized they are more or less engaged in conservation horticulture than they previously thought (Figure 6). Of those who answered this question, 101 (45%) realized they are *more* engaged in conservation horticulture than

they thought prior to taking the survey, and only 11 (5%) realized they are *less* engaged than they previously thought.

To explore possible geographic bias for survey results, responses from US-based individuals were compared to non-US-based individuals, and little variation in responses was found. One notable difference was that 50% of non-US-based individuals realized they are more engaged in conservation horticulture at the end of the survey, compared to 30% of US-based individuals.

This highlights that sharing the definition of conservation horticulture also has an effect on those who already identify themselves as conservation horticulturists, by helping them see the breadth and depth of their work and identifying more of it as related to conservation horticulture.

Having reflected on the definition of conservation horticulture and your work, has your view changed?

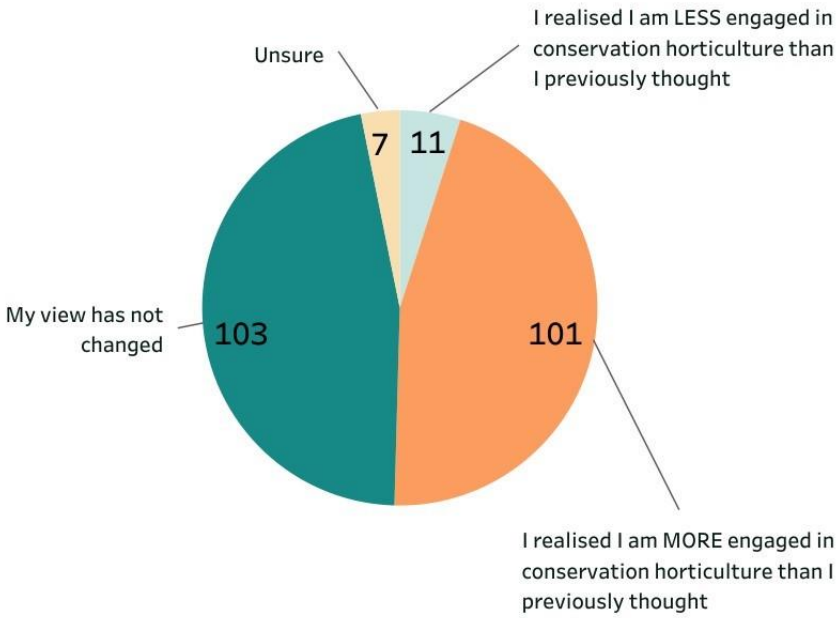

Figure 6. Respondents of the BGCI-USBG Conservation Horticulture Survey (2022) view of their work after the term 'conservation horticulture' was defined.

Interestingly, respondents reported a variety of activities directly related to conservation horticulture, whether or not they considered themselves conservation horticulturists. Perception and understanding of conservation horticulture seem to be critical factors, as well as institutional priority attributed to this area of expertise.
Respondents who consider themselves a conservation horticulturist both pre- and post-survey worked with red-listed species or those underrepresented in botanical gardens with clearly defined goals of maintaining genetic diversity, supporting *in situ* conservation or supporting conservation education: "*Our collection includes a number of critically endangered species and we are working toward increasing their genetic diversity and populations through ex situ plantings in cooperation with other botanic gardens, state and federal conservation bodies and academic researchers.*" Another respondent said "*My job is to collect seed from wild genetic sources of plants underrepresented in botanical collections for safeguarding in the future.*"

Respondents who viewed themselves as conservation horticulturists only post-survey changed their minds once given a definition of conservation horticulture. One respondent said "*Because I am involved in all the three aspects of conservation horticulture as mentioned*" and another respondent stated "*I have never thought about myself as a conservation horticulturist, but now it seems that I am one*."

Respondents who did not view themselves as a conservation horticulturist both pre- and post-survey did not identify with the title because it was not the primary focus of their job "*It is not all I do a 100% of the time, I also am involved in propagating and growing plants for living collections which is not always about conservation*." Another respondent commented "*While I do work with rare, endangered, threatened plants, there is not a huge emphasis on collecting a representation of the gene pool*."

How is conservation horticulture part of your work?

To understand more about the general experience and regular job duties of respondents, we asked two broad questions. When asked 'Do you have more experience in plant conservation or horticulture?' there was a fairly even split among respondents who said mostly horticulture (89; 37%), mostly plant conservation (69; 29%), and both about the same (80; 34%; Figure 7). Next respondents were asked 'Which of the following are part of your current job description or regular job duties?' Of the three types of activities provided, many (96;

40%) respondents reported all three (horticulture, plant conservation, and outreach/education). The remaining respondents selected one or two types of activities only, with a fairly evenly split between horticulture, plant conservation, and outreach/education. Very few (>1%) selected only outreach/education.

Do you have more experience in plant conservation or horticulture?

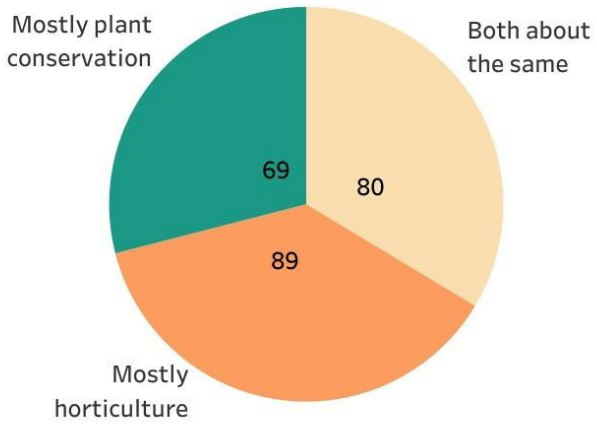

Figure 7. Summary of responses to the BGCI-USBG Conservation Horticulture Survey (2022) demonstrating experience in plant conservation, horticulture or both.

We also asked questions regarding the specific types of conservation and horticulture work that respondents carry out day-to-day (Figure 8). In response to the question 'Do you work with species of conservation concern in any of the following areas?' respondents most frequently responded 'Yes' or 'Somewhat' to 'Living plant collections management' (222; 93%), 'Propagation' (219; 92%), and 'Public outreach, display, or education' (212; 89%). The least common activity was 'Controlled pollination, breeding, or seed production' (129; 54%) but still represents a slight majority of all survey respondents.

When asked about additional activities related to conservation horticulture, a fairly even proportion of respondents said they contribute information to species conservation assessments (e.g., IUCN Red List assessments; 118; 50%); document and share horticultural protocols (e.g., propagation or seed germination requirements; 151; 63%); and/or support *ex situ* genetic diversity management (e.g., track maternal lines, generate seed, backup genetically unique material at other sites, use genetic data to inform crosses, or provide plant

material for molecular research; 157; 66%; Figure 8). For the positive responses to this question, 152 (64%) respondents reported doing either two or three of these additional activities, which might point to possible synergies between the activities and capacities required to do them.

When comparing US vs. non-US based respondents, non-US-based individuals were slightly more likely to contribute to use or do species conservation assessments and rankings (55% versus 43% for US-based individuals) and document and/or share horticulture protocols for threatened species (67% versus 58% for US-based individuals). US-based individuals were slightly more likely to support *ex situ* genetic diversity management (73% versus 61% for non-US based individuals) and have public outreach experience related to conservation horticulture (87% versus 77% for non-US based individuals).

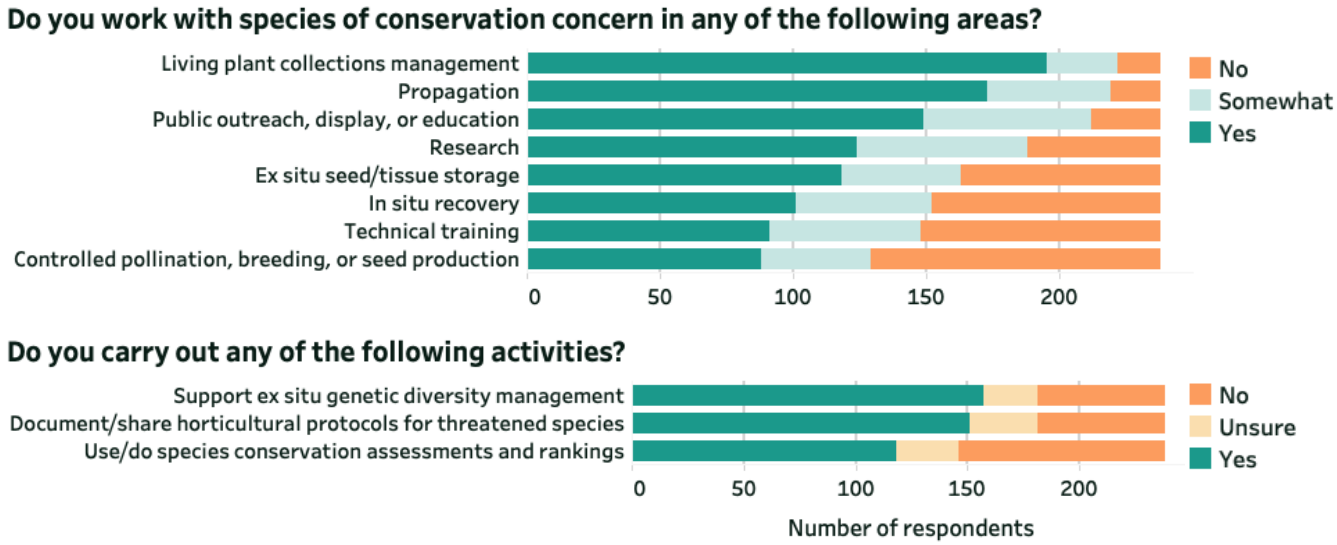

Figure 8. Summary of responses to the 2022 BGCI-USBG Conservation Horticulture Survey, highlighting how conservation horticulture is part of the respondents' day-to-day work.

How can we grow conservation horticulture expertise?

To get a broad view of which learning experiences are most important for developing the knowledge and skills necessary for conservation horticulture work, we asked respondents for feedback in an open-ended question (Figure 9). We interpreted these text responses and grouped them into seven of the most common themes. The most frequently listed important

learning opportunity was hands-on experience in the nursery or lab (98; 41% respondents), followed by communication with or observation of collaborators (78; 33%) and hands-on experience in the field (71; 29%). Notably, twelve (5%) respondents listed public outreach activities as an important learning experience for them.

Which learning experiences have been most important for helping build your knowledge and skills relevant to conservation horticulture?

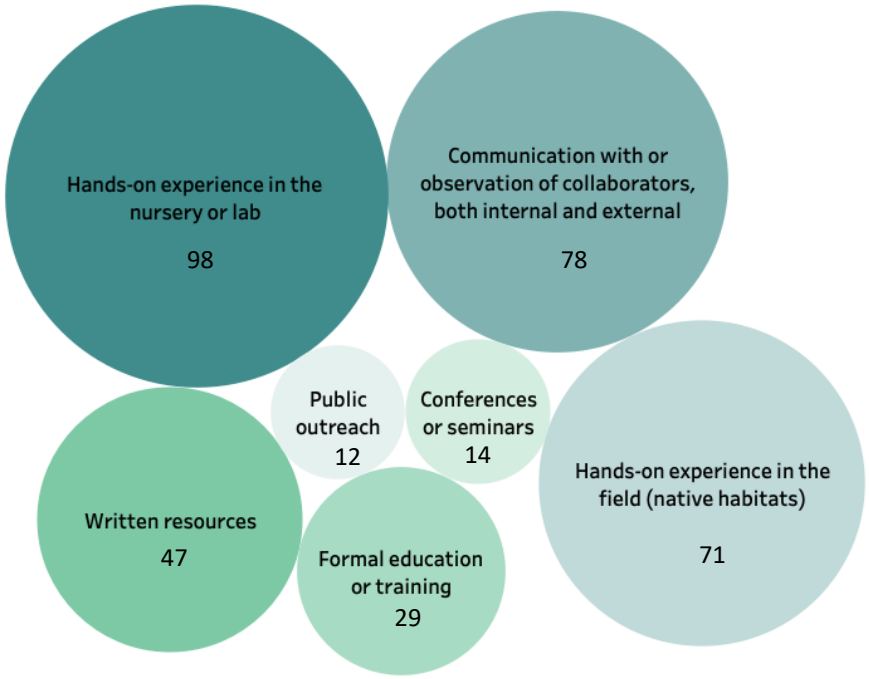

Figure 9. Most important conservation horticulture learning experiences reported by respondents, from results of the BGCI-USBG Conservation Horticulture Survey (2022).

Respondents offered various perspectives on how experiences led them to conservation horticulture work:

"*Most importantly having a good fundamental understanding of plant physiology which allows one to manipulate conditions to achieve a good success rate, whether in seed germination, or vegetative propagation. Obviously observing and witnessing first hand other experts in action. Learn from and document failures*."

"*I have done some projects on my own, cultivating plants and carrying out translocations, which gave me a lot of hands-on experience with ex situ cultivation and reintroduction. I also work scientifically so I have read most of the literature available so I am familiar with the population biology and genetic theory behind the recommendations. This also helps a lot*."

"*...It was a sort of a synchronicity of everything coming together with [my] horticultural experience and passion for [growing] plants, but also the passion for conservation, both of which were lifelong passions for me*."

We asked respondents 'What types of additional training would help to further develop your skills relevant to conservation horticulture?' Respondents answered in an open-ended format and responses were later categorized into five main themes, ordered here by greatest to least number of respondents:

- *Hands-on technical training* (106; 45% respondents) for genetic diversity management, plant records, rare plant propagation, seed banking, or species reintroduction
- *Lectures and workshops* (62; 26% respondents) for collections management, fundraising, mapping techniques, pest management, population genetics, or science communication, or species prioritization
- *Networking opportunities* (29; 12% respondents) for collaboration, mentorship, work exchange, or working groups
- *Information-sharing resources* (24; 10% respondents) for distribution of back up material, field collection and documentation best practices, propagation protocols, success stories and failures, or web-based training videos
- *Taxon-focused guidelines* (11; 5% respondents) which provide advice for individual genera or species

Responses varied widely, however, hands-on technical training was identified as the most important type of training by respondents. One respondent said "*Skills on advanced micropropagation, ex-vitro acclimatization, plant breeding, seed production and reintroduction to the wild and proper collection methods and assessments would help develop skills relevant to conservation horticulture*." Another respondent observed "*Propagation techniques of the various threatened plant groups may help me to develop a diverse plant collection and provide good material for other conservation programs*."

More than a quarter of respondents thought lectures and workshops were important. One respondent commented "*I feel like it would be useful to learn more about the genetics of conservation horticulture, and best practices for maintaining the diversity of ex-situ populations of endangered plants*."

Some respondents thought information sharing was important "*What we [very much] need is not training but sharing information on techniques that work by genus and certainly by species. Even sharing [failure-based] data, what didn't work*." Another respondent noted that "*An exchange of experience or "lessons learned" is crucial here*."

In addition to understanding which activities have been most helpful for conservation horticulture professionals to learn the knowledge and skills relevant to their past work, we wanted to know what kind of additional support would also be most valuable in furthering their career in conservation horticulture (Figure 10). This question was provided in an open-ended format and interpreted to align with four major categories, with more than one category possible for each respondent, ordered here by greatest to least number of respondents:

- *Funding* (153; 64% respondents), for things like improved facilities, more staff, higher wages, buying supplies, performing genetic research, hosting research fellows, conducting long-term studies, and travelling to collect seeds, visit other gardens for collaboration and learning, and attend conferences
- *Information resources* (73; 31% respondents), such as propagation protocols, seed collection guidelines, an open-source journal focused on conservation horticulture, free collections management software designed for conservation-focused collections, webinars
- *Mentorship* (69; 29% respondents), for activities like designing reintroduction experiments and addressing taxonomic issues

- *Formal community* (58; 24% respondents), to support activities such as sharing germplasm, organising garden staff exchange programs, finding project collaborators, navigating legal permissions and paperwork for collecting and transporting germplasm, and finding inspiration from examples of work at other organisations.

Funding was identified as the primary need by the majority of respondents. One respondent said "*Funding is our primary need. There is immense potential to build broader and deeper conservation horticulture understanding and resources if we can continue to build and sustain our already impactful conservation horticulture program*." Another respondent said "*I feel conservation horticulture is a professional career and should be recognized as such by having a salary that is commensurate with the important work I do*."

Information resources were also identified as an important need. One respondent stated: "*Resources to share best practices on the development and publication of propagation protocols/seedbanking, managing multiple maternal lineages in nursery settings, best practices on seed collection to represent appropriate genetic diversity. An open source and freely available journal on conservation horticulture."*

Nearly one third of respondents thought mentorship was important. One respondent commented "*Funding will always be very important, but I think mentorship can be very good support, for giving guidance and experience sharing to deliver those skills in the practice of conservation*." Another noted "L*ong term, sustained mentorship. Being part of a "working group" to continually share ideas...Least valuable are one time "camera ready" events, and more valuable building the long term community connections. The world, climate and technology keep changing, so how we relate is most important*."

What support (other than training) would be helpful for your work relevant to conservation horticulture?

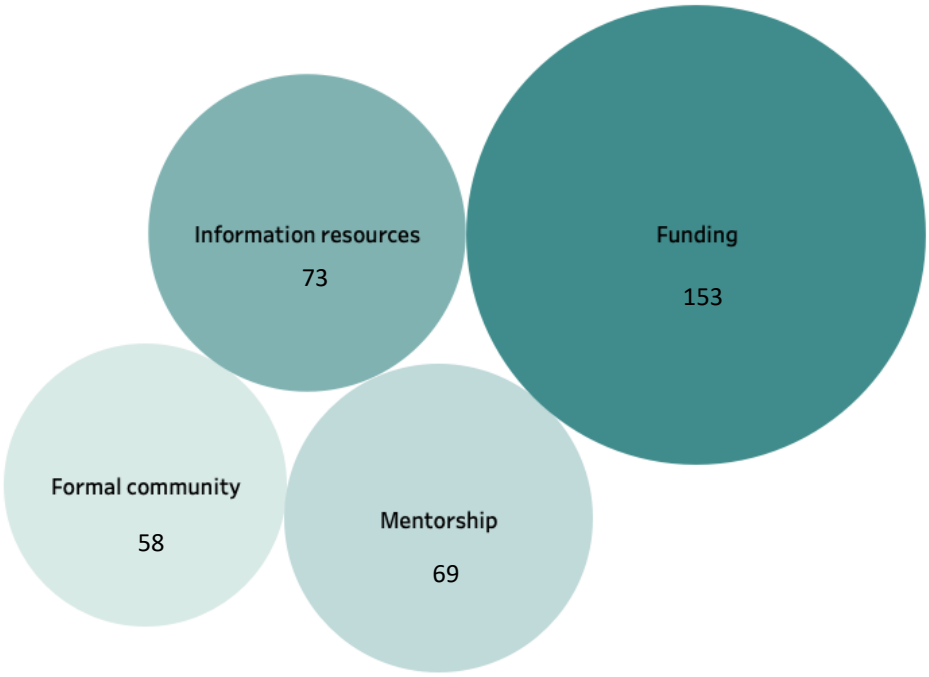

Figure 10. Most commonly requested support relevant to conservation horticulture work, from results of the BGCI-USBG Conservation Horticulture Survey (2022).

Finally, we asked if respondents feel recognized as a conservation horticulturist by their organisation, peers, and/or field, and if not, how they might be better recognized. When asked whether they feel recognized, 84 (35%) of respondents said yes, 56 (24%) said they felt somewhat recognized, 66 (28%) said no, and 32 (13%) did not respond.

More than one-third of respondents felt they were recognized as a conservation horticulturist. One respondent said "*This role is highly praised and valued among partners. There is so much looping of observations of life history in situ and ex situ that is essential to good conservation actions. When land managers, botanists, and the conservation horticulturists can stand on site, in situ, in a rare plant habitat and talk through the best needs for an imperilled species, insightful details come to light in those conversations.*"

Almost a quarter of respondents felt that they were somewhat recognized as a conservation horticulturist. One respondent observed "*Some conservation professionals don't see or understand the role of horticulture in conservation or the very specific ways large living collections can be effectively utilized to support plant conservation on many levels. It is also*

a difficult concept to get across both to the public and [colleagues in] other areas of the organization."

Most respondents did not feel fully recognized as a conservation horticulturist. One respondent stated, "*I do not feel recognized by the leadership at my organization because the horticulture department is not seen as significant as the conservation department. It would be nice for folks to understand how unique conservation horticulture is and just how equally important it is in conservation efforts.*"

In response to the question 'How might you feel better recognized by your organisation, peers, and/or field as a conservation horticulturist?', respondents suggested:

- *Opportunities* to perform research and publish scientific articles, collaborate with other departments and/or institutions, participate in national/international discussions, attend conferences, receive training and/or mentoring, train others, be involved in priority conservation projects, and participate in fieldwork
- *More investment*, including, higher quality facilities, more staff, higher wages, and dedicated time for conservation horticulture work
- *Promotion of conservation horticulture* as a vital part of conserving species, through outreach and education for the public (e.g., garden signage; stories in the media) and botanic garden and conservation professionals
- *Engagement/understanding from senior management*, such as inclusion of conservation horticulture in their department's goals and their organization's mission, or the presence of 'conservation horticulture' in their job title or job description
- *Certification*; in response to the question 'Do you think a conservation horticulture "certification" or another form of recognition would benefit your work and career?', most respondents said 'Yes' (66%), followed by 'Unsure' (23%) and 'No' (12%)

One respondent said, "*For organizations that have horticulture experience but are new to conservation horticulture, it would be great to have resources that introduce them to the concept and how it's different from traditional horticulture*." This could be the case for leadership at botanic gardens as well.

Another respondent said, "*Certification for staff working at botanic gardens [is good for] having a dedicated role [in conservation horticulture]…", and "building a community of conservation gardeners who can help share and exchange ideas and information gives more resources and recognition in the end too*."

Finding inspiration

Following the BGCI-USBG Conservation Horticulture Survey in 2022, we interviewed some respondents, digging more deeply into understanding the different entry points into the field of conservation horticulture, the definition of conservation horticulture, and the most important learning and training experiences. The sections below highlight our discussion with five conservation horticulture employees at Atlanta Botanical Garden in the United States, and a Team Leader at Wellington Garden's Ōtari-Wilton's Bush in New Zealand.

Conservation horticulture at Atlanta Botanical Garden

Through the Atlanta Botanical Garden's Southeastern Center for Conservation & Research, the Garden advances the science of conservation through research, collaborations, and native species recovery programs that include conservation collections at the garden and applied conservation activities that support preservation of species in their native habitats.

Many paths to conservation horticulture

During our discussion with staff on the conservation horticulture team at the Atlanta Botanic Garden, we were struck by the diversity of paths leading to a career in conservation horticulture. With this in mind, we've highlighted each of the five individuals in a brief paragraph. Profiles are sorted by years of work experience, from most experienced to newest to conservation horticulture.

John Evans (he/him), Conservation Horticulture Manager

John earned an undergraduate degree in ecology and evolutionary biology, which included research projects on plant ecology and pollination. He then completed a Master of Science in environmental science, focusing on botany and plant taxonomy. When John exited academia, he couldn't find a position that quite matched his skills and interests, and instead worked at a few native plant nurseries where he gained horticultural experience. When John saw the Conservation Horticulture Manager position opening at the Atlanta Botanic Garden, he knew it was finally the right fit, thinking, 'that has all the things I've trained for.' Today John manages the conservation collections of living plants at the Atlanta Botanical Garden, ensuring the CPC Best Practices are applied in collections management, developing novel propagation protocols for species new to cultivation, and coordinating conservation horticulture efforts with those of the seed bank, micropropagation lab, and field research teams. He also participates in fieldwork, monitoring, augmenting, and collecting from plant populations in the wild.

Tanner Biggers (he/him), Conservation Safeguarding Nursery Manager

Tanner studied biology and environmental studies at university, then worked in native plant landscaping. That was where Tanner really fell in love with native plants, remembering, 'ever since then it has been my dream to work in conservation and work outside, getting my hands dirty.' With that passion, Tanner eventually led a native plant nursery propagation and production program before moving into his position at the Atlanta Botanical Garden. As the Conservation Safeguarding Nursery Manager for Atlanta Botanical Gardens, Tanner curates conservation collections of rare and endangered plants, oversees general plant care and maintenance, coordinates volunteers, and utilizes his creativity and expertise to develop new methods for ex situ conservation.

Brittany Carson (she/they), Senior Conservation Horticulturist

Following an undergraduate degree in earth, environmental and geospatial sciences, Carson pursued a Master of Science in conservation biology. The horticulture spark was ignited in Carson through working in their university's greenhouses and learning about herbal and medicinal plants on their own. After receiving a master's degree, Carson worked with biocultural conservation and conservation horticulture at the National Tropical Botanic Garden in Hawaii, launching their career into conservation horticulture. As the Senior Conservation Horticulturist at the Atlanta Botanical Gardens, Carson manages the day-to-day activities in the greenhouse to meet various project goals, working with species of conservation concern at the earlier stages of the plant's life during propagation and seedling development. Carson keeps track of data for experiments, maintains greenhouse conditions, conducts inventories, coordinates with team members to prepare plants for their intended research purposes, and helps out with occasional field work.

Madison Ohmen (she/her), Conservation Horticulturist

Madison earned an undergraduate degree in horticulture. Afterward, working at a landscape company, she recalls a turning point in her career: 'my coworker dumped excess pesticides down the storm drain and that made me very upset, and so I decided to switch to a more conservation-oriented path.' This conservation path began with a job as an endangered butterfly research technician. Madison now works in the Conservation Safeguarding Nursery at the Atlanta Botanical Garden as a Conservation Horticulturist. She helps to curate and maintain the ex situ conservation collection of rare, threatened and endangered plants for safeguarding. In addition to curating conservation collections, Madison also assists with field work, propagation, and accessioning of plants.

Katherine Johnson (she/her), Conservation Horticulturist

Katherine pursued biology and botany degrees as an undergraduate student. After becoming an ISA certified arborist, she worked for a local tree care company. She had always wanted to work at the Atlanta Botanical Garden, so when Katherine saw the part-time conservation horticulturist position, she 'had to jump on it.' Katherine is currently working as a Conservation Horticulturist at the Atlanta Botanical Garden (Midtown) and completes the daily maintenance of the conservation collections. These duties include initial seed preparation and plant propagation, as well as care during the preliminary life stages of a plant until it is ready for out-planting.

What does conservation horticulture mean to you?

Tanner – '*It takes a lot of passion; passion to restore nature, to put it simply*.'

Katherine – '*It is an extremely fulfilling career choice. Being able to tangibly help the environment at the literal ground level makes every day a wonderful experience.*'

Carson – *'Two words: maintaining genetics. That is something I think about a lot when I'm doing my work in the greenhouse. I'm doing this work to maintain the genetic integrity of these plants. That really is what sets [conservation horticulture] apart from other types of work surrounding horticulture*.'

John – '*I think for a lot of horticulturists, they tend to have a nurturing drive. And I think there's potential there to also look at the whole natural world and want to nurture it as well. And so it works together, it fits. It's just nurturing on a larger scale. And then you get into understanding the genetics and plant ecology, and so it becomes nurturing on steroids.*'

What were your most valuable learning experiences?

Multiple interviewees highlighted the role of paid internships and entry-level jobs as important skill-building experiences to get into conservation horticulture work. They also emphasized that such experiences are most helpful when they cross the spectrum of conservation horticulture, creating a 'full-circle experience' as Carson called it. This includes activities like taking herbarium specimens and measurements in the field, adding data to accessions and spatial databases, working in the nursery, and restoring natural habitats. Another valuable learning opportunity was mentorship from someone with experience in both horticulture and conservation, who provided both theoretical insight such as the importance of genetic diversity and hands-on teaching through activities like DNA sampling and seed collecting.

When it comes to propagating plants, interviewees cited practice with a diversity of plants and seeing species in their native environment as the keys to success. Tanner stressed that 'A*ny great horticulturist has dealt with countless trials and errors in their career*.' The more practice– different soil, light, nutrient, and water needs – the better, he suggested. He also emphasized the importance of learning about a species' ecology and, when possible, having access to wild individuals: '*studying ecology and seeing how these plants grow in their own natural systems is crucial to making decisions [about] how to grow them in our controlled conditions at the nursery*.'

From left to right, Carson, Madison Ohmen, and Tanner Biggers recording data on wild individuals of *Torreya taxifolia*. The species is assessed as Critically Endangered on the IUCN Red List and is one of the Atlanta Botanical Garden's many focal species for their plant conservation efforts in the Southeast US (Photo credit: Atlanta Botanical Garden).

Carson (right) mixing soil with Max, one of the field technicians at the Atlanta Botanical Garden. Creating the right soil blend is a key component in successful propagation and reintroduction efforts, especially for species from unique habitats (Photo credit: Atlanta Botanical Garden).

A perspective from Wellington Gardens

To gain an additional perspective outside the US and for a position without 'conservation horticulture' in the job title or description, we interviewed one individual who, through the BGCI-USBG Conservation Horticulture Survey, realised they are *more* engaged in conservation horticulture than they previously thought (Figure 5).

Learning by experience

Megan Ireland, Team Leader at Ōtari-Wilton's Bush at Wellington Gardens in New Zealand

Megan first realized her passion for plants around age 14, while working at a plant nursery. While earning a Bachelor of Science degree in Horticulture, she spent summers working at gardens in the Scottish Highlands, including estate gardens and a Victorian walled garden that grew food and flowers for an on-site restaurant. After university, Megan worked as an intern at a garden in England. There, she worked with some plants native to New Zealand and knew that was what she wanted to keep pursuing. At the close of the internship, she moved to New Zealand, where she worked and volunteered at various gardens before being hired as a gardener (and eventually team leader) at Ōtari-Wilton's Bush in Wellington.

Ōtari-Wilton's Bush is unique in that it grows only New Zealand native plants and almost all of its plants are of wild origin. A small portion of the land is a botanical garden, while the remaining area is a natural area that they work to restore and conserve. As Team Leader, Megan has a variety of responsibilities, including growing plants in the nursery and planting propagules of rare species in both the garden and in the wild.

What were your most valuable learning experiences?

For Megan, propagation is *'the baseline for the conservation horticulture we do at Ōtari*', so skills in propagating plants were the foundational learning experiences in her journey into conservation horticulture. She learned propagation techniques through on-the-job experience, both as a volunteer and an employee. At first, this included simply being around the people who were propagating plants – watching and listening to them as they worked, and asking them questions.

Similar to Carson at the Atlanta Botanical Garden, Megan also found 'seeing the whole circle' of plant conservation very helpful to her understanding of conservation horticulture. For her, this 'circle' included collecting seed in the wild, propagating the seeds, and planting the seedlings back in the wild.

Gardener David Bidgood (left) and Megan Ireland (right) planting out the garden at Ōtari Wilton's Bush in Wellington, New Zealand (photo credit: Ōtari Wiltons-Bush Trust).

Do you feel recognized as a conservation horticulture expert?

Within her eight-person team, Megan does feel recognized as an expert in conservation horticulture. She sees everyone on the team as being integrally involved in conservation horticulture; from database management, to spraying weeds, to working on tissue culture in the lab. Megan also feels recent momentum in the garden community toward recognizing conservation horticulturists. Part of this has been recognition of the value of native plants, as Megan puts it, *'having people buying into the work that's being done for their native plants... getting people invested*.' Additional recognition for her skills specifically has come through opportunities to lead projects for important rare species and attending garden conferences to meet others working in conservation horticulture. Perhaps the biggest step for Megan feeling recognized as a conservation horticulture expert has been understanding the value of her own work – '*you can save whole species from extinction*.'

Overall Findings

With plant extinctions happening at an unprecedented rate, the need for plant conservation has never been more important. Botanic gardens, arboreta and similar organizations are equipped with the facilities and tools to carry out all aspects of plant conservation, from risk assessments, seed collection, propagation, ex situ conservation, to restoration and reintroduction. This study was designed to understand botanic garden engagement in conservation horticulture and identify ways BGCI can further support this critical area of expertise.

Based on results of the BGCI-USBG Conservation Horticulture survey (2022), we know that many botanic garden staff from across the world are currently engaged and involved in conservation horticulture through a variety of ongoing conservation programs at their institutions, and a majority of those have worked into this area of expertise through 15 or more years of experience. The type of conservation horticulture work being done includes conducting or contributing to species assessments, documenting and sharing horticultural protocols, growing and managing genetic diversity of species of conservation concern, and public outreach activities.

Awareness of conservation horticulture as an expertise area may be lacking but important, as nearly half (45%) of survey respondents realized by the end of the survey they are more engaged in conservation horticulture than they previously thought. It seems that providing a

definition and examples of conservation horticulture broadens the view of those working in conservation and horticulture, making them more likely to identify themselves as doing work relevant to conservation horticulture.

In terms of recognition by peers, their institutions, and across the botanic garden community, a somewhat even split of survey respondents felt recognized (35%), somewhat recognized (24%), and not recognized (28%), with an additional 13% with no response. Awareness and institutional priority seem to be critical factors in recognition and a feeling of institutional support, and several respondents indicated that awareness and prioritization by senior management was critical, such as inclusion of conservation horticulture in their department's goals, their organization's mission, or the presence of 'conservation horticulture' in their job title or job description. In addition to suggestions for more training opportunities and resources for conservation horticulture, a majority of respondents (65%) felt that a conservation horticulture certificate or similar recognition would also benefit their work and career.

The most important learning experiences reported for developing conservation horticulture expertise were hands-on technical training in the field, nursery, and laboratory. Funding for additional staff and higher wages were identified as the greatest needs for conservation horticulture work, but also funding for long-term projects, horticultural research, field work, improved lab equipment and facilities, species recovery programs, seed storage and seed genetics, and more cross-institution partnerships and staff exchanges/trainings.

Interviews with individuals who work as conservation horticulturists revealed that there are many paths into the field, and a fairly even split of respondents reported coming to conservation horticulture from a background primarily based in horticulture, plant conservation, or both. One respondent pointed out that higher education reinforces a separation of plant conservation and horticulture expertises. Paid internships and entry-level jobs were cited as some of the most valuable experiences for getting involved in conservation horticulture work.

Final Remarks

Conservation horticulture brings together a unique and broad skill set that is gaining relevance to biodiversity conservation, and traction across the botanic garden community. It is clear that individuals working at the intersection of conservation and horticulture find their work very satisfying and valuable, and that connecting their work to the global and regional relevance of species' survival is very motivational and empowering for themselves and the organizations they work for.

This is a time for all botanic gardens to be positive forces against the biodiversity crisis we face, and there are many transferable skills among conservationists and horticulturists. As one respondent noted "*Conservation and horticulture are so closely linked, all horticulturists should be regarded as Conservation Horticulturists if they work in a botanic garden and they should get trained to manage/understand the collections which they look after*". With conservation horticulture as a recognized and vital area of expertise, botanic gardens have the potential to save entire species from extinction. The collective conservation power of the botanic garden community can have an even greater impact.

References

Affolter, J. M. (1997). Essential Role of Horticulture in Rare Plant Conservation. HortScience. 32(1):29-34.

Gratzfeld, J. (2017). What is Conservation Horticulture? BGjournal. 14(2):14-17. Richmond, Surrey UK.

Appendix 1

BGCI-USBG Conservation Horticulture Survey Questions

Q1. Please tell us about yourself (this information will be kept confidential)

Organization
Country
First Name
Surname
Email Address
Job Title
Years of Experience

Q2. What type of organization do you work for? (check all that apply)

Botanic Garden/Arboretum (with scientific focus)
Cemetery
Children's Garden
College or University Campus/Garden
Conservation Organization
Display Garden
Gene/Seed Bank
Historic Landscape
Municipal or Government site
Nonprofit/Charity Organization
Plant Society
Preserve/Conservancy/Natural Area
Private Garden/Landowner
Public Park
Zoo
Other (please specify)

Q3. Does your organization have a plant conservation program and/or grow species of conservation concern to directly support species survival?

Yes
No
Unsure

Q4. Before considering the official definition, do you consider yourself a "conservation horticulturist"? (we'll ask you this again later)

Yes
No
Unsure
Please briefly explain your answer choice:

Q5. Which of the following are part of your current job description or regular job duties?

Horticulture
Plant conservation
Outreach/education
None of the above

Q6. In your opinion, do you have more experience in plant conservation or horticulture?

Mostly plant conservation
Mostly horticulture
Both about the same
Neither
Please briefly describe your relevant experience:

Q7. Do you have experience in public outreach about the work that you do related to conservation and/or horticulture?

Yes
No
If yes, please briefly describe:

Q8. Do you work with species of conservation concern in any of the following areas?

Answer Choices: Yes, Somewhat, No
Ex situ seed/tissue storage
Propagation
Controlled pollination, breeding, and/or seed production
Living plant collections management (curation, horticultural maintenance, pest and disease control, etc.)
In situ recovery
Research

Public outreach, display, or education
Technical Training
Other (please specify):

Q9. Do you use or contribute to species conservation assessments and rankings (ex: IUCN Red List) through your work?

Yes
No
Unsure
If yes, please describe how:

Q10. Do you document and/or share horticultural protocols (e.g. propagation methods, seed germination requirements, etc.) for any species of conservation concern?

Yes
No
Unsure
If yes, please describe how:

Q11. Do you support ex situ genetic diversity management through your work? (ex: track maternal lines, generate seed, distribute and backup genetically unique material at other sites, use molecular data to inform crosses, provide plant material for molecular research, etc.):

Yes
No
Unsure
If yes, please describe how:

Q12. Considering the conservation horticulture definition above, what learning experiences have been most important for helping build your knowledge and skills relevant to conservation horticulture?

Q13. Considering the conservation horticulture definition above, what types of training would help to further develop your skills relevant to conservation horticulture?

Q14. Considering the conservation horticulture definition above, what support (not including training) would be helpful for your work relevant to conservation horticulture (e.g., information resources, mentorship, funding)? Please describe.

Q15. Do you feel recognized by your organization, peers, and/or field as a conservation horticulturist? Why or why not, and how might you be better recognized?

Q16. Do you think a conservation horticulture "certification" or another form of recognition would benefit your work and career?

Yes
No
Unsure
Why or why not?

Q17. Are you interested in being included in BGCI's Conservation Horticulture Expertise Directory?

Yes
No
Unsure

Q18. Having reflected on the definition of conservation horticulture and your work, has your view of your engagement in conservation horticulture changed?

I realized I am MORE engaged in conservation horticulture than I previously thought
I realized I am LESS engaged in conservation horticulture than I previously thought
My view has not changed
Unsure

Q19. Having reflected on the definition of conservation horticulture and your work, do you consider yourself a conservation horticulturist?

Yes
No
Unsure
Please describe why:

Q20. Do you have any additional comments or suggestions?