LIVING COLLECTIONS PRIORITIZATION AT PUBLIC GARDENS

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Plant and Soil Sciences

Summer 2017

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ACKNOWLEDGEMENTS

I would like to express my thanks to all who contributed to this thesis. To my committee members, Dr. John Frett, Dr. Susan Barton, and Mrs. Kristina Aguilar, thank you for your constructive comments and suggestions. To the public garden professionals who contributed to the surveys and participated in case study interviews, thank you for your support of graduate student research and enthusiasm for the subject matter. To the staff at the University of Delaware Botanic Gardens, thank you for the opportunity to be selected as your curatorial graduate student. It was a pleasure to work with you for the past two years. Finally, to my friends and family, I am sincerely grateful for the opportunities you have provided me and your support during my time in graduate school.

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ABSTRACT

As living museums, public gardens are responsible for maintaining an assemblage of plants as outlined by a collections policy and in support of an institutional mission. However, not all accessions within a living collection are of equal value to public garden institutions and available space, time, and resources must be allocated to collections of plants or individual plants that are of highest priority. Objective collections planning is a beneficial exercise in preparation for garden renovations, long-range institutional planning, propagation decisions, reviews of the living collection, or allocation of resources in routine or disaster situations. Depending on the mission of an institution, priority plant collections or specimens may be selected for their historic importance, cultural significance, educational value, conservation value (irreplaceable genetics, known provenance, or threatened status), research/evaluation value, aesthetic value, or replacement cost.

This research investigated the processes behind living collections prioritization and evaluated current trends among public garden institutions in the United States. Research was conducted through two surveys, collection policy evaluation, and case study analysis of eight public gardens to answer the following questions: (1) Are public garden institutions actively prioritizing their living collections? (2) How are public garden institutions identifying special or core collections? And, (3) How does identification of core collections benefit public garden institutions? Ultimately, this research advances the topic of living collections management and provides examples of public garden institutions who have successfully completed the collections organization process and recommendations for those seeking to improve upon, or begin the procedure at their own institution.

Chapter 1

INTRODUCTION

Public gardens can be considered museums of living plants. As such, they are responsible for maintaining an assemblage of plants, or living collection, as described in a collections policy and in support of an institutional mission. The American Alliance for Museums (AAM) consists of institutions ranging from art museums, history museums, science museums, and historic sites, to institutions that care for living specimens such as zoos, aquariums, botanic gardens, and arboreta (AAM, 2017). Timothy Hohn, author of *Curatorial Practices for Botanic Gardens*, defines a museum as "a permanent institution for the purposes of acquiring, preserving, researching, and interpreting to the public for its instruction and enjoyment objects and specimens of cultural, scientific, historical, technological, and natural history value." Under these definitions, public gardens, predominantly comprised of botanic gardens and arboreta, can be governed by museum standards and principles.

Public garden institutions utilize living collections for a variety of reasons. Some focus purely on the aesthetic qualities of living plants, while others are simultaneously involved with research and/or conservation of living germplasm (Watson, Heywood & Crowley, 1993). However, the underlying difference between a park and botanic garden or arboretum lies in the stewardship of its collections. The American Public Gardens Association (APGA) defines a public garden as "an institution that maintains collections of plants for the purposes of public education and enjoyment, in addition to research, conservation, and higher learning" (2017a). APGA

member organizations range from botanical gardens, arboreta, cemeteries, zoological gardens, sculpture gardens, college and university campuses, historic homes, urban greening organizations, natural areas, to city/county/state/federal parks (APGA, 2017d). These organizations must be open to the public, function as an aesthetic or educational display and/or have site research, maintain plant records, employ at least one professional staff member, and have interpretive materials such as plant labels or maps (APGA, 2017a). Dr. Richard Lighty (1984) differentiates public gardens from seemingly similar organizations in the following statement:

> An institution primarily involved in research on plants over which it does not exercise ownership and continuing stewardship should be called a botanical institute. A display garden with unrecorded or temporary collections is really a park. And an institution that teaches people about plants without using a carefully assembled and recorded group of objects to do this is a school.

Public gardens maintain both living and non-living plant collections. A living collection consists of all accessioned plants represented at an institution, but may also contain non-accessioned, spontaneous flora found in the landscape. Likewise, a living collection may include plants preserved cryogenically or in a seed bank. Public gardens may also maintain collections of non-living plants such as those in a herbarium. Living collections require unique collections management strategies because they are dynamic and are exposed to the unpredictability of the outside environment. Traditional museum resources do not cover living collections stewardship because they are aimed at static, non-living collections of material objects. Unlike non-living collections, living collections of plants are constantly growing, may be impossible to relocate, can die, become diseased, or spread by seeding in elsewhere. Nevertheless, there are risk management and disaster planning

resources from traditional museum literature that can be expanded and applied to living collections at public gardens. Similar to how an art museum would know which pieces to save in the event of a fire, public gardens should have an understanding of what plants in their collection need to be saved, propagated, or protected in the event of a disaster or for routine maintenance (Dosmann, 2012).

Disaster Planning

Determination of high priority specimens or collections is a valuable exercise for all types of museums, including public gardens, in the context of disaster planning. The Getty Conservation Institute recommends setting priorities for non-living collections and writing a priority list to be disseminated to staff members before a disaster event (Dorge & Jones, 1999). They recommend first examining collections objectively through a "vulnerability and asset analysis" to determine which objects are potentially easily damaged during a disaster event and which are most valuable to the institution. They also recommend setting priorities to collections through the following themes: historic/cultural/religious value, economic value, vulnerability to hazards, institutional mandates, rarity or replacement possibilities, loan status, and condition (Dorge & Jones, 1999). Likewise, the National Park Service (NPS) outlines similar prioritization criteria for salvage of museum collections. They recommend ranking collections (high, medium, and low) based on the following three criteria: risk (hazard likelihood and vulnerability), value (artefactual value, associational value, informational value, evidential value, administrative value, and monetary value), and usage (frequency of use by students, researchers, or in exhibits) (NPS, 2006). Following prioritization, collections are marked with a color-coded tag based on their prioritization score. NPS recommends focusing on groups of collections rather than

individual accessions as well as clearly defining the marking system in the emergency operations plan.

Prioritization of living collections is just as important in the face of disaster situations. APGA recommends that “high priority collections are safeguarded, documentation frequently backed up offsite, and a disaster plan provided for rapid response and triage of the collection” (Weathington, 2017). As an example, staff at the Fairchild Tropical Botanic Garden in Miami, FL were forced to make collections prioritization decisions, an exercise they referred to as “botanical triage,” in the wake of Hurricane Andrew on August 24, 1992. It was estimated that 70% of trees were toppled or snapped during the tropical storm event (Fisher, 1992). Fairchild staff and qualified volunteers were required to make quick and significant decisions about what specimens were central to the mission of the organization. To maximize resources on-hand, plants were assigned levels of priority based on how critical their survival was to the institution. Plants were tagged whether they should be rescued and replanted, recovered through propagation, or removed from the garden. Having detailed plant records was vital in this situation so those working could locate rare specimens hidden by fallen trees of lesser value (Evans, 2003). Amidst the devastation, several researchers did benefit from the hurricane. They were able to gather botanical specimens of palm apical meristems and trunk samples, and other exotic tropical wood samples for dissection and preservation. Additional information on survival and regeneration of the living collection post-hurricane continues to provide valuable data (Fischer, 1992). As the global climate warms, disaster events due to more extreme weather events and increased pest and disease pressure will threaten living collections (Bisgrove & Hadley, 2002; CBG, 2017; Dosmann, 2012). It is best to take stock of

what an institution has and why those plant specimens or collections are central to the mission.

Several previous theses written by fellows in the Longwood Graduate Program for Public Horticulture have identified a need for living collections prioritization through the lens of disaster planning. The first is Burghardt's (2000) case study investigation of five public horticultural institutions and their perceptions, experiences, and responses to natural hazards. The researcher briefly touches on the subject of collections prioritization, but emphasizes this as a reactive strategy to implement after a natural disaster has occurred. Most of the public horticultural institutions presented used their mission statements to guide collections recovery. Other botanic gardens deemed areas of high visitation, endangered plant beds, or academic resources as high priorities (Burghardt, 2000). One of Burghardt's final recommendations, to draft a template for public garden disaster response and recovery, was investigated in Bergquist's subsequent thesis in 2009. Through this research, a standard Federal Emergency Management Agency (FEMA) disaster planning template was modified for use in plant collections management. One of the final recommendations to "evaluate collections and/or plants of high value or worth" through conversations with section gardeners, curators, and other stakeholders is suggested as a collections planning exercise (Bergquist, 2009). The author emphasizes the need to assign priority levels proactively, before a disaster event, to speed the recovery process because it is difficult to make constructive and accurate judgments post-disaster. Further, the disaster planning process allows for collections review through evaluation of the strongest features of a collection, potential threats or maintenance needs, and communication with other botanic gardens to determine specimen rarity (Bergquist,

2009). As of 2009, 18-31% of public gardens surveyed by Bergquist outlined specific steps on protecting and recovering plant specimens post-disaster.

Following Bergquist's research, Gapinski (2010) examined disaster preparedness through a case study analysis of public gardens' responses to emerald ash borer invasion in the United States. In the final recommendations, the need for prioritization at a collection level and at the individual accession level was emphasized. Facing limited resources, it is not always practical to save every *Fraxinus* species in a collection, therefore staff must evaluate which specimens are most important to the public garden and its institutional mission. Similar to the approach by Fairchild Tropical Botanic Garden, the author advocates a triage approach to preserving *Fraxinus* accessions. Public garden institutions must establish which accessions to save, which to abandon over time, and which to remove preemptively as part of a prioritization scheme. Gapinski calls for public gardens to evaluate their living collections alongside the institutional mission in order to identify "those of core significance to the institution, based on clearly identified and informed criteria" (Gapinski, 2010). Likewise, core collections must be allocated appropriate resources in order to maintain their presence at the public garden institution. All three researchers emphasize the need to take stock of a living collection and determine what specimens or collections are most important to an institution as a preemptive step in the disaster planning process.

Living Collections Prioritization

Available space, time, and resources must be allocated to collections or individual accessions with varying levels of value to the institution. In a world of unlimited resources, all collections would be preserved and maintained but this is not

always feasible. Public garden institutions have a responsibility to curate their living collections as a continuous reflection of their mission (Gates, 2006 & Allenstein, 2015). It is the responsibility of a curator to make management and preservation decisions regarding the living collection in accordance with a collections policy, especially in the face of rising costs of labor and materials (Hohn, 2008). A need for collections prioritization has also been identified among public gardens themselves. The Plant Collections section of the American Public Gardens Association (APGA) recommends establishing a long-term commitment to living collections through prioritization (Allenstein, 2015). In a larger sense, collections prioritization is advantageous for long-range institutional planning/master planning, collections review, and resource allocation purposes. Public garden institutions must know what their living collection holds, why specific plants are central to the mission of the organization, and why some garden areas or plants receive more resources than others. Reviewing the collection and taking stock of what it encompasses is a valuable exercise for determining what to propagate to preserve irreplaceable germplasm, what to collect, and just as important, what not to collect. Collections organization through prioritization allows public gardens to rationally and proactively manage their living collections instead of solely reacting to a disaster situation, budgetary constraint, or fiscal opportunity.

Within a broader living collection, there will be plant specimens or groups of plants that are considered of higher priority to an institution. For purposes of this research, “prioritization” is defined as decisions made by public garden institutions to designate which plants or groups of plants are more worthy of resources and attention than others. Groups of collections of higher priority to an institution are often referred

to as core collections, collections of emphasis, special collections, or obligatory collections.

Just as all public garden institutions are unique, the living collections contained within them are distinct and important for a variety of factors. Priority living collections may be considered vital based on the following criteria: historic significance, cultural significance, aesthetic value, educational value, irreplaceable genetics, taxonomic importance, species representation in the garden, conservation value for endangered or threatened species, research/education value, known provenance, rarity, mature size, wild-collected germplasm, significant gift, or replacement cost. Additionally, living collections can be designated as Nationally Accredited Plant Collections™ through APGA's Plant Collections Network in partnership with the United States Department of Agriculture- Agricultural Research Service. As of January 2016, there were 75 participating gardens, 129 Nationally Accredited Plant Collections™ (NAPC), and 4 multisite collections. (Allenstein, 2016). Public gardens may rank NAPC as high priority to their institution because of their national significance and the planning involved in maintaining these collections.

These importance criteria are not mutually exclusive. As an example, the Morris Arboretum of the University of Pennsylvania has a specimen of *Fagus engleriana*; a species that is rare in cultivation, held at only a few arboreta in North America, is a mature specimen, and was planted during the ownership of the Arboretum's founders, John and Lydia Morris. The tree is also a Pennsylvania State Champion and is an example of the Chinese relative of the American beech (*F. americana*) and European beech (*F. sylvatica*) which are more commonly found in the

landscape. For these reason, *F. engleriana* is considered a priority specimen and is included in their Historic Tree Collection (Morris Arboretum, 2017b).

The Arnold Arboretum of Harvard University in Boston, MA specifically identifies high priority "Core Collections" in its Living Collections Policy (2016). Core Collections are "regarded as obligatory" and are further divided into Priority Genera, Conservation Collections, and Synoptic Collections. The Priority Genera section consists of Plant Collections Network genera (*Acer*, *Carya*, *Fagus*, *Stewartia*, *Syringa*, and *Tsuga*); Robust Genera (*Carpinus*, *Forsythia*, *Ginkgo*, and *Ostrya*); and Biogeographic Collections, exemplifying the North America- Eastern Asia disjunct theme, specifically those of *Cornus*, *Hamamelis*, *Hydrangea sensu lato*, *Magnolia*, *Taxus*, *Viburnum*, and *Weigela* & *Diervilla*. Conservation Collections include "species under threat from extinction" and those "grown under the Arboretum's commitment to the Center for Plant Conservation, as well as other taxa of conservation value." The purpose of the Synoptic Collections are to "provide a synoptic representation of the Earth's temperate woody flora." Historic, cultivar, and other special collections (bonsai, display, spontaneous flora, interior, greenhouse, and nursery collections) are designated as lesser priority.

Similarly, Longwood Gardens in Kennett Square, PA has identified a need to prioritize living collections as they relate to disaster planning and institutional goals. The plant records department outlines a process for assigning disaster priorities to their collection. The bulk of the work is assigned to staff responsible for each garden section and individual accessions are ranked as high, medium, low, or no priority, based on replacement cost and availability. The criteria are explained in detail below (Aguilar, 2010):

> High Priority will be assigned to accessions that are impossible to replace. These accessions may be rare in the wild and/or in cultivation. They may be rare based on age and/or may be historically or scientifically significant to your garden or the horticulture community. Medium Priority will be assigned to accessions that are difficult or expensive to replace based on their monetary worth, size, or availability in commerce. Low Priority will be assigned to accessions that are easy and inexpensive to replace. No Priority will be assigned to accessions that would not be replaced.

Additionally, Longwood's collections policy identifies seventeen core collections including: Australian, Azalea, Bonsai and Penjing, Boxwood, *Camellia*, Chrysanthemum, du Pont Legacy, Fern, Holly, Lilac, Magnolia, Oak, Orchid, Peirce's Trees, South African, Victoria, and *Nymphaea* Collections (Longwood Gardens, 2017). All accessions in a core collection are designated as high priority and each core collection is defined by a collections scope. For example, only plants of wild origin are included in the Boxwood Collection, so not every accessioned *Buxus* taxa is included in the core collection (Aguilar, 2016). The *Nymphaea* and *Buxus* collections have received NAPC status (APGA, 2015; Aguilar, 2017) and a requirement of accreditation is the formation of a management plan for the collection, whereby relevance, maintenance, current status, and development goals are periodically reviewed.

Based on a brief review, few public gardens outline specifics of a prioritization scheme in their collections policy at the collections or individual accession level (Aguilar, 2016). Public garden institutions most likely have an idea of individual plants or collections of plants that are a priority but this institutional knowledge may not be fully understood nor documented formally in a collections policy or plan. This research seeks to determine if public garden institutions are actively prioritizing their living collections, how they are identifying core collections or assigning levels of

priority within a living collection, and the benefits of associated with living collections prioritization. The main objective of this research is to report upon the current strategies employed by public garden institutions having gone through a collection prioritization process and to compile a set of recommendations for those seeking to go through prioritization as a collections management exercise.

Chapter 2

MATERIALS AND METHODS

Human Subjects Review Board

This study followed all policies set by the University of Delaware's Human Subjects Review Board. All materials, including survey protocols, survey invitations, online survey questionnaires, interview protocols, interview invitations, and informed consent documents were submitted for Institutional Review Board (IRB) exemption or approval. See Appendix A for IRB documentation.

Online Surveys

Two surveys were distributed using University of Delaware's subscription to the online survey software Qualtrics. Participating institutions were chosen based on American Public Gardens Association (APGA), American Horticultural Society (AHS), and/or American Alliance for Museums (AAM) membership. Surveys were sent to the most pertinent staff person at each institution, such as a Director, Director of Horticulture, Curator, Plant Recorder, or another relevant staff member. Contact information was gathered from the APGA, AHS, and AAM membership lists, and/or institutional websites. Participants received an introductory email message with a link to the online survey. Results from the two surveys were compiled into a Microsoft Excel spreadsheet.

Survey One

The purpose of the first survey was to gather basic institutional data and to determine if public gardens were actively prioritizing their living collections. A total of 576 institutions were invited to participate. The initial survey invitation was sent in

late April 2016. Weekly reminders to non-responders were sent out before the survey closed approximately two weeks later in mid-May 2016. See Appendix B for the initial invitation, reminders, and survey questions. Responses to the first survey informed selection of participants in the second survey.

Survey Two

The purpose of the second survey was to gather information about how public gardens identify priority or core collections and why it is a valuable exercise in collections management. Participants were selected based on their acknowledgement of assigning priority levels as defined in Question 16 or acknowledgement of providing a disproportionate amount of resources for particular garden areas, groups of plants, or unique specimens in Question 18 of survey one. A total of 148 survey invitations were emailed in late July 2016 with weekly reminder emails to non-responders. The deadline was extended to mid-August 2016 to allow for unfinished respondents to finish the survey. See Appendix C for the initial invitation, reminders, and survey questions.

Case Studies

Public garden institutions for eight case studies were selected non-randomly based on previous responses to the second survey and willingness to participate in further communication with the researcher. The purpose of the case studies was to gather more information about the processes behind living collections organization at each institution. Special attention was given to:

- History of collections organization
- Collections policies and any other relevant policies or plans

- Previous and current staff involvement
- Communication of the living collection with staff and the public
- Importance of recognizing priority living collections
- Benefits to the institution

Five institutions were selected who were performing living collections prioritization by identification of core collections and/or assignment of priority levels to individual plants or collections of plants. A third category was added to include three institutions who had recently begun the process of collections organization. Case study institutions were grouped into the following categories as determined from self-reported answers in survey two. Interviewees are included in parentheses.

- *Those with core collections only:*
    - Denver Botanic Gardens, Denver, CO (Cindy Newlander, Director of Horticulture)
    - Brooklyn Botanic Garden, Brooklyn, NY (Melanie Sifton, Vice President of Horticulture and Facilities)
    - University of Washington Botanic Gardens, Seattle, WA (Raymond Larson, Curator of Living Collections)
- *Those with core collections and priority level assignments:*
    - Morris Arboretum of the University of Pennsylvania, Philadelphia, PA (Anthony Aiello, Director of Horticulture and Curator)
    - Arnold Arboretum of Harvard University, Boston, MA (Michael Dosmann, Curator of Living Collections)

- *Those seeking to develop core collections:*
    - Matthaei Botanical Gardens and Nichols Arboretum at the University of Michigan, Ann Arbor, MI (David Michener, Associate Curator)
    - Wellfield Botanic Gardens, Elkhart, IN (Josh Steffen, Horticulture Manager)
    - Moore Farms Botanical Garden, Lake City, SC (Brendan Huggins, Horticulture Supervisor)

Interviews were conducted between November 2016 – February 2017 either in-person or over the phone. One staff member from each institution was interviewed, consistent with those who had filled out the two online surveys. Participants were provided with interview questions and an informed consent form beforehand via email. The interview protocol consisted of an introduction to the research topic followed by a series of questions asked by the researcher in a semi-structured fashion. All interviews were audio recorded using the TapeACall application on the researcher's phone or using a digital voice recorder. Each interview lasted between 45 to 60 minutes and was later transcribed. See Appendix D for invitation to participate, informed consent form, and interview questions. Appendix H contains selected transcriptions from the case study interviews. Collections policies, other institutional collection documents, and information from institutional websites was collected by the researcher to aid in the case study analysis.

Collection Policy Analysis

Collection policies and plans were voluntarily submitted as part of the second survey and were provided to the researcher. A total of 33 policies were collected for

analysis. Evidence of explicit living collections prioritization was found by reading each collection policy and searching for sections related to priority, significant, or core collections. Priority statements related to plant collection acquisition and maintenance were recorded separately. Priority collection information gleaned from the collection policy analysis was compared with self-reported “core collections” as defined in the second survey to identify inconsistencies.

Chapter 3

RESULTS

Survey One

Of the 576 institutions invited to participate, a total of 186 institutions responded to the first survey, yielding a 32% overall response rate. As part of the survey design, not all questions required an answer before submission. Therefore, not all questions received the same number of responses. In general, participation declined towards the end of the survey compared with the beginning.

In the first section, respondents were asked basic institutional questions. The majority of respondents (66%) selected “Arboretum/Botanic Garden/Display Garden” as the primary function of their institution. The next most common response was “Other” (17%), followed by “Museum” (6%), “Historic Site” (6%), “Public Park” (3%), “Zoo” (3%), “Cemetery” (2%), and “Preserve/National Park” (1%). “Other” responses were categorized as follows: University Garden (12), Research/Education Facility (10), Museum and Garden (2), Nature Center (1), Children’s Garden (1), Thoroughbred Farm (1), Private Club (1), Retirement Community (1), and Land Conservation (1).

Regarding institutional budgets, a third of respondents (33%) had annual operating budgets of $3 million dollars or more. This was followed by those selecting $1 million-2.99 million (23%), $400,000-999,999 (15%), $150,001- 399,999 (14%), and $150,000 or less (14%). Respondents also reported the approximate proportion of the annual budget allocated to horticulture-related expenditures. 67 respondents (41%) reported less than 20%, followed by 49 (30%) allocating 21-40%, 24 (14%) allocating 41-60%, 20 (12%) allocating 61-80%, 6 (4%) allocating 81-100%.

Respondents answered questions related to institution size, in acres. The average response to institutional size was 246 acres, with a median of 80, and a standard deviation of 462. The largest institution was 3,600 acres and the smallest was only one acre in size (n=173). Table 1 outlines the remainder of the acreage data as divided by "Intensively managed garden areas" and "Naturalistic areas with minimal input." "Other" responses for acre categories were: parking areas, pathways, roads, water, lakes, museum/shop space, buildings, wetland, agricultural, cattle farming, leased farm land, lawn, hardscape, playgrounds, special events area, or the land was in a development/planning stage.

Table 1 Responses to total number of acres by category

Category	Mean	Median	St. Dev.	# Responses
Intensively managed garden areas	55	20	99	173
Naturalistic areas with minimal input	160	40	359	146
Other	106	15	221	74

When asked about institutional staffing levels, respondents reported an average of 8 full-time horticulture staff and 5 part-time/seasonal horticulture staff. In terms of non-horticulture staff, on average, there were 50 full-time staff and 25 part-time/seasonal staff. See Table 2 for details. Respondents reported an average of 4,299 volunteer hours (median= 1,200 and standard deviation= 10,112, n= 145). On average, 8 staff, students, and/or volunteers maintain plant records as part of their position (median= 1, standard deviation= 62, n= 168). Additionally, on average, 2 staff members are solely responsible for living collections curation at respondent's institutions (median= 1, standard deviation= 2, n= 171).

Table 2 Responses to institutional employment of horticulture and non-horticulture staff

Horticulture Staff	Mean	Median	St. Dev.	# Responses
Full-time staff	8	4	12	172
Part-time/Seasonal Staff	5	2	10	173
None	0	0	3	173
Non-horticulture Staff	Mean	Median	St. Dev.	# Responses
Full-time staff	50	6	121	173
Part-time/Seasonal Staff	25	3	77	171
None	0	0	1	171

The second portion of the survey dealt with questions related to plant collections, specifically prioritization of living collections at public garden institutions. The first question asked respondents how their institution maintains plant records. In total, 93% of responding institutions maintain some type of plant records (n=183). Of this group, 37% use more than one type of record-keeping system. Twenty-three percent indicated they use Microsoft Excel, 14% use BG-BASE, and 13% maintain plant records non-digitally. A complete list of plant records systems used by respondent's institutions can be found in Table 3. "Other" responses consisted of: Journal (1), Google spreadsheet (1), Specify Software (1), Past Perfect (1), Cartegraph (1), Arborscope by Bartlett Tree Experts (1), EverNote App (1), Google Earth (1), Website/AutoCAD (1), MySQL database (1), BRAHMS (1), CollectionSpace (2), Plant Information Records System (FM Pro Based) (1), Computer (unknown system) (1), and three used an unspecified plant records system. Seventy-eight respondents (45%) use plant mapping software at their institution, while the majority, 90 respondents, (53%) do not, and 2 respondents were unsure (1%) (n=266).

Respondents indicated how many living plants, taxa, and genera their institutions held at the time of surveying. As per the survey, the definition of a taxon (plural: taxa) was defined as: any unit or rank within the taxonomic hierarchy such as

genus, species, or cultivar (i.e. different types of plants). Table 4 indicates the average number of living plants, taxa, and genera represented at responding institutions.

Table 3 Plant records systems used by responding institutions

Systems	# Responses	Percentage
Microsoft Excel	61	23%
BG-BASE	37	14%
Non-digitally (i.e. paper records)	34	13%
Microsoft Access	29	11%
Esri GIS software	26	10%
IrisBG	21	8%
FileMaker Pro	21	8%
Other	18	7%
Custom software	12	5%
None (do not keep plant records)	7	3%

Table 4 Summary statistics of respondents' living collections

Category	Mean	Median	St. Dev.	# Responses
# Living Plants	79,049	10,000	345,418	110
# Taxa	3,465	1,735	4511	111
# Genera	660	400	746	106

When asked about assigning priority levels to groups of plants or individual plants, 105 respondents indicated they did assign priority to individual plants while 113 indicated they assigned priority to groups of plants. Figure 1 indicates overall responses while Table 5 divides data by response combination as indicated by institution.

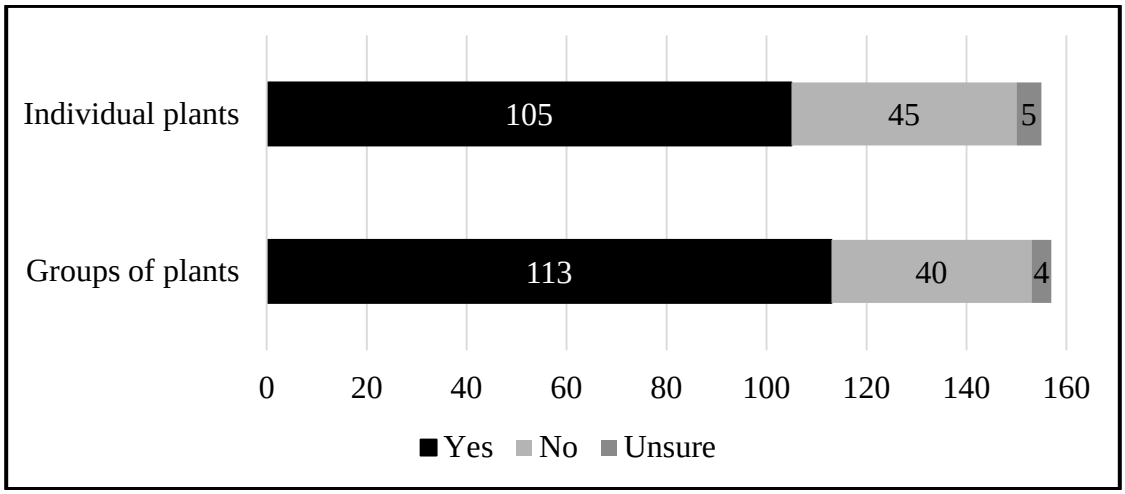

Figure 1 Prioritization level assignment response

Table 5 Prioritization level assignment by response combination

Prioritization Level		# Responses
Groups of Plants	Individual Plants	
Yes	Yes	94
No	No	30
Yes	No	15
No	Yes	10
Unsure	Unsure	4
Yes	No response	3
Yes	Unsure	1
No response	Yes	1

Ninety-four (78%) respondents prioritize at the individual plant and/or plant group level. Thirty (19%) do not assign priority to any plants, and four (3%) of respondents were unsure.

When asked if they divide their living collection into smaller collections with specific themes, the majority of respondents (66%) stated “Yes,” while 31% stated “No,” and 3% were “Unsure” (n=158). Further, 83% of respondents indicated there are garden areas, groups or plants, or unique specimens that receive a disproportionate

amount of resources compared to others (n=159). Sixteen percent stated “No” and 1% were “Unsure.” Ninety percent of respondents highlight gardens or groups of plants in brochures, specialty tours, on websites, or on social media platforms. Of these 90%, gardens, groups of plants, or individual plants are highlighted for “Seasonal interest” (18%), “Inherent value to the institution” (57%), both “Seasonal interest” and “Inherent value” (9%) or for “Other” reasons (15%). “Other” responses include: Nationally Accredited Plant Collections™ (1), recent plantings (1), ethnobotanical significance (1), taxonomic interest (1), perceived appeal (1), ecological services (1), focus of the organization (1), specific plant collections (1), unique habitats (1), endangered species (1), many reasons (9), or for yearly organizational themes (1).

Respondents were asked about prioritization criteria used to determine important plant collections to their institution. Participants were asked to rank the following categories on a 5-level Likert scale regarding their institution [“not at all important” (1), “slightly important” (2), “moderately important” (3), “very important” (4), or “extremely important” (5)] : “historical significance,” “cultural significance,” “aesthetic value,” “educational value,” “irreplaceable genetics,” “taxonomic importance,” “species representation within the garden,” “conservation value (endangered or threatened species)”, “research/evaluation value,” “Nationally Accredited Plant Collection™ status,” “known provenance,” “rarity,” “mature size,” “wild-collected germplasm,” “significant gift,” and “replacement cost.” After scoring based on the average, the top five ranking criteria were aesthetic value (4.0), educational value (4.0), conservation value (3.8), and rarity (3.7). Table 6 displays average scores across each criteria.

Table 6 Scoring for prioritization criteria

Prioritization Criteria	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)	# Responses	Mean
	Count						
Aesthetic value	1	7	35	60	47	150	4.0
Educational value	1	11	32	54	51	149	4.0
Conservation value	5	22	27	40	54	148	3.8
Rarity	7	19	30	55	37	148	3.7
Species representation within the garden	3	18	42	48	35	146	3.6
Historical significance	8	19	35	47	41	150	3.6
Irreplaceable genetics	14	29	18	43	42	146	3.5
Taxonomic importance	8	33	29	40	27	147	3.4
Cultural significance	11	26	46	47	16	146	3.2
Mature size	12	26	47	40	20	145	3.2
Known provenance	18	32	29	35	28	142	3.2
Research/ evaluation value	20	28	39	36	24	147	3.1
Significant gift	23	31	35	38	19	146	3.0
NAPC status	48	22	14	10	37	142	2.8
Wild-collected germplasm	35	34	30	23	24	146	2.8
Replacement cost	31	39	41	18	13	142	2.6

The last question in the survey asked participants to rank the top four prioritization criteria for their institution. One being highest and four being lowest. These rankings were tallied and scored based on the average ranking in Table 7. The top three highest ranking (lowest average score) criteria were “Historical significance,” “Irreplaceable genetics,” and “Educational value.”

Participants for survey two were selected from a sub-group of those participating in survey one. Specifically, those who had responded “Yes” to questions 16 or 18.

Table 7 Ranking for prioritization criteria

Prioritization Criteria	Mean	# Times Selected
Historical significance	2.0	68
Irreplaceable genetics	2.1	22
Educational value	2.2	84
Aesthetic value	2.3	86
NAPC status	2.4	36
Taxonomic importance	2.5	24
Conservation value	2.5	62
Wild-collected germplasm	2.5	30
Species representation within the garden	2.6	50
Mature size	2.7	11
Cultural significance	2.9	35
Research/evaluation value	2.9	24
Significant gift	3.1	21
Rarity	3.2	33
Known provenance	3.2	14
Replacement cost	3.5	4

Survey Two

A total of 148 surveys were sent to selected participants from survey one. A total of 99 respondents submitted surveys, yielding a 67% response rate. All questions were optional and participants were allowed to skip questions if they did not know the answer. Therefore, not all questions received the same number of responses. In general, participation declined towards the end of the survey compared with the beginning.

The first section of the survey included introductory institutional questions. Of the total 99 participants, 97% had an institutional mission statement, while 3% did not. Sixty-four percent of respondents had an institutional written collections policy while 36% did not (n=95). A total of 33 respondents uploaded collections policies for purposes of this study. When asked about disaster plans, only 11% of respondents had one written with information regarding the living collection, compared with 67% who did not, and 22% were unsure (n=94). Thirty percent of respondents held Nationally Accredited Plant Collections™ (NAPC) and 70% did not (n=93). A total of 28 respondents listed their NAPC in the survey and 72 respondents identified their institution voluntarily.

The second section asked participants specifically about core collections. A "core collection" was defined as such:

> Any group of accessions grouped under a specific category such as a taxonomic, morphological, geographic, cultural, habitat, display, conservation, heritage, research, or other theme. Core collections are permanent, central to the mission of an institution, and are given highest priority.

Eighty percent of respondents answered "Yes" to having core collections and 20% responded "No" (n=94). Sixty-six respondents provided a list of core collections currently identified at their institution. See Appendix E for a list of core collections provided.

Of those responding "Yes" to having core collections, 52% of respondents stated their core collections were described in a collections policy document while 48% said "No" (n=67). Participants (n=55) were asked to describe the process of selecting their institution's core collections. Responses were analyzed by the

researcher and grouped into categories as listed in Table 8. For full-text answers, see Appendix F.

Table 8 Response categories to the processes behind core collections selection

Response Categories	# Responses
Historic reasons	33
Locality	11
Mission based	6
No process defined	6
By committee	5
Conservation reasons	5
Current staff interest	5
Cultural reasons	3
Donor interest	3
Education/programming reasons	3
Part of a strategic planning process	3
Availability in trade	2
Display reasons	2
Research/trial purposes	2
Ease of maintenance	1
Value to green industry	1
New garden area interest	1
Public interest	1
Representative taxa	1
Unique genus	1
Unsure	1
Verified taxa	1
n/a	1

When respondents with core collections were asked if their institutions had management plans for core collections, 51% responded “No” and the remaining 49% responded “Yes” (n=67). Respondents were asked to indicate how many collections they had under the following categories: “Taxonomic,” “Morphological,” “Geographic,” “Habitat,” “Cultural,” “Display,” “Economic,” “Conservation,” “Heritage,” “Research,” or “Other.” The criterion with the greatest number of responses was “Taxonomic” (61), followed by “Heritage” and “Habitat” which were tied for 36 responses. The criteria with the greatest average number of collections was “Other” (mean=13.0), followed by “Taxonomic” (mean=9.3) and “Display” (mean=8.6). Means listed in Table 9 correspond with the average number of collections in each category as reported by responding institutions. Table 9 contains the entire dataset. “Other” responses read as follows:

- “Ease of cultivation, by important breeders”
- “Education collections for teaching”
- “Collections are integrated into the landscape”
- “Difficult to fully list/count all of these, depending on how you operationally define a collection. For instance, having 130 highly sensitive conservation taxa... do these count as 1 conservation collection or 130 separate?”
- “We have many of ALL listed, but not as ‘core’”

Additionally, of those answering “Yes” to having core collections, 96% of respondents had some form of “Collections documentation” while 81% had taken steps towards “Identifying core or special collections.” See Table 10 for additional steps taken by respondents. “Other” responses were as follows: “Priority levels by

location on site," "We are developing our collection policy and have just implemented a collections database," and "Creating a new position for Plant Records."

Table 9 Criteria/Themes by which core collections are categorized

Criteria/Themes	Mean	St. Dev.	# Responses
Taxonomic	9.3	8.6	61
Heritage	6.9	8.6	36
Habitat	5.7	6.2	36
Geographic	6.4	8.0	34
Morphological	5.9	7.3	29
Conservation	8.2	9.9	28
Display	8.6	8.4	27
Economic	4.3	5.1	25
Cultural	5.0	6.4	24
Research	3.5	6.3	21
Other	13.0	8.7	6

Table 10 Steps taken towards living collections prioritization for those with core collections identified and those without core collections identified

Steps Taken	With core collections identified		Without core collections identified	
	Count	Percentage	Count	Percentage
Collections documentation	66	96%	15	88%
Identifying core/special collections	56	81%	1	6%
Strategic planning	32	46%	4	24%
Assigning priority levels to collections of plants	30	43%	2	12%
Assigning priority levels to individual plants	20	29%	3	18%
Other	3	4%	2	12%
None	1	1%	2	12%

When asked how collections prioritization benefits their institutions, 75% of respondents indicated “Collections evaluation” as being important, followed by “Long-range institutional planning” at 73% and “Resource allocation” with 63% (n=69). See Table 11 for the remainder of responses. “Other” responses include:

- “Outdoor Educational classroom.”
- “More of a display approach.”
- “Our collections demonstrate plants from around the world sharing our local climate, thus encouraging the population to broaden the scope of plants and trees for their own gardens.”
- “Redefining institution to our University, donors, and community as a contemporary museum and public asset.”
- “Help determine collections submitted to Plant Collections Network”
- “Help bring people to our gardens, and help to educate the public”

Table 11 Benefits of collections prioritization for institutions with core collections identified and perceived benefits for those without core collections identified

Benefits	With core collections identified		Without core collections identified	
	Count	Percentage	Count	Percentage
Collections evaluation	48	75%	12	71%
Long-range institutional planning	47	73%	10	59%
Resource allocation	40	63%	13	76%
Propagation responsibilities	28	44%	5	29%
Disaster planning	17	27%	5	29%
Climate change planning	10	16%	2	12%
Other	6	9%	1	6%
No benefit	0	0%	1	6%

Respondents with core collections identified were asked if there would be anything they would change if they completed the collections prioritization process again (n=69). Responses were sorted into the categories listed in Table 12 (n=34). Some responses were multi-dimensional and fit into multiple categories. For the full list of answers, see Appendix G.

Table 12 Future changes to be made if completing the collection prioritization process again

Status/Future Changes	# Responses
Currently in the process	7
Write or update the collections policy	7
Long-range/strategic planning	6
None	5
Initial record keeping	3
Reassess collections over time	3
Include disaster planning	3
Update collections plan	1
Work with other staff	1
Start with a smaller list	1
Include more specifics in describing core collections	1
Make collections more relevant	1
Assign priority levels	1
Differentiate between core collections and garden areas	1
Start accessioning other plants in the living collection	1
Consider more criteria for nominating core collections	1
Weed control	1

Of those 19 responding “No” to having core collections, 7 respondents identified this as a future goal and 10 did not. Two respondents did not answer any further questions. The 17 respondents identified steps their institution had taken towards collections prioritization. 88% had completed “Collections documentation,” while 24% had gone through a “Strategic planning” process, and 18% responded with “Assigning priority levels to individual plants.” Further details are available in Table

10. The only “Other” response provided was: “We are a very young organization just beginning to discuss collection priorities.”

Additionally, of those institutions who did not have core collections identified, when asked how their institution would benefit from collections prioritization, 76% responded with “Resource allocation,” 71% with “Collections evaluation,” and 59% with “Long-range institutional planning” (n=17). Further answers are outlined in Table 11. The singular “Other” response provided was “don’t know.”

Of the 20% of respondents without core collections identified, 79% have garden areas and individual plants that receive a disproportionate amount of resources than others. And, 41% of respondents in this group were interested in developing a prioritization scheme.

Case Studies

Results from the eight case studies are presented in this section. Three tables outline basic information gathered from the case study interviews. Table 13 provides a summary of the eight institutions, their location, general prioritization system, and relevant documents. Table 14 includes a list of each institutions' core collections as identified in the interview, from a collections policy, or as listed on the institutional website. Table 15 consists of information related to how and why core collections were or will be selected, benefits of prioritization, and how core collections are communicated with staff and the public.

Appendix H contains selected transcriptions from case study interviews. Comprehensive summaries of each case study institution can be found in Appendix I such as institutional background information and further details related to information presented in Tables 13-15.

Table 13 Case study institutional information

Institution	Prioritization System	Relevant Documents	AAM Accredited?
Denver Botanic Gardens	Identifies core collections; assigns individual priority levels for construction projects only	Collections Plan, Collections Management Policy*, Horticulture Standards Manual, Master Development Plan	Yes
Brooklyn Botanic Gardens	Identifies core collections; assigns individual priority levels to major trees only	Living Collections Policy, Disaster Plan (in development), Turf Plan, Collections Management Plans**	No
University of Washington Botanic Gardens	Identifies core collections; assigns individual priority levels for construction projects only; would like to assign maintenance priorities to garden areas	Collections Policy, Conservation Policy, Washington Park Arboretum Master Plan	No, but interested
Morris Arboretum	Identifies core collections; assigns individual priority levels to major trees only	Living Collections Policy, Disaster Plan, Top 25 and 100 Tree Lists	Yes
Arnold Arboretum	Identifies core collections; attempted to assign individual priority levels based on a primary documentation score (in development, see Figure 2)	Living Collections Policy, Landscape Management Plan**, Campaign for the Living Collections, General Procedures for Managing the Flow of Plants though the Department of Horticulture, Plant Inventory Operations Manual	No
Matthaei Botanical Garden and Nichols Arboretum	Seeking to develop core collections; would like to assign maintenance priorities to garden areas	Collections Policy (in development), Collections Stewardship Policy** (in development), Disaster Plan	No, but interested
Wellfield Botanic Gardens	Seeking to develop core collections; interested in assigning priority to individual plants	Collections Policy, Woodland Conservation Garden Management Plan*, Management Plans, Canopy Management Plan (future goal)	No
Moore Farms Botanical Gardens	Seeking to develop core collections; interested in assigning priority to individual plants	MFBG Living Collections Policy, Collection Management Manual***	No, but interested

AAM=American Alliance of Museums
* Covers collections cover relevance, current status, and development goals
** Covers collections maintenance only
*** Covers curatorial procedures (accessioning, deaccessioning, inventory, and maintenance)

Table 14 Case study institution's core collections

Institution	Core Collections
Denver Botanic Gardens	Alpine*, Amenity (i.e. cultivated plants), Aquatic, Cactus and Succulent, Native (*Quercus**), Tropical, and Steppe
Brooklyn Botanic Gardens	Specialty Cultural Collections (Bonsai Collection, Fragrance Garden, Japanese Hill-and-Pond Garden, Mixed Perennial Border, Osborne Garden, Shakespeare Garden), Systematic/Taxonomic Collections [Plant Family Collection (Ferns, Conifers, Flowering Plants), Notable Systematic/Taxonomic Plant Collections (*Prunus*, Cycad, *Syringa*, *Magnolia*, Orchid, *Rosa*, *Wisteria*), Biogeographic and Bioclimatologic Collections (Aquatic Plants, Desert Plants, Native Flora Garden, Rock Garden, Tropical Plants, South African Bulb Collection, Warm Temperate Plants)], Education/Research/Display Collections
University of Washington Botanic Gardens	*Acer** (focused on Asiatic maples and *Acer palmatum*), *Ilex**, *Magnolia**, *Quercus** (and larger oak family), *Sorbus*, *Abies*, *Pinus*, Cupressaceae, *Picea*, *Viburnum*, *Rhododendron* (hybrid rhododendrons and azaleas), Hamamelidaceae, Theaceae *(Camellia* and *Stewartia),* Legumes (Fabaceae), Birches and Poplars, *Crataegus, Fraxinus*, Juglandaceae, *Larix, Tilia*, Azalea Way, Winter Garden, Woodland Garden, Japanese Garden, Pacific Connections Garden [New Zealand (Mid-high Elevation South Island), Central Chile, Siskiyou Mountains/Cascadia, Southeast Australia, and Szechuan/Sino-Himalaya]
Morris Arboretum	*Abies**, *Acer**, *Quercus**, *Prunus*, *Magnolia*, Heritage Trees, *Rosa*, *Ilex*, Hamamelidaceae, Native Azaleas, Conifers
Arnold Arboretum	Priority Genera [Plant Collections Network Genera (*Acer*, *Carya*, *Fagus*, *Stewartia*, *Syringa*, and *Tsuga*), Robust Genera (*Carpinus*, *Forsythia*, *Ginkgo*, and *Ostrya*), and Biogeographic Genera (*Cornus*, *Hamamelis*, *Hydrangea sensu lato*, *Magnolia*, *Taxus*, *Viburnum*, and *Weigela* & *Diervilla*)]; Conservation Collections (i.e. species under threat from extinction); and Synoptic Collections (i.e. representative taxa of Earth's temperate woody flora)
Matthaei Botanical Garden and Nichols Arboretum	*Paeonia**, Conservatory Collections**, Great Lakes Endemics**, Bonsai Collection**
Wellfield Botanic Gardens	*Magnolia***, *Rhododendron***, Emergent/Submergent Wetland Plants**, Mature Canopy Trees
Moore Farms Botanical Gardens	*Taxodium*, *Magnolia**, Conifer

*Nationally Accredited Plant Collection™
**Anticipated core collections

Table 15 Case study institution core collections selection process, benefits, and communication

Institution	Core Collection (CC) Selection Personnel	CC Justification	Perceived Benefits of Prioritization	CC Internal/External Communication
Denver Botanic Gardens	Board, Administrative Staff, Curation Staff, Horticulture Staff	Existing collections, collection strengths, new garden areas, ease of communication with the public, locality	Disaster planning; fundraising; strategic planning	Website, volunteer docents, interpretive signage, staff training
Brooklyn Botanic Gardens	Board, Administrative Staff, Curation Staff, Horticulture Staff, Education Staff, Interpretive Staff	Historic collections, significant specimens, significant taxa, diversity, educational value, cultural value, conservation value, new garden areas	Disaster planning; institutional recognition	Website, social media
University of Washington Botanic Gardens	Administrative Staff, Curation Staff, Outside Garden Clubs	Historic collections, previous director/curator interests, garden club interests, new garden areas, locality	Disaster planning, institutional recognition; strategic planning	Website, monthly staff meetings and reviews, tours, publications, local garden collaborations
Morris Arboretum	Administrative Staff, Curation Staff	Previous and current director/curator interests, historic collections	Disaster planning; institutional recognition	Website, themed events, tours, publications, staff reviews
Arnold Arboretum	Administrative Staff, Curation Staff, External Botanic Garden/Scientific Community Representatives	Collections central to the mission, nationally important collections, locality	Disaster planning; donor response	Website, staff/volunteer meetings, publications, tours
Matthaei Botanical Garden and Nichols Arboretum	Strategic Planning Firm, Administrative Staff, Curation Staff, Horticulture Staff	Taxonomic themes, previous faculty expeditions, academic programs, amenity spaces, locality	Disaster planning; donor response; fundraising; strategic planning	Website, internal documents
Wellfield Botanic Gardens	Administrative Staff	Board, donor, staff interests, new garden areas	Donor response; informs future plantings	None currently
Moore Farms Botanical Gardens	Administrative Staff, Curation Staff	Locality, reference collections for the community, staff research interests	Disaster planning; informs future plantings; institutional recognition	Website, tours, staff on-boarding process

Collection Policy Analysis

A total of 33 institutions submitted collection policies in the second survey. Twenty-four of the policies were written within the last ten years, 2 were written prior to 10 years ago, and 7 had no publication date. Six of the policies were submitted in a draft format.

Only seven institutions used the term “core collections” in their collections policies. Other terms used instead to denote priority collections were: “primary collections,” “primary groupings,” “notable collections,” “collections of emphasis,” “particular emphasis is placed on…” and “significant plant collection groups.”

Ten policies did not list any collections of plants, but five of these participating institutions did list core collections in the second survey. Overall, 24 institutions had differences between what was reported in survey two as their core collections and what was written in their collection policies. Thirteen institutions identified plant acquisition priorities in their collections policy, whereas 19 institutions identified maintenance priorities in their collections policy.

Chapter 4

DISCUSSION

Survey One

Survey one participants represented a diverse group of public garden institutions. A wide range of budgets, size (in acres), staffing levels for horticulture and non-horticulture staff, and collection sizes were reported. The majority of participating public garden institutions identified as arboreta, botanic gardens, and display gardens. It is important to note several institutions identified as having multiple foci as evidenced by the responses in the "Other" category, particularly public gardens identifying as university gardens, research & education facilities, and museums/gardens. It is possible that those responding in the "arboretum/botanic garden/display garden" may also identify as belonging to another category.

The majority (83%) of respondents indicated there are garden areas, groups of plants or unique specimens that receive more resources than other. Public garden institutions should look at what is being prioritized in terms of maintenance and acquisition and make sure it aligns with an institutional mission and is outlined in a collections policy or collections management plan. By default, these priority garden areas, groups of plants, or individual plants have the potential to become core collections. And, 41% of those respondents without core collections expressed an interest in developing core collections at their institution.

Rankings of prioritization criteria indicate public garden institutions are mostly concerned with the aesthetic and educational values of plants in their collections. This finding is not surprising because most public gardens seek to engage the public with garden displays and educational opportunities to generate revenue. Nationally

Accredited Plant Collection™ (NAPC) status ranked lower than expected, considering plant collections with this designation should be of greatest importance to an institution. This finding indicates not many of the responding institutions participate in the NAPC program. Further questions were asked about NAPC involvement in the second survey. There were differences in answers when participants were asked to rank the top four prioritization criteria for their institution. “Historical significance” and “Irreplaceable genetics” took the top two categories while “NAPC status” was ranked 4th overall. This difference suggests that responding institutions may score multiple criteria highly but when forced to rank their top four selections, they may be able to differentiate between prioritization criteria.

Survey Two

The response rate to the second survey was higher than the first because participants were selected from a group who had previously demonstrated an inclination for filling out surveys. This sub-group represented institutions who acknowledged the presence of a prioritization scheme. Almost all the responding institutions (97%) had an institutional mission statement, while only two-thirds (64%) had a written collections policy. This is indicative of some level of institutional organization, but possibly not to the plant collection level. An even smaller number of participants (11%) had written disaster plans with information regarding the living collection. This finding is less than Bergquist’s (2009) finding that 18-31% of public garden institutions have a “natural disaster plan to aid in the plant recovery process.” This dissimilarity may be attributed to differences in the question asked, or because those who responded to the second survey did not represent the entire group of public gardens in the US. Bergquist (2009) asked: “does your institution have a disaster plan

in place?" Whereas the question was posed differently in this research, and specifically asked about *written* disaster plans. Institutions may have disaster plans as indicated in Bergquist's research, but perhaps they are not formally written down. Additionally, 22% of respondents were unsure if they had a written disaster plan in survey two.

Most respondents (80%) indicated they had core collections as defined in the second survey. Fifty-two percent of these respondents indicated they had core collections described in a collections policy. This signifies there is a disconnect between naming core collections and describing them in an institutional document. Core collections, as defined in the survey, are permanent, central to the mission of an organization, and are given highest priority. Therefore, they should be outlined in a collections policy or similar document. Likewise, only half of respondents (51%) had management plans regarding relevance, current status, required maintenance, and/or development goals. Additionally, of the 20% gardens without core collections, 79% had gardens areas and individual plants that received more attention than others.

When describing how core collections were selected, the top two responses were for historic reasons and reasons related to the locality of the public garden. This makes sense, given that many public gardens were previously private homes or estates, have a history of plant exploration, or previous staff members who made important decisions and contributions to a living collection. The geographic component is expected, considering public gardens will only grow what is feasible on the property, unless they have access to climate controlled growing spaces and the resources to maintain them. Types of answers varied to this question because respondents interpreted the question differently. The majority gave answers related to

why certain collections were selected, not the *process behind* the selection, such as who was involved, when they were selected, and what prompted the selection of core collections. Most who answered the question gave their criteria for core collections selection. A few respondents answered specifically about the process by stating their core collections were selected as part of a strategic plan, by committee, or no process was currently defined. Because this question did not garner the anticipated response, further information on this topic was gathered through the case study interviews.

When asked to categorize and count numbers of core collections, taxonomic collections had the greatest number of responses. Collections with a "Heritage" or "Habitat" theme were the second most common core collections. This corresponds with previous results, where respondents stated most of their core collections were selected for historic reasons or due to the locality of the public garden. The "Other" responses also suggested six institutions defined their core collections differently than defined in the survey based on the responses as follows. One respondent had collections that fell under the categories provided, but they were not considered "core," another had collections "fully integrated into the landscape," and one institution was unsure if 130 conservation taxa would count as one collection or 130 separate collections. This confusion points to the importance of having clearly defined core collections in an institutional document, especially since this definition could differ between public garden institutions.

A few major differences stood out when comparing between institutions that have core collections identified and those who do not. Of those with core collections identified, 46% had gone through a strategic planning process, compared with 24% of those who had not identified core collections. This suggests designation of core

collections is an important component of the strategic planning process. Secondly, respondents who had taken steps towards “Assigning priority levels to collections of plants” and “Assigning priority levels to individual plants” were in the minority in both groups. Interestingly, between the two categories, assigning priority levels to collections of plants was more popular among respondents who had identified core collections (43%) compared with assigning priority to individual plants (29%). The opposite was true for respondents who had not identified core collections, with 12% in favor of priority level assignments at the collection level and 18% in favor of assigning at the individual plant level. Perhaps institutions who have not undergone a formal core collections process do not have an understanding of the time and organization it would take to assign priority at the individual plant level. Likewise, maybe those who had identified core collections may have a greater understanding of the efforts required for this process.

Interestingly, 6% of respondents without core collections identified at the beginning of the survey said they had taken steps towards “Identifying core/special collections” in a secondary question. These are assumed to be informally named at this point, or are in the process of being identified. Likewise, of those respondents who replied “Yes” to having core collections in the beginning of the survey, only 81% chose “identifying core/special collections” as a step they had taken later in the survey. Again, perhaps respondents were thinking of informally named core collections at the beginning of the survey.

Differences also occur when comparing between the two groups regarding benefits of collections prioritization. For those who had already gone through the process of recognizing core collections, no respondents saw no benefit to going

through this process, compared with 6% of those who had not identified core collections. Again, this finding speaks to the perceived benefits compared with those who have already gone through the process and those who have not. In hindsight, collections prioritization is a beneficial exercise. For those without core collections identified, “Resource allocation” was identified as the most important benefit (76%). For those with core collections identified, “Collections evaluation” was identified as the most important benefit (75%).

For those who had already identified core collections, the process appears to be part of an ongoing evolution. Seven respondents indicated they were currently in the process and seven were writing or updating a collections policy. Six respondents were going through the process coupled with long-range or strategic planning. Five respondents were satisfied with their progress thus far and three respondents would include disaster planning in the future.

Case Studies

The following six themes emerged after analysis of the eight case study institutions. Case study institutions are abbreviated as follows: The Arnold Arboretum (Arnold), Brooklyn Botanic Garden (BBG), Denver Botanic Gardens (DBG), Matthaei Botanic Gardens and Nichols Arboretum (MBGNA), Moore Farms Botanical Garden (MFBG), Morris Arboretum (Morris), University of Washington Botanic Gardens (UWBG), and Wellfield Botanic Gardens (WBG).

Theme 1: Institutional documents

All case study institutions had mission statements, written collection policies and other collection-related documents, either formally or in development. Six

institutions had management plans regarding their living collections but the purposes of these policies varied. Management plans tended to fall into three categories: for maintenance, collection status/growth, or curatorial procedures. For the Arnold, BBG, and MBGNA, management plans cover or will cover living collections maintenance requirements (Dosmann, 2016; Stifton, 2016; Michener, 2016). For DBG and WBG, management plans exclusively cover relevance, current status, and development goals for core collections or an entire living collection (Newlander, 2016; Steffen, 2017). For MFBG, their Collection Management Manual covers curatorial procedures such as accessioning, deaccessioning, and inventory procedures, as well as general maintenance (MFBG, 2014). Two of the case study institutions had disaster plans in place (Aiello, 2016; Sifton, 2016). Disaster plans cover responses to both operational disasters and disasters sustained by the living collection. See Appendix I for more information.

Theme 2: Identification of core collections

All case study institutions had core collections or were in the process of identifying core collections. For seven institutions, core collections were chosen by a committee. These committees consisted of staff members across departments and even from staff from outside the organization. UWBG and the Arnold included external personnel on committees who were responsible for selecting core collections. All other case study gardens had committees comprised exclusively of internal staff members. For the Morris Arboretum, core collections were developed based on historic staff interest and were developed over time. However, an Advisory Board of Managers is responsible for reviewing and approving the Living Collections Policy (Aiello, 2016; Morris, 2007). Appendix I contains more detailed information such as committee names and staff members involved with core collection selection at each individual institution.

Development of core collections usually starts with an examination of an institution's strengths or historic emphases (Aiello, 2016; Larsen, 2016; Newlander, 2016; Stifton, 2016). Core collections are also chosen because they are central to the mission of an organization (Dosmann, 2016), or because they fit into specific fundamental themes (Michener, 2016). They also may be chosen for new garden areas (Larsen, 2016; Sifton, 2016; Newlander, 2016; Steffen, 2017) or based on what a public garden is able to grow well in its location (Huggins, 2017; Michener, 2016; Dosmann, 2016; Larsen, 2016; Newlander, 2016)

Theme 3: Benefits of collections prioritization

Disaster planning was a reoccurring theme discussed by seven out of the eight case study institutions. Appendix I covers a wide range of disaster situations as discussed by participants, from loss of knowledgeable staff (Sifton, 2016), damage due to construction projects (Larsen, 2016; Newlander, 2016), losses from natural disasters (Sifton, 2016; Huggins, 2017; Dosmann, 2016; Aiello, 2016), and collection losses due to funding cuts (Michener, 2016). Having clearly delineated collections priorities is necessary for maintaining institutional knowledge and helps to communicate collections priorities with new and existing staff members in the event of a disaster.

Prioritization also allows for informed decision-making and suitable communication with potential donors. Monetary donations can be directed to the appropriate collections and inappropriate donations can be turned down based on a strong collections policy (Dosmann, 2016; Steffen, 2017). Inversely, having clearly identified core collections may attract potential donors if collections can be endowed

with sufficient funding to ensure their long-term development (Larsen, 2016; Michener, 2016; Newlander, 2016).

Lastly, prioritization raises the level of recognition for the living collections within the institution but among peer institutions and with outside groups, such as researchers and other public gardens(Larsen, 2017; Sifton, 2017; Aiello, 2016; Huggins, 2017).

Theme 4: Assigning priority levels to collections

Seven case study institutions expressed interest in assigning priority levels to individual plants within their collections (Steffen, 2017; Sifton, 2016; Newlander, 2016; Aiello, 2016; Huggins, 2017; Larsen, 2016). Four institutions already assign priority levels to a sub-set of the overall living collection (Sifton, 2016; Larsen, 2016; Aiello, 2016; Newlander, 2016). See Appendix I for more information. Because of the time required to assign priority levels to individual plants, it is much easier to delineate priority collections, garden areas, or assign priority in connection with specific projects in the garden (Newlander, 2016; Dosmann, 2016). UWBG and DBG assign priority to plants that are effected by construction projects and this is implemented on a project-basis only (Larsen, 2016; Newlander, 2016). The UWBG and the MBGNA assign or will assign priority based on maintenance requirements of garden areas. Staff at UWBG assign priority based on the number of full-time employees required per garden area (Larsen, 2016). For MBGNA, priority will be assigned to garden areas requiring more attention throughout the year, depending on the aesthetic requirements (Michener, 2016). Two institutions assign priority to major trees only (Aiello, 2016; Sifton, 2016). Priority plants can also be communicated

verbally during staff reviews but this information is not always written down in a formal document (Larsen, 2016; Aiello, 2016).

Dosmann (2016) brings up the point that assigning priority levels to plant materials is only successful when an institution has a clear understanding of their overarching collection priorities. Based on the Arnold's example, priority assignment is difficult to implement when faced with confounding factors. Dosmann attempts to create a "primary documentation score" based on the level of documentation associated with an accession (see Figure 2, Appendix I). Under this model, a wild collected plant and a cultivated plant could receive the same score, but wild collected material can score above cultivated material in the "PROVTYPE" category, thus potentially giving it a higher score overall. The model assumes the Arnold Arboretum values wild collected material over cultivated material and this may not be the case at another public garden institution. Also, the model does not take into consideration other factors such as mature size or the aesthetic value a plant can bring to the landscape. It may be easier for newer institutions to assign priority because they lack mature or heritage specimens. For example, MFBG stated it would assign high priority to cultivated material that would be difficult to find in the trade, specifically *Taxodium* cultivars (Huggins, 2017). However, this approach does not consider future changes the institution may want to make in the future, when the landscape matures, or if MFBG decides to place a higher value on wild-collected material, or plants of conservation value.

Theme 5: Communication of core collections

The easiest way to communicate core collections to the public is through an institutional website. Seven of the case study institutions feature core collections on

their websites with access to a plant collections database or map (Newlander, 2016; Aiello, 2016; Larsen, 2016; Dosmann, 2016; Huggins, 2017; Michener, 2016). Social media is used to advertise collection strengths (Sifton, 2016). Docent-led tours are another way to spread the word about collections as well as specific programming featuring a core collection (Larsen, 2016; Aiello, 2016; Dosmann, 2016; Huggins, 2017). For the casual visitor who is not part of a tour, information about core collections is gleaned from interpretive signage and pamphlets (Larsen, 2016; Newlander, 2016). And, institutional or external publications are used to highlight specific collections with a more involved or professional audience (Larsen, 2016; Dosmann, 2016; Aiello, 2016). For staff and volunteers, core collections information is explained during curation meetings or as part of staff reviews (Larsen, 2016; Aiello, 2016). Curation staff may be involved with docent training (Dosmann, 2016; Newlander, 2016) or part of the on-boarding process for new staff members (Huggins, 2017).

Theme 6: Institutional accreditation

Lastly, accreditation by outside organizations was a reoccurring theme among case study institutions. Six institutions are members of the Plant Collections Network and hold Nationally Accredited Plant Collections™ (NAPC). Of these six case study institutions, all consider NAPC as core collections (Newlander, 2016; Aiello, 2016; Larsen, 2016; Dosmann, 2016; Huggins, 2017; Michener, 2016). Because of the level of documentation, benchmarking, and commitment required for accreditation, NAPC are well-suited for receiving core collection status.

Only two case study institutions are accredited through the American Alliance of Museums (AAM, 2017a). However, three expressed an interest in applying for

AAM accreditation, specifically as an incentive to have core documents such as a collections policy and disaster plan in order and for preserving institutional knowledge (Sifton, 2016; Huggins, 2016; Michener, 2016). MBGNA hopes to apply within the next five years (Michener, 2016). See Appendix I for detailed responses.

Collection Policy Analysis

Based on the analysis of the 33 collection policies, it is evident that priority collections are outlined in collections policies. However, self-reported core collections in the survey differed from what was written in collection policies for 24 institutions. Inconsistency could arise from having an outdated collection policy, unclear collection goals, or because core collections are currently in development and have not been finalized or because survey respondents were not familiar with their own institutional collections policy.

Recommendations

The seven recommendations below represent the culmination of this research. They are intended as suggestions for public garden institutions seeking to develop core collections. Several of these recommendations are echoed in the American Public Gardens Association's Standards of Excellence in Plant Collections Management (Weathington, 2017). Details of this document are outlined in Appendix J.

Recommendation 1: Know what your living collection contains

Based on a literature review, priorities cannot be set without a clear understanding of what the living collection contains and having clear plant records is crucial for this process. Public garden institutions should know when inventory checks were last completed as well as locations, health status, and background information for

all accessioned plants in their collection. This information can be maintained in a database or on paper, but any information associated with the living collection should be recorded to maintain institutional knowledge. Likewise, public garden institutions should clearly outline what minimum information is documented for accessioned plants. Required details may differ depending on the mission of the organization. If the public garden serves only for display purposes, having detailed information about a seed collecting trip may not be necessary; while for an institution concerned with preserving biodiversity, it would be imperative to record this information.

Recommendation 2: Assemble a curation committee

While it is the responsibility of the curator to make decisions regarding the living collection, it may be helpful to have a curation committee who reviews changes to a collection policy or selection of core collections. Based on the case study examples, this committee should contain, at minimum, executive staff, and members of the curation and horticulture departments. Depending on the mission of the organization, a curation committee may also contain staff members associated with public outreach such as education, development, or marketing staff; or outside stakeholders to the organization. The committee may also include staff from similar institutions or those from closely allied organizations with which the public garden works.

Recommendation 3: Develop clear goals for the living collection

The next step is to identify clear goals for the living collection. From the survey responses, this process may be completed as part of a strategic plan or master plan, or may be determined by the curation committee. The central task is to determine

what is central to the mission of an organization. What makes the institution unique? What collections are essential to maintaining the core values of the public garden? What core collections highlight the uniqueness of an institution regarding its mission, history, or location in the world? Designated collections do not have to be taxonomic in nature, and can center on broader themes. Are there any core collections that should be developed? What are the priorities for living collections development and maintenance? A living collections review process should be developed to ensure the collections remain relevant to the institution.

Decide if your institution will assign priority levels to individual plants within the collection or name "core collections." Assigning priority may appear simple in theory but can become complicated if the institution does not have clear collection goals and priorities in mind. From case study interview responses, choosing priority core collections out of an overall living collection is easier and takes up less staff time than assigning priority to individual accessions. Understanding individual priority assignment may be most useful on a case-by-case basis such as preparing for a construction project or emerging pest or disease outbreak. Alternatively, it may be easier to break down the collection into a "Top 100" list of priority accessions rather than assigning priority levels within an entire living collection.

Recommendation 4: Maintain up-to-date policies and procedures

Key living collections decisions and standards must be recorded in institutional policies and procedures. Based on industry standards set by the American Alliance of Museums and the American Public Gardens Association, at minimum, public garden institutions should have a collections policy with information regarding the mission, scope of the collection, acquisition, disposal, accessioning, access,

exchanges/loans/gifts, care & maintenance, and ethical considerations. Once a collections policy is written, other policies and procedures can be compiled. These policies may expand upon sections within the collections policy. An institution may be interested in writing disaster plans, management plans for maintenance, management plans for collections development, standards for horticultural care, and detailed accessioning/plant records procedures. These documents should be kept up-to-date and cover procedures for their own review.

Recommendation 5: Consider applying for PCN or AAM accreditation

Based on case study interviews, collaboration with outside organizations can bring a level of robustness and resources to an institution and the collections contained therein. Public garden institutions should consider applying for Nationally Accredited Plant Collection™ status through the Plant Collections Network (PCN). In order to apply, institutions must have a written collections policy updated within the last ten years, maintain a computerized plant records system, map plants within the collection, conduct field inventories of the collection, label plants with accession tags, benchmark current holdings, determine if the current collection "include[s] approximately 50% or more of the taxa [they] ultimately seek to acquire", and obtain a letter of endorsement from the governing body (APGA, 2017b). Mt. Cuba Center offers a Challenge Grant for first time applicants to the PCN. The purpose of the grant is to "offset expenses of Plant Collections Network application and review process, with any remainder going toward curation of the collection" (APGA, 2017c).

Public garden institutions should also consider applying for museum accreditation or completing a Collections Stewardship Assessment (CSA) through the American Alliance of Museum's (AAM) Museum Assessment Program (MAP). In

order to apply for accreditation, institutions must have the following "core documents" as outlined by AAM (2017c): Mission Statement, Institutional Code of Ethics, Strategic Institutional Plan, Disaster Preparedness/Emergency Response Plan, and Collections Management Policy. Institutions might also consider applying for the CSA part of the broader AAM accreditation process. The CSA "focuses on collections policies, planning, access and documentation within the context of the museum's total operations" (AAM, 2017b).

Recommendation 6: Publicize core collections

As stated in the case study interviews, core collections should be promoted internally within an institution and externally for the public, researchers, and other organizations. All staff should have access to living collection policies and procedures, and should have an understanding of core collections at their workplace. Information on core collections should be incorporated into the on-boarding process for staff and any volunteers, especially if they are responsible for tours of the collection. For external outreach, core collections should be publicized on an institutional website, in tours, and during educational and professional programs held at the institution. Details about contents within the overall living collection may be maintained on a publicly accessible database or interactive map. Finally, core collections should be featured in internal and external publications by staff at the institution.

Recommendation 7: Ensure the long-term survival of core collections

Lastly, it is fruitless to prioritize collections without guaranteed long-term backing. Core collections should be assured support for appropriate maintenance, documentation, and future growth. Do available growing conditions adequately

support core collections? Is there enough funding to support their long-term growth and survival? Public garden institutions should consider future challenges due to climate change or cuts to staffing or funding. What collections need to be backed-up through propagation and shared with other institutions? Will projected climate changes allow for these collections to be maintained at the institution? Alternatively, how will a changing climate allow for new collections opportunities?

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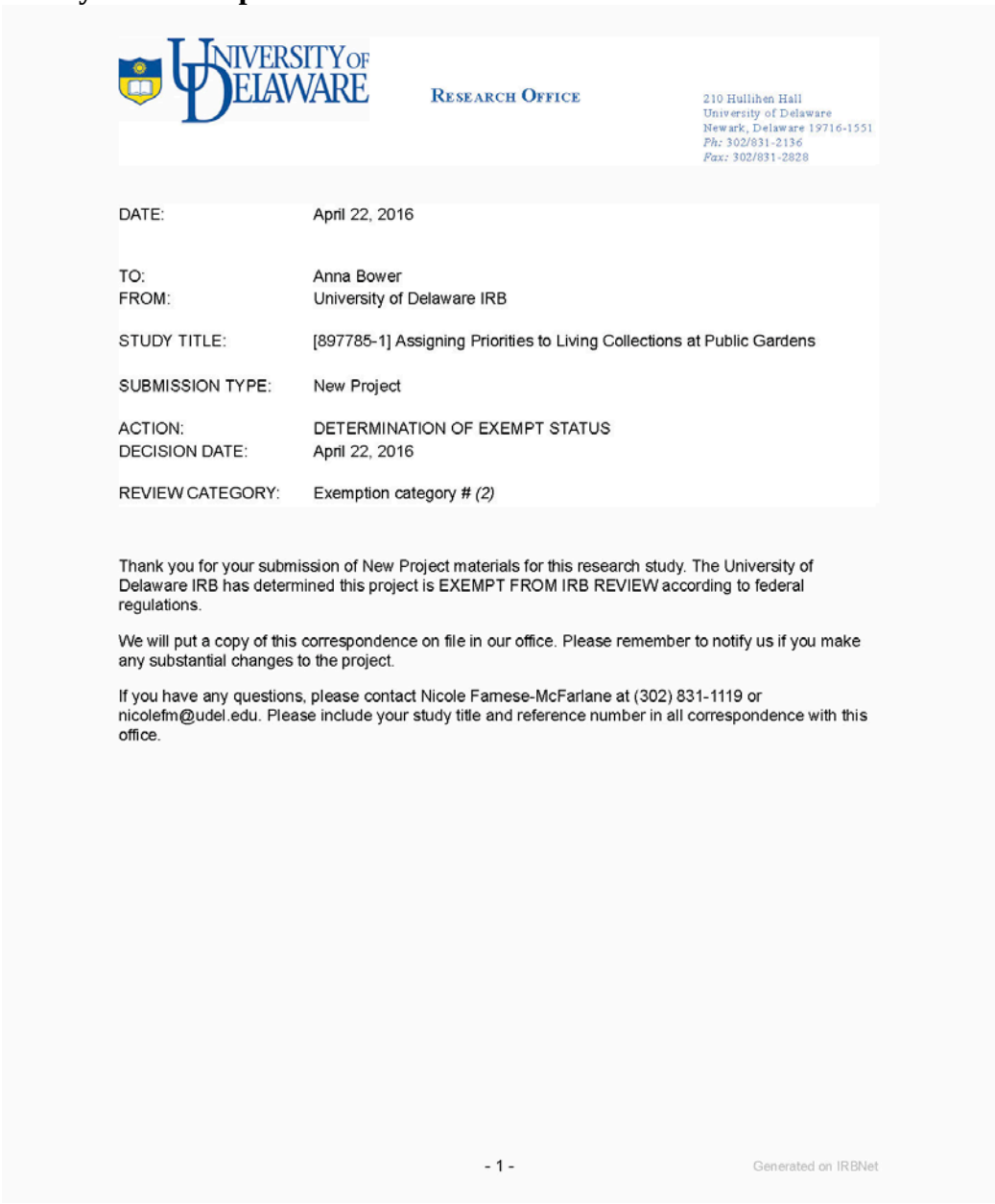
Appendix A

UNIVERSITY OF DELAWARE IRB LETTERS

Survey One Exemption Letter



UNIVERSITY OF DELAWARE

RESEARCH OFFICE

210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE:	April 22, 2016
TO:	Anna Bower
FROM:	University of Delaware IRB
STUDY TITLE:	[897785-1] Assigning Priorities to Living Collections at Public Gardens
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	April 22, 2016
REVIEW CATEGORY:	Exemption category # *(2)*

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

If you have any questions, please contact Nicole Famese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.

Survey Two Exemption Letter

UNIVERSITY OF DELAWARE
RESEARCH OFFICE
210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE:	July 19, 2016
TO:	Anna Bower
FROM:	University of Delaware IRB
STUDY TITLE:	[936466-1] Assigning Priorities to Living Collections at Public Gardens Survey Two
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	July 19, 2016
REVIEW CATEGORY:	Exemption category # *(2)*

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

If you have any questions, please contact Nicole Famese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.

Case Study Approval Letter

UNIVERSITY OF DELAWARE
RESEARCH OFFICE
210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE:	November 18, 2016
TO:	Anna Bower
FROM:	University of Delaware IRB
STUDY TITLE:	[981777-1] Interview Protocol for Prioritization of Living Collections at Public Gardens
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	November 18, 2016
EXPIRATION DATE:	November 17, 2019
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *(6,7)*

Thank you for your submission of New Project materials for this research study. The University of Delaware IRBhas APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.

Appendix B

SURVEY ONE MATERIALS

Invitation to Participate Email

Hello,

You have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. This survey is an integral component of my master's degree research in plant curation at the University of Delaware. The purpose of this survey is to determine if and how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017.

Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. Collaboration with others may be required, as knowledge of basic institutional organization and access to living collection records will be necessary. Please submit only one survey per institution. The survey is expected to take 10-20 minutes and will be available from **Wednesday, April 27th to Wednesday, May 11th at 11:59pm, EST**. Responses will remain anonymous unless you choose to identify your institution at the end of the survey. If you have any questions or concerns about the survey please contact Anna Bower (abower@udel.edu).

Follow this link to the Survey: {Survey Link}

Or copy and paste the URL below into your internet browser: {Survey URL}

Follow the link to opt out of future emails: {Opt Out Link}

Thank you,

Anna Bower

M.S. Graduate Student
University of Delaware
Department of Plant and Soil Sciences
152 Townsend Hall
Newark, DE 19716

Reminder to Participate Email

Hello,

This is a reminder that you have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. This survey is an integral component of my master's degree research in plant curation at the University of Delaware. The purpose of this survey is to determine if and how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017.

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If you have any questions or concerns about the survey please contact Anna Bower (abower@udel.edu).

Follow this link to the Survey: {Survey Link}

Or copy and paste the URL below into your internet browser: {Survey URL}

Follow the link to opt out of future emails: {Opt Out Link}

Thank you,

Anna Bower

M.S. Graduate Student
University of Delaware
Department of Plant and Soil Sciences
152 Townsend Hall
Newark, DE 19716

Final Reminder to Participate Email

Hello,

This is a reminder that you have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. This survey is an integral component of my master's degree research in plant curation at the University of Delaware. The purpose of this survey is to determine if and how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017.

Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. Collaboration with others may be required, as knowledge of basic institutional organization and access to living collection records will be necessary. **Please submit only one survey per institution. Responses must be submitted by tomorrow, Wednesday, May 11th at 11:59pm, EST.**

If you have any questions or concerns about the survey please contact Anna Bower (abower@udel.edu).

Follow this link to the Survey: {Survey Link}

Or copy and paste the URL below into your internet browser: {Survey URL}

Follow the link to opt out of future emails: {Opt Out Link}

Thank you,

Anna Bower

M.S. Graduate Student
University of Delaware
Department of Plant and Soil Sciences
152 Townsend Hall
Newark, DE 19716

Living Collections Prioritization Survey One

You have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. This survey is an integral component of my master's degree research in plant curation at the University of Delaware. The purpose of this survey is to determine if and how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017. Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. Collaboration with others may be required, as knowledge of basic institutional organization and access to living collection records will be necessary. Please submit only one survey per institution. The survey is expected to take 10-20 minutes and will be available from Wednesday, April 27th to Wednesday, May 11th at 11:59pm, EST. There are 22 questions in the survey grouped under two sections (Institutional Profile and Plant Collections). There are no forced responses, so feel free to skip questions if you do not know the answer, and you will have the ability to return to previous pages before a final submission. Responses will remain anonymous unless you choose to identify your institution at the end of the survey. Thank you- if you have any questions, please contact Anna Bower at abower@udel.edu

1. Which category below best describes your institution's annual operating budget?

- ❍ $150,000 or less
- ❍ $150,001-$399,999
- ❍ $400,000- $999,999
- ❍ $1 million- $2.99 million
- ❍ $3 million or more

2. Approximately what percentage of your institution's annual operating budget is allocated to horticulture-related expenditures? (Labor, plants, mulch, other materials, etc.)

- ❍ Less than 20%
- ❍ 20-40%
- ❍ 41-60%
- ❍ 61-80%
- ❍ 81-100%

3. What is the primary function of your institution? (Pick one).

- ❍ Arboretum/Botanic Garden/Display Garden
- ❍ Cemetery
- ❍ Public Park
- ❍ Museum
- ❍ Zoo
- ❍ Historic Site
- ❍ Preserve/National Park
- ❍ Other _____

4. What is the size of your institution in acres?

5. Of the total number of acres, how many are:

Intensively managed garden areas: [text box]

Naturalistic areas with minimal input: [text box]

Other: [text box]

6. How many horticultural staff does your institution employ? For purposes of this survey, "horticultural staff" refers to those actively involved in establishment and maintenance of plants.

_____ Full-time staff

_____ Part-time/seasonal staff

_____ None

7. How many non-horticultural staff does your institution employ?

_____ Full-time staff

_____ Part-time/seasonal staff

_____ None

8. How many volunteer hours does your institution log annually towards horticultural tasks?

9. How many staff members, students, and/or volunteers maintain plant records as a portion of their position?

10. *The following definition will help you in interpreting the question below to best fit your institution:*
Living collection: all accessioned plants represented at an institution; may also include non-accessioned, spontaneous flora found in the landscape.

How many staff members are solely responsible for living collections curation at your institution? (e.g. curator, botanist, taxonomist, head of horticulture, or plant recorder)

11. How does your institution maintain plant records? Select all that apply.
- ❑ BG-BASE
- ❑ IrisBG
- ❑ ESRI GIS software
- ❑ Microsoft Excel
- ❑ Microsoft Access
- ❑ FileMaker Pro
- ❑ Custom software
- ❑ Non-digitally (i.e. paper records)
- ❑ None (we do not keep plant records)
- ❑ Other _____

12. Does your institution use plant mapping software?
- ❍ Yes
- ❍ No
- ❍ Unsure

The following definition will assist you in answering question 14:
Taxon: (plural: taxa) any unit of rank within the taxonomic hierarchy such as genus, species, or cultivar (i.e. different types of plants).

13. How many living plants does your institution hold?

14. How many taxa are represented at your institution?

15. How many genera are represented at your institution?

16. For purposes of this research, "prioritization" is defined as decisions made by public garden institutions to designate which plants or groups of plants are more worthy of resources and attention than others. Does your institution assign prioritization levels to groups of plants or individual plants?

	Yes	No	Unsure
Groups of plants	❍	❍	❍
Individual plants	❍	❍	❍

The following definition will assist you in interpreting the following question to best fit your institution:
Living collection: all accessioned plants represented at an institution and may also include non-accessioned, spontaneous flora found in the landscape.

17. Does your institution divide your living collection into collections with specific themes? (Ex. taxonomic-based collections, geographic-based collections, economic-based collections).

- ❍ Yes
- ❍ No
- ❍ Unsure

18. Are there garden areas, groups of plants, or unique specimens at your institution that receive a disproportionate amount of resources such as staff time, monetary resources, or maintenance compared to others? (E.g. Rose Garden or Japanese Garden, compared with a less maintained wild or general garden area).

- ❍ Yes
- ❍ No
- ❍ Unsure

19. Does your institution highlight any gardens or groups of plants in brochures, specialty tours, on your website, or on any social media platforms?

- ❍ Yes

(a) Are these gardens or groups of plants highlighted due to their:

(i) Seasonal interest?

(ii) Inherent value to the institution? (Ex. Size (Champion Trees), or historic, educational, or conservation value?

(iii) Other _____

- ❍ No

20. If your institution currently prioritizes or were to prioritize your living collections, how would you rank the following criteria on determining the importance of a collection or accession to your institution?

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Historical significance	❍	❍	❍	❍	❍
Cultural significance	❍	❍	❍	❍	❍
Aesthetic value	❍	❍	❍	❍	❍
Educational value	❍	❍	❍	❍	❍
Irreplaceable genetics	❍	❍	❍	❍	❍
Taxonomic importance	❍	❍	❍	❍	❍
Species representation within the garden	❍	❍	❍	❍	❍
Conservation value (endangered or threatened species)	❍	❍	❍	❍	❍
Research/evaluation value	❍	❍	❍	❍	❍
Nationally Accredited Plant Collection (formerly NAPCC)	❍	❍	❍	❍	❍
Known provenance	❍	❍	❍	❍	❍
Rarity	❍	❍	❍	❍	❍
Mature size	❍	❍	❍	❍	❍
Wild-collected germplasm	❍	❍	❍	❍	❍
Significant gift	❍	❍	❍	❍	❍
Replacement cost	❍	❍	❍	❍	❍

Q21. What are the top four criteria from the list below that your institution considers or would consider most important when determining high priority collections?

Drag and drop the top four criteria below:
_____ Historical significance
_____ Cultural significance
_____ Aesthetic value
_____ Educational value
_____ Irreplaceable genetics
_____ Taxonomic importance
_____ Species representation within the garden
_____ Conservation value (endangered or threatened species)
_____ Research/evaluation value
_____ Nationally Accredited Plant Collection (formerly NAPCC)
_____ Known provenance
_____ Rarity
_____ Mature size
_____ Wild-collected germplasm
_____ Significant gift
_____ Replacement cost

Q22. Optional: If you are willing, please provide the name of your institution below:

This is the last page in the survey. Please press the next button only if you are completely finished. Thank you for participating.

Appendix C

SURVEY TWO MATERIALS

Invitation to Participate Email

Hello,

You have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. **This survey is an integral component of my master's degree research in plant curation at the University of Delaware and follows up on a previous survey sent out in May of this year.** The purpose of this survey is to determine how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017.

Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. **Please submit only one survey per institution.** The survey is expected to take 10-25 minutes and will be available from **until Monday, August 8th at 11:59 EST**. There are no forced responses, so feel free to skip questions if you do not know the answer. You will have the ability to return to previous pages before a final submission.

Thank you- if you have any questions about the survey, please contact Anna Bower at abower@udel.edu.

Follow this link to the Survey: {Survey Link}

Or copy and paste the URL below into your internet browser: {Survey URL}

Follow the link to opt out of future emails: {Opt Out Link}

Thank you,

Anna Bower

M.S. Graduate Student
University of Delaware
Department of Plant and Soil Sciences
152 Townsend Hall
Newark, DE 19716

Reminder to Participate Email

Hello,

You have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. **This survey is an integral component of my master's degree research in plant curation at the University of Delaware and follows up on a previous survey sent out in May of this year.** The purpose of this survey is to determine how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017. Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. **Please submit only one survey per institution.**

The survey is expected to take 10-25 minutes and will be available from **until Monday, August 8th at 11:59 EST**. There are no forced responses, so feel free to skip questions if you do not know the answer. You will have the ability to return to previous pages before a final submission.

Thank you- if you have any questions about the survey, please contact Anna Bower at abower@udel.edu.

Follow this link to the Survey: {Survey Link}

Or copy and paste the URL below into your internet browser: {Survey URL}

Follow the link to opt out of future emails: {Opt Out Link}

Thank you,

Anna Bower

M.S. Graduate Student
University of Delaware
Department of Plant and Soil Sciences
152 Townsend Hall
Newark, DE 19716

Final Reminder to Participate Email

Hello,

The deadline has been extended to **Friday, August 12th at 11:59 EST** to allow for unfinished respondents to complete the survey.

You have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. **This survey is an integral component of my master's degree research in plant curation at the University of Delaware and follows up on a previous survey sent out in May of this year.** The purpose of this survey is to determine how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017.Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. **Please submit only one survey per institution.**

The survey is expected to take 10-25 minutes. There are no forced responses, so feel free to skip questions if you do not know the answer. You will have the ability to return to previous pages before a final submission.

Thank you- if you have any questions about the survey, please contact Anna Bower at abower@udel.edu.

Follow this link to the Survey: {Survey Link}

Or copy and paste the URL below into your internet browser: {Survey URL}

Follow the link to opt out of future emails: {Opt Out Link}

Thank you,

Anna Bower

M.S. Graduate Student
University of Delaware
Department of Plant and Soil Sciences
152 Townsend Hall
Newark, DE 19716

Living Collections Prioritization Survey Two

You have been selected to participate in a research survey regarding prioritization of living plant collections at public garden institutions. This survey is an integral component of my master's degree research in plant curation at the University of Delaware and follows up on a previous survey sent out in May of this year. The purpose of this survey is to determine how public garden institutions are prioritizing their living collections. Results will be published in the spring of 2017. Please direct this survey to the individual at your institution who is responsible for curating the living plant collection or maintaining plant records, such as the head of horticulture, curator, or plant records personnel. Please submit only one survey per institution. The survey is expected to take 10-25 minutes and will be available from Monday, July 25th to Monday, August 8th at 11:59 EST. There are no forced responses, so feel free to skip questions if you do not know the answer. You will have the ability to return to previous pages before a final submission. Thank you- if you have any questions about the survey, please contact Anna Bower at abower@udel.edu.

1. Does your institution have an overall mission statement?

- ❍ Yes
- ❍ No

Answer If Does your institution have an overall mission statement? Yes Is Selected
1a. If you are willing, please copy and paste your institutional mission statement into the box below:

Q2. Does your institution have a written living collections policy?

- ❍ Yes
- ❍ No

Answer If Does your institution have a written living collections policy? Yes Is Selected
2a. If you are willing, please upload a document containing your collections policy for purposes of this study.

3. Does your institution have a written disaster plan with information regarding your living collection?

- ❍ Yes
- ❍ No
- ❍ Unsure

4. Does your institution hold any Nationally Accredited Plant Collections™ through the American Public Gardens Association?

- ❍ Yes. Please list all Nationally Accredited Plant Collections™ in the box below: _____
- ❍ No

4b. Optional: Please provide the name of your institution below:

The definition below will help you in interpreting the following questions to best fit your institution:
Core collection (i.e. special collection/collection of emphasis): Any group of accessions grouped under a specific category such as a taxonomic, morphological, geographic, cultural, habitat, display, conservation, heritage, research, or other theme. Core collections are permanent, central to the mission of an institution, and are given highest priority.

6. Does your institution have core collections?

- ❍ Yes
- ❍ No

Answer if "Does your institution have core collections? Yes" is selected.
6a. Please list your institution's core collections in the box below:

Answer if "Does your institution have core collections? Yes" is selected.
6b. Are these core collections described in a living collections policy document?

- ❍ Yes
- ❍ No

Answer if "Does your institution have core collections? Yes" is selected.
6c. Describe the process of selecting your institution's core collections:

Answer if "Does your institution have core collections? Yes" is selected.
6d. Does your institution have management plans for core collections regarding relevance, current status, required maintenance, and/or development goals?

- ❍ Yes
- ❍ No

Answer if "Does your institution have core collections? Yes" is selected.

6e. Under what criteria or themes are your core collections categorized? Slide the bar to the appropriate number of collections within each category.

_____ 1. Taxonomic (ex. oak collection, orchid collection)
_____ 2. Morphological (ex. perennial garden, vine collection)
_____ 3. Geographic (ex. South African plants, Pacific Rim plants)
_____ 4. Habitat (ex. alpine garden, wetland area)
_____ 5. Cultural (ex. Japanese garden, bonsai collection)
_____ 6. Display (ex. winter garden, silver garden)
_____ 7. Economic (ex. water conservation garden, dye plants)
_____ 8. Conservation (ex. threatened or endangered species, wild-collected material)
_____ 9. Heritage (ex. historic plants, cultivars, historic designs)
_____ 10. Research (ex. trial gardens)
_____ 11. Other (fill in the blank)

Answer if "Does your institution have core collections? Yes" is selected.
6f. What steps has your institution taken towards prioritizing its living collection? Select all that apply.

- ❑ Collections documentation (record keeping/mapping)
- ❑ Strategic planning (setting collections guidelines and targets/goals)
- ❑ Identifying core collections that make your institution unique
- ❑ Assigning priority levels (low, medium, high, none, or similar) to collections of plants
- ❑ Assigning priority levels (low, medium, high, none, or similar) to individual plants
- ❑ None
- ❑ Other _____

Answer if "Does your institution have core collections? Yes" is selected.
6g. How does collections prioritization benefit your institution? Select all that apply.

- ❑ Climate change planning
- ❑ Long-range institutional planning
- ❑ Disaster planning
- ❑ Resource allocation
- ❑ Collections evaluation
- ❑ Propagation responsibilities
- ❑ No benefit
- ❑ Other _____

Answer if "Does your institution have core collections? Yes" is selected.
6h. Is there anything you would change if you completed the collections prioritization process again?

Answer if "Does your institution have core collections? No" is selected.
7a. Is identifying priority collections and/or assigning priority levels to collections of plants or individual plants a goal for your institution?

- ❍ Yes
- ❍ No

Answer if "Does your institution have core collections? No" is selected.
7b. What steps has your institution taken towards prioritizing its living collection? Select all that apply.

- ❑ Collections documentation (record keeping/mapping)
- ❑ Strategic planning (setting collections guidelines and targets/goals)
- ❑ Identifying core collections that make your institution unique
- ❑ Assigning priority levels (low, medium, high, none, or similar) to collections of plants
- ❑ Assigning priority levels (low, medium, high, none, or similar) to individual plants
- ❑ None
- ❑ Other _____

Answer if "Does your institution have core collections? No" is selected.
7c. How would your institution benefit from living collections prioritization? Select all that apply.

- ❑ Climate change planning
- ❑ Long-range institutional planning
- ❑ Disaster planning
- ❑ Resource allocation
- ❑ Collections evaluation
- ❑ Propagation responsibilities
- ❑ No benefit
- ❑ Other _____

8a. Would you be willing to participate in further discussion regarding living collections prioritization?

- ❍ Yes
- ❍ No

Answer if "Would you be willing to participate in further discussion regarding living collections prioritization? Yes" is selected.

8b. Please provide your contact information below:

Name:

Institution:

Position Held:

Email Address:

Phone Number:

Thank you for taking the time to participate in the survey. This is the last page. Press the submit button only if you are completely finished.

Appendix D

CASE STUDY MATERIALS

Invitation to Participate Email

Hello,

I would like to invite you to participate in a phone interview regarding organization of your institution's living collection. This interview is a component of my master's degree research in botanic garden curation at the University of Delaware. You may recall contributing to two previous online surveys regarding living collections prioritization at public garden institutions.

This interview serves to gather additional information about the process behind collections planning based on: development of core collections and/or designation of priority levels within the living collection, or a desire to begin a collections planning process. I would like to include your institution as a case study in my final thesis report.

If you would like to participate in further discussion, please contact me to set up a time to talk over the phone. If you feel a different person at your institution would be better suited to contribute to an interview, please forward this email to the appropriate person. Your help is appreciated.

Thank you,

Anna Bower

Informed Consent Form

Informed Consent Form for Interviews

Prioritization of Living Collections at Public Gardens

The purpose of this study is to investigate how public gardens conduct living collections planning based on development of core collections and/or designation of priority levels to individual plants or collections of plants. You have been previously invited to participate in two online surveys regarding prioritization of living collections. This is a follow-up interview seeking to gather more information about the planning process behind living collections organization.
Please read the information below regarding the study procedures. Should you have any questions or concerns, contact information is provided below. Your participation is voluntary and you are free to discontinue at any time or refuse to answer any question without penalty.

Procedures

Interviews will be conducted with staff members who previously agreed to further discussion regarding their institution's living collection. All interviews will be audio recorded. Recordings will be destroyed at the end of the research project in the summer of 2017. Your name, the name of your organization, and direct quotes may be referred to in the final report. There should be no risks associated with this project and there is no compensation for participation.

If you agree to these terms, please initial here: **_____Subject's Initials**

Contact Information

If you have any questions about this research, please contact Anna Bower, Curatorial Graduate Student, (abower@udel.edu), or Dr. John Frett, Director, University of Delaware Botanic Gardens (jfrett@udel.edu). If you have any questions regarding your rights as a participant, contact the Chair of the University of Delaware Institutional Review Board at (302) 831-2137.

If you agree to participate in this research, please print and sign your name below:

_____

Name of subject (Please Print)

_____

Signature of Subject **Date**

Case Study Questions

Questions for gardens with only core collections identified:

1. Please provide the name of your institution, your full name, and position.
2. Describe the process for selecting your institution's core collections.
    a. What prompted your institution to identify core collections?
    b. When were core collections identified?
    c. Who was involved in the decision-making process?
3. Why were these core collections chosen? (Based on historical collections, new acquisitions, mission-based, staff interest, etc.?)
4. Where there any collections of plants that were not included as core collections? (Ex. research/trial collections, temporary displays). Why were these collections excluded?
5. Are core collections outlined or described in a collections policy document?
6. Do core collections have management plans for relevance, current status, required maintenance, and development goals?
    a. Who is involved in writing collections management plans?
    b. How are collections management plans published?
    c. How are the management plans prescribed? Who implements them?
    d. Are they actively referred to by staff members?
7. How often are core collections reviewed and who is part of the review process?
8. Do you foresee additional core collections being added in the future?

9. How does identification of core collections benefit your institution? (Ex. disaster planning, institutional planning, showcasing the importance of your living collection to others).
10. How are your core collections communicated internally to staff and externally to the public?
11. Would your institution be interested in assigning priority levels to individual plants or collections of plants?
12. In your opinion, what is the importance of recognizing your institution's core collections?
13. Has your institution completed a Collections Stewardship Assessment through the Institute of Museum and Library Services (IMLS)/American Alliance of Museums (AAM)?

Questions for gardens with core collections who also assign priority levels to collections and/or individual plants:

Core Collections Questions

1. Please provide the name of your institution, your full name, and position.
2. Describe the process for selecting your institution's core collections.
    a. What prompted your institution to identify core collections?
    b. When were core collections identified?
    c. Who was involved in the decision-making process?
3. Why were these core collections chosen? (Based on historical collections, new acquisitions, mission-based, staff interest, etc.?)

4. Where there any collections of plants that were not included as “core collections”? (Ex. research/trial collections, temporary displays). Why were these collections excluded?
5. Are core collections outlined or described in a collections policy document?
6. Do core collections have management plans for relevance, current status, required maintenance, and development goals?
    a. Who is involved in writing collections management plans?
    b. How are collections management plans published?
    c. How are the management plans prescribed? Who implements them?
    d. Are they actively referred to by staff members?
7. How often are core collections reviewed and who is part of the review process?
8. Do you foresee additional core collections being added in the future?
9. How does identification of core collections benefit your institution? (Ex. disaster planning, institutional planning, showcasing the importance of your living collection to others).
10. How are your core collections communicated internally to staff and externally to the public?
11. Has your institution completed a Collections Stewardship Assessment through the Institute of Museum and Library Services (IMLS)/American Alliance of Museums (AAM)?

Prioritization Questions

12. How does your institution assign priorities to its living collection? To individual plants or collections of plants?
13. How is priority assigned?
    a. Are plants or collections of plants, assigned high, medium, low, or no priority; or high priority vs. lower priority?
14. Who makes collections prioritization decisions in your organization?
15. Where are priority levels documented?
16. How are these decisions communicated to the rest of staff?
17. What was your rationale for assigning priority levels within the collection?
18. In your opinion, what is the importance of recognizing core collections and setting priority levels within the living collection?

Questions for gardens seeking to develop core collections:

1. Please provide the name of your institution, your full name, and position.
2. What is your institution's rationale for developing core collections?
3. How would identification of core collections benefit your institution?
4. How would core collections be identified? (Based on historical collections, new acquisitions, mission-based, staff interest, etc.?)
5. Who in your organization would be responsible for making decisions about core collections?

6. Would your garden be interested in assigning priority levels to individual plants or collections of plants?
7. Can you think of any collections of plants that would not be included as a “core collections”? (Ex. research/trial collections, temporary displays). Why would these be excluded?
8. Would your organization be interested in developing management plans for individual core collections?
9. How would your institution’s core collections be communicated internally to staff and externally to the public?
10. How often would your core collections reviewed and who would be part of the review process?
11. How would identification of core collections benefit your institution? (Ex. disaster planning, institutional planning, showcasing the importance of your living collection to others).
12. In your opinion, what is the importance of recognizing core collections?
13. Has your institution completed a Collections Stewardship Assessment through the Institute of Museum and Library Services (IMLS)/American Alliance of Museums (AAM)?

Appendix E

CORE COLLECTIONS AS IDENTIFIED BY PARTICIPATING INSTITUTIONS IN SURVEY TWO

1	"Boxwood (Historic), London Plane (Historic), Norway Spruce (Historic), Witch Hazel (new), Viburnum (new), Hydrangea (new)."
2	"We have one core/primary collection, the genus *Clematis*."
3	"Core collection is used for teaching Woody Plant Identification for Landscape and Horticulture courses. Therefore, our collections include primarily Ornamental Woody trees and shrubs for landscape demonstration and native trees and shrubs."
4	"Conifers, Asian Maples"
5	**"Specialty Cultural Collections:** Bonsai Collection, Herb Garden, Fragrance Garden, Japanese Hill-and-Pond Garden, Mixed Perennial Border, Osborne Garden, Shakespeare Garden. **Systematic/Taxonomic Collections:** *Plant Family Collection:* This collection consists of woody and herbaceous species and cultivars representing plant orders and families that showcase the diversity of the plant kingdom and illustrate evolutionary relationships. Major groups of plants represented in the Plant Family Collection: Ferns- a representative collection of temperate ferns. Conifers- a representative collection of conifer (gymnosperm) species and cultivars from around the world, including dwarf conifers Flowering Plants- a representative collection of flowering plant (angiosperm) orders and families from around the world. **Notable Systematic/Taxonomic Plant Collections** *Cherry (Prunus) Collection*- This diverse collection of cultivated flowering cherries consists predominantly of the Sato-zakura group. [*Name withheld*] maintains a historical planting of 'Sekiyama' (*Prunus serrulata*) cherries on Cherry Esplanade. *Cycad Collection*- This collection represents a range of wild-collected and garden origin specimens in the plant families Cycadaceae and Zamiaceae,

	Lilac (Syringa) Collection- This collection consists of species lilacs and representative lilac cultivars. *Magnolia (Magnolia) Collection*- This diverse collection of species and cultivars includes representatives of hybrid magnolias developed and introduced by [*name withheld*]. *Orchid Collection (Conservatory)* - [*Name withheld*] maintains a diverse, collection of tropical and subtropical orchids, with an emphasis on species, as well as appropriate hybrids and cultivars, of conservation, educational, heritage and horticultural value. *Rose (Rosa) Collection*- This extensive collection consists of selected seed species and a wide variety of rose cultivars from around the world. The Garden maintains a number of rare and uncommon rose selections from the 19th century. *Wisteria (Wisteria) Collection*- This diverse collection consists of species wisteria and cultivars. **Biogeographic and Bioclimatologic Collections:** These collections consist of plant displays arranged according to their native origin and suitability for various climate conditions: Aquatic Plants, Desert Plants, Native Flora Garden, Rock Garden, Tropical Plants, South African Bulb Collection, Warm Temperate Plants. **Education, Research & Display Collections"**
6	"Camellia, Daylily, Hosta, Native, Rain"
7	"Buckeye Collection, Willow Collection, Native Tree Collection by the 4 geographic regions of Ohio, Hosta Collection, Witchhazel Collection, Conifer Collection, Boxwood Collection, Japanese Maple Collection, Hydrangea Collection, Phenology Garden, Annual Trial Garden, Monarch Waystation/Native Pollinator's Garden"
8	"*Geranium*, *Baptisia*, *Quercus*, *Salix*, *Spiraea*"
9	"Native Plant Collection, The Campus Landscape, Carolyn Black Garden, Greenhouse"
10	"All fifty+ species of trilliums, *Erythronium*, *Paris*, *Dodecatheon*, *Hepatica*, *Arisaema*, Hardy Ferns (*Dryopteris*, *Polystichum*, etc.), *Podophyllum*"
11	"Aquatic, Amenity (cultivars such as *Syringa*, *Hemerocallis*, *Iris*), Alpine, Cactus/Succulent, Tropical, Native, Steppe"

12	"Historical collections (planted by original estate occupants, trace cultural history of area, etc.), heritage cultivars, taxonomic (by genera), display collections"
13	"Wisconsin Garden collection, Hosta collection, Daylily collection, Conifer collection, Magnolia collection"
14	"Legacy bonsai trees of historical or cultural significance."
15	"Pinetum, *Quercus* species"
16	"Conifer, *Fraxinus*, *Quercus*, *Tilia*, Specimen Trees"
17	"Agavaceae, Aizoaceae, Apocynaceae, Araceae, Arecaceae (Palms), Bonsai/Penjing, Bromeliaceae, Cactaceae, Caudiciforms, Conifers, Crassulaceae, Cycads, Euphorbiaceae, Fagaceae, Fouquieriaceae, Lauraceae, Liliaceae/Aloeaceae/related families, Magnoliaceae, Myrtaceae, Orchidaceae, Poaceae (Bamboos), Pteridophyta, Rosaceae, Theaceae"
18	"*Cercis*, *Magnolia*, *Acer*, *Styrax*, *Quercus*, *Aucuba*, *Mahonia*"
19	"Rhododendrons, Azaleas, other Ericaceous plants and native species"
20	"*Primula*, *Meconopsis*"
21	"*Aspidistra*, Agavaceae, *Trillium*, *Hosta*, *Baptisia*, *Pteridophytes*, *Crinum*, *Lycoris*"
22	"Plants original to Harvey Ladew; topiaries"
23	"Core Collections: The following are categories of the core collections at the Garden. Individual accessions can fit into one or more than one category. 1. **Historic Collections.** With early beginnings as Grace Arents' home garden, accessions original to the site will be preserved and maintained. This collection will not be actively developed with the exception of replacing deceased plants or replacement with superior cultivars for pest and disease resistance. 2. **Stewardship Collections.** *Xeriscape Collections*. The Garden is committed to responsible and sustainable management of our water resources. Plants in the Conservation Collections will exhibit superior traits for low

water use and drought resistance, being adapted to the climate, rainfall, and soils of central Virginia.

Synoptic Virginia Native Plant Collections. The Garden is committed to improving its native plant collection. The Flora of Virginia, which will be published in 2012, will be the guiding text for this synoptic collection.

3. **Display Collections.**

Demonstration Collections. Plants that serve the purpose of demonstrating horticultural best practices, new horticultural techniques, or specific growing methods. This can include plants that are part of research trials and demonstration vegetable gardens, as well as other demonstration purposes.

Hardy Display Collections. Plants of cultivated origin, particularly cultivars selected for unique traits, serve important research and education roles. These can include perennials, and woody plants. Examples include ornamentals with exceptional ornamental qualities, landscape plants well suited to the central Virginia climate, as well as those plants under evaluation.

Non-Hardy Display Collections. Non-hardy plant material will be maintained in the Conservatory and Greenhouse for educational and display purposes. This plant material will be used in different formats in containers and temporary displays around the garden, but overwintered each year. This collection also includes annuals which will not be accessioned in the Plant Records Database, but will be tracked.

4. **Economic Botany Collections.** Plants that have provided important medicinal, nutritional, or economic benefits to society. Plants that provide crucial nourishment, healing, or practical benefits to mankind.
5. **Natural Areas.** The uncultivated grounds of the Garden serve as potential area for garden expansion and contain flora representative of central Virginia. These areas are subject to spontaneous generation of native, as well as exotic plants. These areas are maintained by natural regeneration of the present vegetation; however development may occur in the future. As resources allow, some of the plants will be removed due to their noxious characteristics, some will remain in place, and some will be accessioned as an official part of the Living Plant Collections records."

24	“Australian Collection, Azalea Collection, Bonsai Collection, Boxwood Collection, Camellia Collection, Chrysanthemum Collection, du Pont Legacy Collection, Fern Collection, Holly Collection, Lilac Collection, Magnolia Collection, South African Collection, Oak Collection, Orchid Collection, Peirce’s Tree Collection, Victoria Collection, Waterlily Collection”
25	“Our Garden is set up to have 25 raised demonstration beds and 12 themed areas. The demonstration beds house type specimens or modern variations on the work of Luther Burbank. Some are permanent installations; others are changed seasonally. The themed areas include a Cut Flowers Garden, Rose Garden, Medicinal Garden, Edible Landscaping, Sensory Garden, Plum Repository Orchard, Wildlife Habitat Garden, Butterfly Garden, Ornamental Grass Garden, Victorian Garden, Memorial Garden, and Drought Tolerant Garden.”
26	“Native Plants, Shrubs and Trees for Mediterranean climates found worldwide: Australia/New Zealand, S. Africa, Asia, Mediterranean, S. American, California, SW USA”
27	“conservation, iris, daylily, rose, oaks, Caucasus, Altai, Japanese, Chinese, alpine, rock, rhododendron, herb, fern, tropical, temperate, bulb, aquatic, hosta, orchid, aroid, etc.”
28	“Cycads, Palms”
29	“Plant Collections Network (*Abies*, *Acer*, *Quercus*); also *Prunus*, *Magnolia*, heritage trees, *Rosa*, *Ilex,* conifers”
30	“Trillium, Orchids, Clematis, and Large Iconic Trees”
31	“The primary collections include the following genera: *Rhododendron*, *Camellia*, *Ilex*, *Lagerstroemia*, *Rosa*, *Hydrangea*”
32	“Palm, Aroid, Cacti and Succulents, Cycad, Miniature Orchids, Bonsai”
33	“*Acer*, *Magnolia*, *Rosa*, *Cornus*, *Lilium*”
34	“Iowa State University horticultural introductions, Viburnums, Pollinator plants, Bulbs, Buck roses, Buck geraniums, Butterfly nectar plants”

35	"Native perennials, Cypress trees, Oak trees."
36	"Bamboo, Cycad, *Erythrina*, Palm, *Aloe*, *Ficus*, CA Natives, South African and Australian plants"
37	"*Acer*, *Camellia*, *Crataegus*, *Hellebore*, *Hemerocallis*, *Hexastylis*, *Epimedium*, *Iris*, *Magnolia*, Native Ferns, *Paeonia*, *Rhododendron*, *Quercus*, *Trillium*, *Viburnum*"
38	"tropical, succulent, palm, fuchsia, begonia, fern, bromeliad, and cycad collections"
39	"Weeping Japanese Maple, Weeping Higan Cherry, Japanese Red Pines, Japanese Black Pines, (Koi Fish)"
40	"Oak, Pine, Taxa of historical significance to the Italian Gardens, Taxa of historical significance to the Sunken Garden, Taxa of historical significance to the Japanese Garden, Historic plants"
41	"*Magnolia*, *Quercus*, *Hamamelis*, Conifer, *Viburnum*, The Champion Trees, Ohio Natives Collection"
42	"Conifers and Evergreens"
43	"Priority Genera (Plant Collections Network Genera, Robust Genera, Biogeographic Genera), Conservation Collections, Synoptic Collections"
44	"Rock garden plants, Plant Select plants, daylilies, cold hardy cacti"
45	"Conifers, *Acer*, *Magnolia*, *Malus*, *Prunus*, *Quercus*, *Rhododendron*, *Syringa*, *Paeonia*, Woody Legumes, Deciduous Arboretum, Ornamental Shrubs, Forest, *Hemerocallis*, *Iris*, *Narcissus*, Ferns, Rock Garden, Native Plant Garden, Perennial Garden, Herb Garden, Ladies' Border, Rose Garden, *Nelumbo*, Nymphaea, *Begonia*, Carnivorous Plants, Cycads, Orchids, Palms, Economic Plants, Tropical Ericaceae, Lowland Rainforest, Tropical Rainforest, Old World Tropicals, New World Desert, Old World Desert"
46	"*Quercus* collection"
47	"Agavaceae; Nolinaceae; *Aloe*; Gasteria; Crassulaceae; Cactaceae; Aizoaceae"

48	“Naumkeag, Mission House, Castle Hill at The Crane Estate, Stevens-Coolidge Place, The Sedgwick Gardens at Long Hill, The Bradley Estate, Governor Oliver Ames Estate, Allen C. Haskell Public Gardens, Mytoi, Ashintully, Boston Community Gardens, Farandnear”
49	“Historic Painter Trees, Rhododendron Collection, Holly Collection, Native Woodland Walk, Magnolia Collection, Cherry Collection, Crabapple Collection, Lilac Collection.”
50	“*Acer*, *Baptisia*, *Camellia*, *Carpinus*, *Corylopsis*, *Crataegus*, *Ilex*, *Magnolia*, *Pinus*, *Quercus*, *Styrax*, *Viburnum*, Hamamelidaceae”
51	“We have 4 very different properties, with different kinds of "core collections" on each: Core are high quality natural areas (on the properties that have them), and core reference collections (the Peony Garden that is part of the APGA program). We have core cultural collections (bonsai) and landscapes (at the Arb and Gardens - different designers). All the others are to some extent pragmatic, even if lasting generations. As they go, the institution will reappraise the space/resources. We're in a 2-year period re-doing our collection policy / procedures - be glad to share later in the year as chunks are done. I've answered "yes" below based on the in-progress documents.”
52	“*Acer*, *Ilex*, *Magnolia*, *Quercus* (and larger oak family), *Sorbus*, *Abies*, *Pinus*, Cupressaceae, *Picea*, *Viburnum*, *Acer palmatum*, New Zealand (mid-high elevation south Island), central Chile, Siskyou Mountains/Cascadia, Southeast Australia, Szechuan and Sino-Himalaya, Azalea Way, Winter Garden, *Rhododendron*, Woodland Garden, *Camellia* and *Stewartia*, Hamamelidaceae, Japanese Garden, shrubby legumes.”
53	“*Erythrina*, Hawaiian hibiscus and other endemic Malvaceae, Flora of the Mascarene Islands, Flora of Sri Lanka, Flora of Malesia, Flora of the Ogasawara Islands, Arecaceae, Acanthaceae, Hawaiian Ethnobotany (named races of *Colocasia esculenta*, *Ipomoea batatas*, Polynesian-introduced Musaceae), South American shamanic plants”
54	“Great basin Native plants, North American Oak Collection”
55	“Native Hawaiian Plants, Rubiaceae, *Erythrina*, Arecacea, Breadfruit”

56	“Nationally Accredited *Cornus* Collection, Native Collection, Historic Collection, Display Collection”
57	“Aesthetic value, conservation value, and education value”
58	“*Magnolia*, *Lagerstroemia*, Dry Garden, Rose Garden”
59	“Hosta Collection, Daylily Collection, Rhododendron Collection, Rose Garden, Perennial Garden, Woodland Garden, AAS Garden, Pioneer Garden, Herb Garden, Dahlia Display Garden, Lake/Wetlands, Rain Garden.”
60	“Camellias, roses, lilacs, California natives, California oaks, cycads”
61	“Rhododendrons; plant material from Beatrix Farrand's Bar Harbor Estate; plant material no longer available in the nursery trade; own selections of seedlings grown from existing plant material to replace ones that age out”
62	“Native Plants, *Camellia*, Conifer”
63	“orchids, palms, ferns, bonsai, ethnobotanical plants, bromeliads, cycads”
64	“Begonias”
65	“Hardy Ornamental ferns, Peonies, Lilacs, Hosta, Medicinal plants, Conifers, Roses”
66	“Lilacs, Crabapples”
67	“*Taxodium*, *Magnolia*, Conifer, Daylily”

Appendix F

COLLECTIONS PRIORITIZATION PROCESS RESPONSES

Answers to: "Describe the process of selecting your institution's core collections":

1	"Both historic and secondly reflecting passion of previous long-term horticulture director."
2	"There is no process to describe. See mission statement. Our gardens and collection are our mission."
3	"The Curator of the Collections along with the Grounds Maintenance Manager create the plant orders every spring and fall with approval of the Arboretum Council, made up of 12 members representative of departments which have a vested interest in the collection."
4	"The selection process is very fluid - trying to get multiples of specimens, trial species that have been recommended."
5	"These are all notable collections that have been developed at the Garden over the past century that are important to us because of the depth and/or breadth of specimens in the collections, have historical/cultural value to us and our community or have educational value."
6	"These are historic collections from the start of the Gardens which are maintained for historic reasons, except for the native plants collection, which is relatively new. We are in the process of developing a more comprehensive core collection which will include *Cornus, Cercis* and a Theaceae family collections."
7	"Process is not well-defined."
8	"I specifically targeted trilliums as I wanted to specialize in and collect a genus that was unusual and unique. Trilliums are somewhat rare and some species are endangered. There are very few people who are expert in this single genus."
9	"They were selected based on the species we grow well and the types of gardens we have. Many of our gardens are either based upon a taxonomic group (generally with multiple groups in an area for more interest, or a mix of one group with other species interplanted for multiseason interest) or a region of the world (South Africa, Asia, etc.). Each collection may be represented throughout the Gardens, for example, the Native Plant Collection is represented in several gardens, including the Plains Garden, Cottonwood Border, Montane Garden and the collection also exists in mixed gardens throughout the York Street site. Answer to criteria and themes question is based on these numbers of collections being dispersed in these various types of gardens vs. the 7 named core collections above. (somewhat challenging to place each of 40 gardens into

	one specific theme and I would be happy to discuss further with you - also I will send you the collections plan as it is a separate document from the collection policy)."
10	"Based on priorities stated in mission (preserving estate, interpreting/stewarding cultural traditions) and sub-collections best represented."
11	"In the past we based our collections on new garden development and donor interest, however as our young garden grows, we are pursuing collections that can be grown and maintained in our area and that are of interest to the public."
12	"All collection items are donated and only the most significant specimens from a horticultural, artistic, cultural or historical importance are kept in the collection."
13	"Pinetum was established by alumni in the late 1920s to replace former farm fields. Trees were chosen and laid out by family and species. An extensive inventory and labeling in the 1980s confirmed this now mature planting, and the area received special designation status from the college. The oaks were first planted in 1834 and added to over the decades. We've become known for the breath of our mature oaks, and have concentrated in recent years to expand the number of species, as we plan for the arboretum's future."
14	"We started out (1931) making comprehensive species collections of every major genus, in imitation of classical arboreta such as the Arnold Arboretum. Over the years some genera proved poorly adapted to our soils, others were prone to chronic pests/diseases. These practical considerations, combined with a reduction in labor as labor costs increased, mandated an evaluation of our plant collections which led to a reduction to those which were most successful with limited inputs. Now we are looking at a further reduction as emerald ash borer effectively deaccessions the bulk of our *Fraxinus* holdings."
15	"There is not any definite method, mostly a combination of historical significance, importance to the green industry, suitability to the Piedmont region."
16	"Ericaceous plants were found to be the most appropriate for growing on the site based on soil tests before the Arboretum was developed. Of the Ericaceous plants, rhododendrons/azaleas are arguably the showiest, so they were selected as our main collection. Kalmias were added later and again, it is because of the soil conditions. The native species started becoming a focus about 15 years ago and it was around that time that the Arboretum started its Green Ribbon Native Plant program. The goal of this program is to encourage homeowners to use native plants in their home gardens. Staff selects and promotes 3 new native species every year."
17	"Selection criteria was based on what would thrive in our unique climate (cool maritime)"

18	“Tony has favorite plant groups of plants which he amasses large collections of plants. Also, some staff members have done plant collecting expeditions all over the world and in and around the U.S. There are usually specific goals when this happens, be it for a specific species or genus, or a family, plus other cool plants found while in the field.”
19	“Has been informal to this point; if it was known to be original or historic in some way it is considered to be more important than other plants in the gardens. We have a hired a Plant Records Manager to inventory our collections and create a policy to use moving forward.”
20	“These were grouped based on current collections in 2012 and were of large scope. We are in the process of updating these to reflect future needs of the garden based on our new strategic plan, completed in 2016. In regards to the next question about management plans, we are also developing those for each collection.”
21	“We looked through our collection records for plant groups that were important to our overall collection based on historic significance or display significance. These groups contain many accessions and are considered high priority.”
22	“The Garden Curator researches the work of Luther Burbank, taking availability into consideration, and makes recommendations to a Garden Committee. The Garden Committee decides on what to plant. The Garden Curator executes the installation with the help of Garden Volunteers.”
23	“Selections are made depending on availability of material, discretion of current Nursery Plant Specialist/Manager with review and approval of City of Concord as our gardens containing these collections are in a public park.”
24	“We are in the process of setting goals and management plans for each of our garden areas as they relate to collections.”
25	“These are historic, going back to the founders, and have been written into the mission and the living collections policy. They are also included in strategic collections planning.”
26	“These are based on the historical focus of our collections along with current programming and curatorial interests.”
27	“We took suggestions from the staff and put them through a decision matrix. The matrix contained points from our mission and value statements. Each plant group was evaluated on how effectively it helped us accomplish and communicate our mission/ goals.”
28	“These have been assembled with the purpose of either collecting the largest number of taxa adaptable to the Hampton Roads area or displaying a significant number of representative taxa.”
29	“These general rules should be followed when acquiring plants under all circumstances: [*name withheld*] will only obtain plants for its permanent collection that’s scientific name can be properly documented; Our facility

	strengths and limitations regarding cultural requirements must always be taken into account when acquiring new plants for our permanent collection; We will not participate in field collecting that contributes to functional degradation of any ecosystem; When obtaining plants requiring a quarantine we will follow established guidelines regarding that plant material. When those guidelines cannot be met [*name withheld*] will not make that acquisition; Plants that have the potential to become invasive in our eco-region and cannot be confined thru physical means should not be included. (See addendum # 1&2); [*name withheld*] will respect all national and international laws governing plant collection. [*Name withheld*] will adhere to the convention on biological diversity. No laws of any kind shall be broken in any plant acquisition."
30	"Those taxa that are relatively endangered in their native ranges, represent high value horticultural genera, and can be successfully grown in our location."
31	"Collections that strengthen the mission of [*name withheld*] and/or the relationship with our university and its mission."
32	"It had happened before my arrival."
33	"We focus on groups of plants that grow well in our Mediterranean climate and are of conservation value."
34	"It's an informal process of choosing specimen from plant groups (collections) which thrive in our climate. Much of the selection process is dictated by personal preference, nursery and collector availability, and following institution tradition."
35	"Board Committees and 'Working Groups.'"
36	"The institution is part of a national historic landmark, and to maintain the institution's connection to its historic past and to the setting of its historic gardens, taxa in three of the historic gardens must be maintained. The institution is located where it is because of the "pine air", hence the connection to pines, and the other dominant woody plant species in the region is oak, and the institution's historic landscape is heavily oak. The historic plants were plants established by the founders of the institution and have significant institutional history."
37	"From existing plant populations, Articulated in 'Arboretum Plan 2011.'"
38	"Those collection units that, through on-going discussion and analysis, remain central to the Arboretum's core mission."

39	“These were the plant groups we chose to feature and have the largest numbers of plant varieties.”
40	“History and strategic planning.”
41	“Our area is experiencing great disease pressure from Bacterial Leaf Scorch, caused by *Xylella fastidiosa*. As a result, many of our native oaks are in great decline. We are growing many other non-native and nearly-native oaks to test for their resistance for future planting in this area.”
42	“We concentrate on the plant groups that Ruth Bancroft focused on when she was accumulating the plants used in the garden.”
43	“Since we are a multi-site institution, our core collections are the garden areas at our multiple sites.”
44	“These have been determined in the past by the first director of the arboretum, Dr. Wister, or by the Arboretum Collections Committee. Some are listed in the Collections Policy specifically.”
45	“Multi-year process involving Director, Faculty Associates, Development, Curation, University Services and Field Services. Need a phone call, not this box.”
46	“If it is an area of historical emphasis (broad diversity of species and cultivars, or special landscape or taxonomic focus), or more recently, part of the 5 major eco-geographical collections we have been developing (Pacific Rim with similar climate to ours in maritime PNW).”
47	“These well-documented exotic collections remain from the time that this Botanical Garden, started in 1973, was privately owned. I regret that they are no longer being maintained to the degree they deserve, and I try to distribute what can be propagated to other documented collections. Since we came under the umbrella of Hi'ipaka, a non-profit created by the Office of Hawaiian Affairs, (the 6th managing entity in the 27 years I've worked here, and the most supportive since the first, Waimea Falls Park) the trend has moved towards Hawaiian Ethnobotany, exotic edibles, and our top priority is still the native taxa we maintain for the Center for Plant Conservation. In the past we have contributed much research material under our former name, Waimea Arboretum and Botanical Garden. I'm arbitrarily prioritizing the "core collections" on the basis of their natural-source material and verified specimens.”
48	“There is no written selection process. We accession our plants, I review what we have and what is missing and try to acquire and add it to our collection.”
49	“They were created over time, there was no process.”

50	“We looked at our overall plants in our gardens. Originally, we had 18 collections and we regrouped them about 6 years ago into 4 core collections which reflect what we have here.”
51	“Garden founder's interests and research”
52	“Historical basis - collections that have a deep connection with the institution's history and the founder; Conservation basis - collections that offer us the opportunity to educate and inspire visitors to conserve the natural world”
53	“Historical in nature.”
54	“New collections like Medicinal plants, Hosta and Roses are described in the policy. Medicinal plants: Dr. Barnes, a physician, developed a drug and then established the Foundation; absence of a medicinal plants garden in the region for teaching. Hosta, a shade loving ornamental plant (National Display Garden, designated by American Hosta Society: only one on east coast north of South Carolina). Roses: Renovated the historical garden with several historical specimens, and with all classes of roses that can be cultivated in the region, as a teaching resource.”
55	“History and size”

Appendix G

RESPONSES TO CHANGES TO BE MADE IF COMPLETING THE COLLECTIONS PRIORITIZATION PROCESS AGAIN

Answers to: “Is there anything you would you change if you completed the collections prioritization process again?”

1	“Long term regeneration plan for older plants and allée or key sites.”
2	“No. Our Collection Policy is updated every two years, and has just been reauthorized by our board in April 2016.”
3	“Yes - if we could start over I would begin with a professional application for recording the collection as it was built - much harder to document the collection 20 - 30 years into the planting.”
4	“This institution is young and in the process of transferring to a university, so the collections policies haven't been fully developed. “
5	“We are still going through collections prioritization process.”
6	“We are just undertaking this process.”
7	“The conversation to look at a collections prioritization process was done somewhat in conjunction with a master planning process, so we were taking stock of gardens (in addition to the plant collections they contained) and looking at which gardens were most important to us as an institution, which gardens/collections were missing and what was needed to support those collections. The process was eye-opening and led us through the redevelopment and revamping of many areas. It has been several years since we developed our collections plan, so at this time we need to revisit it for the various collections, update our strengths in genera and analyze what we need to continue to build for collections. “
8	“Make it a more formal recorded policy.”
9	“We have a dynamic collection and the core of our program is to constantly re-assess our needs so our core collections evolve over time and are not as rigid as many other gardens.”
10	“No.”
11	“I am actively changing the way that the collections are prioritized working with Tony and the other members of the Research and Garden staff. “
12	“Yes, this is a time of big changes for our collections priorities. We are currently updating our collections policy, identifying our core collections, and prioritizing. Things we are changing include, more specificity in describing our core collections, detailed analysis of current holdings to develop management plans, how each collection can grow based on our master plan that will be

	finished Sept 2016, relationship to our strategic plan that was board approved in April 2016.”
13	“Start with a smaller list.”
14	“As a 99% volunteer organization, we are woefully deficient in collection control and prioritization, but feel we do provide the public with useful knowledge in addition to demonstration gardens.”
15	“We are still in the process.”
16	“We have a 5-year strategic collections development plan. It is due for update in 2018. At that time, we may adjust it slightly, but I do not imagine a large change. “
17	“No.”
18	“Our collections policy has been revised over the years as necessary.”
19	“No.”
20	“I would do what I could to make the collections relevant.”
21	“I would consider more criteria for nominating core collections. Otherwise, we are still working on the collections prioritization process.”
22	“Include Disaster Planning although we have had our share of events including Hurricane Ike and Emerald Ash Borer.”
23	“We are currently looking at updating our collections policy and including some of the items mentioned in this survey such as disaster plans.”
24	“Have a plan before the grounds are planted. Keep records from the beginning. We are 12 years old and are now going back and mapping and cataloging our collections retroactively. This has been prompted by a planned build-out that will double our plant collections.”
25	“Collections should be continuously evaluated for relevance, feasibility of maintenance, etc.”
26	“We would benefit from assigning priority levels to the plants in our collection and formulating a written collections policy.”
27	“Collections process isn't yet completed.”
28	“It’s hard to get people to resolve a core "collection" from a specific, even named space. For example, the Alexandra Hicks Herb Garden will always be a named herb garden, but it’s NOT a core collection of plants, and the theme - herb & medicinal plants - is not unique to it. So, its collection can change quite a bit and still function as a collection/interpretation theme, but it’s NOT a core collection of specific plants. So, it’s a set of relationships among ideas, plants and spaces. I'd like to come up with a good graphic. In other words, we use a very NARROW sense of "core collection". We have over 50 named spaces that people would "think of" as collections, but they are NOT. We can talk on phone.”

29	“We are looking at better integrating disaster planning, and we are going to start accessioning perennials again--the latter had been discontinued nearly 30 years ago. Accessioning native plants will also start shortly--it would have been beneficial to document the native trees formally from the beginning of the collections in 1936.”
30	“Better long-range planning and weed control.”
31	“The process is ongoing so we're still working on the strategic planning part, having only recently revised the collections policy.”
32	“We are just beginning to work towards this.”
33	“No.”
34	“We need an up-to-date strategic plan for the collection.”

Appendix H

SELECTED TRANSCRIPTIONS FROM CASE STUDY INTERVIEWS

Denver Botanic Gardens

Researcher: Describe the process for selecting your institution's core collections.

Cindy Newlander: We went through this process around 2005-2006, when we really started looking at defining our collections. We were mainly doing it for the American Alliance of Museums (AAM) reaccreditation process. We had already been accredited one time by AAM prior to that process. I don't know if they had changed some of their requirements for the reaccreditation or if it was a natural next step for us to focus a bit more on our collections at that time. That was at least what had prompted our rewriting of our collections plan and policies. We had just moved on from thinking of ourselves as a display garden, and were looking become a more collections-focused institution. Just naturally that had happened a bit over time. It had always been true but I think that focus had come more into being.

When we were going through the process for the AAM accreditation we got together a good number of the horticulture team at the time, and actually a good number of those people are still part of our staff to this day. We really started look at what did we have, what are the strengths in our collection. We kind of struggled with how to define them previously. We had discussions about whole kingdoms and various biogeographic ways to really kind of think about the collections. We really wanted to have something that could actually be communicated easily with the public. And, discuss the Mediterranean floristic provinces. It's a bit more challenging than to talk about steppe or native plants. I think we figured out a way that we could connect

our collections based upon what we had already within our collections, what the strengths were as well as what we were hoping to build over time. At the time when we did write the Collections Management Policy, we pretty much had the strengths in those seven collections areas defined for us. And technically, we were probably looking at six collections that were "good" and then we had to determine what to do with all the cultivated material, i.e. what do we do with the Rose Collection? That ended up being the Amenity Collection. We had a lot of discussion about what to call it and we ended up with Amenity as a kind of catch-all to file things like our perennial garden under because plants within this collection don't really fit nicely and neatly within some of the other ones. Some of them are a plant that is originally from the steppe of Asia, for example, but has been cultivated and has gone through some conversions over time to get to where it is today. I think it was the Director of Horticulture, our current person who is the Director of Outreach, our Senior Curator, staff who are on our current curation team, and a good number of the horticulture staff who were here at the time. There was probably 8-10 people who were sitting around the table talking about this discussion.

Researcher: Do core collections have management plans for relevance, current status, required maintenance, and development goals?

Newlander: Pretty much, what ended up happening was there was generally one or two people that collaborated on each of the seven collections, so for example our Amenity Collection was two or three people who focused on that one just because it was a fairly broad group of plant varieties that were involved. But other ones like the Alpine Collection, one person went through and looked at what do we have and kind

of spent some time thinking what are the strengths and weaknesses; and, looking forward, what we wanted to do at that time, was to develop a 10-year plan for the management of those collections. In some cases, you might see something written out like somebody at the curator level for a collection provided specifics. Some of those collections did not have a specific curator at that time so we added them. We went from having two curators (tropical plant and native) to now we have five curator-level people. That added to the integrity of the collection to have people who are actively doing that work. In addition to what they would normally be doing. I think a lot of was one or two people for each one really looking at what should we be doing going forward with these collections. How can we build them, how can we make them better, what anyone would look at for how to improve something, especially something we already set as an important collection. How do we make it better? So we've started talking about seeing where we are now and then looking forward the next ten years so that I think will probably become a focus in 2017. We've also been really busy with a lot of other projects that have happened in the last 10 years here, we've gone through a pretty intense capital campaign and construction of about at least a third of our gardens have been gone or changed through construction and we've built a new visitors center, new structures, and we've had several other gardens moved from one spot to another spot. We've been pretty overwhelmed with that at times. We've had almost every year, at least one or two gardens going under a pretty heavy facelift. I want to say 2007/2008 was kind of when we kicked off the capital campaign and we were able to get some bond money through the City to help us with things. The parking structure was brand new in 2009 and we got a new greenhouse complex and the Children's Garden is all new. It was a lot of new gardens. It's been amazing how

many new spaces we have now within our collection and how things have changed in the last decade. It's been pretty fast and furious at times.

Researcher: How does identification of core collections benefit your institution?

Newlander: I think for us it, especially when we did it, was critical for us because it has helped us with funding, through the grant processes, It has definitely helped us as we started going through, kind of reimagining what Denver BG should be for the next 50 years, going into the planning processes and what we really were looking at when we started the processes, knowing we would be going under a lot of construction. We looked at future changes, what gardens did we have, which ones were the sacred gardens that had to stay where they are now and then which gardens and collections were one that could survive and be anywhere within the grounds. For example, we just relocated our All-American Selections annuals program garden this last year. It doesn't matter where that garden is but we thought it was an important enough one that we have that we wanted to maintain it as a garden and rather than just maintaining it in an area with infrastructure that wasn't great, we decided to actually improve the infrastructure and give it a new home. It also helped us say things like, okay, we don't currently have a garden that is specific to all the steppe regions of the world, especially at the time when we're doing this; we didn't have a Patagonian steppes represented in our collections at all. But it was something we wanted to do and it has driven some of the plant collecting or plant expeditions and research work we've been doing at the gardens. We've also done more steppe development like some trips to Morocco and Kazakhstan and South Africa. So just continuing to build our collections by being able to go to the appropriate location. We also didn't previously have a

really, prior to our planning process, we didn't have a really good location for displaying our Plants Select plants collection, a special plant recommendation and introduction program that we work with Colorado State University and the green industry in Colorado. We wanted to have a place because it is in part our program, so we wanted to have a space where we could really showcase those plants well so we developed a Plant Select Garden that really specifically does showcase those species.

Researcher: How are core collections communicated internally to staff and externally to the public?

Newlander: I think it's mostly been available to collections staff because our plan has living and non-living collections in it. Mostly, I think those who are interested in collections are those who are reading it. I'm trying to think if it is out there on the ShareDrive for all to find. I think the best way that we probably do it is, we probably a couple of ways, is our docents go through quite a bit of training when they first start. They get tours of the different collections from the horticulture staff perspective and I just gave them a two-session talk on what are our core collections; that was about four hours of training for them. They get quite a bit of information and those people are our front-line volunteers giving tours and also just out on the grounds helping to answer questions. Then secondly, our interpretation- we try to focus on those different collections and why they are important. Especially, this is probably best showcased right now in our Steppe Collection since it is a pretty new garden area, we have pretty focused interpretation about why the steppe is important and why we are displaying those plants. Another new area is the Science Pyramid in the fall of 2014 and it's

basically an interpretive center where people can learn more about the research we do here as well as learn about the connections between things like the Plants Select program and the environment of Colorado and the arid west, things along those lines. How much precipitation things get within our region. At least that's something they look at and are continuing to change over time so it had new experiences for people.

Researcher: Would your institution be interested in assigning priority levels to individual plants or collections of plants?

Newlander: We haven't done that, and I'm not sure how we would go about doing that. It would take a lot of time. One thing have done is starting to look at more, like especially for example, like when we have done construction projects that have gone through and wiped out an area or demolished one garden area that had plants in it already. What we would do is look at what was in the inventory, what was in those gardens and say okay, which plants are really important to save. We did do some prioritization in that regard where we would, especially look at what plants come from wild-collected provenance and focus on saving those as our higher level of priority and then also looking at other species that were not represented elsewhere in the garden. If they were indeed important species, we would relocate those as best we could. Large trees, maybe not. On occasion, with some of the large trees that we lost during construction, we did do some cuttings or different things to try to keep those in our collections. The other part of kind of going forward we have been looking at how can we do more stuff with our wild-collected provenance species, making sure they

are represented as vouchers in our herbarium, doing verifications of them to make sure they are what we think they are, that sort of thing.

Brooklyn Botanic Garden

Researcher: Describe the process for selecting your institution's core collections.

Melanie Sifton: I was involved directly. I took the lead on revising our living collections policy a few years ago when I first came on board (July 2012) because our old living collections policy had not been revised in about 10 years. I helped rewrite it but I did this with a mix of staff. I held various meetings and it took me years, actually. It also involved a board of directors working group. So, I have a horticulture board committee. The board and I helped discuss all of it. We totally reorganized how we were categorizing our collections, like all the categories you just mentioned, that was all something that we developed in our new collections policy. It wasn't even outlined like that before, it was kind of like a laundry list. And, which collections actually fell into that was done with a sort of co-development process including directors, gardeners, I put it out to all the horticulture staff and education and interpretation staff, and also the board committees, and then for full board and president approval. It was quite a process. I also looked at a lot of other living collections policies for other organizations. Why we chose certain ones- it was a mix of history, significant specimens that we have in the collections- I don't know if we have a hard and fast rule, the gardens here are a mix from our beginnings in 1910, so there's a lot of historical collections, there are collections that are a lot of garden origin, like not necessarily wild collected material- that has not really been our focus

except in a specific collection like native flora which is all wild-collected. It depends on the area of the garden and whether or not is considered at this point in time a significant enough collection but it could be historical, it could be specimen number, it could be just diversity, is could be taxonomic diversity within a certain collection. It could be education value because we have been a focused organization for education. It's definitely a group effort at this point as to how we are categorizing those. Just to get a consensus from all those people that I mentioned was huge, I feel good about it, what we landed on. Whether or not it was, like, we need to have 20+ specimens in this genus, or something like that, in some cases it could come down to numbers, in other cases it would be like, oh no, this collection was planted for these cultural reasons. Or, it could be endangered species, because we have those too.

Researcher: Do core collections have management plans for relevance, current status, required maintenance, and development goals?

Sifton: We do have management plans for some of the collections, some are in development. We have been without a living collections director for at least a year now. We've hired somebody new but they aren't starting until January so I'm holding off a little bit until that person comes onboard to execute a fuller management plan process. So, some collections have it and some definitely don't have written plans. It doesn't mean that they don't know what they are doing, it just hasn't been necessarily written down for all cases. I depends which collection, and that's not by design, just some of the people who are managing certain areas are more apt to write things down.

Others need a template that they would have to fill out and return, or work it out with us and we will all agree on it.

I am trying to get that whole process started so that it is as cohesive as possible. When they are a different kind of collection it can be hard to compare taxonomic to a cultural collection in the same way. We need this as the next step to accompany the living collections policy and then depending on the stage and the curator of the collection, we may or may not incorporate collections development planning into those management plans. At this point, even if I just get maintenance planning done, that is written down in a consistent format; that is huge. We have a whole turf plan as well. Turf is one of our more robust written plans, I think. We don't call it a turf collection. We are all organic on that and are doing good stuff. We aim to be more consistent with the formatting.

Researcher: How does identification of core collections benefit your institution?

Sifton: Well, I think it brings a lot more value to the collections overall and when you have a clearly delineated and well thought through policies and procedures in place it gives more structure as well to a very large and diverse staff. I'm hoping that it marries both the consistency that long-term staffing can bring if you are actually able to write down and keep your policies written, similar to plant records being regularly updated and monitored can do but it brings a whole new level of robustness and security and sustainability to the whole process and to the management of the garden. We actually didn't have that living collection director's role. It didn't even exist until about three and a half years ago. It is a new position. It is part of a good process

moving forward. It also makes me feel as a manager more secure. We have things written down for disasters for issues. Say, we even just lose a staff person, people get sick, people leave on short notice, or the planning for that kind of thing. We need to have the paper work written down and I'm sure you have talked to lots of people about this. It's not easy if people don't write anything down ever and it all lives in somebody's head. And, some of this stuff is so specific. We have one of the top bonsai collections in America and that is really hard to know what you are doing with that. There are so few people who do. We have a ton of collections like that that that are so unique and special and top notch that it's just not worth risking it not to be doing it. Then, I also think that having it all worked out is very helpful for other kinds of issues like pest and disease management, in particular the disasters that could come to us could be pest disasters and I'm acutely aware of that. So, being more ready so that if Asian longhorned beetle turns up again in our neighborhood, as it has before, having these plans in place and having as much as we possibly can laid out, so people can understand what we've got, how we've been maintaining it, how we want to maintain it, and where we are going with the whole thing is so much more helpful if you are dealing with major regulatory issues that may come up where somebody may try to impose, like "oh, guess what, we want to cut down all of your hardwood trees to avoid a pest outbreak," stuff like that. So wait a second…But if you are just doing everything without some of this backup material, it makes it harder to make those arguments. It's not 100% guaranteed, but it's the advice that anybody who has gone through those terrible times before says, like "thank goodness we had our management plan in place for the collection."

Researcher: How are core collections communicated internally to staff and externally to the public?

Sifton: That's a good question, and something I'm hoping to work on more with the new living collections director. We have a whole website and a digital communications team that manages the website, blog, and goes around to gather photos to keep up to date with different exciting opportunities within the collections that come up all the time. That could range from social media to just pointing out and having a nice picture of something in bloom. It be almost anything. We work with the staff, the horticulture staff in particular, to try to keep regular contact with the marketing team so the staff who are out in the collection, when they see something that they think if worthy of promoting and it could be a bad thing too. Say we had a pest and disease issue, we could talk about that and why it is important to watch out in your whatever, for the exact same pest. It's not always deliberately good news stuff. Sometimes we feel the messages have to get out about certain serious things. But I know that our living collections database is still not very accessible to the public so we do a data dump periodically. I try to do it every quarter, sometimes it doesn't get done as much as it should, a data dump into a searchable database that is on our website. Anyone can go and things look up, from the common name. It's basic plant records stuff. And we don't put locations on anything that is super sensitive like a rare species that is out on the grounds we might not point out its exact location if it's very sensitive and we don't want it to be stolen. But we are trying to open up a more robust way to open up the plant records but that is also safe. We are working on it, we have up technology for the staff. Our first priority with the living collections grant was to make

sure that the staff had all the good tools that they needed for remote tracking and sensing. So we have iPads and, I think, you can use your phone but you can log onto our plant records system a lot more easily than you used to be able to do with BG-BASE. We are working on "GIS-ing" collections and making sure we are getting all the new areas as built in there and it should hopefully be opened up a bit more with the mapping and the tracking and the ability for the public to be able to find things a bit more easily. That is definitely a work in in progress. I probably need to get another grant to be able to do that.

Researcher: Would your institution be interested in assigning priority levels to individual plants or collections of plants?

Sifton: Yes. That is what we are trying to do with the disaster plan. We already do that to a certain extent with trees. We have an arboricultural tree assessment process so there is that already for regular care. We have a lot of old trees so we try to do that as much as we can, particularly because of the liability of big, old trees is serious. So there is that level of assessment. There also are big trees that are very rare and we are trying to work out veteran tree care for them. We are also have endangered tiny little orchids that we have, so that's an entirely different ball game as to what we would consider a disaster. In some cases it could be just extreme heat or cold with conservatory accessions. We have bonsai that are hundreds of years old and fragile. If we have a big storm coming, I'm going to make sure all of the bonsai are going under the benches and are getting some extra protection from when these big windstorms move through. Or, if I am having heating issues right now, and I have to get the hole

in my heating system plugged before winter sets in. I'm ready any day. I'm going to call in supplemental heating if I need to put heaters in.

University of Washington Botanic Gardens

Researcher: Describe the process for selecting your institution's core collections.

Raymond Larsen: It's been going on for about 82 years now. I think, probably, the initial mission was to grow everything that would grow in this climate outdoors, which is pretty broad. The original Olmsted Brother's plan had things grouped taxonomically. Some of those things were pretty well-developed over the course of years. I would guess some of that was due to the ease of which certain plants could be acquired as an arboretum and probably some of the desires of the early folks. I think it may have been initially haphazard from the beginning. Some of the taxonomic collections were fairly well-developed early on like oaks, maples, magnolias, and probably to a lesser extent, hollies. Those are our four Nationally Accredited Plant Collections. I have a feeling with some of that, Brian Mulligan was certainly the main driver of organizing the collection when he was here for the 25 years when he was director. I think things early on where pretty haphazard until he got here. Looking back at some of the history, different plant families and collections were sort of sponsored by different garden clubs, this was a way to encourage outside support and development. For instance, the Tacoma Garden Club took a special liking to Japanese maples and maples in general. I think there was some efforts of that with the oaks and hollies, but with other things I couldn't tell you. From the earliest days we were just acquiring seeds from wherever, including other arboreta and botanic gardens and gardens from different places in the world. We kind of modeled ourselves on the

Arnold Arboretum and we got a lot of seed from there. I think when Brian arrived in 1946 he started focusing. He abandoned some of the taxonomic concepts because the Arboretum layout wasn't especially suitable. The Washington Park Arboretum was the last major arboretum that was laid out in a major taxonomic sequence. After the Olmsted Brothers got through to us… Here it was early on, Brian, I think I read something from the late 40's, where he said this is what we are going to do because a lot of these plant families and genera within them don't want to be glued to the same soils the same types of aspects. The ones that were pretty well-established at the time didn't get moved but other newer developments did. I think that it was more focused. He was still very much a collector of everything and it was all build, build, build back then. We definitely focused on trees, it was an arboretum, and shrubs. He being from the United Kingdom had an affinity for certain things and was more familiar with certain things though we don't have it as part of a national collection. His affinity for mountain ashes is why we have such a good collection of that, and that's a much bigger deal in Europe, probably. I don't know if there is a Plant Collections Network for *Sorbus* but we should definitely look into that. I think things that do really well here, conifers being one, maples, hollies, just do really well. I think it came, as much about, well, we can really get a bunch of these things, more and more of wild origin, or unusual value or provenance. It was probably similar to a winnowing out, just naturally, based on staffing and all that. I think when things got really more serious, you know Joe Witt was the curator for a number of years and he was very active in APGA and some of the collections development. I think then Tim Hohn, who was the next curator after him, he got things more serious. Once we had some large groups of species established within various genera then I think that shaped some of the things. I

think that would be true because oaks, maples, and magnolias are very popular ornamentally and then just showcasing the variety within and then the fact that we can grow those without too much external input in terms of watering and extra care or whatever. That's a good question. The current collections policy we have dates to 2012 but I think Tim Hohn probably formalized a lot of the collections policies in the late 80's. I just spend a fair amount of my time figuring out why certain decision were made or the goals at various times. I think of instance, with Japanese maples, we got a huge strength and amount in that prior to World War II and once those were in place, we decided to build on that with other Asiatic maples which we have strengths in. The site of the maple collection was originally where the Japanese Garden is now so I think at that time, when that was developed, there was an emphasis that we have to move these, we have a lot so let's build on that and focus on what we have. Magnolias is a section that was set aside early on and developed in place, same things with oaks, actually, and hollies, actually, all of those originate from the original Olmsted plan, when the original sites of them were developed. I would have to say the hollies are probably something Brian had a lot to do with as hollies do really well here, English hollies do too well… Back to your question, I would say Tim Hohn, I've seen a lot of documents where he formalized policies. There was a curation committee back then too so we would have worked with the director, Harold Tukey, at the time and staff, but really he had a lot of leeway of area of focus. One area that is interesting, you know we've had a Pinetum since the earliest days, and certainly have a ton of conifers… I've often thought that if we had other plant collections identified, based on the genera within those, there are several, a lot of true firs. We have a pretty nice collection and can grow conifers here very well.

Researcher: Do core collections have management plans for relevance, current status, required maintenance, and development goals?

Larsen: Yes and no. I would say for the national collections we do, because we have to. I know that. For other ones, we are starting to formalize those. We have a conservation policy now which ties in somewhat to some of the collections. We had a student a few years ago update that for us. And look into things. Other than keeping track of things we have a one-offs of or maybe we have several of these but they are a cultivar or all from the same lot then we do that. Honestly, I haven't had a whole lot of time to really update that in the way I would like. We've been starting to try and think if we have anything outside of the Plant Collections Network plans and I don't know if there is yet. That needs some work. Our first one was in the Holly Collection which was in 2002. I would guess it was just whoever was on the curation committee at the time, probably Randall Hitchin, Fred Hoyt, David Zuckermann, most of the people are still here except for Randall. The most recent one was done when I first started, was the *Magnolia* multi-site collection so I know it was the curation committee as outlined in the collections policy. We are taking another look at the collections policy now to update that with the native matrix accessioning and herbaceous things. That is in one of many drafts now. I think we will take a good look at it every five years or so. The conservation policy was written in 2013. With that we have to make sure we go through everything. When we had the student go through that, I was part-time, and she was wrapping that up. In reviewing that, I've noticed, well, BG-BASE says we have this visited in the field, I mean they all were, but in terms of the raw numbers, one of

the things I've been doing, if things haven't been physically visited and verified in the field in ten years then that is a problem, not that they haven't been seen by the gardeners, but they haven't been physically located. We are trying to get that more up to date with the new mapping. And, better communication with the ground staff and us. It's a little frustrating right now. Keith, our plant recorder is half-time and trying to figure out more efficiencies in that position. With the new mapping program we've got and some of the ways we've updated things, with trying maximize those things with Keith at 20 hours a week. The other thing I discovered when I got here was that nothing was really done on the Center for Urban Horticulture side, so I've been spending a lot of time getting out records here up to date. It was out of sight and out of mind. For instance, I've been working in our grove and some of those things, none of it was ever entered in the database so we've got hundreds of plants that we have not records of or were never qualified. BG-BASE says we have an accession of all of these serviceberries out here but no record of no planting records, they aren't being counted. It's a little frustrating, but there's no time like the present to update those things. When we first started using BG-BASE and paper maps were developed, it seemed pretty important. We had a grid system before that but lot of these things were last checked in 1989 and that was a long time ago. Some things are probably not out there anymore or are different. There's a lot of catchup to do. That's most of what I've been doing is catching up and making improvements where I can which largely means going out in the field when I can and assessing how things are doing in certain gardens or spaces and then doing things like making sure the plants we have are being grown the best that they can. In some cases this means things that were in shade thirty years ago now are. We need to get a little bit more light. We have a lot of really nice

collections but a lot of them are really stressed out because we didn't cut down trees for thirty years. We have to make decisions so the trees worth saving look like they are supposed to look like not like sad, little shade-oppressed things. Slowly we are getting there.

Researcher: How does identification of core collections benefit your institution?

Larsen: There are a couple of ways. One things that I'm interested in is that we are an arboretum but we have very nice collections of these certain groups. We want to publicize those not only for the public, but for other institutions. Being a member APGA and some of the individual sections has been really positive in raising our profile amongst established arboreta. And, making it more something people hopefully think about. When we got our fancy new materials from APGA about the Plant Collections Network, we framed those and put them up in the visitor's center. I make sure we mention it on all the maps we have now and the tour maps we give out to people that come visit, and in any speaking or writing that I do we will mention those. I think that's something most people have not been aware of at all. Again, a lot of that is our local constituents. I think that build institutional value and makes people consider the importance of our collections instead of thinking, "oh, it's spring, let's go look at some cherries." Maybe people will say "oh, let's go look at some cherries, and they have an outstanding *Magnolia* collection that is going to be in bloom a couple weeks. We better come back for that." Right now, it's probably anything that helps boost our perceived value to the state. I think in terms of research or the national groups, that is kind of what the emphasis on the Plant Collections Network helps with.

It's more of, in the short term, helps us say what makes us unique or important. We are free, we are open to the public year-round, and we have all these other challenges. If we can highlight the things that make us special, that helps us in the long-run.

With the master plan that has been used to do that but with most of the gardens that have been developed lately, like the ecogeographic garden, it comes up during discussions of why are we moving the Holly Collection? Or, what are we preserving it? Well, it's because it is nationally significant. That may help, but I'd say so far, none the collections have not been used directly in fundraising efforts. Mostly it's been done through the Arboretum Foundation, a separate fundraising arm if you will, and they have been mostly focused on new gardens. I think that is something that we could do when it is tied into an aesthetic grouping such as the Rhododendron Glen. They have expressed some interest in raising money for that. Developmentally-wise, it's been easier to sell these new things and then also what the donor's interest is. We have a big education program right now that has received a lot of support, so maybe it's auxiliary to that. I'd say no, not so much yet. Maybe a slow building of awareness with help with that. We have had some talk internally about maybe endowing a collection but mostly that has just been in the idea phase. Until fairly recently, a lot of fundraising was driven by the Arboretum Foundation and only recently has the University of Washington taken up the job. One of the things I've started doing is writing a yearly article for the *Arboretum Bulletin*, which was done in years past, with information on what we have done that year, here are some of the new things, and when I do talk or write, I try to mention why core collections are important and why we are trying to build them.

Researcher: How are core collections communicated internally to staff and externally to the public?

Larsen: Internally, we have monthly meetings. We call them "cured-ham," so curation, education, horticultural and maintenance/facilities; many of the groups that are out in the garden and that use the collection. We communicate new directions and directives and also hear from staff in those areas. Then, as the curation committee, we meet with individual gardeners in those areas to talk about how things are going, what their concerns are, what our plans are. That has helped. We do get a lot of requests to speak for different gardening groups or even civic groups about things so for instance, with the new Arboretum Loop Trail development, that is less of a collections thing, but I'm often asked to speak about it. One of the things I do mention is that we are using this as an opportunity to build the collections along the route of this trail so when we put plants back in or when it is redeveloped, we are going to try and highlight these areas. There's the *Bulletin*, the website, we write a monthly highlight or plants or collections that is split up amongst the horticulture and education staff. We have other societies that are fairly active like the Northwest Horticultural Society and various clubs. We do get a lot of research requests internally from on-campus so people are aware of us. They look at our collection, especially that it is now online, and realize we are one of the only institutions that has a certain taxa. That's a little more catch-as-catch can. That's both in the University and outside. In the past year we've has requests from NC State, Georgia, other university affiliated programs, and then with others working in different labs on campus there has been a few, particularly in the Ben Hall lab which focuses on *Rhododendron* and other Ericaceous plants. You

probably remember seeing the hemlock wooly adelgid bags. Externally, a lot of it is through the website and the online map has driven a lot of interest and traffic.

Researcher: Would your institution be interested in assigning priority levels to individual plants or collections of plants?

Larsen: I would say we haven't done that. We've done it verbally. In reviews that people get, we reemphasize that in talks with the curation committee. When I'm out there, people talk with me all the time. It's not very hierarchical and I get texts and calls from staff out in the garden with questions. That was done here many years ago but I think when we had a dedicated horticulturist, Kris Pfeiffer, she went down that road with a valuing system. I don't know what became of that. The master plan did some of that where they with suggested maintenance levels based on types of gardens so I know that is followed. For instance, when we make funding requests through the Foundation, or when we are developing a new garden, like the New Zealand Garden, we decide what the desired maintenance level is for that. There is a formula that was developed in the master plan with how many FTE's per acre you should have for each type of garden. That is followed and done for requesting purposes. For instance, in New Zealand and Cascadia we actually have that, which is great. When new things were developed we tried to emphasize the importance of that from for instance the foundation because it is much easier to fundraise for buildings and new garden areas than it is for maintenance. We do use those figures and that's one outcome of the master plan and it is referred to all the time.

Certainly, I think right now, given the fact that we have a certain number of gardeners we've got it well articulated and argued that what is really holding us back as an institution is a certain amount of staffing, particularly on the maintenance side. I would say I'd have to take a closer look at the master plan. That's something Sarah or Fred (our director), associate director, and David (Director of Horticulture) have spent more time on than I have. That has been articulated well enough internally that everybody feels like it is being handled pretty well currently. I should probably take a closer look at. We would probably assign it to collections of plants rather than individual plants, other than the conservation collections. I know when that was developed, those were given special emphasis and those are spread out throughout the garden. The gardeners assigned to those collections know that those need the most attention.

I think it would probably just be a series of documents on our server. For the Arboretum Loop Trail project we did assign values to all the trees, for instance, that were to be affected based on the standard ISA formula, so we have all these price tags on the trees. That's mostly for the benefit of the construction firm so they don't damage things. That's one thing that we've gotten a ton of questions about, with people asking if the trees are for sale. In our fact sheet and just for general information some years ago the arborists did an estimation of overall value but not for individual trees because that is too time consuming. We have had damage or vandalism and we will retroactively breakout some for those figures. There are certainly a lot of areas of BG-BASE that are underutilized.

Morris Arboretum of the University of Pennsylvania

Researcher: Describe the process for selecting your institution's core collections.

Anthony Aiello: It's probably more of an evolutionary process. On the one hand, it's kind of a combination of plants that people have been interested in over time. With each successive curator, that person has his or her own interests, well, *his* own interests in this case. They kind of then get momentum and become established in the garden. For example, Dr. Fogg, who was director in the 1950's into the early 1960's was very interested in magnolias and he was one of the founders of the Magnolia Society and so the Magnolia Slope was originally developed by him. That collection has a critical mass and has momentum and people continue that over time. In a way, that's someone like myself. The Holly Collection originated during Dr. Skinner's time in the 40's and 50's because he was really interested in hollies. And part of it, like in my case, when I became curator, these were already established collections so there is a tradition behind them that you continue to uphold. Then there is the opportunity as curator to, not go off on wild tangents, but to take what might have been less developed collections and develop those into core collections. For instance, we've always had a good flowering cherry collection but about 6 or 7 years ago I became interested in developing it further and so that's something that we've really grown over time. In some cases it's easy to say, Henry Skinner planted this big holly collection so it's pretty clear to know the genesis of that collection. Other things I think just kind of evolve over time like maples, conifers, and other plant groups that we've always had interests in, going back to John Morris. And over the years, people added to those and then they become important collections. In some cases you can more or less point to an origin. I think the Magnolia Collection is a really good

example of that. In other cases, it's more of a gradual evolution over time. Our Witch Hazel Collection is another good example. From the beginning, John Morris planted witch hazels. During the Dr. Fogg era there was a witch hazel collection developed and then in the 80's and 90's, there was interest in it. It kind of grew gradually and then I became very interested in it in the early 2000's. If there was a way of plotting the number of accessions and number of taxa, you would see a big increase in the mid-2000's. Actually, those are two cases where you would see a dramatic increase at a certain time. With the maples, it's probably a much more gradual thing. Again, people were always interested in growing maples here. As we got into foreign plant exploration and the diversity of species increased, it has slowly increased over time but that's a case where you couldn't necessarily put your finger on a time or a person who really developed that, or there is a big spike. That's been more of a gradual increase. Probably the same with the conifers also. Heritage trees are things that we've inherited that are really kind of emblematic of the Arboretum and that we really try our hardest to keep going, keep alive. And with some of the heritage trees you can't really repropagate them. In most cases they are included in the Heritage Tree Collection because of the rarity of the plant but more importantly the size and age. Like the big katsura, we've repropagated it, but a young version of that tree doesn't have the same value and it doesn't have a germplasm value. It's really the age of that tree that has the value. I would say the Arboretum has always been interested in having very broad collections but then also being deep in certain areas. I think what happens over time is that individual curators have particular interests and so they really developed those core collections. If you looked at each of the curators over time you could point to which collections they were interested in and developed during

their period. I don't want to make it sound like it is random but it is more building on strengths over time and it seems that with each succeeding curator that one or more of the collections is developed around his interests. It's not like at some point a group of people sat down and said "this is what we are going to name." It evolved from looking at what we had done and then trying to predict moving forward what we want to continue to focus on.

I would say it is ongoing process. I do get out and have regularly scheduled tours of all the sections throughout the year and that's one way of evaluating what's out there. But no, there is no process of saying "I'm going to go do all the maples this month." And, collections growth goals are something I would really like to address but it's not formalized. One group that I am looking at a more formal, scheduled way of growing is the *Magnolia*. I recognized a need with the flowering cherries because we have a cherry blossom festival that is focused on the *Prunus* collection. I had a realization around 2008-2009 that I had been here around 10 years and had planted very few flowering cherries. When we looked at the collection, and realized that it was becoming an aging collection and that was the impetus to grow that collection. There was an intern project, maybe a year or two before you, by Jess Finch who looked at our oaks and did an age class analysis and species analysis of the oak collection here at the Arboretum. It was very informative because one thing it showed, which was a little bit of a surprise, was that we have a fairly even-aged collection here. It also showed where we have lots and lots of accessions of any given taxa. That's driven where we've focused. We know we don't need any more white or black oak collections. That was a really good analysis of what we have and what we need to add, and moreover what we don't need to add. That was one case where we came up with

collections development goals. As I said, with the flowering cherries, we sort of did that but we were just basically adding accessions; not that we weren't selective, but we tried to add things in that were not widespread. We tried to really increase the diversity of taxa that we had here. We've done this, but not through a formal process, with the witch hazels by trying to collect pretty widely. And, our goals with these groups are not really to have everything, it is to have a pretty broad representation with these collections. We are not set up to have every witch hazel out there. There are limitations, how many more yellows or oranges do you need? Instead, we try to have a pretty good representation. A good example of this is with Japanese maple cultivars. John Morris bought Japanese maple cultivars and they were added over time but there's too many in cultivation. The goal here is to have some representation of all the groups. So that if you wanted to see a variegated one you could come and see it. Our approach has been methodical but we haven't had an overarching plan.

Researcher: Do core collections have management plans for relevance, current status, required maintenance, and development goals?

Aiello: It is an interest, yes. We don't have written management plans for those. The only thing that we come close to is with the Heritage Tree Collection. We do have a priority system for those. The Top 25 and then the Top 100. Those are the number one and number two rankings systems for those. It's a very vague management plan for those. It's more of a concept more than anything. The idea is that we look at the 25, we need to at least inspect and work on those every year, which means two of those a month, roughly. For the rest of the 75 or so, if we look at those every other year, then

those would get completed in a two year cycle. It's sort of a one year cycle and a two year cycle. That's the idea with those.

I think it would have to be a combination of all people in the horticulture department who have to implement it. I think we would focus on these core collections. Our collections, by and large, cut across all of the Arboretum so all of the section leaders have parts of a larger collection in their areas. Say, if we were to write a management plan for maples, every horticulturist has maples in their area, so everybody would have to be involved. Probably the only one that might not involve everyone would be the Rose Collection because it is mostly concentrated in one section. Everything else is dispersed. It would be a much more inclusive process, we would have to get myself, Elinor (the plant recorder) involved, the arborists, and all of the horticulturists, and probably even Shelley, as propagator. As we add plants she is the one who grows them. It would be pretty widespread. The advantage is, we could probably write a management plan that would be a sort of general plan that could address the core collections in a general way and then drill down to each one. We wouldn't have to write eight different plans because they would cut across all of the Arboretum.

Researcher: How does identification of core collections benefit your institution?

Aiello: We hope that it supports all the aspects of our mission, whether it's education, events and programming, or research. We try to make sure that those collections are utilized in those various aspects of the Arboretum. Whether it's adult's, children's, or more formal professional education, we try to make sure that there is some

programming, and it doesn't happen every semester, that over time there is programming related to those core collections or classes related to those core collections. As I mentioned, in terms of events, which is more of an outreach kind of aspect of the mission, the two main ones we have that are tied to core collections are the Witch Hazel Festival in the winter and the Cherry Blossom Festival in the spring. The Fall Festival is less clearly tied to the collections, and is more about scarecrows and pumpkins and apples. It would be nice to have more of a tie to fall color. There is professional programming too, for instance, we had the International Maple Symposium here and we also have professional classes on tree care, plant identification, or botany. We try to tie it to all of those things. In a very broad sense, we have propagation and evaluation research of plants in the core collections. We try to publish any of the results that come out of these things. I'm writing an article on the history of magnolias in the Delaware Valley, so it will talk a little bit about Dr. Fogg and the development of the collection here.

Researcher: How are core collections communicated internally to staff and externally to the public?

Aiello: Those events, like the Witch Hazel and the Cherry Blossom Festivals, and the classes that we run, I think people internally have a pretty good idea of what our strengths are here. That could always be better. Although they should, I'm not sure if everybody in visitor services knows that we have a good witch hazel collection. They may not know that we have a really good conifer collection. I think there is always room for improvement internally as well and to the general public I think we are

always trying to advertise and promote the fact that there are different things going on in different seasons, like when the peak fall color occurs and by promoting tours that the guides have. We are launching, sometime very soon, some online digital tours as well. We are going live with our Collections Connection, through BG-Map's Plant Explorer, the web application. And, we are also simultaneously doing some story maps as an added way of introducing tours digitally like Corey's cherry collection project. Professionally, we are always trying to promote classes here and one of my big goals is to publish about the collection here, whether it is about plant exploration or about specific plants, so that the professional botanic garden world is aware of what we have here. We are also involved with BGCI (Botanic Gardens Conservation International) by uploading our current plant list. One of the best ways to communicate to the botanic garden world is by publishing. It's good to have all of these things, but getting articles out there is best. I publish various places. I'm working on the *Magnolia* article for the Magnolia Society Journal. I just published an article in The Plantsman, a British journal. I had two articles in *Curtis's Botanical Magazine* last summer. They are not peer reviewed, but are read by professionals, similar to *Arnoldia*.

Researcher: How does your institution assign priorities to its living collection? To individual plants or collections of plants?

Aiello: It's more collections of plants that are higher priority. It's not very clear. There are some things that are not in the top 25 or 100 list that are very unusual that are also of high value. That's a good point, we should probably formalize this. We have a fair

number of plants that are very rare, either technically rare in the wild or rare in cultivation, that we should probably, now that I'm thinking about it, that would be a good core collection to add and plants to prioritize their care. I don't really know what to call that, botanic garden rarities or something. There are a few things that only occur in the wild and are endangered or threatened at some level, or they may not but they might not be in cultivation much. That would be a good intern project, actually.

I think it would be valuable. We would probably start with things like the *Abies* collection and other core collections and then work our way down from those. It would be great, but it would take a lot of time. The Arnold Arboretum as an incredibly detailed horticultural management plan which is different than collections development. I think they are in the process of revising the collections management plan.

Researcher: Where are priority levels documented?

Aiello: The things we do prioritize are stored in BG-BASE, but I don't know exactly what table or field they are stored in. Yes, it is communicated largely with the arborist staff but also with the individual horticulture staff as well. They should know what those things are in their sections. Although, it never hurts to remind them.

The Arnold Arboretum of Harvard University

Researcher: Describe the process for selecting your institution's core collections.

Michael Dosmann: I've been at the Arnold Arboretum for ten years and one of the first things I did when I got here was to update the living collections policy. We had had one before and it was mixture of operational procedure as well as additional components of a collections policy, i.e. what are going to have in our collection. While there were some themed collections, which by and large were taxonomic, identified in that earlier version of the collections policy, it didn't necessarily highlight those that were most important, i.e. "core." I doesn't mean that we weren't treating them like that. Nobody ever used the term "core collections" here until about a decade ago. We managed them, kind of, sort of, with that sense of priority but it wasn't, in my mind, sufficient. So, ten years ago we culled together, we changed the name bit, but at the time it was our living collections committee, which was comprised of a few core management staff in horticulture and living collections. We updated the living collections policy. As part of that we identified three hierarchies of importance to the collection; the most important of those being those core collections. That was the time, about ten years ago, when we updated our living collections policy. And how did we identify those? We started with kind of, well common sense. Well, if disaster struck, what would we rush to preserve first? What plants are the most important? What instantly comes to our head if we were to blurt something out? That was sort of the process. We said we have six national collections. Those should be "core." We talked about Nationally Accredited Plant Collections, things that were already of national importance that we are already putting a lot of extra resources into, to maintain either outside as well as inside, in the collections management and curation end of things. That's kind of the way we took stock of and identified those core collections, those

things that are most central to: what does it mean to be the Arnold Arboretum? Which ones support the mission the best and are also of most grand importance?

We have 150 years of history, but the one thing that not every accession can be perfect or the most valuable. At the end of the day, you've got to rank things. Harvard University might think that all of its undergraduates are exceptional and all A+'s, that's just for the undergrads. We can't be the same here for the trees. Some plants, let's face it, are better than others and that's something that was important to state. Not everything can be important. Not everything can be of irreplaceable value. We have to, at least at this point in time, place everything in high, medium, and low categories. That might mean that despite having 150 years of great plant exploration and horticultural introductions, there might be things that we wild collected that might not necessarily be superb or of might be of moderate importance. It is still important to the collection, to the Arboretum, to what we do, but it doesn't rise up to the pedestal. I thought that was an important, philosophically I think that's an important component of a structured collection; where you can recognize those that are more important. And it's not that the other concept that I wanted to communicate, and get it part of our day-to-day language around here at the Arboretum, that I don't care if you are working in curation, or in the greenhouse, or are one of the horticulturists on the crew, or a member of our education department, or a member of the library. Your core collections should be easy enough so any member of your staff, any member of your board, even your membership staff should be able to at least name a few of them. In my opinion, you have succeeded enough if people can instantly name your national collections, or what are you most known for, i.e. your core collections. That's a successful test if people who are working on-the-line in curation, your head of

horticulture, or the director, if you can get people besides them to name the core, or sometimes if you can get the director to make the core, depending on your garden, then you have succeeded.

Researcher: Do core collections have management plans for relevance, current status, required maintenance, and development goals?

Dosmann: One of our schools of though is that we want to keep, I'm not saying there is a right or a wrong, our take on plan versus policy is to keep them separate, and a procedural manual separate from a policy. There are some institutions that have a collections policy might be 400 pages long and tells you what to collect, how many, where to grow it and how to label it. We keep it separate just because it is easier to update a short, simple policy every five years, it is just short and simple. We have our policy from which procedural manuals can be updated. We have two procedural manuals. One is our Plant Inventory Operations Manual, which, for the most part, deals with how we field check, inventory, and evaluate the collection on a regular basis. That came about just as we had been doing it that process since the 30's. We wanted to take stock of our procedures to see what was working, see what could work better, see what was working exceptionally well already and a product of that was that manual which has been updated once into a second edition. We are probably going to do a third edition soon. That's the Plant Inventory Operations Manual. The other manual, which come out recently, or plan, I should say, if our Landscape Management Plan. That's in its third edition now and that's really the nitty gritty. It's about 400 pages of how to maintain the plants in 70-something zones across 300 different acres.

A lot of it is repetitive. It's meant so you could pull out each zone separately, so we named them so for the horticulturists they could see what the weeds in this area are, how to control them, and what the calendar events for this area are. That was created as we restructured the management of the Arboretum out of the collections and that Landscape Management Plan was an essential tool to deliver those results. We are now in the process of taking that two-dimensional, static landscape plan, now in its third edition, and we are making it a dynamic system that will never be printed. It will be an online system that is capturing information, making it responsive to seasonal events and if it says, "we want to renovate this bed in the next year or take out this bed, or add a new bed, or something like that, the plants"… you know, writing it on paper or writing it down is nice, but what happens when you do it, it's nice to keep track of how you are doing it and when you are doing the work. This whole new system is kind of a project management system that has developed and it will probably be a year or year and a half before that is fully operational. It will fully integrate our procedures with a lot of technology, primarily but not exclusively our GIS.

It was initiated as a joint thing. Our previous deputy director, who is now the director of the LA County Arboretum and Botanic Garden, Richard Schulhof. It was his genius that we need to transition into this new approach to managing the landscape. He really took the major initiative for version one. It was a committee. I need to give him full credit for that. It also involved our Manager of Horticulture, our Assistant Manager of Horticulture, myself, our Greenhouse Manager, basically our Living Collections Management Team, our records. That was the first edition. Between the first and the second edition it made another major leap and everything we learned after making the first edition we incorporated into the second one and it also

incorporated the horticulturists and arborists ideas and comments especially as they were working, so they tweaked it. There wasn't much of a change between the second and the third edition. And now with this new system, our Landscape Management System, our Director of Horticulture is taking charge of that, working closely with a Living Collections Fellow that we hired for two years just to focus on assessing and delivering the product. And then there is a Steering Committee that I sit on and so does the Director, and our Director of Operations. There is still an oversight Steering Committee.

Researcher: How does identification of core collections benefit your institution?

Dosmann: I think one is kind of at the 38,000 foot perspective, is we know what is most important. We can't just that every piece of art in the museum is of equal importance. If the building is on fire, hopefully, you are grabbing what is most important or they are in the best fire suppression zone. By extension, it's not that we wouldn't rely on the database or things like that, if heaven forbid, like the hurricane of '38 came and wiped out all of our plants, if we had another hurricane or natural disaster and we had to go through and assess quickly and repropagate quickly, we would, without even the benefit of a database, although we would still use one, we could easily construct what is important. That is part of disaster planning, I guess, we could respond to whatever the need is. Whether it is responding to a disaster or responding to an opportunity. It is important for museums and gardens to know what is important. I think there are several different kinds of disasters like a hurricane that blows through and wipes out half of your collection and you have to deal with it.

Another thing could be somebody what wants to drop 20 million dollars on your lap but to force you to build a collection you don't want. Heaven forbid somebody came to the Arnold Arboretum and said "We're going to give you 20 million dollars to put in a daylily collection." Now, I don't want that, but if we don't talk about what is important and what is not, I could, luckily our director would say no in a heartbeat, but I could see another director saying, "I really could use the money, so why not?" That's a disaster by opportunity. I think it's really important to know and being able to rank and respond to whatever you need to. It is important, I gave a talk one time, but I gave a picture of Dolly Madison, and the story during the War of 1812 and the White House was set on fire by the English, she rescued a few famous paintings and she didn't rescue them all but she rescued some, including one of them of George Washington. She had an idea of what was most important. We should all be like Dolly Madison and if the English are setting fire to our gardens we can at least rescue the most important ones.

Researcher: How are core collections communicated internally to staff and externally to the public?

Dosmann: What we did was to give the collections policy a revamp, I gave a presentation at the staff meeting. I also put out a really beautiful *Arnoldia* article, so luckily we have a print vehicle in order to put this out. If not, I could have put this out in a newsletter or whatever. The other thing is, you start using the lingo, you making it a part of your lexicon, when I'm talking to our volunteers. I remember one time, we had a little raffle with door prizes for who could name our six Plant Collections

Network collections at the time. They got it eventually. We have little games and you just start talking about it and use that terms collection or "core collection." Some of them are easy in the sense of the CPC (Center for Plant Conservation) collections or the PCN ones. There are other ones where it is a little grayer perhaps in concept, but we started using it. That has succeeded, there is still more work to do, but that's the approach we have taken.

We have very little interpretation at the Arboretum. I'm not saying that's a good thing, that's just the way it is. So most visitors have no concept of that if they are on their own that they are being alerted to it because we don't have any signage. We are open dawn to dusk, free of charge, there is no gate. We have chosen not to heavily interpret the Arboretum with interpretive signs because of vandalism and things. Now, that being said, our volunteer docents that are giving tours, they certainly know more about our more important collections and they mention them, particularly the national collections because that is an easy thing to communicate. They will mention, say, our maples, we have a fabulous maple collection. It's one of the six national collections. I know many of our docents incorporate that story into their tour. If you are a visitor on a tour you certainly are hearing it, but that's only a minority.

Some of that information might be captured in the LMP or in the collections policy where other might be in part of our Campaign. They are captured in separate spots. Thinking about maybe really good example of that would be with our Center for Plant Conservation (CPC), those are core collections, part of our conservation collections. Those we have a number of CPC beds. Those are things that we've got lot of different accessions in large beds or groupings of bed. Some of these are shrubs that like to sucker of root sucker and they get maintained as single individuals otherwise

their value is lost. In the LMP for those beds, it states to keep an eye on this. Make sure annually you are pruning these things back, doing that kind of stuff because they are important, because they are "core." That is on the management side. As I developed the list of desiderata and there's even a species listed there, we need to get it from these spots. There is an acquisition target kind of maintained in that system.

Researcher: How does your institution assign priorities to its living collection? To individual plants or collections of plants?

Dosmann: We haven't. I've toyed with it. It's easy in theory. Harder to implement. It can work as long as you have a very good understanding of how you value something. How we value something based on our DNA, based on our mission, we can come up with that. That may be very different than how perhaps, how Winterthur might value something. They might be equally valuable but our definitions of that value are different. And that make perfectly fine and dandy. I think rating scales can work, they are generally not universal across all collections but they can be unique and discrete for that institution based on their own DNA and their own mission and how they can come up with a value judgement. But then, moving from the qualitative and subjective over into the quantitative and objective gets to be difficult. What I did do is I came up with a rating scale, 1-9, for things based on their backstory, based on their documentation, and created kind of a documentation score. It works really well for wild-collected things. You can easily define things into a rank. I works really well when you are trying to make really coarse determinations. When it is between 1 and 9 I can't think in quantities above three, so it's always high, medium, and low for me.

It's pretty easy if you just need to chunk things into 0-3, 4-6, 7-9. If you just need to get them into those three boxes, it's kind of easy. Once you try to say, is that a four? Is that a five? It's kind of harder to do, and maybe you don't need to. For the cultivated material, it's harder to assign the values to discriminate things of cultivated origin. Whether it's a cultivar or maybe just a *Rhododendron mucronulatum* you got at Westin Nurseries. It's harder to discriminate the fine-grain details for cultivated material. Especially when you are trying to get up there in the high scores. The more we knew about an accession, where it came from, the higher the score. We tried, we don't implement anything here, I just need to try and make sense of it as pragmatic and easier. That's outside of just saying does that species belong to a core collection. That's kind of easy. If you've got 18 accessions of *Acer platanoides* in the collection, well, not all of those are created equal. All those 18 accessions might belong to one of our core genera, so they are core, but they are not all equally important, so you start to split them up. That's where it gets a little more tricky. You can do it, it may be easy to say this is wild and this is really wild with a lot of detail, this is a cultivar that we got at the nursery down the road, this is a cultivar that we co-introduced. I incorporated that into my rating scale but we never got around to implementing it. Also we didn't have time to go through 10,000 accessions. That's the other thing. You just get bogged down in details. Sometimes it's easier to do it at your desk but the thing that is important is that you can assign a priority to that plant, to the genetics, but then there is another layer that is just as important, which is that individual's value in the collection as an exhibit. You could have a plant that scores very low based its backstory, maybe we don't know where it came from, someone planted it there in 1914 and it's there, we have no idea where it came from. It might just have a score of

1 out of 9. But, it might be the most beautiful individual plant that you have ever seen. The important thing about that is that we can go through all the work and have all the robots do our metrics and that's fine, but you still have to get out and look at the plant.

A long time ago, I basically came up with a system to easily assign things, to give it a score from 0-9 based on its backstory. I presented it a couple of times at conferences and things. But because we never started to use it I never launched it or published it. I want to tweak it some more. What is did, I said there's three categories. The first question was, do you know where you got it, like the PSource category in BG-BASE. Some things have a PSource, almost everything has a PSource, but some things don't. If it has a PSource, versus those that don't that's a nice way of discriminating. That was one of the first questions. If it has a PSource, it gets a point. After that, we looked at the provenance. If it was an unknown provenance it had a 0, if it had garden provenance it had a 1, and if it was of wild provenance it had a 2. If it has a PSource it has a 1 and if it had a PSource and was also collected from the wild it would get 3 points. That makes the assumption that wild origin things are of higher value but that is not always the case. You could have something that we collected from the wild but we only have the information on the country of origin. That last category was added later. What is the level of granularity on what you know about where it came from? If you just know the country of origin you get one point, if you have the country and province you get 2, if you have the country, province and township you get 3. If you get up to the point where you have a GPS location, maybe you get 5 extra points. If you at least have a latitude and longitude, that's pretty good. And, if you have a latitude and longitude then you can repatriate all the other stuff. If you have other contextual details related to habitat. You could simply have "we

collected this thing and here is the latitude and longitude" and that gives you a chance to repatriate all the other information but it doesn't really tell you about the habitat, vegetation, so that's kind of like the crème-de-la-crème. That's kind of the approach that we took. It works kind of well for the wild stuff. But when you starting thinking about the cultivated stuff it gets tricky. The crème-de-la-crème might be, we got this cultivar from the actual introducer, so that's pretty good- I have good confidence that information is true to type, that I got the real thing. That's on par with something from the wild with all those contextual details. What's going on, what is the pedigree. Where I always fall apart, where I've never felt comfortable making it prime time is there are still some not understood questions.

Researcher: Where are priority levels documented?

Dosmann: We tried it, we kind of went through some on for size, so we did not implement this. It works in theory but it didn't fully work in practice. We could have recorded it in BG-BASE. We didn't feel confident that we were doing it right. It may work fine just for the wild stuff and for the core collections. Maybe we need to just put it in 1-3, high, medium, and low, something like that. I think simpler is always better. I think high, medium, and low, you can divide nine by three and place them into "bins." I did another analysis a couple years ago based on our lineages as we've got about 8,000-9,000 lineages here to repropagate, so we have fewer lineages than accessions. It basically chunked itself into three categories (high, medium, and low). About a third were immediate, if they were going into decline I would immediately repropagate or schedule. If it's important enough to repropagate, I guess it is enough to keep. Another

third, if they started going into decline, I would be the one to use the chainsaw. Or, maybe we should use the chainsaw before it goes into decline. And then there was the third that were in the middle, where do those fit?

Matthaei Botanical Gardens and Nichols Arboretum

Researcher: How would core collections be identified?

David Michener: This is a great question and one we are trying to make sense of. To be honest, in our almost 110 years, core collections have in large part been accidental. They ultimately tie to some faculty project who started them but then they continue on. The University started the Botanic Garden as a joint effort between the School of Pharmacy and the Botany Department well over a century ago. It was very much focused on plant diversity for the pharmacy school but structural diversity for the botany students. We've always had a lot of taxonomic diversity at the family level so we never really developed that many more generic collections. Since we are not a land-grant college, like Michigan State which has a land-grant function, we've never had a horticulture department. The ornamental functions have been kind of secondary until the last 50 years. Our core collections have been primarily what I would call taxonomic (to show families), historical by accident (based on faculty expeditions to collect succulents in Mexico between the two World Wars, mostly during the depression), and a peony collection that we are really well known for from the 1920's. In the last twenty-some years we have been charged with managing a total of four properties which contain about a third of all the native flora of the Great Lakes. Now, our collection spans from ornamental peonies and pharmaceutical plants all the way

through to bog plants. We are trying to make sense about what is really important. We are trying to be more organized such as, “we have core collections because of one, two and three.” We are using the Arnold Arboretum’s Landscape Management Plan as a structural outline to go through all 127 different identified kinds of collections or areas that are managed differently. It’s just nuts and they can’t all be that important.

What we are trying to do is identify five themes that are fundamental to our institution that will carry over regardless of fluctuating faculty interests. We’ve identified the Great Lakes endemics such as they are on threatened habitat, such that we have them in nature or in our Great Lakes garden which is about two-and-a-half acres in size. That will become a core collection because it ties in with conservation and stewardship in Michigan. The Peony Garden will be a core collection because it is part of a historic ornamental collection that was given to us in the 1920’s. It is almost unrivaled for historic extinct cultivars. Something like the conservatories, which have about 25 of those collections I mentioned... We are trying, because they are in inventory areas with different themes, we are going, “Well, we don’t really need an Asian-themed tropical collection,” that’s not really a collection. We are trying to take the whole conservatory and focus it on conservation themes. We are trying to come down to what is really important at a future time when the budget goes into crisis. What are we going to manage carefully and which are ones that we manage to the best that we can with our volunteers and our Friends group money?

In the most recent iteration, it was the Director, the Associate Director (Karen Sikkenga) who you may have met two weeks ago when she was at UD as part of the consulting company, she doesn’t have any horticultural or botanic background but is a good manager. Very good at asking important questions. Bob, our Director, is a

landscape architect. I am involved as curator, our head of Field Services, also Horticulture and Natural Areas, and then our other Curator of Native Plants, the groups of us are the key persons. Karen isn't involved that much with the actual deciding of it but she is involved in being sensible and not being too academic. As part of the reason for doing this is that realized we could not be raising more money, including making staffing decisions until we were able to give them a coherent reason about why we were important after 110 years.

I'm going to give you two dates. I've been here 26 years, it will be in 27 years in another week. I started the process for the first time about 25 years ago. When I arrived this place was nuts. The more serious effort about it occurred about 3 years ago when we decided since we were managing four properties now, with different purposes, that we needed to have a coherent strategic plan and an outside firm was brought in. The same one that was on-site doing the UDBG master plan. Part of what it's been is to identify what is really core, build endowment to run it, and then treat a lot of the rest of it amenity space. For example, some of our gardens must be beautiful for weddings and social events but they don't really host a core collection right now. So, let's focus, let's identify the core collections as ones where the University has to manage for its academic programs and the other we will manage with visitor services as an income stream. That actually seriously began about three years ago and two years from now, that is 2019, we expect to have worked through all the areas for what is core, what is really valuable and how prioritize them once we are done.

We actually got rid of our Ericaceous collection. That was during the first operation. We are really alkaline, we are on alkaline glacial soils our well water pH varies between 8.5 and 7.4. We can't grow Ericaceae. So the Ericaceae went out.

Before, it was one of our important ornamentals. It was one of the best collection of diseased Ericaceae in Michigan. That is, they were pathogenic, they were horrible. It's not worth it! We've also determined that our orchid collection, which was historically important, is not a core collection, but we will probably morph it into a tropical epiphyte collection of conservation value, but the family Orchidaceae won't be important. I can list you a number that just aren't important any more. We used to have what I would call a dwarf conifer collection that still exists. We have no idea what they really are. We haven't known for over 50 years. As they die, that part of the property will just become something else. We are just waiting. We used to have a collection, a specifically dispersed, whether it was a core collection, of important Asian trees and shrubs that were hardy in our climate, just for the hell of it. We are no longer doing that. We are going to focus it much more on the ones that have relative disease resistance in North America. Rather than just having it for the heck of it, we are going to grow *Exochorda*, no Ericaceae. We don't need to have Ericaceae anymore. They get rust fungus, fire blight of several different kinds, so what was the point. So instead we are going to ecologically viable ornamental shrubs. We are deciding themes that aren't family or generic-based any more. It gives it more latitude. We have the same staff on all properties. We used to operate with having two of the properties having different staff. So it is complicated but that's what makes it fun abut also very frustrating. One of things, you may be asking this in a bit, is we are completely redoing our collection policy, which I last redid 15 years ago. It needs a total redo. And it will be redone this year by hook or crook.

Researcher: Would your institution be interested in developing management plans for individual core collections?

Michener: We are trying to apply it to all four properties and making it so it deals with what I call ornamental collection areas such as the Peony Garden, the dispersed collection such as the conifers across all properties, and the wild natural areas. The natural areas have their own management plans and we view them as collections that we have to manage, whether it be through fire management or invasive control. We are using it as a framework that they really thought things there are the Arnold. I really like the plan although I had nothing to do with it. Thirty years ago I was at the Arnold as their research taxonomist and curator, my first job out of grad school, and they had a very different structure. I hadn't really paid attention then because I had not relationship to it. But, they have thought it through really well. We are using their structure to see how we can modify it to fit us. We have thought a lot about it. We are following their lead with parts of it.

We have asked the staff who are responsible for the different areas to break it into a three-year cycle. We are one year into it and people take a stab at what they think they are managing each year. The collections committee is the group that came into do the collections plan and management plan and we decided to get the staffs' idea of what they are doing, rather than us just sitting up in a cloud telling them what they are doing. That's really important and that was a change of perspective here at the institution and somewhat of a break from how the University of Michigan manages them. We are very much a faculty-run institution was a whole, so involving the non-

faculty staff is considered somewhat out-there. But, it makes sense and will work in the long-run.

Researcher: How would identification of core collections benefit your institution?

Michener: There are a couple of really important things for us. When the next crisis comes, we will know what is important to manage. The University Botanic Garden has been through two staffing crises in the last century and people didn't know what to prioritize. They just tried to grab what they thought was interesting or a proportional amount of everything. As a result we lost a lot of really important historical accessions because nobody understood the importance. It will help us with emergency planning and knowing what to save. It also helps us in explaining to donors why they need to endow something or fund summer interns for the next couple of years to work on a collection. What is valuable about it? I think those are the two important things.

Researcher: How would your core collections be communicated internally to staff and externally to the public?

Michener: As an institution, we have what's called a ShareDrive to internally publish documents. Things, even like the weekly work plan, are all on an internal document sharing device and that's how we push it back and forth with each other. It's how we push everything back and forth between ourselves. That is a change from the behavior over the last ten years when the four properties merged into one institution. We used to not communicate internally very well and everyone had their own thing or they

would print it out. What we are increasingly moving to is sharing documents and we are making PDFs as we build our website that will be available to the public. As a public university, we are trying to be completely transparent to all of our supporters whether they be faculty, donors, members, or whoever.

Right now collections are not communicated with the public, other than that we have them. We haven't designated core collections or important collections. That's a really good question you are posing, Anna, and that's a question I will have to pose back to the whole group. Because the visitors do not want to see an uneven mosaic of "this is well managed and that's not." We've been working on what we call aesthetic codes or aesthetic standards, A, B, and C based on the amount of effort put into it. Good question, but I don't have a great answer for you.

Researcher: Would your institution be interested in assigning priority levels to individual plants or collections of plants?

Michener: We are thinking of doing that. We certainly have it in terms of effort. Some areas we deal with when we can get there and others have to look good. Part of this is also, this may sound strange, the events gardens that are rented for weddings and anniversaries, they have to be stunning no matter what. Whereas, the Peony Garden has to look stunning only during peony season. The effort may change seasonally based on the needs of the public to engage with it. Whereas the Pharmaceutical Garden, which bluntly, is always academically interesting, but no one is going to have their wedding in it. First, we would put them with the collection policy and the management policy. Two, we are looking at how to make better sense

of our databases in terms of plant records. They are not all in one place at the moment. Third, we are keeping a spreadsheet of areas of the collections as we work through them and indicating priorities for what I call public amenity, that is, the rental spaces with donor impact. We are trying to keep a spreadsheet in one place where everyone can look at it. The quick and dirty lookup chart, kind of the same way with budgets, month-to-month, what is the balance, sort of thing.

Wellfield Botanic Gardens

Researcher: How would core collections be identified?

Josh Steffen: When I came on board, I had no staff and I was hired to create this department from scratch. One of those key pieces that separates a botanic garden from a park is having collections. In 2014, I knew that if we're going to start a collections function, obviously the key piece to that is having a collections policy. I brought together several people in a meeting who were on the board, people from extension, and somebody who had been a director at a garden an hour west of here who I had worked under and had gone through a similar process. This person understood what it is like as a new garden to carve out your piece of what you are doing. I sat them down and said, “What should we be collecting? What are our priorities? What are we about?” We had a mission, which hasn’t really changed, although we have messed around with the wording.

We are trying to demonstrate the interconnectedness between water and all other life such as plants and animals. What seemed really clear to the groups is that close to half of our total 36 acres is water. There is a lot of water/land edge zones in

which to do something. We started restoring some of the pond and creek shoreline with native plant material there is local nursery/habitat restoration/wetland mitigation company we work with. They have grown and expanded and been bought out by a larger company by the name of Cardno Native Plant Nursery, who we partner with. I will mention them a little later on as to where we are at today with collections. They supply the material and the expertise in shoreline stabilization and how to actually solve these things. The other piece the group seemed to agree on was to focus on natives and also on "nativars." That has become an expanding part of horticulture and that's going to be a potential research area for us. Everyone is whipping out new varieties of native plant material but they are not examining the consequences, ecologically, of introducing new types of *Echinacea*, or new types of aster and goldenrod down the line. What is that going to do to wildlife? Those two things are, what we have at least said on paper, are our emphases. You have to keep in mind, when I came on board, several gardens had already been built, and the landscape architect for most of these theme gardens had provided not only a master plan for the entire site, but also had done designs for each theme garden and provided a plant list. The people who had worked on installing these, which included a local, very well-respected landscaper, and my boss; they had looked at the plant list but had gone and done what they wanted to do and installed a very beautiful garden. There wasn't any thought to plant collections or plant collection priorities. We are a display garden, not a true, strict botanic garden. That is an important distinction. I don't know if anyone has talked to you or introduced that topic. Longwood Gardens is a display garden. They have collections, but it is all driven towards aesthetic purposes. You can compare Longwood against more botanically driven institutions like the New York

Botanic Garden, the Arnold Arboretum, the Morris Arboretum, or the Morton Arboretum. They were started with botanical emphases and then they realized they had to get funding for other different reasons to generate different revenue. It was bunch of plant nerds trying to figure out how to keep the collections going and keep it viable and relevant to the people who were forking over the cash. We are a display garden, collections are not in the mind of the founders; they are not plant nerds, they are not research driven. It was strictly driven by civic mindedness. They wanted to create a beautiful place that is a crown in the jewel of Elkhart. You have to remember these guys are business people they are not from the professional world of botanic gardens. Again, collections is not on their mind. None of the design, arrangement, or the setup for displaying plants has really been driven by that. Nor was the acquisition of plants focused on specific genera, like *Magnolias* that are appropriate to north-central Indiana. They just worked off the plant list that the landscape architect provided and modified it based on what was available and so forth. However, because the landscape architect was the same person, and he often uses many of the same plants in many spaces, he had the same landscape contractor installing them, there was a number of repeats in terms of cultivars and the same species. But, we do have collections. We have started collecting magnolias. We have a whole slew of magnolias in our Spring Garden, for example. One of the landscape contractors who was hired to do a garden was really into Rhododendrons. We have a number of different types of Rhododendrons in there. So, the “collections” were driven by the landscape architect and whims of the people involved so far. There was no top-down, intentional focus until this point.

If you are wording them as “core” collections, we don’t really have those. “Core” emphasizes the intentional planning, top-down driven process. Up to this point, because plant collections have not been the priority, the entire focus and motivation has been to build these gardens. Build this “jewel.” That is the entire motivation. Plants have not been the emphasis of those involved. It was certainly my emphasis and two other people on the board, this was largely a volunteer driven organization. They were the hands and feet and brains, especially until I started as the first full-time, non-director, employee to come along. It required some strong personalities on the board to say “you need to diversify this, what about these plants.” It required somebody who was in tune with horticulture trends, who was kind of a counter-voice against the people involved with building to make them think about other things.

We set our mission based on what was already here and based on what was planted. If you were going to group these things, we do have a collection of this, we do have a collection of that, and could you see a theme emerge out of that. For example, we have a lot of “nativars”, so let’s have a collection of that. It was sort of a mixture of things that brought us to the point where, just this month, I have taken steps toward really starting to look at *ex situ* conservation of wetland and riparian species. We work with a consultant who has helped us with our Woodland Conservation Garden with monitoring and installation. We have a 2.5-3 acre Woodland Garden that is being rehabilitated from being a mess of invasive material to something that is a little more typical of the oak-hickory forests that have dominated this part of the country in our ecoregion. This person has helped to advise the plant palette and plant species going in there. I am working with him along with a person who is involved

with Cardno, the company that I mentioned earlier, to identify a shortlist of rare and endangered species. The list is kind of a mix of material that this guy will go out to collect because we don't have the time nor the expertise to go out plant collecting ourselves. Plant curation is just one portion of what I have to do with my staff. That person will then go out as part of their normal collecting trips in the wild populations. They do this as their business. They will go out and collect those species that we request. We have to figure out the rest of it from there, like how we will propagate these things to eventually be planted on site and be maintained. That is going to serve as one of the core collections. We will continue with our emphasis on "nativars" and that's the way I have tried to go. Anytime we are installing or renovating a new garden I look at that space and think, well, here is an opportunity to include more straight native species or "nativars" into the mix so that moving forward we can be tucking these things into the display.

Researcher: Would your institution be interested in developing management plans for individual core collections?

Steffen: We have done it informally at this point. The only example I can think of is with our "*Rhododendron* Collection." When I came on board, the rhododendrons had been planted the year or two prior. The person who did the design for that garden who really knows *Rhododendron* had given us guidelines as to what we needed to do in order for them to survive because they don't grow here very well; mostly in terms of changing the soil. I "created" a plan based on his recommendations to keep those things going. That is one of the hard things about having a dispersed collection as far

as making sure things have the correct cultural requirements. It's a lot easier when they are concentrated in one spot and have similar cultural requirements. We will have to look at that when we start propagating and installing endangered species and so forth where we will have to modify the environment a bit for each particular species. We will have to write a management plan. I did create a management plant for our Woodland Conservation Garden, so it's kind of as we go along. The only time I have written one out formally is when I need to communicate to a decision maker, donor, or someone on the board because they want to hold me accountable to how it would be instituted or implemented. I need to sell them on how and why I would take care of that particular space.

I have not written but will probably need to write ones for our wetland and shoreline areas. If nothing else, it documents how things first started. I am always trying to think of the person who will have the job after me so I can set them up so they aren't coming in blind. They will know what has been done and they can decide how to proceed from there. I guess I hadn't really thought of this that way until you mentioned it, but one of our core collections really is our mature canopy trees. They would be, and are, a definite priority. I am creating a plan to communicate this fact. Basically, everyone values the trees but they don't necessarily understand why some of these trees are declining. There is going to be some significant budgetary funds that will be needed to put towards them along the way to rehabilitate and to save these trees. That would be a Canopy Management Plan. That is driven by the need to basically, "sell" something as a priority to the board. They are going to want to see numbers and justifications for why those numbers are the way they are. They will ask

“Why should we devote a portion of your horticulture budget to this?” Or, “Should we go out for a major gift or something to get an influx of cash to start this?”

Researcher: How would identification of core collections benefit your institution?

Steffen: Well obviously, it helps to prioritize operations. If you say something is important you can sell to people and articulate why it is important. That’s a lot of what I have to do. I don’t have to sell it to my boss, he gets it. He has worked in botanic gardens and is a plant nerd. He understands. But helping others who are our bosses to understand that. If we do starting looking at prioritizing our collections it certainly would inform and affect the plant sourcing decisions I make. If I have a choice between buying and putting in bunch of daylilies versus several different types of “nativars,” I am going to maybe cut the number of daylilies in half or in two thirds if appropriate to that particular garden design and intent. A good example of that would be in our English Cottage Garden. The style there is really wild, woolly, loose, and “weedy.” This great for incorporating some of our natives and more prairie species. That is the challenge with some of our natives. A lot of what is sold by the native nurseries that I have access to have endemic prairie species. It's harder to find something that is endemic to woodlands or shady areas. Long story short, it can help inform plant purchasing and it would also help in terms of maintenance. If I have two plants side-by-side that are on their way out the door, health-wise, which one of them am I going to put more effort into trying to rehabilitate or keep alive. That will be the one that is more central to our mission. The collections policy emphasizes criteria of prioritization in it. I would check that out. If you look at it we have two tiers. Why

does this plant have value? Is it for purely aesthetic reasons? Is there a potential research value to it? All of those things factor into it being purchased but also factor into why it should be kept in the collection versus ripped out. I just ripped out two *Berberis* yesterday that I inherited. As I was doing winter pruning, I thought, you know, I don't even like *Berberis* anyway. Not only are they invasive, but they are not "core" to our mission. We've even been starting to weed out some of the invasive plants that were planted prior to my arrival. So there you go, there is an example of the prioritization decision making process. Native plant material is more core to our mission. Unless invasive plants have some educational value I might leave them in because it is good to point out what this plant looks like as a conversation piece. We can talk about why you shouldn't plant *Euonymus alatus* all over the place. Here is what it looks like. It raises public awareness and all of those things need to be factored in. It is based on that two tiered criteria.

An example where this might come in is with plant donations and this is one of the reasons why I have those criteria in the collections policy. When I wrote it, I asked my former coworker at the Cleveland Botanic Garden, who is the curator there, to send me the collections policy. I also pulled up the Marie Selby Botanical Garden's policy because theirs was online, and there might have been a third one. I looked at those to inform the format and some of the language that needed to be in there and then adapted it for us. One of the reasons why I put the plant donation policy in there was based on conversations with the curator at Cleveland. One of the things he would run into was people saying "Hey, I want to give you my jade plant. I don't want to get rid of it and it is really gorgeous." How are you going to decide whether you are going to accept that or not? What are the justifications for being able to deny a donor's

request or accept it in your plant collections policy? Then you can say “I’m sorry that is just not something that we are really looking to collect.” As another example, someone might say “Hey, the community garden foundation wants to plant a *Ginkgo* tree on our site because *Ginkgo* is a part of their logo. What do you think, Josh?” I would say, “Well, we already have two or three *Ginkgo* trees on site, so adding another one might not be appropriate. What about a tulip poplar? Do we have any of those? No? Well, it is the state tree.” In that case, we could probably plant a couple even though they are not part of our core collection. But someone wants to donate the money for that tree and it becomes donor tree. That would be more appropriate because it has an educational function with it being the state tree and so forth. Or, “We just put in a whole bunch of endangered species along this new shoreline restoration project and we need to be able to maintain it. It would be really nice if we got some additional finding to support that.” “Oh, so-and-so is really into conservation and he is really concerned about endangered plants in an amateur native-plant enthusiast way. He is willing to give us some money to be able to set up a certificate of deposit that kicks out money every year to help maintain that.” If people approach us, based on our collections policy, we can direct them and help us to inform where the money would go to and which areas we should put more effort into. It already does and has influenced decisions both big and small.

Researcher: How would your core collections be communicated internally to staff and externally to the public?

Steffen: I needed to explain why it was important that we have a plant collections function and why I was spending time creating a database and doing database entry to those who were on the board at the time, those people who had to approve the plant collections policy. What separates us from a park is that we have a wealth of information about these plants that is accessible to the public. You can't do that if you don't have a place to house that information. They understood that. We try to communicate to staff internally the same way. I always use the art museum analogy as an example because it is the most accessible. You inventory the art that is there and it is a part of what the museum collects. You are going to display that art and are going to educate people about the art, and that's what we are doing with the plants. That is a way people can understand what it is we are doing. It is also a way to explain to the public our garden's development. Prior to the garden being built it was a free and open city park of sorts. Then we came along and started developing it and at some point we created a gate and started charging people. People were wondering why they should come here when they had to pay for it when they could just go down the street to the park and walk.

Externally to the public, it has been hard to try to help them understand what is a botanic garden, what is the value of a botanic garden, how is it different than going to Ox Bow Park, a city park, where you don't have to pay. What is the difference? One of the talking points is that not only do we display plants in a more well-cared for and manicured way, but also we educate people about the plants and we are going through and collecting stuff.

This is a plant collection, no matter how much education you do and events and weddings, the core of a public garden is still, and always will be, plant collections.

Whether it is a display garden or a more traditional botanic garden. I think people get it when you do communicate it but it is such a foreign concept to them. You and I live it every day, and I haven't worked in any other industry but this. I did a year and a half stint in retail, but other than that I have worked in the public garden sphere. I live and breathe this stuff every day, but for other people, a plant collection is sort of a hard thing for them to get their mind around. Even if you talk about a zoo's living collections, the public doesn't realize that they go around collecting gorillas, when in fact they do. It is much easier for them to understand collections of say, rare coins, or any object. The museum paradigm has been the best way to explain it. I start by talking about non-living collections and then I make the jump to say that like a zoo or an aquarium, we also have living collections. We are just a zoo for plants. That is one way for them to begin to understand the esoteric and abstract concepts of public gardens. It is a bit more of a challenge, but the bigger challenge is trying to roll the big boulder up the hill of pushing this concept and the master plan forward with the resources that we have. We've got resources that other new gardens that I have talked to don't have. We are doing very well. To be 11 years out from conception and being already almost half of the way through building the theme gardens, that is pretty good. And, that's all due to the civic spirit and the entrepreneurial mind. As much as I roll my eyes and rail against the entrepreneurial spirit of getting things done quickly, that kind of ramrods or runs over our artistic side of things. They also forget about maintenance and operating costs over time. But, it is what has gotten us to where we are today.

Researcher: Would your institution be interested in assigning priority levels to individual plants or collections of plants?

Steffen: I don't know. We are just not that far in the development of our thinking. I don't know if we would actually formalize that. It would be a case-by-case basis. There are a lot of different options for assigning a value to a plant. If it is of conservation concern or is endangered, we would promise that invasive plant material won't come in and wipe that out. That plant would be of high value because it is part of our mission. If it is an established black oak that has been on the property for a long time, and we don't have a lot of black oak on the property, we might go through extra effort to save that tree. We go through extra effort to maintain any of our large canopy trees. We are in the early stages of a Canopy Management Plan so that we can preserve what trees we do have. We are going to have, at least it is still on the books, a *Hosta* area as part of the Japanese Garden, one of the few gardens that will be based on a named group of plants. This was driven not by curatorial reasons to have a national *Hosta* collection. It was driven by people on the board saying, "You know, we can get money from a donor to develop that space. I know somebody who would really be interested in developing a *Hosta* garden and they would really grow there nicely." That's the way some of this has developed. They are entrepreneurs on the board. They are just interested in getting the job done. They are catalysts and not necessarily interested in collections.

Moore Farms Botanical Garden

Researcher: How would core collections be identified?

Brendan Huggins: What we really do is we have the whole garden collection that we look at and are constantly trying to increase. Our main areas of focus, which we consider our core collections, are our *Taxodium* Collection, our *Magnolia* Collection, and our Conifer Collection. Those are the three collections we have placed a significant collection emphasis on. Overall, our mission as a garden, in terms of collections, is to focus on plants that can be grown successfully on the coastal plain of the Pee Dee region of South Carolina. That kind of helps us identify plants that will be successful in our area and that's why we have chosen *Taxodium* and *Magnolia*. They are plants that are native to the southeast but also in our particular setup with the water table and humidity being what they are, these are plants that are already very well adapted. Our Conifer Collection had been developed as we went along. The south has a smaller palette of conifers available because of the heat and humidity. We get a lot of people moving from the mid-Atlantic, Midwest, and the Northeast, into the Southeast and they want blue spruces or things like that which we know won't work. We have developed our Conifer Collection into a reference garden as we acquired more material. We really feel like we can assist with plant choices for the community, particularly for people who are moving into the community. They have an idea of what conifers will work here so they can be realistic in their choices. Also, several staff members over the course of time, have had an interest in conifers in general, so it was also kind of a staff research interests. It had also been great for us because we have a few conifers now that are no longer available in the trade. We have a little bit of a genetic bank there that is exciting because at some point in time, people are going to want to go back to some of these things that are less available. We want to be able

to be a garden that is a source of genetic material for future hybridizing and genetic research.

What we did was a lot of the supervisory positions in production and horticulture got together and we wanted to select taxa we knew we could raise in our production center but then also once we took them out of the nursery and out of the greenhouses, that they would be successful. The person in my role as well as the Production Manager, the Operations Manager, and the Plant Curator. We all wanted to collaborate to make sure we were making intelligent choices. *Rhododendrons* also do well in a lot of our areas but the National Arboretum already has a massive collection of them. We wanted to identify collections that maybe didn't have the same sort of national recognition, *Taxodium* in particular, we have around 70-80 cultivars and we are continually trying to track down the new ones that are coming out. You can go to a lot of other gardens and ask them about their *Taxodium* and they might have one or two. It's a great tree. We have done some brief collaboration with the University of Florida. They have done a lot of work researching *Taxodium* to identify them as a timber tree because they can resprout after you cut them down, which is better than most of the trees we are currently using for timber. Aside from that, we have found very little research being done on them. Dr. Dave Creech, out at Stephen F. Austin State University has done a lot of work and then Tom Cox at the Cox Arboretum has also done a lot of work. After the two of them, gardens with large collections kind of dropped off dramatically. We thought that would be a great opportunity for us to start collecting taxa and put them out.

We are actually right now, growing our collection of *Quercus lyrata*. And so right now it is still a small collections. We definitely foresee in the future it being a

plant that can thrive in our conditions and something we are looking to expand. We are looking into new taxa that are in development or are coming to our attention that we can utilize and show our surrounding community that these are plants that can be successful in the area. Also, for people coming into the area, these are something you could give your first attention to.

Researcher: Would your institution be interested in developing management plans for individual core collections?

Huggins: Yeah, we are definitely interested in that. It is one of our short-term/long-term goals and is something that we would like to develop over the next 3-5 years. The more of these natural disasters that are happening, the more we are losing trees that we hoped would go away anyway, and you are not too worried about them. Once you start getting new 6" caliber oaks out, we have to be more mindful of what we are going to do to protect these things that we want to be around long term. Even we have Lady Banks Rose leaning on a pine tree that this last hurricane kind of, didn't knock the pine over but it started to pull out of the ground. Even for situations like that, we need to be able to decide if we are going to brace this, cable this, or take it down. That is something that we are starting to develop plans for. That aspect is more disaster preparedness. As far as our collections go, if someone comes out with a new *Taxodium* tomorrow, we want to obtain it. We are looking, when it comes to our *Magnolia* or *Taxodium* Collections, we want it to be as complete as possible and our goal is to strive to make it as complete as possible. That is a very lofty and ambitious

goal but I think it helps people to understand how serious we are about this and we want our collections to be important and an emphasis.

Researcher: How would identification of core collections benefit your institution?

Huggins: It is definitely one of those things where the core collections start to form the backbone of the garden. In the southeast we are very well known for our *Taxodium* and *Magnolia* Collections. Once you identify that you can grow your reputation regionally and nationally for those core collections but also you can use it to guide some of the other plant collections. We are starting to try, we've got a lot of *Taxodium* and we know swamp azaleas will grow with them, but what else will grow with them? It starts to lead us along a question and trial and error path where we want to identify possible other plants that would be good combinations with our core collections so we can really utilize them beyond just saying "this *Magnolia* at 20 years will be 20 ft. tall and 20 ft. wide." We want to be able to say "You can underplant it with *Caladium* and it will be beautiful. But, you can also use dwarf *Alpinia* and things like that as well."

I think that for us it is important, like I said, to grow our reputation but also when you have a core collection you start to be able to "hang your hat" on that and you get people in the industry that are interested in those plants. We've had Dr. Creech from FSA here. We've had Tom Cox here. We've had a lot of people that do *Magnolia* breeding come through here and those people are attracted to the garden because of these collections. I would like to say it's our award winning personality but they definitely come through because they are interested in seeing that sort of DNA and when you are attracting people in the industry to come to your garden, the word of

mouth starts to spread. I think that is much more valuable than any kind of advertising campaign than you can run. You are all the way up in Delaware and Tony Aiello knew we were a good garden to speak too. It allows us to continue to network and grow in the industry, so I think again, it all comes back to core collections and that you can get someone to come here because of those. And, when they are here, maybe they start to notice other things too. But, they are there because you had that core collection.

Researcher: How would your core collections be communicated internally to staff and externally to the public?

Huggins: This is actually a great question because we just started to develop an interactive map that we are going to be uploading to our website, hopefully sooner than later. You will be able to go in and if you are interested in, say, deciduous magnolias, there will be kind of like a map that we have gleaned of the property and it will have tags for every single deciduous *Magnolia* and you will be able to click on the tag and the tree will pop up with pictures and a description. We are developing that as we speak and that is going to be one of our biggest development in terms of interacting with the public-at-large. When visitors come to our gardens it is something that we make sure to mention that we have a *Magnolia* Collection, and we have large *Taxodium* Collection, and we are a conifer reference garden. And then as far as staff goes, during the onboarding process, we do emphasize the expectations for core collections in particular as well as our collections in general. Even people in education or maintenance understand that the magnolias, taxodiums, and conifers are more important than a white pine growing out in the middle nowhere. Even people who

would be thought of as having an idea of that thing are able to answer questions when it comes to that information.

Researcher: Would your institution be interested in assigning priority levels to individual plants or collections of plants?

Huggins: I think that is definitely a long-term goal of ours as we are growing and start to identify collections that we want to prioritize. They are raising their own kind of priority level in terms of protection. Our hopefulness is that we are able to prevent a lot of damage to our core collections but we also want to be prepared for the inevitable natural disasters that are coming through the area. I think some of the natural disasters have helped us up the collections out into the garden but they've also raised our awareness level that we need these plants being constantly re-grafted in the nursery so we have plants ready to go if something happens to them.

I think it's going to end up being a little bit more, even within the *Taxodium* Collection… For example, 'Shawnee Brave' is very easy to come by in the nursery trade in the southeast. There is another *Taxodium* 'Cristata' that is very difficult to come by and was created by a nursery in Holland or Belgium, I think it was Holland. I wrote and asked them if they could recommend anyone in North American who had the plant material. They said it was a horrific tree and we don't graft it anymore we don't recommend anyone who has it keep it. Some of it is just trying to get some of these materials in here because nurseries are getting rid of them and you don't know when the genetic diversity will be necessary or if someone is trying to breed certain characteristics into a tree, you don't know which of these cultivars will have what they

are looking for. Another great example is *Taxodium* ‘Gabriel’ which is from Ohio that a landscape architect found. I want to say the Dawes Arboretum has the majority of ‘Gabriel’ and they’ve found that it is too slow growing to be of interest to landscapers, but botanic gardens have a desire to acquire it. And then they’ve run into the problem, most *Taxodium* are easy to graft and for whatever reason, ‘Gabriel’ is hard to graft so we are working with them on acquiring some of those plants so we can have them. If something were to happen to Moore Farms they would have that genetic backup in Illinois, but conversely if something were to happen there, we would have genetic backups here. We are trying to work with other gardens to ensure that these things aren’t getting lost and all those things go into the priority of saving certain specimens. I think at this point in our development it’s hard to say how we would prioritize for the future. But, we also know if we are the only place that has a certain cultivar that will end up being a much higher priority plant than something that we can drive down to Florida, Georgia, North Carolina, or South Carolina and buy a new one. That will be a lower priority.

Appendix I

CASE STUDY SUMMARIES

The following case study summaries were derived from interviews, websites, and institutional documents from each participating institution. Selected interview transcriptions can be located in Appendix H.

Denver Botanic Gardens

Background Information

Located in the middle of Denver, CO, the Denver Botanic Gardens (DBG) comprises 23 acres at their main York Street location which contains a conservatory and a variety of theme gardens, grouped into the following categories: Gardens of the West, Internationally Inspired Gardens, Ornamental Gardens, Shady Gardens, Water Gardens, and a Children's Garden. The organization also owns property at Chatfield Farms, a 750-acre native plant refuge and working farm, located 30 minutes southwest of the main garden campus. The mission of the Denver Botanic Garden is "to connect people with plants, especially those of the Rocky Mountain region and similar regions around the world, providing delight and enlightenment to everyone" (DBG, 2007). Horticulturists working at DBG take care of three or four garden areas and are responsible for "everything from overall aesthetics to the collections records and working with the plant records team to keep things mapped, inventoried, and labeled" (Newlander, 2016). DBG uses BG-BASE and BG-Map software to maintain plant records. Information regarding the living collection can be accessed online through DBG's Gardens Navigator. The living collection at DBG holds more than 32,000 plants, representing around 14,000 taxa (DBG, 2008a). DBG is home to two

Nationally Accredited Plant Collections™ (NAPC), Alpines of the World and *Quercus*, the latter of which is part of a multisite collection. See Table 14 for full core collections information.

DBG has a Collections Plan, a Collections Management Policy, and a Horticultural Standards Manual. The first two documents cover the living collection as well as herbarium, library, and art collections. The Collections Plan outlines the scope of these collections, acquisition, accessioning & documentation, deaccessioning, disposal, access, exchanges, loans, gifts, exhibitions, and care & maintenance. The Collections Management Policy gives an in-depth analysis of each collection, including a collection description, collection content summary, history of the collection, justification for having the collection, strengths, weaknesses, opportunities and priorities, implementation strategy (with timeline), and evaluation procedures (DBG, 2008a). The Horticulture Standards Manual outlines "sound horticultural plant care practices" used on the living collection (DBG, 2007).

Living Collections Organization

The organization went through the core collections selection process around 2005-2006 mainly for the purposes of American Alliance of Museums (AAM) accreditation and in conjunction with a Master Development Plan (MDP) in 2007 (Newlander, 2016). One of the goals in the MDP was to "unify and strengthen core collections." As outlined in the MDP, each core collection was required to meet the following criteria: relevance to the mission and garden narrative, contribution to the legacy of historic assets, displays Best of Class and four-season interest, transformative in their ability to captivate and inspire, unique reflection of plant and material selection, provide balance between art and science of horticulture, and

demonstrate best management practices in horticulture (DBG, 2008b). Core collections were chosen by an 8-10 person committee consisting of the Director of Horticulture, Director of Outreach, Senior Curator, staff from the curation team, and horticulture staff. DBG's core collections are listed in Table 14. In general, one to three staff members collaborated on each of the seven collections. Staff looked at future directions of each core collection, how they could be built, and how to improve upon existing collections. At the time, a few of the core collections did not have a specific curator assigned to them, prompting an increase in curation staff from two to five. Ideally, each core collection was to be reviewed ten years after publishing the Collections Management Policy. In reality, this has not been the case due to a major capital campaign and construction in about one third of the Garden in the last ten years. It will most likely become the focus in 2017 when a new Collections Plan will be drafted to reflect goals for the next ten years (Newlander, 2016).

DBG's core collections are not mutually exclusive. For example, plants in the Cactus and Succulent Collection could easily be included in the Steppe Collection. Staff have not come up with a good way to assign plants to a specific collection in BG-BASE, but work has been done within the Alpine Collection because of its NAPC status. Alpine plants have been assigned as "Alpines of Europe," "Alpines of Asia," and "Alpines of North America" so they can be retrieved easily from the database. Staff have discussed completing this with the other core collections so they are recorded electronically and are easily accessible instead of having to rely on staff members to remember during inventory checks. There are a few collections at the garden that were not included as core collections. This includes seed collections and

the native tree Bonsai display. However, these two collections could be grouped into the Native Collection (Newlander, 2016).

Core collections are communicated to the public through methods listed in Table 14. On the institutional website, core collections are listed along with brief descriptions under the living collection webpage (DBG, 2017). Core collections are covered during volunteer docent training as part of a four hour, two session talk given by the Associate Director of Horticulture, and in tours by horticulture staff. Additional interpretation is provided in the garden via signs located in the Science Pyramid, and in specific garden areas. The Science Pyramid is an interpretive center where visitors can learn about research at the DBG, the Plant Select® program, and connections with the environment of Colorado and the arid west. The Steppe Collection most recently received focused interpretive signage because of its location in a newer garden area (Newlander, 2016).

Perceived Benefits and Importance of Collections Prioritization

The process of core collections identification has benefited DBG with funding opportunities and grants, and vision planning for the next 50 years, as part of the master planning process. At DBG, staff looked at which gardens were “sacred places that had to stay and which gardens and collections would be able to survive anywhere on the grounds” (Newlander, 2016). As part of this process, garden spaces were allocated to showcase specific groups of plants such as the Plant Select® program or the All-American Selections of annuals and new garden areas were added to support additional collections. Collections prioritization also helps in building upon existing core collections. Additions to the Steppe Collection has driven development for collecting trips to Morocco, Kazakhstan, and South Africa (Newlander, 2016).

Identification of priority collections has benefited DBG in planning for construction projects. When dealing with potential removals, Newlander (2016) looks at which plants are of wild-collected provenance, which are represented elsewhere in the garden, and if they could be relocated elsewhere. If mature specimens cannot be moved, DBG will take cuttings and try to propagate the specimen to keep it in the collection.

Brooklyn Botanic Garden

Background

Brooklyn Botanic Gardens (BBG) is located in Brooklyn, NY. The land was reserved in 1897 by the state of New York and the garden was officially founded in 1910 (BBG, 2017a). Today, the BBG comprises 52 acres and has a total of 28 garden areas and conservatories: Discovery Garden, Children's Garden, Herb Garden, Rock Garden, Plant Family Collection, Compost Exhibit, Aquatic House and Orchid Collection, Desert Pavilion, Tropical Pavilion, Warm Temperate Pavilion, Bonsai Museum, Lily Pool Terrace, Perennial Border, Annual Border, Magnolia Plaza, Daffodil Hill, Bluebell Wood, Japanese Hill-and-Pond Garden, Celebrity Path, Fragrance Garden, Shakespeare Garden, Tree Peonies, Cherry Esplanade, Rose Garden, Native Flora Garden, Lilacs, Osborne Garden, and the Water Garden. (BBG, 2017c). BBG's mission statement reads as follows:

> Brooklyn Botanic Garden is an urban botanic garden that connects people to the world of plants, fostering delight and curiosity while inspiring an appreciation and sense of stewardship of the environment. In the Garden, in its community, and well beyond, BBG inspires people of all ages through the conservation, display, and enjoyment of plants; with educational programs that emphasize learning by doing; and with

> research focused on understanding and conserving regional plants and plant communities (BBG, 2015).

BBG uses a custom FileMaker Pro database to manage the living collection. They received a grant from the Institute of Museum and Library Services (IMLS) to switch over their plant records system from BG-BASE because they wanted to "go with a more decentralized accessioning and record keeping system" (Sifton, 2016). Curators and gardeners both have curatorial responsibilities and switching to FileMaker Pro allowed for more self-directed plant records responsibilities. Only woody plants and perennials are accessioned and information on BBG's plant collection can be accessed online through a searchable database. As of October 2016, BBG's plant records system held a total of 43,905 accessions (18,129 living) with 95,226 individual specimens (BBG, 2017b). BBG has a Living Collections Policy, a Disaster Plan (in draft phase), a turf plan, and management plans written for some of the collections. BBG does not hold any Nationally Accredited Plant Collections™. See Table 14 for full core collections information. BBG has a full-time plant records staff member and a nine-month plant records intern. Other horticulture staff also share curatorial responsibilities. At the time of the interview, BBG was in the process of hiring a Living Collections Director, a position that was previously vacant for a year and is only about three and a half years old. The next Living Collections Director will be involved with mapping the living collection via GPS. The goal for BBG is to aim for a 20-25% collections inventory every year (Sifton, 2016).

Living Collections Organization

BBG's Living Collections Policy was revised in 2013-2014, about ten years after the previous edition was published. At that time, core collections were selected by a mix of "directors, board committees, and horticulture, education, and

interpretation staff" before being sent for full board and president approval (Sifton, 2016). The garden was "developed as a concept of many gardens within a garden" so the core collections are often synonymous with a geographic location within the garden but are also scattered across the landscape. The notable Systematic/Taxonomic Collections were chosen based on numbers of taxa and for historical significance (Sifton, 2016). As an example, the Magnolia Collection represents the history of *Magnolia* breeding at the BBG. The Education, Research, and Display Collections are curated by the Education Department because of the need to be "more flexible for classes and research." Annuals are not formally accessioned but it is a future goal to develop a plant records system for annuals, vegetables, and herbs, mainly for labeling and tracking purposes (Sifton, 2016).

Individual staff members have management plans for collections they oversee. It is a goal of BBG to transform these individual plans into a cohesive document to accompany the Living Collections Policy. As a next step, "depending on the stage and the curator of the collection, [BBG] may or may not incorporate collections development planning into those management plans" (Sifton, 2016).

Plants are not tagged as belonging to certain collections in the database. For the most part, core collections are spatially based in a specific garden area or are identified by genera or family. As such, an accessioned plant could belong to more than one core collection.

Plant collections are communicated with the public on the website with the help of the Digital Communications Team. They gather photos, and keep the website, blog, and social media accounts up-to-date with "exciting opportunities within the collections" (Sifton, 2016). Horticulture staff are encouraged to stay in contact with

the marketing team to promote the collection and also promote topics the public might also be facing in their own gardens, such as pest or disease issues. The living collection can also be accessed by the online database and Sifton does a quarterly "data dump" to provide the public with information about the living collection. Specific location information about rare taxa is withheld from the online database to discourage vandalism. Staff can access the living collection through iPads and are able to log onto the database easily while in the field. Access to information about the living collection continues to be a work in progress, especially tracking and location data and adjustments due to new construction projects in the garden (Sifton, 2016).

Additional future living collection goals of BBG include: accessioning 20,000 perennials that were planted in the new Water Garden, applying for American Alliance of Museum Accreditation, potentially applying for a NAPC, and updating the Disaster Plan. BBG is interested in assigning priority levels to individual plants within the living collection. They have already started this in conjunction with the Disaster Plan. The Disaster Plan would need to include collections of mature trees to smaller plants such as "endangered tiny orchids" where "extreme heat or cold" could spell disaster (Sifton, 2016). Currently, prioritization has only been assigned to trees. BBG has an arboricultural assessment process for the mature trees on the property, which is primarily for risk management and veteran tree care.

Perceived Benefits and Importance of Collections Prioritization

Sifton (2016) identifies several benefits to collections prioritization. The first is related to the difficulty in unifying "curatorial responsibilities in terms of the collections… at the garden with outside designers" while working on capital projects. New collections added to the garden must be relevant to the mission of the institution

and “it is not always obvious how to go about that” without a clear collections policy. Second, collections prioritization “brings value to the collections overall” especially when “clearly delineated and well though through policies and procedures” are in place. Staff at BBG are diverse and are not necessarily long-term, and having clearly organized living collections “brings a whole new level of robustness and security and sustainability to the whole process and to the management of the garden” (Sifton, 2016). This is especially true for disaster planning in terms of staff changes, pest and disease outbreaks, operational disasters, and even civil disobedience. Having policies and plans for the living collection is essential. Sifton (2016) explains: “if people don’t write anything down and it all lives in somebody’s head,” detailed plans are required “so people can understand what we’ve got, how we’ve been maintaining it, how we want to maintain it, and where we are going with the whole thing.” In the face of pest and disease outbreaks, such as Asian long-horned beetle, which has already plagued BBG once before, the institution will be able to advocate for the collections and ensure backups are propagated of important germplasm. Third, the establishment of the Living Collections Director position three and a half years ago was instrumental in moving forward with the collections organization process (Sifton, 2016).

University of Washington Botanic Gardens

Background

The University of Washington Botanic Gardens (UWBG) is located in Seattle, WA and consists of two sites along the shoreline of Union Bay, Lake Washington: the 230-acre Washington Park Arboretum and the 90-acre Center for Urban Horticulture/Union Bay Natural Area. The Washington Park Arboretum (WPA) and

Center for Urban Horticulture (CUH) were founded in 1934 and 1984, respectively. In 2005, the two properties were united under the UWBG name. UWBG is part of the School of Environmental and Forest Sciences in the College of the Environment and is jointly managed by the UWBG and the City of Seattle's Department of Parks and Recreation, and receives fundraising support from the Arboretum Foundation (UWBG, 2017b). The mission of the UWBG is: "Sustaining managed to natural ecosystems and the human spirit through plant research, display, and education" (UWBG, 2012).

WPA is divided into garden areas including the Pacific Connections Garden, the Joseph A. Witt Winter Garden, the Woodland Garden, Shoreline and Foster Island, Rhododendron Glen, Azalea Way, and a Japanese Garden. Other plants are grouped taxonomically by genera or family (UWBG, 2017b). CUH contains the following garden areas: Soest Herbaceous Display Garden, Seattle Garden Club Fragrance Garden, McVay Courtyard, Goodfellow Grove, and the UW Farm. The Elizabeth C. Miller Library, Hyde Herbarium, Miller Seed Vault, Union Bay Natural Area with the Yesler Swamp are also located on the CUH property (UWBGb).

UWBG uses BG-BASE for their living collections database and uses ESRI's ArcMap to record location data. The living collection can be accessed online through a searchable database and an interactive map. The living collection contains over 12,700 specimens representing around 4,000 taxa. 2,308 accessions are of known wild origin (UWBGb, 2017b).

UWBG has a Collections Policy written in 2012, a Conservation Policy written in 2013, and the Washington Park Arboretum Master Plan was adopted in 2001. UWBG holds Nationally Accredited Plant Collections™ of *Acer*, *Ilex*, *Magnolia*, and

Quercus. Core collections are not outlined in the collections policy but are described on the institutional website (UWBG, 2017a).

Living Collections Organization

UWBG's core collections are listed in Table 14. Core collections were selected based on historical emphases and as part of the 2013 addition of the Pacific Connections Garden. In the beginning, the initial mission of UWBG was to collect everything that could grow in the Pacific Northwest climate and the original Olmsted Brother's plan was to group collections taxonomically. Past directors of the Arboretum drove the organization of collections as well as sponsorship by garden clubs. For example, the Tacoma Garden Club "took a special liking to Japanese maples and maples in general" and a collection was added (Larsen, 2016). Brian Mulligan, who started as Director in 1946, laid out the major collections and abandoned the taxonomic grouping system because the "plant families and genera within them [didn't] want to be glued to the same soils and same types of aspects." As a result, established collections such as the hollies, magnolias, maples, and oaks remain in place while the newer ones have been moved elsewhere. Joe Witt, a later curator, was very active in the American Association of Botanic Gardens and Arboreta (now American Public Gardens Association) and with collections planning. When Timothy Hohn, the subsequent curator was hired, the collections organization and development became more serious with "large groups of species established within various genera." Hohn was responsible for writing a collections policy in the late 1980's along with then Director, Harold Tukey (Larsen, 2016).

Currently, the living collection is prioritized only at the collection level and not at the individual plant level. Part of this is due to limited staff time. Prioritization at

the individual plant level is only communicated verbally and as part of the staff review process. Individual accessions of conservation concern (rare or endangered species) are given special emphasis and the "gardeners assigned to those collections know that those need the most attention" (Larsen, 2016). If UWBG were to prioritize at the individual plant level, information would not be recorded in BG-BASE but would be available on a series of documents on the server because training all the staff in BG-BASE would be too difficult. As part of the Arboretum Loop Trail Project, UWBG did assign values to trees potentially impacted by the construction, based on a standard International Society of Arboriculture formula. "Price tags" were posted on the trees, "mostly for the benefit of the construction team so they [wouldn't] damage things" (Larsen, 2016).

Core collections are communicated internally in monthly meetings with staff from the curation, education, horticulture and maintenance/facilities departments. "New directions and directives" for the collections are discussed in these meetings (Larsen, 2016). UWBG has a Curation Committee consisting of the UWBG Administration, UW Faculty, a Hyde Herbarium representative, UWBG Horticulture and Plant Records Staff, UW student(s), and a Seattle Parks and Recreation Representative (UWBG, 2012). The Curation Committee meets with individual gardeners to "talk about how things are going, what their concerns are, and what [the committee's] plans are." In terms of public outreach, UWBG staff highlight the collections when giving lectures to civic or gardening groups. Core collections are also mentioned during tours of the Arboretum, in the *Arboretum Bulletin*, on the Arboretum tour map, and on the UWBG website as monthly core collection or plant highlights. Now that the information on the living collection is online, UWBG is

getting more research requests from the University of Washington as well as outside universities interested in the unique taxa UWBG holds (Larsen, 2016).

Future collection goals include adding more NAPC (possibly *Sorbus*) and building upon diversity within genera and families that UWBG already has strengths in. Larsen (2016) would like to engage in more plant collecting trips to increase diversity in native plant material and add more wild-collected germplasm to the collection. Another goal is to accession plants in the "native matrix" and work on accessioning perennial herbaceous material. Management plans for core collections need to be formalized and expanded to include all core collections. The only core collections with management plans are the NAPC because this was required as part of the accreditation process (Larsen, 2016).

Perceived Benefits and Importance of Collections Prioritization

Membership in the Plant Collections Network has raised the profile of UWBG "among established arboreta" as well as in the public sphere (Larsen, 2016). NAPC are advertised on tours of the Arboretum and the accreditation certificates are displayed in the Visitor's Center. Being a member of APGA has helped with national recognition and networking for research opportunities. Larsen states that having core collections of plants encourages the casual visitor to think about what might be blooming at the Arboretum and encourages repeat visitation. Perhaps a visitor came to see the cherries blooming one week. During their visit, they might learn about the Magnolia Collection and come back a few weeks later to see another floral display. Highlighting unique collections boosts the perceived value of the institution to the public as well as within Washington State. UWBG also participates in the Great Plant Picks program, a committee comprised of horticulturists from the Pacific Northwest.

This group includes staff from other public gardens such as the University of British Columbia Botanical Garden, Hoyt Arboretum, and the E.C. Miller Botanical Garden. This local network has encouraged “collaboration between the regional gardens” (Larsen, 2016).

During the master planning process, discussions about the importance of certain collections came up and the reasons for keeping nationally significant collections in place instead of moving them elsewhere. The master plan gives a formula for suggested maintenance levels (full-time employees per acre) for garden areas in terms of “how many gardeners and staff people we should have for what is in place or what is desired” (Larsen, 2016).

UWBG has not leveraged the core collections directly with fundraising efforts, but there is potential for this to happen. It is difficult to raise money for existing garden areas and maintenance compared with new garden construction. For the New Zealand and Siskiyou Mountains/Cascadia collections, suggested maintenance levels provided in the Master Plan were used to request funding from the Arboretum Foundation. There has been some talk of “endowing a collection but mostly that has been in the idea phase” (Larsen, 2016). Potential donors may be interested in helping with a specific named collection or garden area, such as the Rhododendron Glen, rather than contributing to a general fund. What is needed is a “slow building of awareness” of the core collections. Larsen tries to build this cognizance by writing a yearly article in the *Arboretum Bulletin* with information on current and future collections-related projects.

Morris Arboretum of the University of Pennsylvania

Background

Located in Philadelphia, PA, the Morris Arboretum was founded in 1887 by siblings John and Lydia Morris. After Lydia's death, the property became associated with the University of Pennsylvania in 1932 as a public garden and arboretum. The Morris Arboretum is the official Arboretum of the Commonwealth of Pennsylvania. The mission of the Morris Arboretum is as follows:

> The Morris Arboretum of the University of Pennsylvania is a historic public garden and educational institution. It promotes an understanding of the relationship between plants, people and place through programs that integrate science, art and the humanities. The Arboretum conducts four major activities: education, research, outreach, and horticultural display. As the official Arboretum of the Commonwealth of Pennsylvania, the Morris Arboretum of the University of Pennsylvania provides research and outreach services to state agencies, community institutions and to citizens of Pennsylvania and beyond (Morris Arboretum, 2007).

The Morris Arboretum's 92-acre Compton property contains the following garden areas: Azalea Meadow, Cottage Garden, Dorrance H. Hamilton Fernery, English Park, Garden Railway, Herb Garden, Holly Slope, Japanese Hill & Water Garden, Japanese Overlook, Magnolia Slope, Oak Allée, Orange Balustrade, Out on a Limb, Pennock Flower Walk, Rose Garden, Widener Visitor Center, Sculpture Garden, Wisteria Walk, Swan Pond, Spring House, Meadow, Wetland, and Penn's Woods. The Arboretum also extends across the street to the 74-acre Bloomfield Farm property which houses the Horticulture Center, Springfield Mills, and research/evaluation plots (Morris Arboretum, 2017c). The living collection contains approximately 12,000 accessioned plants, representing 2,500 taxa and thirty-seven percent of the living collection is of wild origin (Morris Arboretum, 2007). Only

woody plants are accessioned at the Arboretum and about half of the large trees in Penn's Woods have been accessioned into the collection (Aiello, 2016).

The Morris Arboretum has a history of plant collecting and focuses on taxa from "eastern Asia, the Caucuses, Pennsylvania, and eastern North America." Significant plant collections at Morris include maples, magnolia species, native azaleas, the witch hazel family, roses, hollies, and conifers" (Morris Arboretum, 2007). Morris holds Nationally Accredited Plant Collections™ of *Abies*, *Acer* (multisite), and *Quercus* (multisite).

Information on the living collection can be accessed online through the Collection Connection, an interactive map and database powered by BG-Map (Morris Arboretum, 2017a). A *Catalogue of Plants on the Living Collection* can be downloaded on the website and is available in the Visitor's Center. Morris has a Living Collections Policy (LCP) and a Disaster Plan. The current LCP dates to 2007 and Aiello plans on revisiting the LCP to "relook at [the] core collections, update the invasive plant policy, and also look at things like plant conservation efforts" (2016). The Disaster Plan was written for the purposes of AAM accreditation. It covers damages to the collection, structures, buildings, and non-living collections in the herbarium and library (Aiello, 2016).

Living Collections Organization

The Morris Arboretum's core collections are listed in Table 14. Core collections are described in the Living Collections Policy as "significant plant groups." Collections have been developed over time, mostly at the discretion of previous directors and curators. In some cases, it is easy to point to an origin. The *Ilex* Collection originated during the time of Dr. Henry Skinner, the first curator, in the

1940's and 1950's. Dr. John (Jack) Fogg, director from 1954-1967, was a founder of the Magnolia Society, and developed the Magnolia Slope. These collections were already well established when Aiello was hired as Director of Horticulture and Curator. He states the collections as they are today "evolved from looking at what we had done and then trying to predict moving forward what we want to continue to focus on" (2016). The *Prunus* Collection of flowering cherries had always been a focus of the Arboretum, but Aiello chose to further refine the collection about 6-7 years ago. Other collections such as *Acer*, Hamamelidaceae, and conifers, were gradually added to by staff and "they became important collections." When Aiello was hired, the number of *Hamamelis* accessions and taxa dramatically increased in the early 2000's partially because it was of personal interest, but also because "John Morris planted witch hazels" and "during the Dr. Fogg era there was a witch hazel collection developed" (Aiello, 2016).

Specimens in the Heritage Tree Collection date back to the era of John and Lydia Morris or existed on the property prior to WWII. A few other trees planted in the 1930's are included in the collection as well. These trees are "emblematic of the Arboretum" and are integrated in the Heritage Tree Collection primarily because of the "size and age of the tree," and because they can't be propagated or are rare (Aiello, 2016). Some trees, like the *Fagus engleriana* are rare in cultivation, others like the large *Cercidiphyllum japonicum*, are not significant from a germplasm perspective, but are valued because of their mature size and status as Pennsylvania State Champion Trees.

Management plans for core collections have not been written, but the Heritage Tree Collection does have its own priority system. The Top 25 and Top 100 trees have

been selected from the overall living collection and this information is stored in BG-BASE. The goal is to "at least inspect and work on" the Top 25 trees every year and the remaining 75 trees "every other year or so." If management plans were to be written for each core collection, a "combination of all people in the horticulture department" would be involved with its implementation (Aiello, 2016). This would include the Curator, Propagator, Plant Recorder, Arborist, and all horticulture staff Core collections are the Morris Arboretum are dispersed across the landscape, so "everybody would have to be involved…except for the Rose Collection because it is mostly concentrated in one section" (Aiello, 2016). Aiello (2016) foresees writing a plan "that could address the core collections in a general way" and then would "drill down to each one" individually. Currently, "collections growth goals are not formalized" but this is desired. There have been a few projects in the *Magnolia*, *Prunus*, and *Quercus* Collections that have been implemented informally. One was an intern project that analyzed oak age-classes and species to determine in which taxa the Arboretum had strengths and weaknesses. Growth of other collections, in the case of the witch hazel and Japanese maple collections, was guided by the desire to increase diversity and showcase representative cultivars. Altogether, "the approach has been methodical but [without] an overarching plan" (Aiello, 2016).

Aiello states a need to "circle back to some of the core collections and do a gap analysis," specifically in the *Magnolia* and Conifer Collections. For the *Magnolia* Collection, adding "three or four taxa per year over the next 5-7 years" would be beneficial. Likewise, broad collection of conifers, *Abies* in particular, has not been a focus recently, but should be a future goal. Potential future collections emphases could

include a broadleaf evergreen collection and a collection of rare plants, “either technically rare in the wild or rare in cultivation” (Aiello, 2016).

Core collections are communicated with the public during collections specific programming such as themed festivals and events promoting seasonal changes in the landscape. Docents and staff lead collection-based tours of the Arboretum such as the Conifer Tour. Online, self-guided tours are also available for “Great Trees,” Native Trees,” and “Witchhazels” (Morris Arboretum, 2017d). Aiello also strives to share information about the living collection within the public garden world by uploading the current plant list to Botanic Gardens Conservation International and publishing in professional journals such as the *Magnolia Society Journal*, *The Plantsman*, *Curtis’s Botanical Magazine,* and *Arnoldia*. Horticulture staff working at the Arboretum gain an understanding of collection priorities during annual reviews alongside the Director and Curator. During this time “broad collections goals are set” (Morris Arboretum, 2007). Collections priorities for the Top 100 Trees are primarily shared with the arborist staff. Aiello (2016) believes staff “have a pretty good idea of what [the Arboretum’s] strengths are” but perhaps the non-horticulture staff may not know the collections concentrations.

Perceived Benefits and Importance of Collections Prioritization

Identification of core collections benefits the Morris Arboretum by supporting “all aspects of [the] mission, whether it’s education, events and programming, or research” (Aiello, 2016). In terms of education, collections are highlighted in “programming or classes related to core collections.” The Arboretum hosts two events tied to core collections: a Japanese Cherry Blossom Festival every spring and witch hazel tours and events in late winter. Professional programs such as the International

Maple Symposium are often held at the Arboretum as well as “professional classes on tree care, plant identification, or botany.” And, “in a very broad sense” the Arboretum conducts “propagation and evaluation research of plants in the core collections” (Aiello, 2016). Results from conducted research are later published and advertise the importance of the living collection at the Morris Arboretum to a broader audience.

The Arnold Arboretum of Harvard University

Background

The Arnold Arboretum of Harvard University is located in Boston, MA. It was established in 1872 and became affiliated with Harvard University when the trustees of James Arnold’s will transferred a portion of his estate to Harvard College. Charles Springer Sargent became the first director of the Arboretum in 1873 and Frederick Law Olmstead was commissioned to design the Arboretum in 1874 (The Arnold Arboretum, 2017e). The Arboretum was originally laid out according to Bentham and Hooker’s taxonomic classification system with plants arranged by family and genus and this tradition continues today. Major areas of the Arboretum include the: Azalea Border, Bussey Brook Meadow, Bradley Rosaceous Collection, Conifer Collection, Cosmopolitan Meadow, Crabapple Collection, Explorers Garden, Hemlock Hill, Larz Anderson Bonsai Collection, Leventritt Shrub & Vine Garden, Lilac Collection, Maple Collection, Rhododendron Dell, Peters Hill, Hunnewell Visitor Center (The Arnold Arboretum, 2017d). The mission of the Arnold Arboretum is as follows:

> The Arnold Arboretum of Harvard University discovers and disseminates knowledge of the plant kingdom to foster greater understanding, appreciation, and stewardship of Earth’s botanical diversity and its essential value to humankind. (The Arnold Arboretum, 2016).

Today, the Arnold Arboretum consists of 281 acres and, as of March 2017, contains 15,441 accessed plants representing 3,825 taxa (The Arnold Arboretum, 2017b). The Arnold Arboretum has a tradition of plant collecting, particularly in North America and eastern Asia. In 2015, the Arnold Arboretum announced its Campaign for the Living Collections, a 10-year initiative to expand upon the living collections "as a valuable resource for scientific research and conservation" (The Arnold Arboretum, 2017a). Staff at the Arboretum have published a refined list of desiderata, or collection target list, of almost 400 species. Components of the Campaign include plant exploration trips to sample and document biodiversity, and improvements to care and collections monitoring through the Landscape Management Plan (The Arnold Arboretum, 2017a).

The Arnold Arboretum uses BG-BASE to record living collection data and ESRI desktop and mobile GIS software to manage geographic information (The Arnold Arboretum, 2017c). Information regarding the living collection can be accessed from the institutional website in a searchable database and through the Arboretum Explorer, an interactive map (The Arnold Arboretum, 2017b).

In addition to the previously mentioned Landscape Management Plan, the Arboretum also has a Living Collections Policy, General Procedures for Managing the Flow of Plants though the Department of Horticulture, and a Plant Inventory Operations Manual. The Living Collections Policy is "reviewed at least every five years, and revised as needed" (The Arnold Arboretum, 2016). The Plant Inventory Operations Manual covers how staff "field check, inventory, and evaluate the collection on a regular basis" (Dosmann, 2016).The Landscape Management Plan covers maintenance for "plants in 70-something zones across 300 different acres."

Each zone is individually described so horticulturists can understand "what weeds are in [the area], how to control them, and what calendar events" are recorded for each area. The Arboretum is in the process of converting this document into a "dynamic system that will never be printed" and will be available online. The previous deputy director, Richard Schulhof, initiated the transition to the dynamic system and the first edition involved the Manager of Horticulture, Assistant Manager of Horticulture, Curator of Living Collections, and Greenhouse Manager. Horticulture and arboriculture staff were involved with the second and third editions (Dosmann, 2016). The Arboretum holds Nationally Accredited Plant Collections™ (NAPC) of *Acer* (multisite), *Carya*, *Fagus*, *Stewartia*, *Syringa*, and *Tsuga*.

Living Collections Organization

The Arnold Arboretum outlines the scope of the collections in its Living Collections Policy. The living collection is divided into three major categories: Core Collections, Historic Collections, and Special Collections. Core Collections "are of highest priority and receive the greatest focus with respect to development, management, and enhancement" and are "regarded as obligatory" (The Arnold Arboretum, 2016). Core Collections at the Arboretum are divided into three secondary collections as listed in Table 14. The four "Robust Genera," act as "national collections in waiting." They are managed differently than the six NAPC, where the goal is for "maximum species diversity" (Dosmann, 2016). Biogeographic Collections are maintained for "maximum breadth" in a phylogenetic sense. For example, it is not the goal of the Arboretum to have "every single *Viburnum* species," but "if *Viburnum* has twelve different subgenera," they will make sure "as many of those are represented as possible." The overarching goal is to "be thoughtful and be as efficient

as possible while having as much diversity as possible" (Dosmann, 2016). Individual core collections do not have management plans, but instead important specimens are referred to in the Landscape Management Plan under an individual plan for the group of beds in which they reside. As an example, suckering shrubs that belong to the Conservation Collection, are to be "maintained as single individuals, otherwise their value is lost" if they were to become mixed up (Dosmann, 2016).

The Core Collections were selected ten years ago by the Living Collections Committee when the Living Collections Policy was updated. The term "core collections" had not been used at the Arnold until this time. The Living Collections Committee was composed "of a few core management staff in horticulture and living collections." Core collections decisions were mostly based on common sense, because these collections would be preserved first if disaster struck and they were central to the mission of the Arboretum. The six NAPC were included because they were "already of national importance" and staff were already prioritizing these collections in the landscape and "in the collections management and curation end of things" (Dosmann, 2016). The Living Collections Committee has since morphed into the Living Collections Advisory Board, which consists of the "Curator of Living Collections…the Director and Manager of Horticulture, as well as external members that are representative of the scientific and botanical garden communities" (The Arnold Arboretum, 2016).

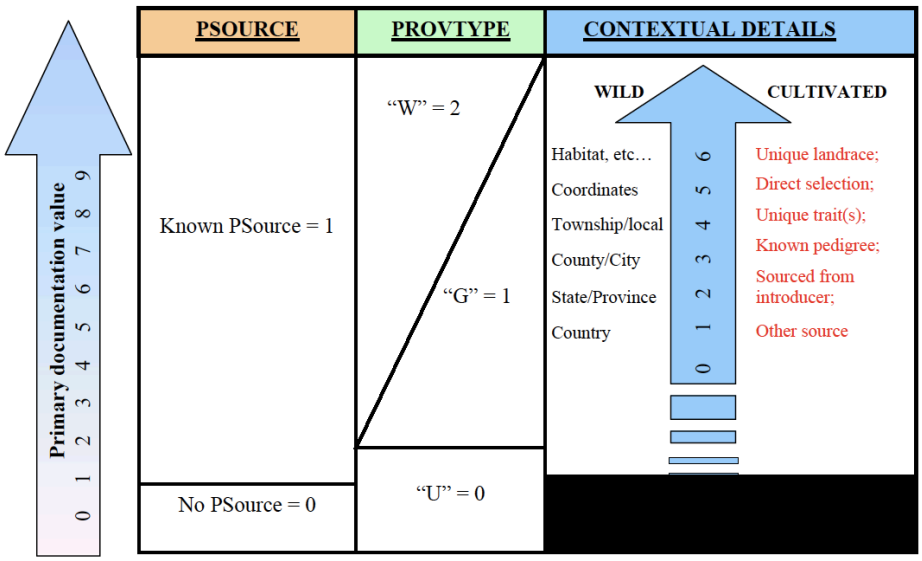
Even with the Arboretum's 150 year history of plant exploration and horticultural introductions, not all plants in the living collection receive the same amount of attention. Dosmann states "not everything can be important, not everything can be of irreplaceable value. We have to, at least at this point in time, place

everything in high, medium, and low categories." Dosmann (2016) stresses the importance of having core collections that are easy enough to remember "so any member of your staff, any member of your board, even your membership staff should be able to at least name a few." Having the term "core collections" built into the "day-to-day language" of the Arboretum is essential. After the collections policy was rewritten, Dosmann gave a presentation at a staff meeting and wrote an illustrative article in *Arnoldia*, the Arboretum's print publication. For the Arboretum volunteers, he held a "raffle with door prizes for those who could name [the] six Plant Collections Network collections at the time." However, for visitors, there is little interpretation at the Arboretum and they must rely on volunteer docents who give tours of the collection. Docents tend to share information about NAPC because it is easy to understand and incorporate into a tour for the public (Dosmann, 2016).

Individual plants or accessions in the Arboretum's living collection are not assigned priority levels. Dosmann considered implementing a prioritization system but it proved too difficult to apply and can only work when an institution has "a very good understanding on how [they] value something." Thus, value systems "are not universal across all collections but they can be unique and discrete for [an individual] institution based on their own DNA and their own mission." Dosmann originally came up with a rating scale, based on a "documentation score," or level of knowledge about a plant's backstory. This works better for wild-collected material than material of cultivated origin. Documentation scores are based on three categories, the plant source (if it is known or unknown), the provenance type (if it is of wild origin, garden origin, or unknown) and contextual details. For wild collected material, contextual details range from details with a low score such as country and state/province, up to high scoring

details such as geographic coordinates or surrounding habitat. For cultivated material, a different scale was developed, ranging from plants sourced from the introducer to those who represent a unique landrace (Dosmann, 2017). Figure 2 gives a graphic representation of primary documentation scores (Dosmann, 2017).

There are several challenges associated with assigning scores and applying ranking systems to living collections. First, the process takes a lot of time. Dosmann does not "have time to go through 10,000 accessions" and it would be easy to "get bogged down in details" (2016). Second, it is easier in theory than in application because there are multiple factors that contribute to a plant's value to an institution. For example, "you could have a plant that scores very low based on its backstory...but it might be the most beautiful plant that you have ever seen" (Dosmann, 2016).



(Dosmann, 2017; used with permission)

Figure 2 Arnold Arboretum: Primary documentation scores

Perceived Benefits and Importance of Collections Prioritization

Identification of core collections benefits the Arnold Arboretum in responding to both disasters and opportunities. If a natural disaster were to occur, staff at the Arboretum could quickly assess the collection to construct what most important plants should be saved or repropagated. Core collections are clearly delineated and "without even the benefit of a database," they could make these decisions. It is important "for museums and gardens to know what is important" (Dosmann, 2016). In a similar vein, responding to an opportunity can be similar to responding to a disaster. If a donor wanted "to drop 20 million dollars…but force you to build a collection you didn't want" that could be considered a "disaster by opportunity." Some gardens might need the money and accept the donor's terms, but others with strong collections priorities can "rank and respond to whatever" is required to stay within the mission of the organization (Dosmann, 2016).

Matthaei Botanical Gardens and Nichols Arboretum

Background

The University of Michigan maintains over 700 acres of gardens, research areas, and natural preserves in Ann Arbor, MI (MBGNA, 2017a). Collections of plants are maintained at the Matthaei Botanical Gardens, Nichols Arboretum, Horner-McLaughlin Woods, and Mud Lake Bog (MBGNA, 2011). The mission of the institution is: "Developing leaders and inspiring people to care about nature and enrich life on earth" (MBGNA, 2017c).

The Matthaei Botanical Gardens (MBG) is a 6 mile drive northeast of the Nichols Arboretum. It contains a variety of gardens which include the following areas: Visitor's Center, Bonsai & Penjing Garden, Great Lakes Gardens, Gaffield Children's

Garden, Medicinal Garden, Alexandra Hicks Herb Knot Garden, Gateway Garden of New World Plants, Helen V. Smith Woodland Wildflower Garden, Marie Azary Rock Garden, Perennial Garden, Sitting Garden, Urban Picket Garden, Ground Cover Display, Labyrinth, Alternative Lawn, Marilyn Bland Prairie, Matteson Farmstead & Historic Farmhouse, Normal Memorial Grove, Conservatory, Campus Farm and five hiking trails (MBGNA, 2017b). The MBG was started as a "joint effort between the School of Pharmacy and the Botany Department well over a century ago," when the focus was on "plant diversity for the pharmacy school but structural diversity for the botany students." The University of Michigan is not a land-grant university and has never had a horticulture department, unlike its counterpart Michigan State University (Michener, 2016).

The Nichols Arboretum is 123 acres in size and houses the following garden areas: Nichols Arboretum Gateway Garden, Alex Dow Field, Centennial Shrub Collection, Heathdale (Julie Norris Post Collection of Ericaceous and Appalachian Plants), Main Valley, Magnolia Glen, Oak Openings, Peony Garden, School Girl's Glen, Clean Water Trail, and Laurel Ridge Trail (MBGNA, 2017d).

Information about the living collections at the Matthaei Botanical Gardens and Nichols Arboretum (MBGNA) is provided on the institutional website. The only available database is for the *Paeonia* Collection which dates to the 1920's and is MBGNA's only Nationally Accredited Plant Collection™. The peony website and online database is supported by an Institute of Museum and Library Services grant (University of Michigan, 2017).

MBGNA has a Collections Policy (in draft phase), Collections Stewardship Policy (in draft phase), and a Disaster Plan. The Collections Policy is currently in the

process of being rewritten and will be published in 2017. MBGNA is also in the process of writing a Collections Management Plan (CMP), as inspired by the Arnold Arboretum's Landscape Management Plan. The Collections Committee, consisting of the Director, Associate Director, Curator, Head of Field Services, Head of Horticulture and Natural Areas, Curator of Native Plants, decided to take a "bottom up" approach to collections management decisions. Garden staff are involved with this process and are asked to break down their garden areas and come up with three-year maintenance cycles that will be described in the CMP (Michener, 2016). The Collections Committee meets twice a year.

Living Collections Organization

Over the approximately 110 year history of the MBGNA, core collections have been based on taxonomic themes or were "historical by accident based on faculty expeditions." Altogether, MBGNA houses a total of "127 different identified kinds of collections or areas that are managed differently" (Michener, 2016). Serious efforts to analyze the living collection began about three years ago when an outside firm was brought in to develop a strategic plan for all four properties for the next 50 years. The strategic plan is expected to reach completion in 2019. One of the goals of the strategic plan is to "identify what is really core, build endowment to run it, and then treat the rest of it as amenity space" for weddings and social events (Michener, 2016). Ideally, core collections will be necessary for University academic programs while the other areas will be managed as an income stream. As part of this process, MBGNA continues to identify "themes that are fundamental" to the institution and will "carry over regardless of fluctuating faculty interests" (Michener, 2016). Part of the strategic plan includes intentionally not developing all properties to allow for future generations

to make their own decisions regarding collection priorities. At the time of interview, Michener (2016) had identified three preliminary core collections as listed in Table 14).

MBGNA prioritizes garden areas in addition to collections of plants. Michener has developed a "prioritization rubric" based on how well current garden areas fit into defined goals for the institution. Goals are presented as four themes: "increase collaborative research and teaching with the University community, expand our leadership in environmental conservation and restoration, advance interpretation and care of our culturally significant plant collections and landscapes, and continue to build innovative outreach programs for connecting people with nature" (MBGNA, n.d.). Nested within each of these themes, specific statements such as "this meets the teaching needs of University of Michigan students" are given a score from 0=no fit to 4=exemplary fit. Scores for each statement are weighted, tallied, and compared between garden areas. Collections are also prioritized based on seasonal maintenance and "the needs of the public to engage with it." For example, the "Peony Garden has to look stunning only during peony season" whereas the Medicinal Garden "is always academically interesting, but no one is going to have their wedding in it." There are a few collections that contain plants from specific collectors "important to the University's history." These remain because they are part of the "historical context" (Michener, 2016).

A few previously named collections have been discontinued. Michener (2016) reports the Ericaceous Collection was removed due to inadequate soil pH and associated disease problems. The Orchid Collection, while historically important, will "probably morph into a tropical epiphyte collection of conservation value." The Dwarf

Conifer Collection still exists but has not been verified in 50 years and "that part of the property will become something else." A collection of important Asian trees and shrubs hardy in the Michigan climate will be reshuffled into a collection of trees and shrubs with "relative disease resistance in North America" or "ecologically viable ornamental shrubs" (Michener, 2016). Instead of choosing themes that are taxonomically-based, staff are defining core collections with more latitude.

Reviews of core collections at MBGNA will depend upon the type of collection and will fall into "three different cycles based on intensity" (Michener, 2016). The Bonsai Collection is in the process of being expanded with the addition of a major gift. This collection is constantly being documented and will require review at least every other year. The Peony Garden will be reviewed every five years. In contrast, major tree collections and natural areas will be reviewed every ten to fifteen years to track large changes. Annuals and display perennials are not accessioned into the collection and only the plant names are recorded (Michener, 2016).

All institutional policies and plans are published on an internal document sharing device to encourage transparency and communication between the four properties. Once the documents are finalized, living collection priority decisions will be documented in three places: the Collections Policy, Collections Management Policy, and a spreadsheet. The spreadsheet acts as a "lookup chart" with priorities for "public amenity" or rental spaces with donor impact" (Michener, 2016). Because they are in the development phase, core collections are currently not advertised to the public. Once they have been designated, they will be publicized on the website.

Perceived Benefits and Importance of Collections Prioritization

Michener (2016) views collections prioritization as a necessary step for disaster planning and for attracting donors. The institution has faced two staffing crises in the last century. Losses to the collection were sustained when staff were unsure of what to prioritize. They "tried grabbing what they thought was interesting or a proportional amount of everything," resulting in loss of important historical accessions. Having clear collection goals "will help when the next crisis comes" and with emergency planning. Identification of core collections also helps in explaining to donors "why they need to endow something or fund summer interns for the next couple of years to work on a collection" (Michener, 2016).

Wellfield Botanic Gardens

Background

Wellfield Botanic Gardens (WBG) is a 36-acre public garden located in Elkhart, IN. WBG leases the land from the City of Elkhart, which maintains and operates 13 wells on-site for community drinking water (WBG, 2017b). The Elkhart Rotary Club started the garden after Rotary International "challenged Rotary chapters to pick a community project" in 2003 for the 100th anniversary of the organization (Steffen, 2017). After the Club raised a quarter of a million dollars, a Master Plan was completed, the garden was incorporated in 2005, and construction began on "25 themed garden and event spaces, as well as a visitor center and guest amenities" (WBG, 2017b). The mission of WBG is to:

> Promote the inseparable relationship between water, plants and animals; inspire creativity and education while celebrating nature; foster stewardship for the natural world; bring people together and

> build community; and provide a spiritual richness to life that is an essential part of being human (WBG, 2017b).

WBG currently employs two full-time staff members, an Executive Director and a Horticulture Manager. The rest of the staff are part-time employees and include an Education Coordinator, Office Administrator, Chief Financial Officer, Volunteer Coordinator/Guest Services, seasonal horticulture staff, and Visitor Center Staff (Steffen, 2017).

Implementation of the Master Plan is currently 40-45% complete and the garden contains the following areas: Annual Garden, Conversation Garden, English Cottage Garden, Sensory Garden, Adventure Path, Traditional Boarder Garden, Waterfall Garden, Lotus Creek Garden, Pergola Garden, Spring Garden, and West Promenade Garden, Woodland Conservation Garden, and Visitor's Cottage. The Children's Garden, Hosta Garden, and Swan Island Garden are still under construction and several other garden areas Amphitheater, Wetlands Learning Center, and future Visitor's Center will be eventually built according to the Master Plan (WBG, 2017a).

WBG has a Collections Policy, written in 2014. Collection priorities divided into two tiers and are spelled out in this document. First tier collections priorities are placed upon:

> Emergent wetland, northeast woodland and nativar plant materials of other habitats; plant materials of documented wild source or vegetative propagation from such plants…; Plants classified as type, rare, threatened, endangered or sensitive by international, federal or state agencies or NGO's specializing in plant conservation for ex situ conservation purposes (WBG, 2014).

The second tier of plant collection priorities include:

> Plants of botanical, horticultural, cultural or genetic research or educational interest. Resource availability (i.e. staff, facilities and space) must be adequate for sustainable care of plant(s) (WBG, 2014).

Only permanent plants are accessioned into the collection. Thus, annuals, seasonal display material, and tender perennials are not accessioned (Steffen, 2017). Staff are also working on a Canopy Management Plan to preserve existing trees on the property.

Living Collections Organization

The living collections at WBG are not divided into separate plant collections at this time. Instead, emphasis is placed on development of garden areas rather than collections of plants. Because the founders of the garden were mostly business-oriented Rotary Club members, their reasons for starting a botanic garden were "strictly driven by civic-mindedness" and donor interest (Steffen, 2017). Consequently, none of the design, arrangement, or acquisition of plants was originally driven with the intent to develop an organized living collection.

Steffen (2017) understands the importance of having plant collections even though WBG functions primarily as a display garden. Steffen remembers acting as a "counter-voice against the people involved with building to make them think about other things" and to consider the importance of having clearly defined living collection goals. In 2004, he brought together "several people who were on the board, people from extension, and somebody who had been a director at a garden" to determine collection priorities and to write the collections policy (Steffen, 2017). Because the property is fifty percent water, the group decided to focus on plant material for "water/land edge zones" as well as native plants and "nativars" (native plant cultivars). When these emphases were chosen, several garden areas had already been built, "without any thought to plant collections or plant collections priorities." However, the Collections Policy has informed plant additions and plant lists for new

garden areas and Steffen (2017) has started to include “more native species or ‘nativars’ into the mix.”

A few collections of plants, specifically *Magnolia* and *Rhododendron*, have developed as WBG has become more established, but growth of these collections has largely been mediated “by the landscape architects and whims of the people involved so far.” Until the point that the Collections Policy was written, “there was no top-down, intentional focus” (Steffen, 2017). Steffen would not use the term “core collection” to describe these plant collections because this is not the focus of the organization at this stage. Instead, collection themes begin to emerge after gardens are installed. However, there is interest in developing a collection of *ex situ* wetland and riparian species, or emergent/submergent wetland plants. A shortlist of rare and endangered species for collection, propagation, and planting in the Woodland Conservation Garden has been developed with help from a local consultant and Cardno Native Plant Nursery. Ultimately, it will be the Executive Director’s decision to name specific plant collections in the Collections Policy (Steffen, 2017).

Setting collections priority levels is not a concern in this stage of WBG’s development. If priority levels were assigned, it “would be a case-by-case basis” and would not be formalized. Steffen foresees high priority being assigned to plants of conservation concerns, those with a mature size, species representation in the garden, and those plants that fit into the two-tiered description as outlined in the Collections Policy (Steffen, 2017).

Steffen has faced challenges when communicating the purpose of plant collections to the staff and board. He needed to explain why he was “creating a database and doing database entry” and “what separates [WBG] from a park.” He uses

an art museum analogy to explain this difference both internally to the board and externally to the public. Emphasis is placed on the difference between a botanical garden and a park; in that WBG "display[s] plants in a more well-cared and manicured way," "educate[s] people about the plants" and participates in plant collecting.

Other than the Canopy Management Plan, no other management plans have been formally written for other collections. Instead, staff rely on guidelines provided by the designer of particular gardens to write plans based on these recommendations. As an example, Steffen created a plan based on recommendations given by the person who designed a garden with an emphasis on *Rhododendron*. Similarly, The Woodland Conservation Garden required a management plan, but it will be used primarily "to communicate to a decision maker, donor, or someone on the board" with how the garden will be implemented (Steffen, 2017). Management plans would also be useful for documenting how the gardens first start and keeping institutional knowledge written down is useful for future staff who were not there at the beginning of the process (Steffen, 2017).

Perceived Benefits and Importance of Collections Prioritization

Steffen indicates having clear collection priorities and goals is necessary for plant acquisition and to "prioritize operations" at WBG. As Horticulture Manager, Steffen reviews plant lists before installation of new garden areas and can "work on plant substitutions" as collections are guided by the Collections Policy. Likewise, priorities in the Collections Policy inform donation decisions. If a supporter wants to donate plants, staff can accept or reject these requests and have the necessary institutional documentation to justify their decision. The Collections Policy also guides where monetary donations should be directed as to remain relevant to the

institution. In terms of maintenance operations, collections prioritization is useful for informing maintenance decisions. If an existing plant is failing, staff should easily be able to decide if it should be rehabilitated or removed. Also, WBG does not have any Nationally Accredited Plant Collections™, but Steffen (2017) could see this as a potential public relations benefit and as a driver for board approval.

Moore Farms Botanical Garden

Background

Moore Farms Botanical Garden (MFBG) is located in Lake City in the Pee Dee region of South Carolina. Originally a working tobacco farm, MFBG was founded in 2002 by Darla Moore after the death of her grandparents who owned the property. Darla Moore "wanted to start giving back to the community" by providing a destination garden that would "bring in young professionals who [could] help grow the town" (Huggins, 2017). Because MFBG is a relatively new public garden, it is only open to the public 7-12 days annually. The rest of the year, visitors must make a reservation for a guided tour or attend an event at the garden. The mission of MFBG is "to promote research, education in horticulture, agriculture and forestry for the benefit of the people of South Carolina and beyond" (MFBG, 2017a).

MFBG is currently in the development phase and staff "are putting a lot of emphasis on the infrastructure" but want to "have the garden in a good place" for when it fully opens to the public (Huggins, 2017). The 50-acre garden consists of the following major areas: Crepe Myrtle Allée, Cut Flower Garden, Fire Tower and Fire Tower Center Garden, Formal Garden, Fields & Meadows, Swimming Pond, Pine

Bay, Production Center, Spring House, Spring House Pond Garden, Fishing Pond, Vegetable Garden, Turf Grass, and Green Roof and Living Wall (MFBG, 2017b).

MFBG has a collections policy (Moore Farms Botanical Garden Living Collections) from 2013 and a Collection Management Manual. Review of the collections policy is done every five years by the collection policy committee, consisting of the "Garden Director, Production Manager, Lead Horticulturist, Research Assistant, Plant Registrar, and a Horticulturist" (MFBG, 2013). As of 2013, the living collection at MFBG held 4,995 taxa, representing 1,073 genera and 2,478 species. MFBG accessions "annuals, perennials, trees, vines, grasses, turf and shrubs" (MFBG, 2013), although "emphasis is being put on perennials, trees, and shrubs" (Huggins, 2017). Plant records are maintained using FileMaker Pro and visitors to the website can access the Plant Search to view information and photographs of accessioned plants in the living collection (MFBG, 2017c).

MFBG hosts a Nationally Accredited Plant Collection™ of *Magnolia* as part of the multi-site collection. They have "one of the largest collections of southern magnolia in the country" because it thrives in Pee Dee climate (Huggins, 2017).

Living Collections Organization

Living collections at MFBG focus on plants that thrive in the southeastern United States, specifically in the Pee Dee region of South Carolina. Huggins considers the core collections of MFBG to be the *Taxodium* Collection, *Magnolia* Collection, and Conifer Collection. *Taxodium* and *Magnolia* are "native to the southeast" and are already well-adapted to "the water table and humidity" on site. The Conifer Collection was added as a reference collection for the community. Many residents move from the "mid-Atlantic, Midwest, and Northeast, into the Southeast" and "they want blue

spruces," which will not grow in the area. This collection helps "people moving into the community…have an idea of what conifers will work" in their own landscapes (Huggins, 2017). Additionally, garden staff have research interests in conifers and Huggins (2017) hopes MFBG "can be a source of genetic material for future hybridizing and genetic research."

Core collections were chosen by a committee of staff in supervisory positions in the production and horticulture departments, including the Horticulture Supervisor, Production Manager, Operations Manager, and the Plant Curator. They decided to "identify collections that maybe didn't have the same sort of national recognition" as others. The committee considered having a core collection of *Rhododendron*, but "the National Arboretum already had a massive collection" (Huggins, 2017). Having a collection of *Taxodium* allows for future collaborations with researchers at the University of Florida, Stephen F. Austin State University, and the Cox Arboretum. Core collections are not fully described in the collections policy document because they have only "been developed, more or less, in the last 4-5 years" and are just "starting to get out of the greenhouse" and into the landscape (Huggins, 2017). When the policy is next updated, the three core collections will be described. Huggins also foresees adding a core collection of *Quercus lyrata* in the future. It thrives in the local conditions, new taxa are in development, and it could be an option as landscape tree "for people coming into the area" (2017).

Prioritization of individual accessions is a "long-term goal" as MFBG grows and starts to identify priority specimens (Huggins, 2017). MFBG focuses on obtaining cultivars within each of the core collections. Therefore, priority levels would be based on the level of difficulty a cultivar is to find in the nursery trade. MFBG is interested

in obtaining cultivars of *Taxodium* that may not be popular from a nursery standpoint, but the genetic diversity could be valuable in future breeding programs. MFBG also tries to work with other public gardens to have backups of important germplasm. If MFBG is the only institution with a certain cultivar, "that will end up being a much higher priority plant" compared with one that could be purchased easily. Management plans have not been written for individual core collections, but it is a goal within the next 3-5 years (Huggins, 2017).

Core collections are currently communicated with the public during tours of the garden. Staff are working on an online interactive map that will allow visitors to search for accessioned plants on property and view pictures and a description. In terms of staff communication, when new employees are hired, part of the onboarding process involves "emphasis on the expectations for core collections in particular" (Huggins, 2017). Everyone at the institution understands "that the magnolias, taxodiums, and conifers are more important than a white pine growing out in the middle of nowhere" and can answer questions regarding the core collections. Plants in core collections are not tagged as such in the database because the staff is so small. If the number of staff were to increase, this could pose an issue and the collections may have to be communicated more clearly (Huggins, 2017).

Perceived Benefits and Importance of Collections Prioritization

Identification of core collections benefits MFBG because they "start to form the backbone of the garden." They also help grow the reputation of the garden "regionally and nationally" and can be used to "guide some of the of the other plant collections" (Huggins, 2017). For example, visitors to the garden could view plant combinations such as *Taxodium* underplanted with swamp azalea and be inspired to

apply a similar planting scheme in their own yard. Collections prioritization is also necessary in preparation for disasters. MFBG has already weathered three major disasters: “a major ice storm, a thousand-year flood event, and a hurricane.” Having clear collection priorities allows staff to make plant salvage decisions. Huggins (2017) explains: “we need to be able to decide if we are going to brace this, cable this, or take it down.” The production team understands which plants to propagate and have “gotten very good at grafting magnolias and taxodiums” so if anything happens, MFBG has a backup that can go back out in the garden.

Appendix J

STANDARDS OF EXCELLENCE IN PLANT COLLECTIONS MANAGEMENT

Standards of Excellence in Plant Collections Management (Weathington, 2017). Shaded standards align with research findings.

Scope	Documentation	Use	Management
Standard 1 Plant collections reflect and support and institution's mission, and long-range institutional plans.	**Standard 1** Thorough records are actively maintained for accessioned plants tracking what/ where/how plants were obtained, their garden location, and any conditions regarding their acquisition, use, or distribution.	**Standard 1** Reasonable access to the collections and their documentation are provided for researchers, breeders, and other professionals as well as the public, while ensuring the collection's preservation and security.	**Standard 1** Living collections are maintained for optimum health, and monitored for pests, diseases, and potential invasiveness.
Standard 2 Collections are well-defined, appropriate for the site's growing conditions, facilities, and space, and can be realistically developed given institutional resources.	**Standard 2** Durable accession tags and maps link plants in the collection to their documentation, and to any associated collections of images, herbarium vouchers, and DNA.	**Standard 2** Collection records are shared online through databases to maximize use and facilitate coordination with other collection holders	**Standard 2** High priority collections are safeguarded, documentation frequently backed up offsite, and a disaster plan provided for rapid response and triage of the collection.
Standard 3 Plants within the collection represent broad taxonomic diversity, with current holdings comprising a minimum of 50% of the stated collections scope.	**Standard 3** Periodic field inventories are conducted, records and maps updated, and missing/ damaged labels replaced.	**Standard 3** Plant collections are utilized throughout the institution for education, engagement, evaluation, research, and/or conservation	**Standard 3** A recently approved collections policy and development plans for each collection guide decision-making; prioritized maintenance standards and management procedures govern collections care.

Standard 4 Plants are acquired legally and ethically according to their collection's stated purpose.	**Standard 4** Records are kept of plant evaluations, verifications of identity and nomenclature, documented use, propagation, and distributions.	**Standard 4** The institution commits to strengthening staff expertise through ongoing professional development and study of collections.	**Standard 4** Long-term institutional support is provided to maintain an active collections program with sufficient funds for acquisitions, documentation, maintenance, and professional curation.
Standard 5 Plant species are of known wild provenance for greatest conservation value; cultivars are obtained directly from breeder/ introducer.		**Standard 5** Strategic partnerships with outside experts, relevant plant societies, and other public gardens are leveraged to maximize collection use and ensure relevance.	