

***ILEX* AT THE UNIVERSITY OF DELAWARE BOTANIC GARDENS:  
A TEMPLATE FOR MEASURING COLLECTION RELEVANCE AT SMALL  
UNIVERSITY GARDENS**

by

Jason M. Veil

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

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## ABSTRACT

University gardens commonly tout their vital roles as “living laboratories” and “outdoor classrooms”, but how can we ensure that their inherent educational benefits are delivered as effectively as possible? As with other instructional materials, academic plant collections should be assessed periodically to judge their fitness for purpose based on predetermined, mission-centric standards and objectives. A key objective of the University of Delaware Botanic Gardens (UDBG) is to inform and inspire students of horticulture and landscape design. This goal is facilitated by students' exposure to vibrant, relevant plant collections that aim to sustainably exhibit the region's ornamentally and functionally useful taxa. However, financial adversity, insufficient staff, and limited space are common barriers to maximizing collection value. In an effort to move beyond historically qualitative characterizations of academic gardens, the UDBG's holly (*Ilex*) collection served as test case for producing a quantitative example of collection evaluation for educational purposes. Evaluation criteria were based on survey data from university garden leadership, post-secondary plant materials instructors, and wholesale nursery growers and distributors. These elements were then synthesized to develop an assessment method for grading the collection's overall relevance. The resulting data will be used to identify any weaknesses in the collection's scope, promote curatorial accuracy, and improve managerial efficiency. Information pertaining to collection relevance will also help communicate the garden's value to university administrators and other stakeholders.

## **Chapter 1**

### **INTRODUCTION**

In recent decades, one of the fastest growing segments in public horticulture is that of the college or university-affiliated garden (Rakow and Lee, 2011). The missions and shared attributes of university gardens make for a unique curatorial approach to establishing and maintaining their respective plant collections. University gardens and their plant collections are widely regarded as a valuable resource for institutions and their various stakeholders. Scoggins (2010) acknowledges that these stakeholders are often different from those associated with non-academic public gardens. Though based specifically on an individual garden's mission, the primary focus of most university gardens is undergraduate and graduate-level education and research whereas the main foci of their non-academic counterparts are display, plant collections and/or conservation (Scoggins, 2010).

This distinct mission of university plant collections therefore requires evaluating the specific needs of these unique stakeholders and developing collections that maximize educational benefits. This must be an active process that continually guides the curatorial goals of university gardens. Pertinent considerations include (but are not limited to) which plants should be acquired and displayed, how they are maintained and appropriate guidelines for removal.

The primary characterization of university plant collections is that of “teaching gardens” and this inherent instructional purpose identifies their main goal. Teaching gardens create opportunities for students to interact, apply theories discussed in classes and gain practical hands-on experience (VanDerZanden and Cook, 1999). Therefore, students and faculty are the most important of university garden stakeholders (Scoggins, 2010). In fact, a general assessment of literature characterizing university gardens continually reveals the terms “living laboratory” and “outdoor classroom.” These include assessments by Lewis and Affolter (1999), Hamilton (1999), Rakow and Lee (2011) and Scoggins (2010).

Beyond qualitative generalities, the individual missions, purposes, and uses of university gardens are wide-ranging. Depending on the institution, academic plant collections support instruction and research in a number of disciplines and topics. These include but are not limited to horticulture, plant pathology, entomology, landscape architecture, international agriculture, plant breeding and forestry—whose students benefit from study inside the garden (Rakow and Lee, 2011). The “use” of university plant collections is varied and well-documented. Hasselkus (1984) summarizes the main uses of academic plant collections, especially those affiliated with land grant universities, as an equilateral triangle. He explains that each side of the triangle (research or evaluation, education, and display) complements the others.

In order to maximize the usefulness of this project to the UDBG, only academic collections falling within a similar size range, and having similar missions and functions were surveyed regarding the issue of collection relevance. The primary qualifier was the collection's support of a horticulture department and/or degree programs in horticulture, landscape design or a related discipline. For example, extensive, well-documented plant collections exist at The Botanic Garden of Smith College (Northampton, MA), and the Scott Arboretum of Swarthmore College (Swarthmore, PA). However, neither institution supports undergraduate or graduate study in horticultural science and was not included in the scope of this project.

Garden size is another important factor affecting collection curation. As at the UDBG, restricted collection space presents a critical challenge to small university gardens and affects decisions on plant acquisition, planting, pruning and removal. The UDBG currently exists as 12 distinct garden areas within a 15-acre contiguous property (excluding the 35-acre Ecology Woods). This is relatively small by non-academic public garden standards (Longwood Gardens and the Morton Arboretum boast 1,077 and 1,700 acres, respectively), but mirrors the size of many plant collections at similar institutions. For example, the Hahn Horticulture Garden at Virginia Tech (Blacksburg, VA) and the University of Tennessee (UT) Gardens (Knoxville, TN) encompass 5.8 and 9 acres, respectively (Hahn Horticulture Garden, 2014; UT Gardens; 2014). It was determined that limiting this project's scope to similarly sized gardens (i.e. those having 50 acres or less of cultivated area) would provide more applicable insight to the curation of the UDBG.

A second important distinction of the UDBG is that its gardens are clearly delineated and concentrated into a distinct portion of the campus. Many institutions boast comprehensive plant collections that span the entire campus but lack the identity and convenience of a designated area for plant display and study. These include the Mizzou Botanic Garden of the University of Missouri (Columbia, MO) and the University of Maryland Arboretum and Botanic Garden (College Park, MD). University gardens assessed in this study, like the UDBG, are spatially distinct and either adjacent or within a walkable distance from other academic facilities.

Just as “non-living” laboratories vital to the teaching of disciplines such as chemistry or engineering require modern, up-to-date equipment to support learning, plant-based educational amenities should receive similar consideration. Outdated or inadequate equipment is typically discarded and replaced. So too should plant collections be actively managed to maximize their benefit as instructional aides. However, these activities do not come without unique challenges. Long-term maintenance costs and availability of space are two common limitations encountered at university gardens (Wilson, et al., 2008).

Many academic collections (particularly those at land grant institutions and the academic programs they support) fill a vital role in training graduates for employment in the environmental horticulture, or "green" industry. This one of the fastest growing segments of the nation's agricultural economy and is comprised of wholesale nursery and sod growers, landscape architects, designers/builders, contractors and maintenance firms, retail garden centers, home centers and mass merchandisers with lawn and

garden departments, and marketing intermediaries such as brokers and horticultural distribution centers (re-wholesalers). In 2002, the total economic impact of the U.S. green industry was estimated at \$147.8 billion and 1,964,339 jobs (Hall, et al., 2006).

However, Looney (2004) reports that the number of “stand alone” departments of horticultural science at North American universities declined from 61 in 1970 to fewer than 40 in 2000. Recent decades have seen a precipitous decline in both the number of universities offering horticulture programs, as well as the ongoing trends of departmental consolidation, program curtailment, course elimination, and decreased funding for those units that persist (Looney, 2004).

In recent years, many academic plant collections have also had to adapt to reduced financial support from internal university sources and rely on increased support from non-university stakeholders such as community members or groups and the local green industry (Barr and Turner, 2013). Limited funds for plant acquisition, planting, and maintenance require an increased focus on the prioritization of various curatorial initiatives.

Time constraints require instructors to carefully select those taxa to be covered during indoor class time and outdoor laboratory periods. This fact underscores the importance of curating academic collections for maximum instructional relevance. For example, a total of 15 *Ilex* taxa are presented in the two woody plant courses at the University of Delaware. Students are responsible for the outdoor identification of 11 taxa in PLSC 212 (Woody Landscape Plants) and 5 additional taxa in PLSC 214

(Woody Plants of the Eastern United States). One taxon (*I. crenata*) is covered in both courses. (Frett, 2015).

The syllabi for these courses list an additional 99 taxa to aid in students' appreciation of intrageneric breadth. These taxa consist of species, named hybrids, and cultivars; a subset of which are currently held within the UDBG and potentially serve as students' introduction to key higher taxa. For example, students are required to identify *I. cornuta* only to the species level, but six additional taxa listed for consideration include the cultivars 'Burfordii', 'Carissa', 'Compacta', 'D'Or', 'Dwarf Burford', and 'Rotunda' (Frett, 2015). In addition to *Ilex cornuta*, two of the latter ('Dwarf Burford' and 'Rotunda') are held in the collection and available for laboratory presentation or extracurricular inspection. Appendix A contains a full list of all *Ilex* taxa presented in PLSC 212. Appendix B contains a full list of all *Ilex* taxa presented in PLSC 214.

While it is clear that the species level is the most basic and generally the most important level of identification in introductory undergraduate plant materials courses, the availability and prominence and of infraspecific taxa and cultivars should be addressed. Spongberg (1979) argues that variants are sometimes of greater economic and/or horticultural importance than the typical infraspecific taxon, and representatives of these taxa, when grown together, often provide living examples of concepts difficult to convey to students of botany and horticulture. In particular, representatives of these taxa are extremely helpful in illustrating the taxonomic

concepts of subspecies, variety, and form, and the criteria employed in their definitions (Spongberg, 1979).

Moreover, taxa of infraspecific rank and cultivars dominate the offerings of both re-wholesale distributors and wholesale nursery growers (see Chapter 4 and 5). In the context of landscape horticulture, an immersive collection prioritizes popular and important ornamental taxa while looking to augment both active and passive learning by integrating as diverse an assemblage of educationally relevant taxa as possible. This requires looking beyond the common taxa required for laboratory class discussion and strategically incorporating a wider range of taxa important (or showing a potential for importance) to the horticultural trade. Unfortunately, nothing has been published that investigates this process or the possible benefits. This thesis incorporates these factors as the basis for evaluation and curation.

As it pertains to university collections, a measure of relevance also reflects how well the living accessions support a garden's specific purpose or mission(s). Plant collections are a valuable resource to their respective institutions, but how can we be sure that these "living classrooms" provide the maximum benefit (i.e. offer the most pertinent educational tools) to undergraduate students?

This thesis first investigates the current perception and attainment of collection relevance among the leadership and curatorial staff of small university gardens. Based on this feedback, it also proposes assessment criteria for collection composition and the physical standards for a representative sample of the UDBG's woody plant collection. The purpose is to use the holly collection as a test case for measuring

instructional value and provide a useful metric for the assessment of other important plant groups. The resulting metric can be used to quantitatively assess the current educational relevance of a collection in relation to predetermined goals. Goals can be set based on data from wholesale nursery growers, re-wholesale distributors, and post-secondary woody plant material instructors, and provide a measure for future curatorial initiatives, propagation, maintenance, and removal.

### **The UDBG Holly Collection as a Template for Measuring Collection Relevance**

This project was primarily concerned with this collection's benefit to undergraduate landscape horticulture students. As a result, the first step was to establish criteria to evaluate the educational relevance of a taxon and the relative importance to the collection. The objective of this research was to develop standards for collection curation, for students in plant materials courses. All supporting data collected during this process fell into one of three categories: **Industry Prevalence**, **Academic Value**, and **Physical Condition**.

#### **Industry Prevalence**

The overall visibility of a given species, hybrid or cultivar in the nursery and landscape trade is a good measure of its acceptance and/or suitability for cultivation in a given area. This project surveyed *landscape distribution centers*, *re-wholesalers*, or heretofore, "re-wholesale distributors", which are market facilitators that offer regionally specific mixes of landscape products for immediate pickup or delivery to landscape professionals (Hall, et al., 2006). The fact that re-wholesale distributors source plant material from a variety of wholesale growers, in many cases nationwide,

and serve a diverse clientele qualifies their inventory as a useful illustration of current holly popularity.

The second segment of the green industry surveyed was wholesale growers. These firms typically propagate, grow, and ship finished nursery stock to re-wholesale distributors, retail garden centers, and end-users such as larger design-build companies, landscape architects, developers, and government agencies (Hall, et al., 2006).

Table 1 Holly Society of America “Gene Eisenbeiss Holly of the Year” award winners

TAXON	YEAR
<i>Ilex crenata</i> ‘Helleri’	2015
<i>Ilex</i> × <i>meserveae</i> ‘Mesgolg’ (Golden Girl®)	2014
<i>Ilex pedunculosa</i>	2013
<i>Ilex aquifolium</i> ‘Proud Mary’	2012
<i>Ilex</i> ‘Nellie R. Stevens’	2011
<i>Ilex verticillata</i> ‘Red Sprite’	2010
<i>Ilex</i> ‘Scepter’	2009
<i>Ilex verticillata</i> ‘Maryland Beauty’	2008
<i>Ilex aquifolium</i> ‘Lewis’	2007
<i>Ilex</i> × <i>attenuata</i> ‘Sunny Foster’	2006
<i>Ilex</i> × <i>koehneana</i> ‘Lassie’	2005
<i>Ilex crenata</i> ‘Sky Pencil’	2004
<i>Ilex opaca</i> ‘Satyr Hill’	2003

Another factor illustrating suitability are the various awards bestowed upon plants by plant societies, related horticultural organizations, and industry groups. For example, the Holly Society of America (HSA) names an annual “Holly of the Year” as selected by an internal selection committee (HSA, 2014). Those taxa receiving this designation since the award’s inception in 2003 are presented in Table 1.

Also, the Pennsylvania Horticultural Society (PHS) has developed a prominent “Gold Medal Plants” program to promote garden-worthy taxa in the Philadelphia region. This designation, when utilized in the marketing of plants in a retail or wholesale setting, can be a persuasive point-of-purchase tool throughout the Mid-Atlantic region. Table 2 lists the nine *Ilex* taxa that have been named Gold Medal Plants since the program began in 1988 (PHS, 2014).

Table 2        Hollies named to the PHS “Gold Medal Plants” program

TAXON	YEAR
<i>Ilex</i> ‘Rutzan’ (Red Beauty®)	2010
<i>Ilex verticillata</i> ‘Winter Gold’	2005
<i>Ilex opaca</i>	2001
<i>Ilex ×meserveae</i> ‘Mesid’ (Blue Maid™)	1996
<i>Ilex verticillata</i> ‘Scarlett O’Hara’	1996
<i>Ilex verticillata</i> ‘Winter Red’	1995
<i>Ilex glabra</i> ‘Densa’	1994
<i>Ilex</i> ‘Harvest Red’	1991
<i>Ilex</i> ‘Sparkleberry’	1988

*Ilex* ‘Sparkleberry’ was also named a Delaware Nursery and Landscape Association “Plant of the Year” in 1999 (DNLA, 2015). Since these awards could be directly tied to popularity and ornamental merit, they have been incorporated into this project’s overall measurement of educational relevance.

### **Academic Value**

Rakow (2006) states that, by making inquiries into the departments that most typically utilize the collections, curators can ascertain how the garden can be of greatest utility to the academic program. This is the link between academic value and relevance. To determine the academic value of a broad array of *Ilex* taxa, this thesis includes a survey of post-secondary plant materials instructors at institutions falling within USDA hardiness zones 6-8. These areas cover the bulk of locations suitable for holly cultivation in the Mid-Atlantic and Southeastern United States.

### **Physical Condition**

Landscape plants are living organisms subject to the effects of climate, disease, pests, mechanical damage and neglect. As such, two specimens of the same taxon may appear physically different based on the single or combined effect of any of these factors. In developing criteria for evaluating the physical condition of holly taxa, it is first imperative that baseline definitions for physical condition and landscape contribution are determined.

Just as the American Kennel Club publishes guidelines for the acceptable standards for dog breeds, so too could physical benchmarks for ornamental plant appearance or function be used to guide their evaluation. This will be especially appropriate to assessing the individual relevance of the many clonal varieties that

dominate the modern horticultural trade. Said varieties were purposely bred, selected, and/or introduced due to a specific trait(s) or function(s). They should be used and evaluated accordingly.

The inherent subjectivity overshadowing any assessment of ornamental plant condition, quality, functionality, or aesthetic appeal cannot be ignored. Several studies assessing the impact of landscape plants on real estate values, office rental prices, and other economic factors (Henry, 1999; Laverne & Winson-Geideman, 2003; Stigarll & Elam, 2009) acknowledge an inability to overcome at least some bias. For example, the widely accepted Guide for Plant Appraisal, 9<sup>th</sup> Ed. (Council of Tree and Landscape Appraisers, 2000) leaves much room for interpretation of many components affecting the appraised value of so-called amenity trees. In addition to size and condition, the appraiser is required to determine and quantify a given specimen's "location" value. Of several factors, the functional and aesthetic contributions of a plant influence its value in most settings. These benefits may be affected by plant size, shape, branching structure, and foliage density and/or foliage distribution. A plant may have historic significance, be a rare species, or possess a unique structure (Council of Tree and Landscape Appraisers, 2000). The person(s) performing this analysis, however, must be capable of discerning these characteristics and able to compare that being evaluated to accepted or prescribed standards.

Valen (1986) highlights the value of evaluation committees comprised of multiple types of stakeholders to ameliorate the effect of subjectivity. This can be effective at institutions where human resources (paid or volunteer) permit. Such endeavors permit the evaluators to look at a plant from various perspectives and helps (us) to make intelligent decisions on a plant's future (Valen, 1986). Documentation of

the goals and implementation of this process also provides support for any management decisions that result. Objections (to plant removals) can be tempered by an explanation of the decision-making process (Valen, 1986).

If we cannot claim objectivity even in scientific evaluation, then the role of the curator as connoisseur becomes even more critical in the evaluation process (Knell, 1997). Lanmon (1999) reiterates fourteen points of connoisseurship applicable to the evaluation of museum objects originally put forth by prominent fine arts expert, curator, professor and former Winterthur Museum director, Charles F. Montgomery (1910-1978). Though developed specifically for the assessment of collectible antiques or museum objects, much of Montgomery's characterization of the "art and science of connoisseurship" can be transferred to the evaluation of ornamental plants. Of these fourteen points, *form, ornament, function, condition, and overall appearance* can and have been applied to ornamental plants in this thesis. It is appropriate that Montgomery's final point ties all of these factors together and is termed *evaluation*. Davidson (2004) terms this process *connoisseurial evaluation* or *expertise-oriented evaluation*.

In setting standards for the assessing the physical condition of the UDBG's holly accessions, traits such as density, habit, branch structure, and spacing that typify a reasonable majority of healthy, sustainable landscape plantings in the Mid-Atlantic region were considered. Predetermined aesthetic and physiological standards provided a baseline for plant evaluation.

Collecting the descriptive data described above will serve as a scorecard for measuring how well the garden meets its current educational mission. The results will illustrate a "snapshot" of the current state of *Ilex* prevalence in the nursery and

landscape industry and present physical state of plants in the UDBG's collection. The resulting index should serve as a guide for future curatorial goals and supporting processes related to undergraduate education. It will be useful evidence for prioritizing which holly taxa should be propagated, acquired or removed and how those taxa should be maintained.

The recommendations put forth at the conclusion of this project should be viewed as a starting point for the development of curatorial goals and future curatorial actions. It is also likely that this template for assessing relevance could be utilized in the evaluation of other important ornamental taxa or groups of taxa at the UDBG.

Klatt and Pickering (2003) argue that garden staff must be able to answer the challenging question: "Why should scarce resources be directed toward anything but the most core academic mission and the most cutting-edge science?" Quantifying the relevance of plant collections will be a method for justifying the continued funding of plant display and maintenance as an indispensable tool for the success of academic programs—not just as an ornamental amenity. While their aesthetic attributes are easily recognizable to even casual visitors, it should be a priority of all university gardens to be able to quantify their value and persuasively describe their purpose when queried by university administrators (Klatt and Pickering, 2003).

### ***Ilex* in Modern Landscapes**

In relating the concept of collection relevance to the UDBG, the garden's holly collection served as a template for establishing standards and conducting subsequent assessment. The UDBG's holly collection (*Ilex* species, cultivars and hybrids) represents a diverse group of woody plants that play a prominent role in the nursery

and landscape industry. An excellent overview of their range of landscape applications is provided by Galle (1997):

Hollies have many fine qualities that make them an important group of both evergreen and deciduous plants in landscapes today. With proper selection they can become the main feature throughout the garden. They are versatile plants that can be used in a wide range of situations; dwarf hollies are suitable for bonsai, rock gardens, and facing taller shrubs; medium hollies are useful as foundation plants; and tall hollies make excellent screens, hedges, and windbreakers. However they are used, the year-round landscape appeal of hollies stems from their habit of growth, pleasing foliage, and ornamental berries.

Galle (1997) also documents a broad taxonomic description of the genus. He describes 30 deciduous species and over 780 evergreen species worldwide. This effectively demonstrates the botanically cosmopolitan nature of the genus and leaves much opportunity for further selection, breeding and utilization. However, it should be noted that many holly species are found in the tropical and subtropical regions, thereby largely limiting their ornamental use in the Mid-Atlantic region. Galle also describes hundreds of cultivated varieties and hybrid taxa. Bauers (1993) reduces Galle's worldwide species count to the 114 species and subspecies that have been introduced into cultivation.

Further refining the taxa described by Galle and Bauers into those of particular ornamental or functional importance, Dirr (2009) details nearly 50 popular species and hybrids currently available in the horticultural trade. When the various named cultivars of these species and hybrids are considered, the total number of hollies listed by Dirr climbs to nearly 400 unique taxa. The fact that Dirr's text is a leading reference for green industry professionals illustrates the myriad choices of *Ilex* taxa available to nursery growers, landscape architects and designers, contractors, wholesale distributors and retail garden centers. Dirr's text is also the required text for

many undergraduate plant identification courses, including those at the University of Delaware.

Bailes (2006) presents a more detailed assessment of the most common or promising *Ilex* taxa of interest to home gardeners as well as horticultural professionals. Though addressing the genus from the viewpoint of English garden cultivation (i.e. an extensive presentation of *I. ×altaclerensis* and *I. aquifolium* selections), most of the taxa described exhibit transatlantic appeal and usage. In total, Bailes describes 333 taxa with demonstrated or potential use in the Mid-Atlantic region (i.e. USDA Hardiness Zone 7 and colder).

### ***Ilex* at the UDBG**

In its current collection of nearly 2,700 individual woody plants, the UDBG holds 240 individual holly specimens representing 108 unique taxa. Considering that the genus *Ilex* is but one of 216 woody genera represented in the UDBG, the fact that this genus makes up approximately 9% of the garden's accessions is quite significant. However, comparing this figure with the number of taxa presented by both Dirr and Bailes highlights that a great number of others may have potential for accession but are not currently part of the collection.

An expected post-evaluation determination is that a number of the collection's existing taxa (or individual plants or accessions of certain taxa) have little relevance (or exhibit a substandard level of relevance in relation to recommended standards) and therefore needlessly occupy space that should be devoted to the display of taxa of greater instructional value. On the other hand, other taxa may be considered instructionally valuable resources according to the factors influencing the outcome of this project. Assessing commercially and educationally important taxa will also help

determine a benchmark for the proportion of *Ilex* taxa in relation to all woody accessions and also the ideal proportion of subgroups (*evergreen tree* taxa, *evergreen shrub* taxa, and *deciduous shrub* taxa) within the holly collection itself.

## Chapter 2

### LITERATURE REVIEW

#### University Gardens as Academic Resources

The educational value and role of botanical gardens has been noted by authors focused on the study of museums as informal learning institutions (Diamond, 2009; Falk, et al., 2007; and Lord, 2007). Various terms have been used to describe the learning that takes place in museums, zoos, botanic gardens, aquaria, and nature centers, including *informal learning*, *out-of-school-learning*, *complementary learning*, *passive learning*, and *free-choice learning*. What is common across all of these descriptions is an emphasis on the learning that occurs outside of the formal education system in which the learner has a choice and control over his or her experience (Diamond, 2009).

In the context of this project, the most insightful of the above terms is *complementary*—in that university gardens have traditionally supported formal, classroom-based courses through laboratory instruction, but also permit additional informal learning. George W. Tressel has described this form of education as that which takes place before, after, and outside our brief exposure to science in the classroom (Tressel, 1980). Simon (2010) advocates for the role of museums as "participatory" environments—a benefit capable of being provided or augmented by many types of outdoor learning venues. An important tenet of Simon's argument is the idea of the *audience-centered* institution that is as relevant, useful, and accessible as a shopping mall or train station. This increasingly popular view of museum education is based on the work of John Cotton Dana, Elaine Heumann Gurian, and Stephen Weil (Simon, 2010).

University gardens can build upon the importance of *experiential learning* as defined by Dewey (1938) and supported by Lewin (1951), Piaget and Inhelder (1969), and Kolb (1984). The tenets of this school of educational theory state that learning is initiated in the works of an interaction between the learner and his or her environment (Bauerle and Park, 2012). In relation to living collections, outdoor learning exercises (e.g. field trips, outdoor laboratory instruction) have been shown to qualify learning experiences by making them more rewarding to students prone to further self-driven inquiry, and longer retention of materials and experiences (Anderson and Piscitelli, 2002). Field experiences in undergraduate plant sciences courses improve student achievement and engagement (Bauerle and Park, 2012).

### **Collection Relevance**

In the context of museums, relevance can be defined as the logical connection one thing has with another, for example, the orientation of an institution's philosophy and practice to prevailing issues—locally, regionally, and/or globally (Koster, 2006). This is directly tied to usefulness, which cannot be a matter of whim. Rather it requires a wholehearted and enduring commitment by the institution's leadership and staff to define and adhere to a value-driven mission, vision, and strategy (Koster and Falk, 2007). University gardens must be able to identify their educational (and other) missions, purpose(s) for existence and continually strive to curate collections that support these objectives.

Michener (1996) provides an excellent role of living collections as functional resources: The defining criteria of a collection are focus and stewardship. Focus is the concept that allows the component plants to be ranked relative to each other and

less important plants removed based on their limited ability to serve the defining focus within space and resource limitations (Michener, 1996).

Gates (2006) includes relevance as one of the characteristics of an exemplary plant collection. He explains that botanic gardens, as nonprofit public entities should share pertinent information and expertise with others. He concludes that it is vitally important for botanic gardens to have curated collections that are, and will remain, relevant to science and society for multiple generations (Gates, 2006).

Relevant university garden collections maximize horticultural literacy. A working knowledge of prominent and useful ornamental plants is a major benefit to university graduates entering the green industry. A Delphi study conducted by Basinger, et al. (2009) concluded that competency in “plant identification” was agreed to be the leading requirement of undergraduate horticulture curricula. However, one of the most common criticisms by the green industry is that horticulture departments do not do a good job when preparing students for “real world” experiences (Arnold, et al., 2001).

The critical importance of plant identification skills to both employers and recent graduates has also been illustrated by Berle (2007), Beidler, et al. (2006), Kitto, et al. (1996), and VanDerZanden and Reinert (2009). Most universities are coming under the scrutiny of the assessment movement and studies like (these) position faculty to answer the questions: Did your students learn what was taught and can today's students compete in the job market? (Andelt, et al., 1997). Developing and utilizing gardens that bridge the gap between the needs of industry and goals of academic programs increases collection relevance.

Graduates seeking green industry employment should be familiar with plant taxa prevalent in the trade, their specific physiological and ornamental traits, proper usage and maintenance. This need is particularly vital in our time of rapid fire introduction of “new and improved” cultivars of both woody and herbaceous ornamental plants. Horticulture students preparing for industry employment should have experiential knowledge of common, popular and superior taxa.

Relevant university gardens effectively prioritize the acquisition and curation of plants to be encountered and utilized by graduates. Bühler and Kristofferson (2009) present an excellent summary of this purpose in their description of Denmark’s Urban Tree Arboretum (UTA): As a neutral guide, the UTA is (also) supposed to complement, illustrate and validate the information available in nursery catalogues and other plant literature (Bühler and Kristofferson, 2009). This implies that the responsibility of university garden curators is to identify the most pertinent of these taxa and display them in a manner that supports student education and the appreciation common, popular, and otherwise useful plants.

### **Collection Evaluation**

Many authors, namely Anderson (2004), Diamond (2009), Falk & Dierking (2004), and Merritt (2008) are cognizant to include botanical gardens within the definition of museological institutions—generally as a subset of those museums offering informal educational opportunities, such as aquariums, science centers, and zoos. Thus, botanical gardens should strive to adhere to all accepted standards for museum ethics and collection stewardship. Collecting goals, as informed by institutional mission and supported by a written collection policy must guide the purpose, execution, and beneficial outcomes of any collection evaluation.

In a detailed review of the deaccessioning of museum holdings, Malaro (1991) notes that collections should be reviewed periodically for relevance, condition, and quality. When this is done routinely more objective opinions result, and with no urgency to remove, there is time to reflect on initial judgments. As part of responsible collection management, one must be able to demonstrate that collections are periodically and objectively reviewed for adherence to collecting goals (Malaro, 1991).

At public gardens, regular horticultural evaluations provide a means for the continual review of collections to assure their relevance to the purpose of the garden (Jones, et al., 1986). In the case of the UDBG's holly collection, the collections mission is primarily educational, and its main purpose is the training of landscape horticulture and other undergraduate students (UDBG, 2015). This explicit goal is essential to defining the purpose of this or any evaluation.

The main purposes of evaluation are defined by Davidson (2005) as an effort to determine the overall quality or value of something, to find areas for improvement, or both. Both outcomes were expected results of this project. Scriven (1981) coined the term *summative evaluation* to describe evaluations undertaken to determine value or merit. The UDBG's holly collection will benefit from a quantitative benchmark, or starting point for any future curatorial action. In other words, this encompasses evaluations that are done primarily for reporting and decision-making purposes rather than improvement of the evaluand (Davidson, 2005). *Formative evaluation* is enacted solely for the purpose of improvement (Scriven, 1981). The use of this data to alter the collection to increase its relevance to undergraduate instruction imparts the formative component to this project.

In addition to frequent (albeit brief) treatments as one of the key components of written collection policies (Jones, et al. 1986; Koller, 1986), discussion of the role of periodic evaluation in the curation of plant collections is sporadic. Valen (1986) presents a detailed account of the evaluation process employed by the Strybing Arboretum and Botanical Gardens (San Francisco, CA) to rebuild an aging, established collection.

An example of a program that incorporates a form of collection evaluation is the North American Plant Collections Consortium (NAPCC). Established and administered by the American Public Gardens Association (APGA), this program exists as a network of botanical gardens and arboreta working to coordinate a continent-wide approach to plant germplasm preservation, and to promote high standards of plant collections management (American Public Gardens Association, 2015). This organization exists mainly to survey and ensure benchmarks for the stewardship, security, and physical and informational accessibility of a variety of plant taxa. At present, the NAPCC recognizes 53 unique collection categories comprising those at the family level (e.g. Agavaceae), generic level (e.g. *Abies*, *Ilex*, *Quercus*), similar plant types (e.g. Bamboos, Grasses) and multigeneric collections with a common geographic or cultural attribute or theme (e.g. Alpine Plants of Colorado, Mesoamerican Cloud Forest). Collections may be found at a single site or spread among multiple institutions (American Public Gardens Association, 2015).

The establishment of benchmarks for collection curation is a vital step in evaluating the merit of collections as stated by the goals of the program. This is first accomplished through an application process that demonstrates a set of minimum standards for collection management (namely evidence of institutional commitment to

the collection in question, a written collection policy, and a designated collection curator, et al.). A final decision on NAPCC approval is a comprehensive site visit by a NAPCC-trained and approved peer reviewer to determine that the collection's physical attributes, current management techniques and goals are acceptably consistent with the institution's NAPCC collection application (Allenstein, 2014).

The primary difference between this evaluation process and the assessment undertaken to assign education value to the UDBG holly collection is one of conservation-centric collection breadth (NAPCC) versus targeted relevance and usefulness to a particular audience (UDBG). The NAPCC's mission is directed toward a "comprehensive representation of a designated plant group." The goal of the UDBG holly collection is to selectively acquire or retain taxa based on predetermined educational value. This is not to say that the researcher's evaluation and subsequent management of the UDBG's *Ilex* collection could not be a precursor to future NAPCC application or accreditation.

The key similarity between these initiatives is the establishment of a rubric to guide the evaluation process. Davidson (2005) defines a rubric as a tool that provides an evaluative description of what performance or quality looks like at each of two or more defined levels. Chapter 3 contains a complete description of the physical evaluation rubric employed in grading the physical condition of the UDBG *Ilex* taxa. Another distinct commonality between the NAPCC's approach and the objectives of this project is the unavoidable bias of the collection reviewer. To ensure a high level of expertise (connoisseurship) and understanding of NAPCC standards and requirements for approval, NAPCC evaluators are carefully vetted and must attend a training program facilitated by the program coordinator (Allenstein, 2014).

In another discussion of curatorial best practices, Hohn (2008) briefly addresses both collection *monitoring* (or inventorying) and *evaluation* as a component of botanical garden research, and proposes that these are fundamentally separate (yet frequently linked) activities. *Monitoring* is equated with systematic scrutiny to ascertain a certain category of data. *Evaluation* is defined as the segment of any research or other program or project to when the value or worth of the outcomes or products of that program or project are fixed or ascertained. We may monitor plants (in the collections) without evaluating them, but evaluation is not possible without monitoring (Hohn, 2008). In keeping with Hohn's characterization of these activities, the assessment of the current physical condition (density, size, health, etc.) of the UDBG's *Ilex* taxa constitutes monitoring. Evaluation requires combining or comparing this data with the information gleaned from industry and academic surveys to determine the collection's value or worth.

### **Benefits of Collection Evaluation**

Aplin (2013) presents one of the few detailed discussions of the purpose and benefits of plant collection evaluation. He defines evaluation as the periodic assessment of part of the collection to determine whether it remains fit for purpose and concludes that it is therefore a process for determining the value of living accessions to the institution. Evaluation is a tool for ensuring that high-quality accessions are maintained to facilitate the garden's mission (Aplin, 2013). However, Aplin (2013, 2008) and others (Miller, et al., 2004, Ponder, et al., 2001) have been primarily concerned with assessing, describing, and maximizing the conservation value (not the educational value) of living collections.

Evaluation is about assessing situations and taking responsibility to change what needs to be changed (Aplin, 2013). The findings and recommendations stemming from this evaluation of the UDBG *Ilex* collection are aimed at identifying and initiating a course of action to maximize the educational usefulness of the collection to landscape horticulture education. These "changes" will involve taxon acquisition (guided by a desiderata of unheld *Ilex* taxa deemed important by this study), taxon propagation, plant or taxon removal, and horticultural maintenance.

Richard Lighty (1984) recognized the multiple benefits of well-managed plant collections and asks, "if we must add a plant for educational uses, why not have it serve a landscape need as well?" (Lighty, 1984). Beyond the intended benefit of maximum instructional value, curatorial initiatives leading to improved aesthetics can result from collection evaluation. Because aesthetics are easily understood and appreciated by the public and private donors (who are often vital in assuring the survival of an institution), attractive displays become a necessary part of a botanical garden's presentation to the public (DeMarie, 1996).

This key public component is not ignored by other authors. Scoggins (2010) notes that members of the surrounding community are key stakeholders in university gardens and can be an important source of volunteer labor, and financial or political support. This ancillary benefit is also discussed by Wilson, et al. (2004); Olsen, et al. (1999); and Klatt and Pickering, (2003). While not the prime beneficiary of relevant collections, non-students will likely be interested in viewing well-curated collections that exhibit the preferred or otherwise suitable ornamental taxa for a given area. Thus, academic relevance begets interest from amateur horticulture enthusiasts and home gardeners who may become interested in supporting other functions of the garden.

In terms of green industry outreach and support (also a mission of the UDBG), Scoggins (2010) discerns that many horticulture alumni find themselves in a position to "give back". Providing an enriching educational experience, whether or not is immediately appreciated, can potentially stimulate monetary support or in-kind donations from graduates employed within or outside the green industry.

The value of an educationally relevant collection should also be explained and communicated to industry employers who require horticulturally literate graduates. Demonstrating how the garden fosters this skill may lead to increased industry support and visibility. It may be one way to decrease the proportion of industry professionals who feel that university programs are not in touch with the needs and expectations of industry (Beidler, et al, 2006). This effort would support the comprehensive recommendation of Aldous, et al. (2014) who conclude that horticulture curricula must be continually assessed and revised so that they remain relevant to future challenges facing the industry (Aldous, et al, 2014).

A final source of industry support may stem from reiterating the role of university plant collections as a resource for the professional development of current industry employees. Appleton (2006) notes the value of the utility line arboretum at Virginia Tech (Blacksburg, VA) in educating nursery growers, landscape contractors and tree care professionals regarding taxa compatible with overhead utility lines. Likewise, Bühler & Kristoffersen (2009) mention the benefit of the urban tree arboretum to professionals demanding knowledge about tree development on a cultivar level and options for increasing diversity of tree species in urban areas.

In describing methods for combating the modern funding environment of university gardens, Klatt and Pickering (2003) stress the importance of "internal

publicity". In this sense, the results of an evaluation and documented steps to academic improvement should be communicated not only to a gardens' home department but also across the wider university community. As a part of newsletters and one-page "fact sheets" to be distributed to university colleagues, details of the garden's measurable relevance to academic programs should be prominently conveyed (Klatt and Pickering, 2003).

Klatt and Pickering conclude with the importance of demonstrating institutional value: "Cast your arguments within the framework of the overall mission of your institution; provide specifics as to exact benefits provided; strive to show the connections between your unit, students, researchers, and the public; and continue to emphasize your strengths..." (Klatt and Pickering, 2003).

## Chapter 3

### MATERIALS AND METHODS

#### **Industry Prevalence of *Ilex* Taxa (Re-wholesale Distributors)**

The researcher surveyed holly availability at 15 re-wholesale distributor locations (Table 3) in the Mid-Atlantic region at three separate, equally spaced points during the spring of 2014. Care was taken to select multiple firms serving each of the major metropolitan markets of the region, thereby reflecting the plant palette of the likely employment locations of Mid-Atlantic horticulture graduates. As a result, plant availability data reflects the taxa typically offered in the following markets: Richmond, VA (2 sites), Washington, DC (2 firms), Baltimore, MD (3 sites), Philadelphia, PA (4 sites) and Central-Northern New Jersey (4 sites).

The taxon name, selling size and available quantity of all *Ilex* taxa offered for sale was recorded during the weeks of 28 April, 19 May, and 9 June 2014. This was accomplished by accessing and reviewing the current availabilities published on firms' websites or via availability lists e-mailed directly to the researcher upon request. The names of all taxa recorded were standardized to adhere to currently accepted rules of nomenclature and/or cultivar registration as cited by Galle (1997) or the Holly Society of America (2015c). All data was entered and saved in a Microsoft Excel spreadsheet.

Table 3 Re-wholesale distributors surveyed to determine industry prevalence of *Ilex taxa*

<b>DISTRIBUTOR</b>	<b>CITY</b>	<b>STATE</b>
Colesville Nursery	Ashland	VA
Country Springs Wholesale Nursery	Woodbine	MD
Feeney's Wholesale Nursery	Buckingham	PA
Glen Allen Nursery and Garden Center	Richmond	VA
Manor View Farm	Monkton	MD
Plant Detectives, Inc.	Chester	NJ
Pleasant Run Nursery	Allentown	NJ
Sam Brown's Wholesale Nursery	Malvern	PA
Shemin Nurseries	Aston	PA
Shemin Nurseries	Branchburg	NJ
Shemin Nurseries	Burtonsville	MD
Shemin Nurseries	Lawrenceville	NJ
Shemin Nurseries	Manassas	VA
TDH Nurseries	Phoenix	MD
Water Crest Farms Nursery	West Grove	PA

The primary assumption made in collecting industry prevalence data was that all taxa offered by commercial entities are true to name. Also assumed was that quantities and availability directly reflect consumer demand and plant popularity.

#### **Industry Prevalence of *Ilex Taxa* (Wholesale Growers)**

A second assessment of industry prevalence was conducted to identify the *Ilex taxa* offered wholesale producers of nursery stock. The researcher recorded all unique *Ilex taxa* offered for sale (via the printed or online catalog) at each of 27 wholesale nursery growers during on 1 August 2014. This date was selected to increase the likelihood of including the most current marketing information as dictated by summer nursery inventories instrumental in the publication of all taxa available for fall sale.

In this case, nurseries from the Mid-Atlantic to the Southeastern United States were surveyed. A portion of wholesale nursery stock sold each year is grown and sold within the Mid-Atlantic states of Delaware, Maryland, New Jersey, Pennsylvania and Virginia but an additional quantity of stock is grown further south (Florida, Georgia, North Carolina, South Carolina, Tennessee, et al.) and shipped northward for use or resale, thus the inclusion of the southern sources.

Each taxon listed was entered and saved in an Excel spreadsheet. All wholesale nurseries surveyed are listed in Table 4. Two firms, Manor View Farm (Monkton, MD) and Water Crest Farms Nursery (West Grove, PA) operate separate field production and re-wholesale operations and are thus listed in both Table 3 and Table 4. For this study, the taxa listed and/or offered at each operation were recorded separately. As with the survey of re-wholesale distributors, all taxon names were standardized according to Dirr (2009) and/or Galle (1997).

Table 4 Wholesale growers surveyed to determine industry prevalence of *Ilex* taxa

<b>GROWER</b>	<b>CITY</b>	<b>STATE</b>
Abby Farms	Waldorf	MD
Angelica Nurseries	Kennedysville	MD
Bennett's Creek Nursery	Suffolk	VA
Bold Spring Nursery	Hawkinsville	GA
Fernbrook Farms Wholesale Nursery	Bordentown	NJ
Foxborough Nursery	Street	MD
Greenleaf Nursery Company	Park Hill	OK
Hawksridge Farms	Hickory	NC
Holly Hill Farms	Earleville	MD
Ingleside Plantation Nurseries	Oak Grove	VA
Johnson Farms	Deerfield	NJ
Lancaster Farms	Suffolk	VA
King's Sunset Nursery	Liberty	SC
Manor View Farm	Monkton	MD
Monrovia Growers	La Grange	NC
Mobjack Nurseries	Foster	VA
Overdevest Nurseries	Bridgeton	NJ
Panoramic Farm	Marshville	NC
Pender Nursery	Garner	NC
Piedmont Carolina Nursery	Colfax	NC
Tankard Nurseries	Exmore	VA
Taylor's Nursery	Raleigh	NC
Waverly Farm	Adamstown	MD
Water Crest Farms Nursery	West Grove	PA
Waynesboro Nurseries	Waynesboro	VA
Worthington Farms	Greenville	NC
Wye Nursery	Hillsboro	MD

## **University Garden Collection Relevance**

The researcher constructed a web-based survey instrument made available through the University of Delaware's subscription to Qualtrics LLC Online Survey Software. This initial survey, entitled "University Garden Collection Relevance", was intended to gather the baseline information reflecting the physical and philosophical attributes of a range of university-affiliated plant collections. Target gardens were vetted to maximize the relevance of the survey results to the mission, size and academic function of the UDBG. The views of key university garden staff (e.g. Directors, Assistant Directors, Curators, Horticulturists, et al.) were expected to guide the researcher's efforts to design an evaluation plan for the UDBG's *Ilex* collection to determine its relevance to student audiences.

The survey was distributed via electronic mail to 101 individual employees at 40 university gardens in 29 states. The initial distribution was on 7 August, 2014 and reminders were sent to the recipients of unopened or incomplete surveys on 18 August, 2014. The survey was closed to responses and completed surveys were recorded on 1 September, 2014. Access to the survey instrument was provided through an anonymous link recording the Internet Protocol (IP) address of the computer used to complete the survey, but the name or e-mail address of any respondents were not known to the researcher. Details regarding the goals and methodology of this survey were submitted to the University of Delaware Independent Review Board (IRB) regarding human test subjects on 17 July 2014 and the survey was granted exemption from review on 23 July 2014. Documentation of the IRB decision is found in Appendix C.

The survey consisted of three sections. Section one collected baseline data regarding the position or primary responsibilities of each respondent and recorded that

institution's various quantitative and qualitative data such as mission, physical size, staffing, and revenue source(s) and funds allocation.

Section two addressed the specific curatorial policies and activities undertaken at each garden. Respondents were asked to identify the personnel responsible for curatorial decisions, currently utilized plant records and mapping databases, sources of accessioned plant material and other collection-centric programs and designations affecting the management of the plant collection.

Section three focused directly on the issue of collection relevance at each of the gardens surveyed. Respondents were asked to provide feedback regarding their perception of the definition, purpose, characteristics, composition, challenges and benefits of assembling and maintaining plant collections maximally pertinent to horticultural training. Additional questions solicited views on the importance, benefits, timing and overall role of evaluating these collections to assess, rate and improve their educational relevance. The invitation message sent to all potential respondents is found in Appendix D. The full text and results of this survey are found in Appendix E.

### **Academic Garden Visitation**

To increase familiarity with the common attributes of academic plant collections (both university-affiliated and technical and/or community college gardens), the researcher visited several academic gardens during August, 2014. This trip included tours of the Hahn Horticulture Garden at Virginia Tech (Blacksburg, VA), UT Gardens at the University of Tennessee (Knoxville, TN), the South Carolina Botanical Garden at Clemson University (Clemson, SC), Spartanburg Community

College (Spartanburg, SC) and the Sandhills Horticultural Gardens at Sandhills Community College (Pinehurst, NC).

University Garden Collection Relevance surveys were also e-mailed to staff at all of the gardens mentioned above. However, the anonymous nature of the survey prevented identification of respondents by the researcher.

### **Woody Plant Instruction and the Academic Value of Holly Taxa**

This survey aimed to gather the views of woody plant instructors at post-secondary institutions offering coursework and degrees in Horticulture, Landscape Design and related disciplines. This was accomplished via a comparable Qualtrics web-based survey instrument, entitled “Woody Plant Instruction and the Academic Value of Holly Taxa”, and distributed via electronic mail to 85 woody plant instructors (as determined by the researcher) at 79 institutions in 26 states. Institutions of interest consisted of either 4-year colleges or universities ( $n = 36$ ) or 2-year community or technical colleges ( $n = 43$ ). All institutions surveyed fell within the geographic range of USDA Hardiness Zones 6A to 8B in order to correspond with those portions of the South Central and Eastern United States conducive to the cultivation of at least one deciduous and evergreen *Ilex* taxon.

In order to maintain relevance to the plant usage trends as affected by the humid continental climate of the Mid-Atlantic region, institutions located within any of the aforementioned USDA Zones in the Western United States (i.e. within the Mountain or Pacific Time Zones) were not surveyed. In contrast to the survey on university garden collection relevance, anonymity was not assured and the e-mail addresses and latitude/longitude of all respondents were recorded by the survey software and visible to the researcher. Details regarding the goals and methodology of

this survey were submitted to the University of Delaware Independent Review Board (IRB) regarding human test subjects on 24 September 2014 and granted exemption from review on 26 September 2014. Documentation of the IRB decision for this survey is found in Appendix F.

The goal of this survey was twofold and the instrument consisted of two corresponding sections. Section one sought to compare and contrast the usage needs of instructors with the attributes of academic plant collections utilized as venues for outdoor woody plant instruction. Questions focused on the professional background(s) of the respondent, the size, type, climatic characteristics and available academic programs of their institution. Respondents were also asked to describe specific teaching methods and preferences as related to the type(s) of venues used for outdoor plant instruction.

Section two of this survey focused specifically on the Academic Value of Holly Taxa as ranked by the instructors. Each respondent was asked to rank the most important *Ilex* taxa in terms of student preparation in each of three categories: 1) *evergreen tree* taxa (those species, hybrids or cultivars typically attaining a height of 15 feet or greater at landscape maturity; 2) *evergreen shrub* taxa (those species, hybrids or cultivars typically maturing at less than 15 feet in height; and 3) *deciduous shrub* taxa (all deciduous hollies regardless of mature size). Choices for each category were supplied in clickable drop boxes and populated with taxa resulting from both surveys of industry prevalence mentioned above as well as selected taxa within the UDBG's holly collection.

Respondents were also free to select "OTHER" and enter taxa not found in the drop boxes. After selecting (and/or entering) up to a total of 25 taxa, respondents were

prompted to list up to 5 taxa of any category no longer taught due to unpopularity, unavailability, environmental factors or other limitations. Likewise, respondents were asked to list up to 5 taxa of any category that they would consider teaching in the future due to increased prominence, suitability or appeal.

The invitation message sent to all potential respondents is found in Appendix G and the full text and results of this survey are found in Appendix H.

### Physical Evaluation of the UDBG *Ilex* Collection

To facilitate evaluation of this extensive genus at the UDBG, all taxa were assigned to one of three main categories (see Table 5). The individual species, hybrids or cultivars falling into each category were assessed using the same criteria predetermined standards. Using a numerical rating system developed by the researcher for each group, a full inventory and assessment of the physical condition of each accession was completed during April, 2015. In addition to confirming basic identifying traits such as name, accession number, and location, the size (i.e. height) of each specimen was recorded.

Table 5 General categories of *Ilex* taxa evaluated at the UDBG

CATEGORY	APPROXIMATE MATURE HEIGHT	EXAMPLE TAXA
<i>Evergreen Tree</i> taxa	>15 FEET	<i>Ilex opaca</i> 'Satyr Hill' <i>Ilex latifolia</i> <i>Ilex</i> × <i>koehneana</i> 'Wirt L. Winn'
<i>Evergreen Shrub</i> taxa	<15 FEET	<i>Ilex crenata</i> 'Hoogendorn' <i>Ilex glabra</i> 'Shamrock' <i>Ilex</i> × <i>meserveae</i> 'Conapri'
<i>Deciduous Shrub</i> taxa	N/A	<i>Ilex decidua</i> <i>Ilex</i> 'Sparkleberry' <i>Ilex verticillata</i> 'Winter Gold'

The size rating for each specimen was based on the instructional preferences indicated by the researcher’s survey of woody plant instructors (see Chapter 7). Said survey indicated that the most instructionally effective size for outdoor presentation to students is approximately 60-70% of the typical mature size exhibited by a taxon in a given area. Thus, the actual height of each plant (in feet) was converted to a four-point ranking (1 = least relevant; 4 = most relevant) based on the observed deviation from this proportion of each taxon’s typical mature size observed by the researcher in the Mid-Atlantic and/or as cited by Dirr (2009). This system accounted for the decreased relevance exhibited by very young specimens and also by overly mature plants. The guidelines for size relevance rankings used by the evaluator for each plant are presented in Table 6.

Table 6 Size relevance ranking guidelines used for physical evaluation of *Ilex* accessions

APPROXIMATE % OF TYPICAL MATURE LANDSCAPE HEIGHT	SIZE RELEVANCE RANKING
<20%	1
20-40%	2
41-60%	3
61-80%	4
81-120%	3
121-160%	2
>160%	1

In addition to height measurements for each accession, the researcher assessed each plant on four additional metrics of current physical condition (Density, Habit, Health, and Spacing). These evaluation criteria for *evergreen tree* and *evergreen shrub taxa* were identical due to similar expectations for the relationship of density,

habit, health and spacing to instructional value. The criteria for *deciduous shrubs* differed in that the guidelines for measuring density favored a measure of percentage of foliage cover over a percentage of opacity. Samples of the evaluation sheets used to record these attributes for each taxon category are found in Appendix L.

Density for both the *evergreen tree* and *evergreen shrub* categories was based on the evaluator's estimation of the percentage of opacity exhibited by each specimen. The four point scale used to grade each plant was as follows: 1 = <25% opaque; 2 = 25-50% opaque; 3 = 51-75% opaque; 4 = 76-100% opaque. Representative images of three grades of opacity for three similarly-sized specimens of *Ilex ×aquipernyi* 'Meschick' are presented in Figures 1, 2, and 3.



Figure 1 *Ilex x aquipernyi* 'Meschick' (Dragon Lady®) at 50% opacity



Figure 2 *Ilex x aquipernyi* 'Meschick' (Dragon Lady® at 75% opacity



Figure 3 *Ilex x aquipernyi* 'Meschick' (Dragon Lady®) at 100% opacity

Habit was based on the evaluator's assessment of each accession's deviation from the intended and/or preferred landscape habit for each taxon. These are more easily defined for clonal plants, but open to more connoisseurial interpretation for species-level taxa. These standards arose from observation of a wide variety of holly

taxa in a number of public and private landscapes in the Mid-Atlantic region. The four point scale used to grade each plant was as follows: 1 = POOR (severe deviation from intended/preferred habit); 2 = FAIR (moderate deviation from intended/preferred habit); 3 = GOOD (minimal deviation from intended/preferred habit); 4 = EXCELLENT (an exemplary physical representation of the taxon). Examples of habit are also demonstrated by Figure 1 (POOR), Figure 2 (FAIR), and Figure 3 (EXCELLENT).

Health was measured based on the evaluator's observation of dieback, stem or foliar disease, or signs/symptoms of insect pest infestation and/or animal herbivory. The cumulative effect of any of the above factors was converted to a four point scale used to grade each plant was as follows: 1 = POOR (severe dieback, etc.); 2 = FAIR (moderate dieback, etc.); 3 = GOOD (minimal dieback, etc.); 4 = EXCELLENT (no dieback, etc.).

The rating of current spacing attributes was based on the evaluator's observation of a specimen's contact with another non-hedge or other object. The four point scale used to grade each plant was as follows: 1 = POOR (contact with another non-hedge or screen accession or object now); 2 = FAIR (contact imminent in 1-3 years); 3 = GOOD (contact imminent in 3-5 years); 4 = EXCELLENT (no contact imminent within 5 or more years). Accessions planted with the intent of creating a hedge or screen were given a rating based on how well that objective was exhibited (1 = POOR, 2 = FAIR, 3 = GOOD, 4 = EXCELLENT). In addition, each evaluation sheet offers a space for comments as determined by the evaluator. These could be related to details on a given plant's identity, location, maintenance needs, recommendations for propagation, etc.

Once a ranking of 1-4 had been assigned to each criterion for each accession, the scores were averaged to arrive at a mean score (1-4) reflecting the current physical condition of each plant. In addition, these scores were assigned weights based on the findings of the survey of plant materials instructors (“Woody Plant Instruction and the Academic Value of Holly Taxa”) and the researcher’s determination of their specific importance to use of the UDBG holly collection. As a result, ratings of size and habit were afforded a greater weight (.3 each) than ratings of density (.2), health (.1), and spacing (.1). The weighted scores were used to calculate this project’s final judgment of collection values, but could be easily altered to conform to future evaluation guidelines or instructional objectives.

The minimum weighted score for any one plant was “1” and the maximum weighted score was “4”. The weighted mean score for each plant was then placed in one of three categories to help reflect the overall physical condition of the collection and subgroups within the collection. Plants receiving a physical condition score of 1 to 1.9 were labeled POOR, those scoring from 2 to 2.9 were labeled FAIR, and those scoring between 3 and 4 were labeled GOOD.

### **Measuring the Current Educational Relevance of the UDBG *Ilex* Collection**

To arrive a final calculation of current instructional relevance, data from surveys of wholesale nursery growers (“growers”), re-wholesale plant distributors (“distributors”), and post-secondary plant materials instructors (“instructors”) was combined to illustrate the relative importance of the variety of *Ilex* taxa available in the trade and pertinence to undergraduate instruction at the University of Delaware.

First, the availability data recorded at 15 re-wholesale plant distributors in the Mid-Atlantic region during the spring of 2014 (Chapter 4) was ranked according to the

percentage of total sampled days ( $n = 45$ ) it was recorded as available for purchase. Second, data derived from the printed or online catalogs of 27 prominent growers (see Chapter 5) was used to rank the relative prevalence of 181 legitimate *Ilex* taxa offered by these firms. Those offered by the highest percentage of growers were deemed most prevalent. Third, the voting results of the 37 completed surveys instructor surveys were also ranked to illustrate instructors' view of the most important taxa to undergraduate education. As with all other assessments of holly in this study, taxa were broken into categories of *evergreen trees*, *evergreen shrubs*, and *deciduous shrubs*.

The respective percentages of grower availability, distributor availability, and instructor popularity were then converted to non-percent numerals and summed to create a 300 point index of current holly prevalence and academic value. Due to a relatively low vote count from instructors, the percentages of votes for each taxon were multiplied by 10 to facilitate an appropriate comparison to the percentages recorded at distributors and growers. Also, since instructors were permitted to cast votes for species-level taxa and also cultivars of the same or any species, any vote for a species was also counted as a vote for any of the corresponding cultivars also receiving votes (see "Modified Votes" column in Appendix I). This provided a means for ranking the most important species to undergraduate instruction while also incorporating a ranking of selected cultivars of each species. This assumes most cultivars are acceptable representations of the species-level taxon in most teaching situations.

Two additional measures of relevance were incorporated into this index of overall taxon relevance. Any species or hybrid (including cultivars thereof) required

for outdoor identification in either PLSC 212 or PLSC 214 at the University of Delaware was afforded an additional 100 points (under the category of “UD Relevance”) to indicate its importance to inclusion within the UDBG. Second, two prominent plant society awards were considered in calculating overall relevance. Any taxon named as the “Gene Eisenbeiss Holly of the Year” (see Table 1) by the Holly Society of America (HSA) was given an extra 50 points under the category of “Awards”. Any taxa named to the Pennsylvania Horticultural Society’s (PHS) “Gold Medal Plants” program or the Delaware Nursery and Landscape Association “Plant of the Year” was given an extra 25 points under this category. These additions bring the total number of points possible for any one taxon to 500. In addition, any plants receiving either award were added to the master list of relevant Mid-Atlantic taxa.

Legitimate cultivars of any species recorded in either industry prevalence survey or receiving votes from instructors were given the lowest (species level) Relevance Score (e.g. *I. opaca* ‘Arden’ was ranked equally with *I. opaca*). Any taxa required for PLSC 212 or 214 but not offered by industry firms or deemed important by instructors received only the standard “UD use” score of 100 (e.g. *I. ×attenuata* ‘Tanager’). Any named cultivar held in the collection but not appearing in either industry survey and not named by instructors but exhibiting reasonably similar characteristics to a more prevalent taxon was given the Relevance Score highest ranking similar taxon (e.g. *I. opaca* ‘Canary’ was ranked equally with *I. opaca* f. *xanthocarpa*).

## Chapter 4

### RESULTS

#### Industry Prevalence of *Ilex* Taxa (Re-wholesale Distributors)

The 15 distributors surveyed at 3 discrete dates during spring 2014 reflected a wide range of *Ilex* taxa available for sale. A total of 117 uniquely named offerings were recorded. Of these, 114 were legitimately named or recognized taxa, one item was an unregistered, therefore illegitimate taxon (*Ilex*  $\times$  *attenuata* 'Orange Delight' offered by Colesville Nursery), and two listed were the result of a marketing scheme whereby sexually compatible male and female taxa are produced in the same growing container to facilitate pollination and fruit production. The two examples found were the deciduous "Sweetheart Combo" consisting of *I.* 'Apollo' (male) and *I.* 'Sparkleberry' (female) listed for sale at Colesville Nursery and line of evergreen "Berri-Magic®" items marketed by Monrovia Nursery Company. In the latter example, items sold as "Berri-Magic® Royalty" consist of individual plants of *I.*  $\times$  *meserveae* 'Conablu' and *I.*  $\times$  *meserveae* 'Conapri' grown in one container (Monrovia, 2015). Caution must be taken to avoid the acceptance of these solely commercial entities as a legitimate taxa.

Of the 114 legitimate holly taxa recorded, 46 taxa fell into the predetermined category of *evergreen tree* taxa, 50 taxa were classified as *evergreen shrub* taxa and 18 were classified as *deciduous shrub* taxa. The mean number of individual plants of any taxon offered for sale on any given sample day was 11.1 for the *evergreen tree* category, 35.4 for *evergreen shrub* category and 25.3 for the *deciduous shrub* category. This reflects the tendency of *evergreen tree* taxa to be utilized as single specimens or in small groupings, whereas those in the *evergreen shrub* and *deciduous*

*shrub* categories are typically used in multiple quantities as foundations plants, hedges or mass plantings.

The most prevalent *evergreen tree* taxa offered for sale were *I. ×aquipernyi* ‘Meschick’ and *I.* ‘Nellie R. Stevens’ which were each listed as available by 14 of 15 firms surveyed. ‘Meschick’ was recorded on 42 of 45 possible sample dates, while ‘Nellie R. Stevens’ was recorded on 41 of 45 sample dates. These taxa were followed by *I. aquifolium* ‘Argentea Marginata’ (11 firms, 31 sample dates), *I.* ‘Conin’ (10 firms, 27 sample dates), *I. opaca* (9 firms, 24 sample dates), and *I.* ‘Rutzan’ (8 firms, 24 sample dates). The most commonly offered taxa of this category are presented in Table 7. Appendix J contains a full list of all *evergreen tree* taxa recorded in this survey.

Table 7 Most common *evergreen tree* taxa offered by re-wholesale distributors

TAXON	FIRMS	SAMPLE DATES	% OF DATES
<i>Ilex ×aquipernyi</i> ‘Meschick’ (Dragon Lady®)	14	42	93.3%
<i>Ilex</i> ‘Nellie R. Stevens’	14	41	91.1%
<i>Ilex aquifolium</i> ‘Argentea Marginata’	11	31	68.9%
<i>Ilex</i> ‘Conin’ (Robin™)	10	27	60.0%
<i>Ilex opaca</i>	9	24	53.3%
<i>Ilex</i> ‘Rutzan’ (Red Beauty®)	8	24	53.3%
<i>Ilex</i> ‘Conaf’ (Oak Leaf™)	8	22	48.9%
<i>Ilex opaca</i> ‘Satyr Hill’	8	22	48.9%
<i>Ilex</i> ‘Centennial Girl’	7	20	44.4%
<i>Ilex</i> ‘Magland’ (Oakland™)	7	19	42.2%

The most prevalent *evergreen shrub* taxon was *I. ×meserveae* ‘Mesid’ which was recorded as available at all 15 firms and all 45 possible sample dates. This was the only taxon of any category recorded on every possible sample date. It was

followed by *I. crenata* ‘Sky Pencil’ and *I. crenata* ‘Steed's Upright’ (both at 15 firms, 44 sample dates), *I. glabra* ‘Shamrock’ (15 firms, 43 sample dates), *I. crenata* ‘Hoogendorn’ (14 firms, 42 sample dates), *I. crenata* ‘Helleri’ (14 firms, 41 sample dates) and *I. ×meserveae* ‘Conapri’ (15 firms, 41 sample dates). Table 8 contains a list of the most commonly offered taxa in this category. Appendix J contains a full list of all *evergreen shrub* taxa recorded in this survey.

Table 8 Most common *evergreen shrub* taxa offered by re-wholesale distributors

TAXON	FIRMS	SAMPLE DATES	% OF DATES
<i>Ilex ×meserveae</i> ‘Mesid’ (Blue Maid®)	15	45	100.0%
<i>Ilex crenata</i> ‘Sky Pencil’	15	44	97.8%
<i>Ilex crenata</i> ‘Steed's Upright’	15	44	97.8%
<i>Ilex glabra</i> ‘Shamrock’	15	43	95.6%
<i>Ilex crenata</i> ‘Hoogendorn’	14	42	93.3%
<i>Ilex crenata</i> ‘Helleri’	14	41	91.1%
<i>Ilex ×meserveae</i> ‘Conapri’ (Blue Princess®)	15	44	97.8%
<i>Ilex</i> ‘Mesog’ (China Girl®)	14	39	86.7%
<i>Ilex ×meserveae</i> ‘Conablu’ (Blue Prince®)	12	35	77.8%
<i>Ilex crenata</i> ‘Compacta’	11	31	68.9%
<i>Ilex crenata</i> ‘Soft Touch’	11	29	64.4%

The most prevalent Deciduous Shrub Taxa were the female *I. verticillata* ‘Red Sprite’ and *I. verticillata* ‘Winter Red’ which were both listed as available at 14 of 15 firms and recorded on 42 of 45 sample dates. These were immediately followed by their respective pollenizers, *I. verticillata* ‘Jim Dandy’ (13 firms, 36 sample dates) and *I. verticillata* ‘Southern Gentleman’ (12 firms, 35 sample dates), the female *I. ‘Sparkleberry’* (9 firms, 26 sample dates) and its pollenizer *I. ‘Apollo’* (8 firms, 21

sample dates). Table 9 lists the most commonly offered taxa of this category.

Appendix J contains a full list of all *deciduous shrub* taxa recorded in this survey.

Table 9 Most common *deciduous shrub* taxa offered by re-wholesale distributors

TAXON	FIRMS	SAMPLE DATES	% OF DATES
<i>Ilex verticillata</i> ‘Red Sprite’	14	42	93.3%
<i>Ilex verticillata</i> ‘Winter Red’	14	42	93.3%
<i>Ilex verticillata</i> ‘Jim Dandy’	13	36	80.0%
<i>Ilex verticillata</i> ‘Southern Gentleman’	12	35	77.8%
<i>Ilex</i> ‘Sparkleberry’	9	29	64.4%
<i>Ilex</i> ‘Apollo’	8	24	53.3%
<i>Ilex verticillata</i> ‘Winter Gold’	4	12	26.7%
<i>Ilex verticillata</i> ‘Afterglow’	3	9	20.0%
<i>Ilex verticillata</i> ‘Spravy’ (Berry Heavy®)	3	9	20.0%
<i>Ilex verticillata</i> ‘Maryland Beauty’	3	7	15.6%
<i>Ilex verticillata</i> ‘Spriber’ (Berry Nice®)	3	7	15.6%

### Industry Prevalence of *Ilex* Taxa (Wholesale Growers)

Unlike the survey of re-wholesale distributors (Chapter 4), the quantities of each taxon available were not recorded. Instead, only each unique name listed in these firms’ catalog or online marketing literature was recorded. The survey revealed a total of 188 uniquely named offerings which included 181 legitimate, properly registered names, two solely commercial entities and five illegitimate names.

The two commercial entities each consisted of two legitimate taxa combined to facilitate pollination and fruit set. These were marketed as “Blue Twins” and “China Twins”. The former consists of *I. ×meserveae* ‘Conablu’ and *I. ×meserveae* ‘Conapri’ grown in the same container. The latter consists of *I.* ‘Mesog’ and *I.*

‘Mesdob’ grown in the same container. Both are produced and marketed by the Greenleaf Nursery Company (Greenleaf Nursery Company, 2015a, 2015b). The five illegitimate names recorded were *I.* ‘Unique’ (Ingleside Plantation Nurseries), *I.* ‘Augusta’ (Tankard Nurseries), *I.* ‘Ellyn Capper’ (Manor View Farm), *I. opaca* ‘Pamela Orton’ (Foxborough Nursery), and *I. ×attenuata* ‘Yellow Foster Holly’ (Wye Nursery).

Of the 181 legitimately named taxa recorded, 89 taxa (49%) fell into the predetermined category of *evergreen tree* taxa. The most prevalent taxa of this category were *I.* ‘Nellie R. Stevens’ (20 firms), *I. ×aquipernyi* ‘Meschick’ (17 firms), *I.* ‘Conaf’ (12 firms), *I. opaca* ‘Satyr Hill’ (10 firms), *I.* ‘Rutzan’ (10 firms), *I. ×attenuata* ‘Foster No. 2’ (10 firms), *I. cornuta* ‘Anicet Delcambre’ (9 firms), and *I.* ‘Doctor Kassab’ (9 firms). The most commonly offered taxa of this category are listed in Table 10. A full list of all taxa offered by wholesale growers is found in Appendix K.

The most prevalent *evergreen shrub* taxa recorded were *I. crenata* ‘Sky Pencil’ (20 firms), *I. crenata* ‘Compacta’ (17 firms), *I. crenata* ‘Steed's Upright’ (16 firms), *I. cornuta* ‘Dwarf Burford’ (15 firms), and *I. glabra* ‘Shamrock’ (14 firms).

A list of the most commonly offered taxa of this category is presented in Table 11. Appendix K contains a full list of all *evergreen shrub* taxa recorded in this survey.

The most prevalent *deciduous shrub* taxa recorded were *I. verticillata* ‘Winter Red’ (16 firms), *I. verticillata* ‘Red Sprite’ (13 firms), *I. verticillata* ‘Southern Gentleman’ (13 firms), *I. verticillata* ‘Jim Dandy’ (10 firms), *I. verticillata* ‘Winter Gold’ (6 firms), and *I.* ‘Sparkleberry’ (5 firms). A list of the most commonly recorded

taxa of this category is presented in Table 12. Appendix K contains a full list of all *deciduous shrub* taxa recorded in this survey.

Table 10 Most common *evergreen tree* taxa listed by Wholesale Growers

TAXON	NO. FIRMS	% FIRMS
<i>Ilex</i> 'Nellie R. Stevens'	20	74.1%
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	17	63.0%
<i>Ilex</i> 'Conaf' (Oak Leaf™)	12	44.4%
<i>Ilex opaca</i> 'Satyr Hill'	10	37.0%
<i>Ilex</i> 'Rutzan' (Red Beauty®)	10	37.0%
<i>Ilex</i> × <i>attenuata</i> 'Foster No. 2'	10	37.0%
<i>Ilex cornuta</i> 'Anicet Delcambre' (sold as 'Needlepoint')	9	33.3%
<i>Ilex</i> 'Doctor Kassab'	9	33.3%
<i>Ilex</i> 'Conin' (Robin™)	8	29.6%
<i>Ilex opaca</i> 'Miss Helen'	7	25.9%
<i>Ilex</i> × <i>attenuata</i> 'Greenleaf'	6	22.2%
<i>Ilex</i> 'Centennial Girl'	5	18.5%
<i>Ilex</i> 'HL10-90' (Christmas Jewel®)	5	18.5%
<i>Ilex</i> 'Mary Nell'	5	18.5%
<i>Ilex opaca</i>	5	18.5%
<i>Ilex opaca</i> 'Dan Fenton'	5	18.5%
<i>Ilex opaca</i> f. <i>xanthocarpa</i> (sold as 'Xanthocarpa')	5	18.5%
<i>Ilex opaca</i> 'Jersey Knight'	5	18.5%
<i>Ilex opaca</i> 'Jersey Princess'	5	18.5%
<i>Ilex</i> 'Carolina Sentinel'	4	14.8%
<i>Ilex cornuta</i> 'Fine Line'	4	14.8%
<i>Ilex</i> 'Emily Bruner'	4	14.8%
<i>Ilex</i> 'Magiana' (Acadiana™)	4	14.8%
<i>Ilex</i> × <i>aquipernyi</i> 'San Jose'	4	14.8%

Table 11 Most common *evergreen shrub* taxa listed by wholesale growers

TAXON	NO. FIRMS	% FIRMS
<i>Ilex crenata</i> ‘Sky Pencil’	20	74.1%
<i>Ilex crenata</i> ‘Compacta’	17	63.0%
<i>Ilex crenata</i> ‘Steed's Upright’ (sold as ‘Steeds’)	16	59.3%
<i>Ilex cornuta</i> ‘Dwarf Burford’	15	55.6%
<i>Ilex glabra</i> ‘Shamrock’	14	51.9%
<i>Ilex crenata</i> ‘Green Lustre’	13	48.1%
<i>Ilex crenata</i> ‘Helleri’	13	48.1%
<i>Ilex crenata</i> ‘Soft Touch’	12	44.4%
<i>Ilex ×meserveae</i> ‘Conapri’ (Blue Princess®)	11	40.7%
<i>Ilex ×meserveae</i> ‘Mesid’ (Blue Maid®)	11	40.7%
<i>Ilex pedunculosa</i>	10	37.0%
<i>Ilex ×meserveae</i> ‘Conablu’ (Blue Prince®)	10	37.0%
<i>Ilex crenata</i> ‘Hoogendorn’	9	33.3%

Table 12 Most common *deciduous shrub* taxa listed by wholesale growers

TAXON	NO. FIRMS	% FIRMS
<i>Ilex verticillata</i> ‘Winter Red’	16	59.3%
<i>Ilex verticillata</i> ‘Red Sprite’	13	48.1%
<i>Ilex verticillata</i> ‘Southern Gentleman’	13	48.1%
<i>Ilex verticillata</i> ‘Jim Dandy’	10	37.0%
<i>Ilex verticillata</i> ‘Winter Gold’	6	22.2%
<i>Ilex</i> ‘Sparkleberry’	5	18.5%
<i>Ilex</i> ‘Apollo’	4	14.8%
<i>Ilex verticillata</i> ‘Spravy’ (Berry Heavy®)	4	14.8%
<i>Ilex verticillata</i> ‘Maryland Beauty’	3	11.1%
<i>Ilex verticillata</i> ‘FarrowBPop’ (Berry Poppins™)	2	7.4%
<i>Ilex verticillata</i> ‘Late Male’	2	7.4%
<i>Ilex verticillata</i> ‘Spriber’ (Berry Nice®)	2	7.4%

### University Garden Collection Relevance Survey

Of the 101 survey links e-mailed to potential respondents, 44 (44%) were opened by the recipient and a total of 36 (36%) were completed. Incomplete surveys were excluded from further analysis. The average time required to complete the survey was 10 minutes and 45 seconds.

The initial question asked respondents to indicate their title or primary responsibility. Respondents were permitted to select more than one title as applicable. The majority of respondents (66%) identified themselves as having the title of "Curator" or "Director" with each title being selected by 12 of 36 respondents (33%). A smaller proportion of respondents identified themselves as "Faculty/Instructor" (19%), "Director of Horticulture/Garden Manager" (17%) or "Assistant Director" (14%). The fewest respondents identified themselves as "Horticulturist/Gardener" (8%) or "Other" (8%). The three respondents selecting "Other" entered the titles of "Arborist", "Plant Breeding and Accessions" and "Plant Records Specialist". Nine of 36 respondents (25%) reported two or more titles or responsibilities. The most common of these were "Director" *and* "Faculty/Instructor" (2 respondents) and "Curator" *and* "Faculty/Instructor" (2 respondents).

A majority of respondents (58%) selected "Education" as the primary mission or function of their garden. The next most common response was "Display" (28%). Significantly less common was the primary mission of "Extension" (8%) and "Research" (3%). One respondent selected "Other" and entered "We have equally important: research, teaching, conservation (natural diversity as well as cultural landscapes) and public outreach." No respondents indicated a primary mission of "Community Recreation" or "Conservation".

The total cultivated area of the gardens surveyed varied widely. A majority of respondents (28%) reported cultivated acreage of 11-20 acres. An equal percentage of respondents (25%) selected either "6-10 acres" or "51-100 acres". Fewer respondents reported a cultivated acreage of 21-50 acres (11%), 2-5 acres (6%), under 2 acres (3%) and over 100 acres (3%).

Most respondents (61%) reported a full-time horticulture staff of 1-3 employees. Twenty-eight percent reported a full-time staff of 4-6 employees and 8% of respondents indicated a staff of 7-10 employees. A staff of 16-20 was reported by 3% of respondents and no respondent selected "11-15" or "21+". Much more variation existed in the number of part-time staff reported. Twenty-eight percent of respondents reported 4-6 part-time horticulture employees, 25% reported 11-15 employees, 22% reported 7-10 employees and 17% reported 1-3 employees. The smallest proportion of respondents indicated a part-time horticulture staff of 16-20 (6%) or 21+ (3%).

In terms of each garden's horticulture budget, most respondents (43%) reported that under 20% of their most recent fiscal year's total operating budget was allocated to horticulture-related expenditures. This was followed by 29% reporting that horticulture-related spending made up between 41-60% of the total budget and 20% indicated that 20-40% of the annual budget was devoted to said expenses. Only 6% of respondents reported spending 61-80% of their budgets on horticulture and 3% reported spending 81-100%. When asked to provide a total dollar amount for annual horticultural expenses, most respondents (33%) selected "less than \$50,000", 30% selected \$201,000-\$500,000 and 21% selected \$101,000-\$200,000. Nine percent indicated spending of \$51,000-\$100,000. The smallest proportions of respondents indicated horticulture spending of \$501,000-\$1,000,000 (3%) or \$1,000,000+ (3%).

Respondents were also asked to report the percentage of the above dollar figure provided by their respective university or college. Five respondents (14%) indicated that they receive no financial support from this source. The remaining respondents (86%) reported at least some level of administrative support. Most of these (27%) indicated that this source provided for 41-60% of their annual budget, 23% selected 81-100% and 17% selected 21-40%. Thirteen percent of respondents indicated this proportion to be 61-80% while an equal percentage of respondents (10%) selected either "10-20%" or "less than 20%".

A majority (54%) of respondents indicated that the bulk of their total annual funding came from their respective university or college. Six respondents (17%) indicated that a majority of annual funding was generated by garden admission or membership revenue. An equal proportion (17%) indicated that endowment income provided the majority of annual funding. One respondent indicated that the majority of funding was derived from an annual plant sale or other retail revenue. Three respondents (9%) selected "Other" and indicated that most revenue came from a comparable combination of more than one source. Two of these cited a "combination of plant sale, fundraiser event (gala), and membership program - all about the same %" and "a combination of plant sale, memberships, donations and endowment - majority is private." The third respondent selecting "Other" provided a more complex response:

Ours is a dynamic mixture of university funding and self-generated funds. We don't have a "horticulture" budget per se since Natural Areas management is included in the overall budget that includes the Horticulture (in the strict sense). This makes since [sic] because the staff and spaces are shared rather than in un-collected administrative silos. And isn't managing public semi-natural areas and native plant

gardens "horticulture" as much as our Conservatory and gardens of exotics or exotics + cultivars of natives?

Respondents represented gardens of varying ages. Most (25%) indicated that their garden had been established for 21-30 years. These were followed by those selecting "51-100 years" (22%), "31-50 years" (19%), "11-20 years" (14%) and "over 100 years" (14%). The fewest respondents indicated their gardens had been established fewer than 10 years (6%). Similar percentages of respondents indicated that "Horticulture" (81%) or "Landscape Architecture" (84%) was offered as a major, minor or concentration at their institutions. Others indicated the availability of a range of other plant-related academic programs including "Landscape Contracting/ Design/ Management" (61%), "Urban/ Community Forestry" (55%), "Nursery Production/ Management" (48%), "Public Horticulture" (42%) and Ornamental Plant Breeding (26%). Thirty-five percent of respondents indicated the existence of programs in Museum Studies.

When asked to indicate which garden employees were primarily responsible for curatorial duties (e.g. plant acquisition, propagation, removal or maintenance), most respondents (28%) selected "Director or Assistant Director". Similar proportions indicated that these duties were assigned to the Curator (22%) or Director of Horticulture/ Garden Manager (25%). A smaller group of respondents indicated that these tasks were the responsibility of a "Committee of Faculty and/or Internal Staff" (17%). This total includes three respondents who selected "Other" and indicated a collaborative effort. These comments included: "team effort - horticulturist, woody plant curator, and director", "Curator - but in discussion with Director and program managers" and "It really is a group decision - though Director has final say". Even fewer respondents selected "Horticulturist(s) or Gardener(s)" (6%), or a "Combination

of faculty/ staff and outside expertise (e.g. green industry)” (3%). No respondents indicated that curatorial decisions were the responsibilities of an outside advisory committee, students or volunteers.

Sixty-one percent of gardens stated the existence of a written collections policy, while 31% indicated the lack of said document. Two respondents (6%) indicated that a written collections policy was currently “being developed” and one respondent indicated that he or she was “unsure” of the status of a collections policy. A large percentage of respondents (92%) indicated the use of some type of computerized plant records system. Most respondents (47%) cited the use of general spreadsheet programs (e.g. Microsoft Access or Excel; FileMaker Pro) while others (37%) cited the use of a software suite developed specifically for plant records (BG-BASE, IrisBG). The latter total includes one respondent who indicated a current switch from Excel to BG-BASE and another who indicated that their institution was about to purchase IrisBG. Three respondents (8%) indicated that a computerized plant records system was not currently in use. A complete list of the plant records systems cited in this survey is found in Table 13. Only 46% of survey respondents indicated the utilization of plant mapping software.

Most respondents (67%) indicated that the majority of plants to be accessioned or planted in the garden were purchased from commercial growers or distributors, while 14% of respondents cited a reliance on industry donations or plant trial distributions for the majority of plant acquisitions. Others indicated either “Wild collection/ index semina” (8%) or “In-house propagation/ production” (3%) as the

Table 13 Plant records software used at university gardens

<b>SOFTWARE</b>	<b>% OF RESPONDENTS</b>	<b>NUMBER OF RESPONDENTS</b>
Microsoft Access or Excel	42%	15
BG-BASE	31%	11
None	8%	3
Custom Software/GIS	6%	2
FileMaker Pro	6%	2
IrisBG	6%	2
CollectionSpace	3%	1

primary source of plant material. Three respondents (8%) selected “Other” and indicated a combination of sources, citing “all of the above” or multiple sources depending on where the plants are to be used.

All but three respondents (8%) selected the presence of at least one of a number of promotional initiatives or collections-based programs. These ranged from regular plant sales and “recommended plants” programs to plant trial participation and the existence of a North American Plant Collections Consortium (NAPCC) collection. Regular plant sales were the most common of these and were reported by 75% of respondents. Plant sales were followed by “National/regional plant trial participation” reported by 48% of respondents, an NAPCC collection (42% of respondents) and an “Internal plant evaluation program” at 36% of gardens. A full list of these programs is found in Table 14.

The third portion of this survey dealt with the matter of collection relevance and how respondents viewed and addressed the issue. Respondents were first asked to indicate the most important benefit of an educationally relevant plant collection (i.e.

one that displays the most pertinent taxa to undergraduate instruction). Most respondents (42%) indicated that the most important benefit was adequate student training. This proportion includes the 28% of respondents who selected "adequately prepare students for green industry employment or further study", and five additional

Table 14 Collections-based programs or other promotional events at university gardens

<b>PROGRAM/ EVENT</b>	<b>% OF RESPONDENTS</b>	<b>NUMBER OF RESPONDENTS</b>
Regular plant sale(s)	75%	27
National/ regional plant trial participation	44%	16
North American Plant Collections Consortium (NAPCC) collection	39%	14
Internal plant evaluation program	33%	12
“Recommended Plants” promotional program	22%	8
Industry demonstrations/ field days	19%	7
Plant society reference collection(s)	17%	6
None of the above	8%	3

respondents (14% of all responses) selecting "Other" and entering comments related to educational training not specific to green industry employment. This arose due to a flaw in the survey design which did not provide for the selection of broader educational benefits dealing with other fields within plant science, environmental studies or ecology. One respondent (3%) did not include a comment attributable to any one benefit. The comments of those selecting “Other” are listed below:

The collection is primarily to teach plant biology, taxonomy, ecology, local plant communities and ornamentals that will grow well in inland Southern California, The department is Botany & Plant Sciences, rather than horticulture.

That is SERVES as an educational tool--that visitors (students, colleagues, community) learn about plants and the relationship between plants, human health and nutrition in both the designed and natural landscape.

Imbue future leaders with a passion for environmental stewardship”

What is an educationally relevant plant collection?

Provide an accurately botanically identified and interpreted collection of plants relevant to the courses and research programs that utilize the garden.

Provide plants that are conceptually challenging - from engineering to conservation to the sheer enjoyment factor.

A significant portion of respondents (31%) indicated that the prime benefit as being able to demonstrate or quantify the value of the garden to their respective institution or department. Seventeen percent of respondents (17%) selected either “ensure high standards for horticultural display and maintenance”. Far fewer respondents indicated that the primary benefit of an educationally relevant collection was to initiate or strengthen relationships with outside support groups: six percent of respondents selected “cultivate support from members, alumni or community stakeholders” and 3% selected “cultivate mutually beneficial relationships with industry groups/ commercial firms”.

When asked if their garden currently incorporated written guidelines to evaluate or maximize collection relevance, 81% of respondents indicated that they did not. Eight percent of gardens indicated that these guidelines were currently in place, 6% indicated that they were under development and 6% were unsure. Those

answering “no” to the previous question were then prompted to indicate whether an evaluation of collection relevance would be a valuable future endeavor. A majority of respondents (57%) selected “yes” while 9% selected “no”. Thirty-one percent of respondents indicated that they were not sure. One respondent (3%) selected “we already have evaluation guidelines in place”.

Most respondents (50%) indicated that most important benefit of the evaluation process would be to use the data to prioritize taxa to be acquired or propagated. Eighteen percent of respondents answered “make more efficient use of garden space” and 13% of respondents answered “develop or improve maintenance practices.” Eleven percent of respondents selected “prioritize the removal of poor quality specimens or ornamentally obsolete taxa.” Three respondents (6%) selected “Other” and entered the following comments:

Assess how applicable our collections are to educational purposes and our mission statement, and use as a tool to evaluate what specimens to add or remove.”

I answered no to the previous question. (Would an evaluation of collection relevance be a valuable future endeavor?)

All of the above

The majority of respondents (32%) felt that, in its current state, the cumulative educational relevance of their garden was “Good” while 29% selected “Very good”, 21% selected “Fair” and 11% selected “Excellent”. Three respondents (8%) selected “Not sure”. Using a 7-level Likert (1932) scale, respondents were asked to rank each of several management initiatives according to their importance to improving the educational relevance of their collection. For this question, a ranking of “1” represented “most important” while a ranking of “7” represented “least important”.

Therefore, the mean ranking for each management initiative corresponded with its relative importance to all respondents. Lower mean rankings indicated initiatives of higher importance.

The initiative receiving the lowest mean ranking (2.7) was “add locally adapted/ improved/ popular taxa”. It was followed by “add newer introductions for evaluation” (2.9), “thin/ renovate crowded garden areas/ beds” (3.7), “improve pruning methods/ frequency or other maintenance practices” (3.8) and “remove aged/ diseased/ deceased specimens” (4.3). The least important initiative both received a mean ranking of 5.2. These were “provide better control of insect pests/ disease” and “remove taxa deemed obsolete or no longer commercially important”.

When asked to indicate (aside from a lack of funding or staff) the primary obstacle to achieving increased collection relevance, most respondents (39%) selected “lack of institutional/departmental interest”. This proportion includes one respondent who selected “Other” and commented “I would say insufficient interest, not lack. A lot of faculty have a passive interest in our collections for instructional and other purposes, but they are often reticent about advancing their agendas.” The second most prevalent response was “Other” and comments represented a variety of concerns:

Differences of opinion regarding which plants to add or remove

Bring plants on site useful and important to faculty/students and still engage the public w exciting displays

Lack of communication with campus bureaucracy

Lack of good database/records/mapping system

Lack of upper administrative (Vice President/President) understanding of the academic function of a garden

Collections policy

### Budgetary restraints

Dynamic needs of the University faculty. We're not in a department/college but a peer to the University Museum of Art and thus expected to be relevant to art, language, science, technology, health sciences, etc. etc. We're NOT focused on horticulture which is the presumption here. Being freed from departmental agendas has been truly liberating and we're much more dynamic/broadening our collections for it

### Lack of cohesiveness

A smaller proportion of respondents indicated the primary obstacle to collection relevance was a “lack of space” and “difficulty keeping up with new introductions” (both 11%), “timely pruning/maintenance” (8%) and “lack of communication with the green industry” (6%).

Respondents were also asked to choose the ideal interval for conducting periodic evaluations of collection relevance. Forty-four percent indicated that said evaluation should be conducted every 4-6 years while 31% selected “every 7-10 years”, 17% selected “every 1-3 years”, 6% selected “every 11-15 years”. No respondent selected “every 16-25 years”. One respondent (3%) selected “evaluating collection relevance is not important”.

Respondents were then asked to judge (via a 4-level Likert scale) the importance of a quantitative measure of collection relevance to each of eight possible benefits. In this case, the scale points ranged from “1” (not important) to “4” (very important) so that a higher mean ranking indicated a higher relative level of importance to all respondents. The benefit receiving the highest mean ranking (3.3) was “earning institutional recognition/ visibility”, followed by “securing outside grants/funding (3.2) and “securing/ justifying institutional funding” (3.2), “gaining recognition/ visibility among other institutions/ gardens” (3.1), “garnering community/

visitor/ alumni support” (2.9), “fostering industry collaboration/ support” (2.8), “recruiting faculty or staff” (2.6) and “recruiting students” (2.2).

Next, respondents were prompted to rank the importance of each of several curatorial actions to promoting an educationally relevant plant collection. This was also accomplished via a 4-point Likert scale ranging from “1” (not important) to “4” (very important). The action receiving the highest mean ranking (3.5) was “displaying taxa in well-designed, properly-sited landscape situations”, followed by “growing all specimens to mature size” and “grouping contrasting species/ cultivars to aid in identification/ evaluation” (both 2.7), “growing/ maintain specimens at the size seen in the majority of local landscapes” (2.3), “grouping taxa according to taxonomic/ phylogenetic relationships” (2.1) and “displaying multiple sizes/ ages of the same taxon” (1.9).

Respondents were also asked to rank the most important sources of information when determining which plants are most prevalent or important to local and regional horticulture. This data was also obtained via a 4-point Likert scale ranging from “1” (not important) to “4” (very important). The sources receiving the highest mean ranking were “other botanical gardens and arboreta” and “university faculty/ instructors” (both 3.0) followed by “garden staff/ students/ volunteers” (2.9), “plant societies/ cultivar registrars” (2.7), “plant breeders/ marketing firms” and “wholesale plant producers” (both 2.5), “retail garden centers” (2.4), “landscape architects/ designers” (2.3), “landscape contractors” (2.2), and “re-wholesale plant distributors” (2.0).

In terms of how to determining criteria for the physical condition of plants in university gardens, respondents were asked to rank each of five attributes according to

a 5-point Likert scale ranging from “1” (most important) to “5” (least important). The attribute receiving the lowest mean ranking represented the most important criteria among all respondents. The lowest mean ranking (1.6) was attributed to “proper siting (sun/shade, moist/dry, etc.)”, followed by “proper spacing/ lack of crowding” (2.7), “harmonious/ aesthetic design” (3.2), “proper pruning/ form/ branching habit” (3.1) and “control/ prevention of disease/ insect pests” (4.4).

Finally, respondents were prompted to the ideal proportional breakdown of each of six categories of plant accessions in an educationally relevant plant collection. The highest percentage was allocated to “locally adapted/ recommended or popular taxa (native or exotic)” at 40.8%. This category was followed by “New introductions or “up and coming” taxa” (14.9%), “Historic/ mature specimens” (13.9%), “Rare/ threatened germplasm” (11.9%), “Taxa important to past or current breeding work” (6.9%), “Other” (5.8%) and “Unusual plants and genetic freaks” (5.7%). Those respondents selecting “Other” entered the following text:

Plants used in classwork

I can't answer a question like this.

Plants relevant to courses taught and in support of academic research.

Tropical and non-hardy varieties

The results of this question are illustrated in Figure 4.

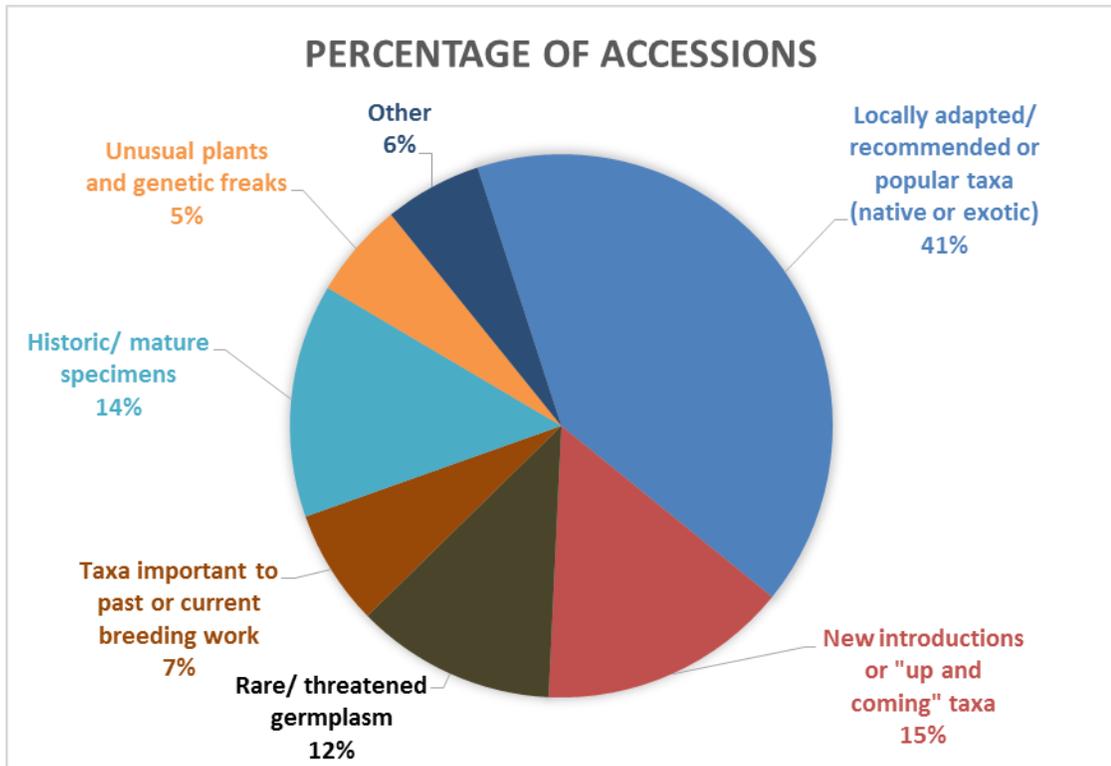


Figure 4 Ideal breakdown of an educationally relevant plant collection as reported by university garden leadership

### Academic Garden Visitation

During the researcher's visit to the academic gardens listed in Chapter 3, personal contact was made only with staff at the Hahn Horticulture Garden (Dr. Holly Scoggins, Director and Professor, and Dr. Alex Niemiera, Curator and Professor), UT Gardens (Dr. Sue Hamilton, Director, and Mr. James Newburn, Assistant Director), and the South Carolina Botanical Garden (Dr. Patrick McMillan, Director).

Discussion with these staff indicated insufficient funding as the primary obstacle to collection development and program implementation. For example, the Hahn Horticulture Garden receives no financial support from the parent institution (Virginia Tech) and must raise all operating revenue through event rentals, which

consist mostly of weddings (Scoggins, 2014). A nearly total lack of university funding was also cited by UT Gardens (Hamilton, 2014). Both gardens cited the importance of in-kind donations from industry sources (Niemiera, 2014; Newburn, 2014). Another perceived issue was the sense of bureaucratic barriers within the university environment. Dr. Hamilton (UT Gardens) explained that two major garden projects were "shovel ready" but had been delayed by regulatory matters (Hamilton, 2014).

With the exception of the South Carolina Botanical Garden, these gardens claimed a central mission of program support for university programs in horticultural science, ornamental plant display, and to a lesser extent, community engagement. South Carolina Botanical Garden places much more emphasis on assembling and displaying the native plant communities of South Carolina and primarily serves programs in botany and environmental science (McMillan, 2014). Dr. McMillan downplayed the influence of ornamentally important taxa to current garden objectives in favor of wild-collected native germplasm.

### **Woody Plant Instruction and the Academic Value of Holly Taxa**

Of the 85 survey links e-mailed to potential respondents, 44 recipients (52%) began the survey and 37 surveys (44%) were submitted to Qualtrics and recorded as complete. Only surveys recorded as complete were retained for further analysis. The mean time required to complete the survey was 11 minutes and 34 seconds. The results exhibited a significant disparity in terms of the percentage of questions completed in each of the survey's two sections.

Section one (questions 1-13) asked for baseline demographic information and feedback on instructional venues and methodology. The full text and results of this

portion of the survey are listed in Appendix H. This section had a substantially higher rate of completion than Section two (questions 14-21), which prompted respondents to select academically important *Ilex* taxa from a series of drop-down lists or enter them manually. Of the 44 respondents beginning Section one, an average of 95% completed all 13 questions.

For section two, this average dropped to 58%. The latter figure represents the mean response rate for the mandatory block of questions (questions 14, 16, 18, 20, 21) in this section. It should be noted that these five questions exhibited decreasing mean response rates of 82%, 77%, 75%, 34%, and 25%, respectively. The optional block of questions (15, 17, 19) was required only where respondents did not find their selected taxon included in the provided drop-down menus. These questions had mean response rates of 11%, 2%, and 7%, respectively. All taxa receiving votes in section two are listed in Appendix I.

### **Section One Results**

This survey first asked respondents to identify their primary responsibility or title. Respondents had the option to select more than one choice. The majority of respondents (84%) indicated that they currently serve as full-time faculty. The remaining respondents claimed a variety of roles including “Adjunct or part-time faculty” (11%), “Garden administrator, Curator or Horticulturist” (8%), “Green Industry Professional” (8%), and “Extension Professional” (3%). Two respondents (5%) selected “Other” and entered “Horticulture Department Chairperson” and “Horticulture Program Director”.

Six respondents (16% of completed surveys) indicated multiple titles or responsibilities. These included “Full-time faculty” *and* “Green Industry

Professional” (2 respondents), “Full-time faculty” *and* “Garden administrator, Curator or Horticulturist” (1 respondent), “Full-time faculty” *and* “Other (Horticulture Department Chairperson, Horticulture Program Director)” (2 respondent), and “Full-time faculty” *and* “Garden administrator, Curator or Horticulturist” *and* “Green Industry Professional” (1 respondent).

The majority of respondents (41%) indicated affiliation with a large university (over 20,000 students). The second most common affiliation (22%) was with a mid-sized community college or technical institute (5,000 to 10,000 students). The remaining respondents indicated a variety of affiliations with institutions of various types and sizes. All responses to this question are listed in Table 15.

Table 15 Institution type of respondents

<b>INSTITUTION TYPE</b>	<b>% OF RESPONDENTS</b>	<b>NUMBER OF RESPONDENTS</b>
Small University (fewer than 10,000 students)	3%	1
Mid-sized University (10,000 - 20,000 students)	8%	3
Large University (more than 20,000 students)	41%	15
Small Community College or Technical Institute (fewer than 5,000 students)	11%	4
Mid-sized Community College or Technical Institute (5,000 - 10,000 students)	22%	8
Large Community College or Technical Institute (more than 10,000 students)	16%	6

Respondents were also asked to indicate how many years they have been responsible for woody plant instruction. This question elicited a wide variety of responses, but most (28%) indicated that they have been teaching woody plant materials from 5-9 years. One respondent declined to answer. The full list of responses to this question is provided in Table 16.

Table 16 Respondents' years of experience teaching woody plant materials

<b>YEARS OF EXPERIENCE</b>	<b>% OF RESPONDENTS</b>	<b>NUMBER OF RESPONDENTS</b>
Less than 5 years	14%	5
5-9 years	28%	10
10-15 years	22%	8
16-20 years	14%	5
21-30 years	19%	7
Over 30 years	3%	1

Another identifying attribute was the location of respondents' respective institutions in relation to United States Department of Agriculture (USDA) Hardiness Zone and American Horticultural Society (AHS) Heat Zone designation. Survey recipients were pre-qualified by the researcher's determination of a location within Hardiness Zones 5B to 8B for each institution. Most respondents (24%) indicated a Hardiness Zone of 6B, while the fewest (3%) indicated a Hardiness Zone of 8B. Heat Zone designation ranged from 4 (16%) to 9 (3%), with the majority of respondents (27%) indicating a Heat Zone of 7 for their institution. The list of Hardiness Zone designations for all respondents is found in Table 17.

Table 17 USDA Hardiness Zone (2012) of respondents' institutions

<b>HARDINESS ZONE</b>	<b>% OF RESPONDENTS</b>	<b>NUMBER OF RESPONDENTS</b>
5B	12%	5
6A	21%	9
6B	28%	12
7A	19%	8
7B	7%	3
8A	12%	5
8B	2%	1

When asked to indicate the academic disciplines of students typically enrolled in respondents' woody plant courses, a variety of programs were represented. Most respondents (81%) indicated the presence of students enrolled in Landscape Contracting/ Design/ Management programs. This group was followed by Nursery Production/ Management (62%), and Public Horticulture (54%). An equal proportion of respondents (38%) reported the instruction of Landscape Architecture or Forestry, Urban Forestry or Arboriculture students. The fewest number of respondents (8%) indicated that students of Ecology or Wildlife Ecology are typically enrolled in their woody plant courses. Thirty percent of respondents selected "Other" and entered a range of other disciplines. Due to the various terminology and scope of these programs, no distinct categories could be identified.

In order to determine the breadth of taxa covered in most woody plant courses, respondents were asked to describe the most accurate characterization of the plants presented during outdoor instruction. These descriptions covered a range of characterizations indicating the proportion of species-level taxa to lower taxa such as

botanical or cultivated varieties. Most respondents (67%) selected “I cover mostly species, but also cover a few important hybrids or important cultivars”. Twenty-eight percent of respondents selected “I cover one or more important hybrids or cultivars of many plants”. Two respondents (6%) selected “Other” and entered “Native and non-native and cultivars of both - and the importance especially of native cultivars” and “I provide on-line lectures. There is a long version with related plants, hybrids and cultivars and a short version without the related species. The students are responsible to ID only to the species level.” No respondents indicated selected “I cover plants only to the species level” or “the majority of plants covered are hybrids or cultivars”.

Respondents were also asked to indicate the ideal proportion of several categories of plants that should be covered in these courses. The mean proportions reported for each category are illustrated in Figure 3. Respondents indicated that the majority of taxa covered (61%) should comprise the “Locally/ regionally popular landscape plants (native and introduced)”. Next, respondents indicated that 12% of course taxa should be categorized as “Native plants not typically seen in the landscape/ nursery trade” and 11% should be fall under the category of “New introductions or lesser known (“up and coming”) plants”.

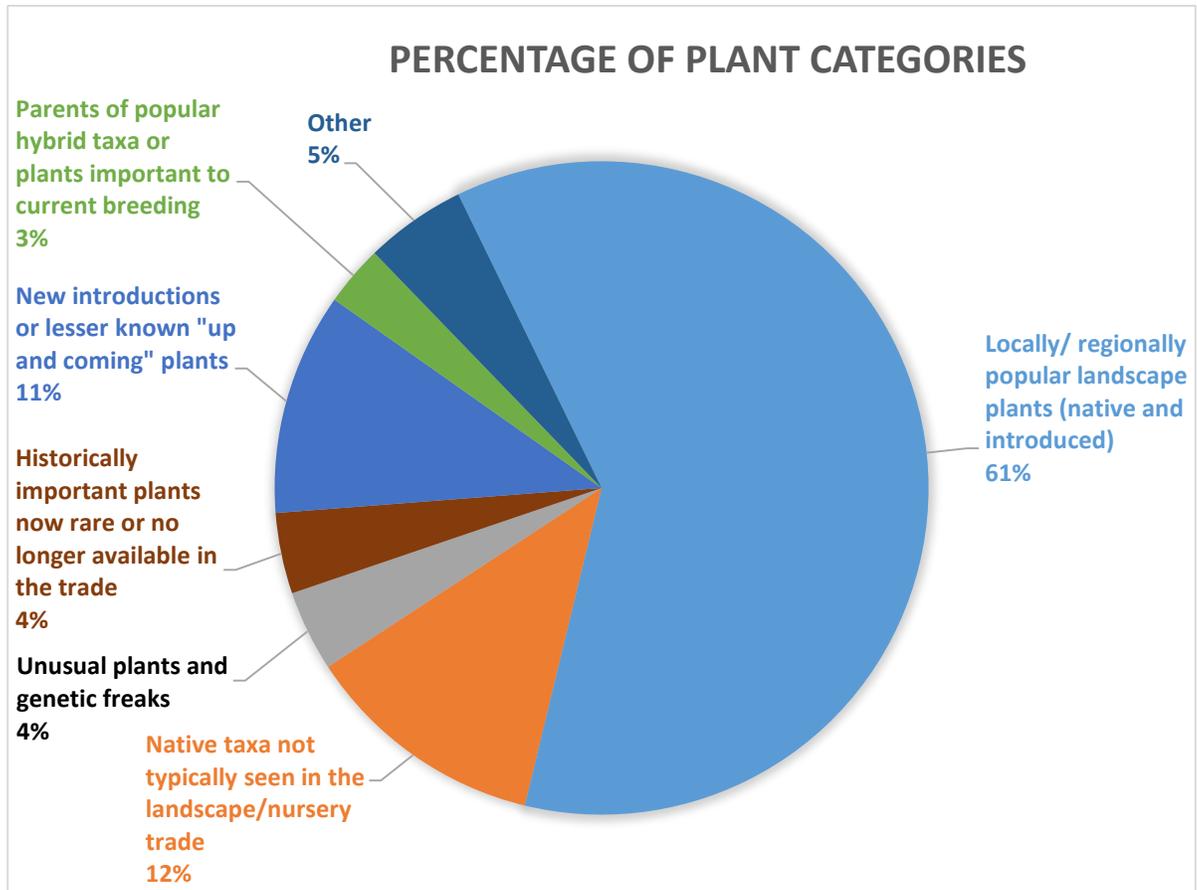


Figure 5 Ideal proportion of plant categories to be covered in woody plant materials courses as reported by woody plant instructors

The remaining proportions were split relatively equally between “Unusual plants and genetic freaks” (4%), “Historically important plants now rare or no longer available in the trade” (4%), “Parents of popular hybrid taxa or plants important to current breeding” (3%). Respondents indicated that 5% of course taxa could be categorized as “Other” and entered several additional categories of taxa. However, many of these could potentially be included in other categories:

Important taxa from other regions, we buy them in each year even though they will not survive where we are long term

Exotics (Europe, Asia)

Not sure what a perfect world means. 80% of my students are LA and I therefore primarily cover plants commonly available in the nursery industry. As mentioned before, I provide a long version of the lectures that include additional plants in each family for those students who are truly interested in a more comprehensive woody plant course.”

Plants required for Certified Plant Professional exam

What is commonly grown in area

invasive woodies

The proportion of class time spent at various types and locations of outdoor instructional venues was also investigated. Respondents were asked to report the approximate proportion of outdoor class time spent at each of several sites. The mean proportion of time spent at each venue was indicative of their general importance. The highest mean proportions were reported for "Part(s) of campus designated as an arboretum or botanical garden" (40%) and "Part(s) of campus NOT designated as an arboretum or botanical garden" (34%).

Though a majority of class time (73%) was reportedly spent on campus, the time spent at institutionally-affiliated venues grew to 81% when supplemented by the mean 8% of time spent at "Off-campus (requiring transportation) arboretum/ botanical garden affiliated with your institution". A similar mean percentage of class time (8%) was reportedly spent at "Arboretum or botanical garden(s) NOT affiliated with your institution". Non-institutional and/or non-garden venues were also selected, but in much lower mean proportions. A mean of 8% of outdoor instruction time was reported at "Off-campus neighborhood, park or forest" and 3% of class time was reportedly spent at a "Nursery production facility or retail garden center". Two related comments were supplied by respondents: "I offer two off-campus optional field trips."

and "Use to spend nearly a 90% of time in the garden until it was lost to budget cuts."

The venues utilized for outdoor instruction are presented in Table 18.

Table 18 Mean proportion of outdoor class time spent at venues utilized by woody plant materials instructors

VENUE	MEAN PROPORTION OF OUTDOOR CLASS TIME
Part(s) of campus designated as an arboretum or botanical garden	40%
Part(s) of campus NOT designated as an arboretum or botanical garden	34%
Off-campus (requiring transportation) arboretum or botanical garden affiliated with your institution	8%
Arboretum or botanical garden(s) NOT affiliated with your institution	8%
Off-campus neighborhood, park, or forest	3%
Nursery production facility or retail garden center	3%

In order to evaluate overall satisfaction with the academic effectiveness of the primary venue used for outdoor instruction, respondents were asked to rate this venue in each of six qualitative categories. This was accomplished via a 7-level Likert scale ranging from "1" (very ineffective) to "7" (very effective) so that a higher mean ranking indicated a higher relative level of satisfaction to all respondents. The highest mean ranking (5.6) was reported for "Overall relevance of the plant material to your teaching needs", followed by "Overall health/ physical condition of the plants displayed" (5.2), and "Demonstration of current plant usage trends in your region" (5.1). An equal mean ranking (4.4) was attributed to "Display of multiple ages/ sizes of the taxa covered" and "Incorporation of new and/or superior woody landscape

plants". The lowest mean ranking (4.1) was reported for "Timely removal/ replacement of inferior or ornamentally obsolete taxa".

Next, respondents were prompted to describe the level of input regarding curatorial activities (e.g. planting, pruning, or removal) they had at their primary instructional venue. A majority of instructors (35%) selected "I make suggestions from time to time". This proportion includes one respondent who selected "Other" and entered "We have some say in what gets planted. We have major problems with poor maintenance. We have unique challenges in that we share the location with a National Park Historic Site (Springfield Armory). I am currently in the process of setting up and applying for Tree Campus USA designation to try and alleviate some of our challenges. We have a newer head of Facilities Dept. who is very cooperative and we are developing systems and communication improvements with her."

Twenty-seven percent of respondents selected either "I have direct responsibility for which plants are displayed and their care" or "Other" (two respondents) and entered comments consistent with direct or semi-direct responsibility. These comments were "I am able to make suggestions for new plants and do have a wish list that gets addressed each year. I also sometimes plant sections of plants in the arboretum and on the grounds with my landscape management class or also make suggestions" and "I have direct responsibility for which plants are displayed, but care is shared with others". Fewer respondents (22%) selected "I have no input". The smallest proportion of respondents (16%) selected "I am part of a committee that determines planting/ removal/ maintenance".

To gauge the opinion of individual specimen size on educational relevance, respondents were asked submit feedback on the preferred size of an example taxon (as

a percentage of the taxon's maximum landscape size typically observed in the respondent's region), given the availability of only one specimen of that taxon for instruction. The same question was posed for each of the three categories of *Ilex* taxa used in other portions of this study: *evergreen trees*, *evergreen shrubs* and *deciduous shrubs*. The results were relatively consistent for each category. The mean preferred percentage of maximum size reported was 65% for both *evergreen trees* and *evergreen shrubs*, and 69% for *deciduous shrubs*.

Finally, respondents were asked to indicate the importance of several factors to the decision to discontinue covering a particular taxon in class. This was accomplished via a 5-level Likert scale ranging from "1" (not important) to "5" (very important) so that a higher mean ranking indicated a higher relative level of importance to all respondents. The highest mean rankings were attributed to "Environmental unsuitability (heat, cold, soils, etc.)" (3.9) and "No plantings available for local observation" (3.6). Two factors, "Chronic disease problems (fungal, bacterial, etc.)" and "Chronic insect or animal pest problems" received equal mean rankings (3.3). Next in importance were "Unavailability from growers/ retailers" (3.2) and "Invasiveness or potential invasiveness" (3.1). According to respondents, the least important factor would be "Decreased popularity with local designers/ contractors" (2.8). Five respondents entered text in the space marked "Other". These comments were:

I try to propagate plants in our collection because we have plants that are not found anywhere else. Historically some of the plants are important to our collections.

Show good and bad to illustrate both what should be planted and what should not, so just as important to show the students undesirable as desirable plants

I teach an entire week on invasive species hence my rating on invasive species

I had difficulty answering this question because I consider the lecture and lab to be complementary but not duplicative. For example, we discontinued *Hamamelis virginiana* as a lab plant because campus construction removed the only existing plant. We still include in the lecture as an important native landscape plant.

Interesting historical place

## Section Two Results

Section two of this survey addressed respondents' opinion of the most important holly taxa to student preparation. This exercise did not explicitly require respondents to list any or all taxa taught in woody plant courses, but encouraged respondents to list, in no particular order, the taxa “students should know.” As outlined previously, respondents were asked to provide a “Top 10” list of both *evergreen tree* and *evergreen shrub* taxa and a “Top 5” list of *deciduous shrub* taxa. The 37 completed surveys made for a total of 370 possible votes for *evergreen tree* taxa, 370 possible votes for *evergreen shrub* taxa and 185 possible votes for *deciduous shrub* taxa. The total number of votes possible for all taxa was 925. A total of 638 votes were cast, making for a response rate of 69%. This percentage includes all selections of “Other” where one taxon was manually entered in the following question. However, there were an additional 22 selections of “Other” where no taxon was entered in the follow-up question. A full list of all taxa receiving votes is found in Appendix I.

For *evergreen tree* taxa, a total of 215 votes were cast, representing a response rate of 58% relative to the total votes possible for all completed surveys. Thirty-five of 37 respondents (95%) began this question and selected at least one *evergreen tree*

taxon. However, only 16 of 35 (46%) selected or manually entered choices for all 10 possible selections. A total of 45 unique *evergreen tree* taxa were identified, including any taxa inadvertently entered manually under either of the other two categories.

The highest ranked taxa (i.e. those within the 80<sup>th</sup> percentile) in this category were *I. opaca* (29 total votes), *I.* ‘Nellie R. Stevens’ (25 votes), *I. cornuta* ‘Burfordii’ (22 votes), *I. ×attenuata* ‘Foster No. 2’ (21 votes), *I. aquifolium* (17 votes), *I.* ‘Emily Bruner’ (10 votes), *I. ×attenuata* ‘Savannah’ (10 votes), *I. latifolia* (6 votes), *I.* ‘Mary Nell’ (6 votes), and *I. ×aquipernyi* ‘Meschick’ (6 votes). These taxa are listed Table 19.

Table 19 Highest ranked *evergreen tree* taxa identified by respondents

TAXON	NUMBER OF VOTES
<i>Ilex opaca</i>	29
<i>Ilex</i> ‘Nellie R. Stevens’	25
<i>Ilex cornuta</i> ‘Burfordii’	22
<i>Ilex ×attenuata</i> ‘Foster No. 2’	21
<i>Ilex aquifolium</i>	17
<i>Ilex</i> ‘Emily Bruner’	10
<i>Ilex ×attenuata</i> ‘Savannah’	10
<i>Ilex latifolia</i>	6
<i>Ilex</i> ‘Mary Nell’	6
<i>Ilex ×aquipernyi</i> ‘Meschick’ (Dragon Lady®)	6

For *evergreen shrub* taxa, a total of 286 votes were cast, representing a response rate of 77% of all possible votes for the 37 surveys submitted as complete.

Thirty-four out of 37 respondents (77%) began this question and selected at least one taxon. Only 23 of these (68%) selected or manually entered choices for all 10 possible selections. A total of 51 unique *evergreen shrub* taxa were identified, including any taxa inadvertently entered manually under either of the other two categories. The same procedure outlined for the *evergreen tree* category was used to allocate these votes.

Table 20 Highest ranked *evergreen shrub* taxa identified by respondents

TAXON	NUMBER OF VOTES
<i>Ilex glabra</i>	22
<i>Ilex crenata</i>	19
<i>Ilex crenata</i> 'Helleri'	18
<i>Ilex cornuta</i> 'Dwarf Burford'	15
<i>Ilex glabra</i> 'Shamrock'	15
<i>Ilex crenata</i> 'Sky Pencil'	14
<i>Ilex cornuta</i> 'Rotunda'	12
<i>Ilex cornuta</i> 'Carissa'	10
<i>Ilex vomitoria</i>	10
<i>Ilex crenata</i> 'Convexa'	10
<i>Ilex ×meserveae</i> 'Blue Girl'	10

The highest ranked taxa (i.e. those within the 80th percentile) in this category were *I. glabra* (22 votes), *I. crenata* (19 votes), *I. crenata* 'Helleri' (18 votes), *I. cornuta* 'Dwarf Burford' (15 votes), *I. glabra* 'Shamrock' (15 votes), *I. crenata* 'Sky Pencil' (14 votes), *I. cornuta* 'Rotunda' (12 votes), *I. cornuta* 'Carissa' (10 votes), *I.*

*vomitorea* (10 votes), *I. crenata* 'Convexa' (10 votes), and *I. ×meserveae* 'Blue Girl' (10 votes). These taxa are listed in Table 20.

For *deciduous shrub* taxa, a total of 125 votes were cast, representing a response rate of 68% of all possible votes for the 37 surveys submitted as complete. Thirty-four out of 37 respondents (77%) began this question and selected at least one taxon. Only 23 of these (68%) selected or manually entered choices for all 10 possible selections. A total of 20 unique *deciduous shrub* taxa were identified. One respondent manually entered “Any male cultivar of *Ilex verticillata*”. This vote was attributed to *I. verticillata* ‘Southern Gentleman’ which was the highest vote total recipient for male selections of this species. The highest ranked taxa (i.e. those within the 80th percentile) in this category were *I. verticillata* (24 votes), *I. verticillata* 'Red Sprite' (17 votes), *I. 'Sparkleberry'* (15 votes), *I. verticillata* 'Winter Red' (14 votes), and *I. decidua* (12 votes). These taxa are presented in Table 21.

Respondents were next prompted to list taxa not attributed to any of the three preceding categories by entering up to five taxa no longer covered (in class) due to unpopularity, unavailability, environmental factors or other limitations. Fifteen of 37 respondents (41%) entered at least one taxon. A total of 185 votes were possible for this question but only 34 votes were cast (18% of all possible votes), identifying 26 unique taxa. This does not include the comments of two respondents who instead entered the following text: “Most species of *Ilex* popular on LI (Long Island) have stayed constant” and “our limitation is unsuitability in the climate of NE Ohio”.

Table 21 Highest ranked *deciduous shrub* taxa identified by respondents

TAXON	NUMBER OF VOTES
<i>Ilex verticillata</i>	24
<i>Ilex verticillata</i> ‘Red Sprite’	17
<i>Ilex</i> ‘Sparkleberry’	15
<i>Ilex verticillata</i> ‘Winter Red’	14
<i>Ilex decidua</i>	12

The eight taxa receiving multiple votes (2 each) were *I. amelanchier*, *I. cornuta*, *I. crenata* ‘Convexa’, *I. crenata* ‘Rotundifolia’ (erroneously entered by one respondent as the illegitimate “*Ilex crenata* Rotundiloba” and counted as a vote for *I. crenata* ‘Rotundifolia’ by the researcher), *I. glabra*, *I. latifolia*, *I. pedunculosa*, and *I. rugosa*. A list of all taxa (and in the case of one respondent, groups of taxa) named in this question is presented in Table 22.

The final question in section two asked respondents to manually enter up to five taxa not previously identified as plants “students should know” but that they would consider teaching in the future due to increased prominence, suitability or appeal. Eleven of 37 respondents (30%) entered at least one taxon. A total of 185 votes were possible for this question but only 24 votes were cast (13% of all possible votes), identifying 22 unique taxa. The two taxa receiving multiple votes (2 each) were *I. decidua* and *I.* ‘Rock Garden’. The submissions of three respondents identified a group of cultivars or lower taxa, which are included in Table 23.

Table 22 *Ilex* taxa no longer covered due to unpopularity, unavailability, environmental factors, or other limitations

<b>TAXON</b>	<b>NUMBER OF VOTES</b>
<i>Ilex amelanchier</i>	2
<i>Ilex aquifolium</i>	1
<i>Ilex aquifolium</i> cultivars	1
<i>Ilex</i> × <i>attenuata</i> 'Greenleaf'	1
<i>Ilex cassine</i>	1
<i>Ilex cornuta</i>	2
<i>Ilex cornuta</i> 'Burfordii'	1
<i>Ilex cornuta</i> 'Rotunda'	1
<i>Ilex crenata</i>	1
<i>Ilex crenata</i> 'Convexa'	2
<i>Ilex crenata</i> 'Hoogendorn'	1
<i>Ilex crenata</i> 'Rotundifolia'	2
<i>Ilex crenata</i> 'Sky Pencil'	1
<i>Ilex decidua</i>	1
<i>Ilex glabra</i>	2
<i>Ilex latifolia</i>	2
<i>Ilex</i> 'Mesdob' (China Boy®)	1
<i>Ilex</i> × <i>meserveae</i>	1
<i>Ilex</i> × <i>meserveae</i> 'Blue Boy'	1
<i>Ilex</i> × <i>meserveae</i> 'Conablu' (Blue Prince®)	1
<i>Ilex</i> × <i>meserveae</i> 'Conapri' (Blue Princess®)	1
<i>Ilex</i> 'Mesog' (China Girl®)	1
<i>Ilex pedunculosa</i>	2
<i>Ilex</i> 'Raritan Chief'	1
<i>Ilex rugosa</i>	2
<i>Ilex vomitoria</i>	1

Table 23 *Ilex* taxa named by instructors as having future instructional value due to increased prominence, suitability or appeal

<b>TAXON</b>	<b>NUMBER OF VOTES</b>
<i>Ilex aquifolium</i> 'Argentea Marginata' (entered as 'Variegata')	1
<i>Ilex aquifolium</i> 'Golden King'	1
<i>Ilex aquifolium</i> 'Golden Milkboy'	1
<i>Ilex</i> × <i>aquipernyi</i> ("selections")	1
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	1
<i>Ilex</i> 'Carolina Sentinel'	1
<i>Ilex</i> 'Conin' (Robin™)	1
<i>Ilex</i> 'Conty' (Liberty™)	1
<i>Ilex crenata</i> ("hardy cultivars")	1
<i>Ilex crenata</i> 'Soft Touch'	1
<i>Ilex decidua</i>	2
<i>Ilex</i> 'HL10-90' (Christmas Jewel®)	1
<i>Ilex latifolia</i>	1
<i>Ilex</i> × <i>meserveae</i>	1
<i>Ilex</i> × <i>meserveae</i> 'Honey Maid'	1
<i>Ilex</i> 'Nellie R. Stevens'	1
<i>Ilex opaca</i> 'Maryland Dwarf'	1
<i>Ilex pedunculosa</i>	1
<i>Ilex</i> 'Rock Garden'	2
<i>Ilex</i> 'Rutzan' (Red Beauty®)	1
<i>Ilex verticillata</i>	1
<i>Ilex verticillata</i> 'Maryland Beauty'	1

Additionally, three respondents submitted the following comments: “ANY PROVEN HARDY IN OUR AREA”, “New hybrids”, and “Several of the newer holly hybrid cultivars” which were not helpful to this portion of the survey. One related

comment was “We teach more *I. verticillata* than I was allowed to list, it is one of the more important hollies for us”.

### **Physical Evaluation of the UDBG *Ilex* Collection**

Prior to the researcher’s evaluation of all accessions in the UDBG holly collection, the inventory of all *Ilex* accessions totaled 268 individual plants representing 130 taxa. As this assessment focused only on intensively cultivated academic gardens, 20 plants of *Ilex verticillata* (accession number 08-36) located in the UDBG’s wetland garden were excluded from evaluation.

Also excluded from physical evaluation were 13 containerized plants representing 10 taxa that had been accessioned but not yet planted out. These consisted of three taxa already held in the collection and seven taxa not held in the collection. The researcher concluded that the assessments of age, density, habit, and spacing applied to in-ground plants would be of little relevance in evaluating juvenile plants, so these plants were not assigned physical condition scores. These omissions reduced the total number of expected evaluands to 235 plants representing 120 taxa.

Following the collection’s physical evaluation, 28 plants representing 25 taxa were determined to no longer exist. However, three of these taxa were still represented by extant accessions. Missing taxa were either found dead by the researcher or not located due to prior undocumented death, removal, or errors in previous inventories. The majority of missing plants (19 plants representing 18 taxa) had been located in an area of the UDBG previously devoted to nursery production. This area had not been adequately inventoried in several years. Extant plants in this area exhibited considerable physical deficiencies as a result of crowding, competition, or neglect. Also, two undocumented plants were discovered during evaluation.

Post-evaluation, the total number of plants available for relevancy analysis totaled 207 plants representing 98 taxa. These consisted of 59 plants (46 taxa) categorized as *evergreen trees* (29% of all evaluands), 69 plants (29 taxa) categorized as *evergreen shrubs* (33% of all evaluands), and 79 plants (23 taxa) categorized as *deciduous shrubs* (38% of all evaluands). The mean date of accessioning for all in-ground hollies at the UDBG was 1991. Assuming a mean age of 3 years for all plants at the time of accessioning, the approximate mean physical age of all plants evaluated was 27 years. The physical evaluation results for all groups of taxa are found in Appendix M.

For *evergreen trees*, the mean year of accession of all evaluands was 1985. Using the categories for physical condition outlined above, 22 plants (36%) were deemed “GOOD”, 24 plants (39%) were deemed “FAIR”, and 15 plants (25%) were deemed “POOR”. The mean year of accession for each category was 1989, 1958, and 1982, respectively. For *evergreen shrubs*, the mean year of accession of all evaluands was 1993. Thirty plants (44%) were deemed “GOOD”, 27 plants (40%) were deemed “FAIR”, and 11 plants (16%) were deemed “POOR”. The mean year of accession for each category was 1994, 1993, and 1990, respectively. For *deciduous shrubs*, the mean year of accession of all evaluands was 1993. Forty-two plants (54%) were deemed “GOOD”, 33 plants (42%) were deemed “FAIR”, and 3 plants (4%) were deemed “POOR”. The mean year of accession for each category was 1998, 1988, and 1984, respectively.

To assess the relative independence of the variables used in the physical evaluation process (Density, Habit, Health, Spacing) a post-evaluation Pearson

Correlation test was conducted using Microsoft Excel. The results are listed in Table 24.

Table 24 Pearson Correlation (*r*) values of physical evaluation variables

<b>VARIABLE</b>	Density	Habit	Health	Spacing
Density	-	.754353	.648404	.522144
Habit	.754353	-	.615092	.477214
Health	.648404	.615092	-	.399181
Spacing	.522144	.477214	.399181	-

In all calculations, either a moderately strong (Spacing and Health) or strong positive correlation (Density and Habit; Density and Health; Density and Spacing; Habit and Health; Habit and Spacing) was exhibited.

### **Determining the Current Educational Relevance of the UDBG *Ilex* Collection**

As discussed in Chapter 3, a synthesis of the independent measures of current industry prevalence (distributors, growers, and pertinent awards), academic value (instructor opinion and UD academic use), and physical condition for each plant in the UDBG holly collection will reflect the collection's instructional relevance. The scores for each of these five factors (100 possible points each) were combined to create a 500-point scale applicable to each taxon. This scale will be utilized to prioritize, in descending order, the most desirable *Ilex* taxa for acquisition by (or continued cultivation at) the UDBG. In many cases, this will require the removal of less relevant taxa.

The above sources revealed a total of 229 legitimate taxa made up of 112 (49%) *evergreen tree* taxa, 86 (37%) *evergreen shrub* taxa, and 31 (14%) *deciduous*

*shrub* taxa. The highest scoring *evergreen tree* taxa were *I.* ‘Nellie R. Stevens’ (354.1), *I. opaca* ‘Satyr Hill’ (285.7), *I. ×aquipernyi* ‘Meschick’ (267.2), *I. opaca* (242.0), *I. ×attenuata* ‘Foster No. 2’ (209.7), and *I. aquifolium* ‘Argentea Marginata’ (204.3). The highest scoring *evergreen shrub* taxa were *I. crenata* ‘Sky Pencil’ (361.2), *I. crenata* ‘Helleri’ (333.4), *I. glabra* ‘Shamrock’ (291.5), *I. crenata* ‘Steed's Upright’ (280.9), and *I. crenata* ‘Hoogendorn’ (252.9). The highest scoring *deciduous shrub* taxa were *Ilex verticillata* ‘Red Sprite’ (386.2), *I. verticillata* ‘Winter Red’ (365.4), *I. verticillata* ‘Southern Gentleman’ (297.5), *I. verticillata* ‘Jim Dandy’ (281.7), and *I. verticillata* ‘Winter Gold’ (240.9). The complete relevance rankings for all taxa are listed in Appendix O.

A measurement of current educational relevance is based on 1) the proportion of highly rated taxa currently held in the collection relative to how many taxa it can be expected to hold and 2) how well these taxa are displayed (physical condition). The first step in determining a current measure of educational relevance for the UDBG holly collection was to set benchmarks for the size and composition of this part of the garden. To maintain the current amount of holly taxa and present a simplified model for collection relevance assessment, a total count of 100 was selected as the collection’s target “carrying capacity” for *Ilex* accessions. Proportionally, the collection will be comprised of 50 *evergreen tree* taxa, 30 *evergreen tree* taxa, and 20 *deciduous shrub* taxa to roughly mimic the post-evaluation breakdown of holly categories. These proportions could be easily modified to accommodate the target amount of different ornamental taxa either within the UDBG or similar academic collections.

For the collection as a whole, the compositional goal utilized for this project was as follows: 65% commercially prevalent or common ornamental taxa (as identified by the surveys of distributors and growers), 15% newer introductions in need of further evaluation, 10% instructionally or locally important taxa, 5% regionally native taxa not typically found in the nursery trade, and 5% unusual hollies of specific ornamental interest. These proportions were also guided in part by instructors' recommendations for course composition and can be altered depending on future needs or revisions of collection goals. Using the current amount and proportions of living holly taxa as a guide, the proposed collection goals are presented in Table 24.

Further analysis of the taxa identified by both industry surveys was required to allocate each taxon into the appropriate category as listed in Table 25. For this analysis, only taxa receiving instructor votes on their own merit were included, thus negating the employment of "modified votes" as outlined in Chapter 3 and listed in Appendix I. The actual number of votes received from instructors was added directly to the summed percentages of distributors and growers offering a taxon.

This step was required to reduce the excessive number of taxa (specifically those of *I. opaca* and *I. crenata*) offered by only one firm and/or named by only one instructor. Also excluded were any species-level taxa not recorded as available in the nursery trade but otherwise represented by at least one available cultivar (e.g. *I. aquifolium*, *I. crenata*, *I. cornuta*).

Table 25 UDBG *Ilex* collection composition goals by quantity of taxa

CATEGORY (approx. % of collection)	TARGET NUMBER OF TAXA ( <i>n</i> = 100)		
	<i>Evergreen tree</i> taxa ( <i>n</i> = 50)	<i>Evergreen shrub</i> taxa ( <i>n</i> = 30)	<i>Deciduous shrub</i> taxa ( <i>n</i> = 20)
Prevalent taxa (65%)	32	19	13
Newer introductions or less common taxa in need of further evaluation (15%)	7	4	3
Instructionally or locally important taxa (10%)	5	3	2
Native taxa not commercially common (5%)	3	2	1
Unusual plants of specific ornamental interest (5%)	3	2	1

The complete list of the 32 most prevalent *evergreen tree* taxa are presented in Table 26 in descending order of popularity. Using the same criteria outlined above, the 19 most popular/prevalent *evergreen shrub* taxa are listed in Table 27, and the 13 most popular/prevalent *deciduous shrub* taxa are listed in Table 28. Each table includes the overall availability percentages at distributors (D), growers (G), and the total votes received from instructors (I). Each taxon is also labeled according to its current inclusion in the UDBG (YES or NO).

Table 26 Prevalent evergreen tree taxa for possible inclusion in the UDBG

TAXON	D <sup>1</sup>	G <sup>2</sup>	I <sup>3</sup>	TOTAL <sup>4</sup>	IN UDBG
<i>Ilex</i> ‘Nellie R. Stevens’	74.1	91.1	25.0	190.2	YES
<i>Ilex</i> × <i>aquipernyi</i> ‘Meschick’ (Dragon Lady®)	63.0	93.3	6.0	162.3	YES
<i>Ilex opaca</i>	18.5	53.3	29.0	100.9	YES
<i>Ilex</i> × <i>attenuata</i> ‘Foster No. 2’	37.0	40.0	21.0	98.0	NO
<i>Ilex</i> ‘Conaf’ (Oak Leaf™)	44.4	48.9	2.0	95.3	NO
<i>Ilex</i> ‘Rutzan’ (Red Beauty®)	37.0	53.3	2.0	92.4	YES
<i>Ilex</i> ‘Conin’ (Robin™)	29.6	60.0	0.0	89.6	NO
<i>Ilex opaca</i> ‘Satyr Hill’	37.0	48.9	3.0	88.9	YES
<i>Ilex aquifolium</i> ‘Argentea Marginata’	7.4	68.9	1.0	77.3	YES
<i>Ilex</i> ‘Doctor Kassab’	33.3	33.3	1.0	67.7	YES
<i>Ilex</i> ‘Centennial Girl’	18.5	44.4	0.0	63.0	YES
<i>Ilex cornuta</i> ‘Burfordii’	11.1	22.2	21.0	54.3	NO
<i>Ilex</i> ‘Magland’ (Oakland™)	11.1	42.2	0.0	53.3	NO
<i>Ilex cornuta</i> ‘Anicet Delcambre’ (‘Needlepoint’)	33.3	13.3	4.0	50.7	NO
<i>Ilex opaca</i> ‘Jersey Princess’	18.5	26.7	4.0	49.2	NO
<i>Ilex opaca</i> ‘Miss Helen’	25.9	15.6	2.0	43.5	YES
<i>Ilex</i> × <i>attenuata</i> ‘Greenleaf’	22.2	17.8	0.0	40.0	NO
<i>Ilex</i> ‘Mary Nell’	18.5	13.3	6.0	37.9	NO
<i>Ilex opaca</i> ‘Dan Fenton’	18.5	17.8	1.0	37.3	NO
<i>Ilex opaca</i> ‘Jersey Knight’	18.5	13.3	4.0	35.9	NO
<i>Ilex</i> ‘HL10-90’ (Christmas Jewel®)	18.5	15.6	0.0	34.1	NO
<i>Ilex cornuta</i> ‘Fine Line’	14.8	17.8	0.0	32.6	NO
<i>Ilex</i> ‘Emily Bruner’	14.8	6.7	10.0	31.5	NO
<i>Ilex</i> ‘Conty’ (Liberty™)	7.4	20.0	1.0	28.4	NO
<i>Ilex opaca</i> f. <i>xanthocarpa</i>	18.5	0.0	4.0	22.5	YES
<i>Ilex</i> × <i>koehneana</i>	11.1	6.7	3.0	20.8	YES
<i>Ilex</i> × <i>attenuata</i> ‘Savannah’	7.4	0.0	10.0	17.4	NO
<i>Ilex</i> × <i>aquipernyi</i> ‘San Jose’	14.8	0.0	1.0	15.8	NO
<i>Ilex opaca</i> ‘Paterson’	11.1	4.4	0.0	15.6	NO
<i>Ilex</i> ‘Carolina Sentinel’	14.8	0.0	0.0	14.8	NO
<i>Ilex</i> ‘Magiana’ (Acadiana™)	14.8	0.0	0.0	14.8	NO
<i>Ilex</i> ‘Conal’ (Cardinal™)	6.7	7.4	0.0	14.1	NO

<sup>1</sup> Distributors

<sup>3</sup> Instructor votes

<sup>2</sup> Growers

<sup>4</sup> Total relevance score

Table 27 Prevalent *evergreen shrub* taxa for inclusion in the UDBG

TAXON	D <sup>1</sup>	G <sup>2</sup>	I <sup>3</sup>	TOTAL <sup>4</sup>	IN UDBG
<i>Ilex crenata</i> 'Sky Pencil'	97.8	74.1	14.0	185.9	YES
<i>Ilex glabra</i> 'Shamrock'	95.6	51.9	15.0	162.4	YES
<i>Ilex crenata</i> 'Steed's Upright'	97.8	59.3	1.0	158.0	NO
<i>Ilex crenata</i> 'Helleri'	91.1	48.1	18.0	157.3	YES
<i>Ilex crenata</i> 'Hoogendorn'	93.3	33.3	3.0	129.7	NO
<i>Ilex crenata</i> 'Soft Touch'	64.4	44.4	5.0	113.9	NO
<i>Ilex crenata</i> 'Green Lustre'	62.2	48.1	3.0	113.4	YES
<i>Ilex crenata</i> 'Chesapeake'	48.9	63.0	1.0	112.9	NO
<i>Ilex cornuta</i> 'Dwarf Burford'	40.0	55.6	15.0	110.6	YES
<i>Ilex ×meserveae</i> 'Conapri' (Blue Princess®)	97.8	3.7	9.0	110.5	NO
<i>Ilex ×meserveae</i> 'Mesid' (Blue Maid®)	100.0	0.0	2.0	102.0	NO
<i>Ilex</i> 'Mesog' (China Girl®)	86.7	3.7	7.0	97.4	YES
<i>Ilex ×meserveae</i> 'Conablu' (Blue Prince®)	77.8	3.7	6.0	87.5	YES
<i>Ilex crenata</i> 'Compacta'	68.9	0.0	5.0	73.9	NO
<i>Ilex ×meserveae</i> 'Blue Girl'	26.7	37.0	10.0	73.7	YES
<i>Ilex cornuta</i> 'Carissa'	35.6	25.9	11.0	72.5	NO
<i>Ilex</i> 'Mesdob' (China Boy®)	64.4	3.7	4.0	72.1	YES
<i>Ilex glabra</i> 'Densa'	46.7	22.2	1.0	69.9	YES
<i>Ilex glabra</i> 'Compacta'	44.4	14.8	4.0	63.3	YES

<sup>1</sup> Distributors

<sup>3</sup> Instructor votes

<sup>2</sup> Growers

<sup>4</sup> Total relevance score

Of the 32 most prevalent *evergreen tree* taxa, only 10 (31%) are currently held in the UDBG. One taxon, *I. opaca* f. *xanthocarpa*, was included in this total due to its current representation by the cultivar 'Canary'. Of the 19 most prevalent *evergreen shrub* taxa, 11 (58%) are currently held in the UDBG. Of the 13 most prevalent *deciduous shrub* taxa, 6 (46%) are currently held in the UDBG. The mean percentage of current inclusion for all prevalent taxa is 42%. Post evaluation curation of the

UDBG holly collection should aim for a much higher proportion of educationally relevant taxa.

Table 28 Prevalent *deciduous shrub* taxa for inclusion in the UDBG

<b>TAXON</b>	<b>D<sup>1</sup></b>	<b>G<sup>2</sup></b>	<b>I<sup>3</sup></b>	<b>TOTAL<sup>4</sup></b>	<b>IN UDBG</b>
<i>Ilex verticillata</i> ‘Winter Red’	93.3	59.3	14.0	166.6	YES
<i>Ilex verticillata</i> ‘Red Sprite’	93.3	48.1	17.0	158.5	NO
<i>Ilex verticillata</i> ‘Southern Gentleman’	77.8	48.1	7.0	132.9	YES
<i>Ilex verticillata</i> ‘Jim Dandy’	80.0	37.0	4.0	121.0	NO
<i>Ilex</i> ‘Sparkleberry’	64.4	18.5	15.0	98.0	YES
<i>Ilex</i> ‘Apollo’	53.3	14.8	3.0	71.1	NO
<i>Ilex verticillata</i> ‘Winter Gold’	26.7	22.2	5.0	53.9	YES
<i>Ilex verticillata</i>	13.3	3.7	24.0	41.0	YES
<i>Ilex verticillata</i> ‘Spravy’ (Berry Heavy®)	20.0	14.8	0.0	34.8	NO
<i>Ilex verticillata</i> ‘Maryland Beauty’	15.6	11.1	1.0	27.7	NO
<i>Ilex verticillata</i> ‘Afterglow’	20.0	3.7	3.0	26.7	YES
<i>Ilex verticillata</i> ‘Spriber’ (Berry Nice®)	15.6	7.4	0.0	23.0	NO
<i>Ilex verticillata</i> ‘Golden Verboom’	13.3	0.0	0.0	13.3	NO

<sup>1</sup> Distributors

<sup>3</sup> Instructors

<sup>2</sup> Growers

<sup>4</sup> Total relevance score

Table 29 Mean physical rating for prevalent *Ilex* taxa

TAXON	PLANT S	MEAN PHYS. RATING
<b><i>Evergreen Tree</i></b>		
<i>Ilex aquifolium</i> 'Argentea Marginata'	1	1.9
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	3	3.1
<i>Ilex</i> 'Centennial Girl'	1	3.3
<i>Ilex</i> 'Doctor Kassab'	1	2.2
<i>Ilex</i> × <i>koehneana</i>	4	2.9
<i>Ilex</i> 'Nellie R. Stevens'	2	2.5
<i>Ilex opaca</i>	4	3.3
<i>Ilex opaca</i> 'Miss Helen'	1	1.9
<i>Ilex opaca</i> 'Satyr Hill'	1	2.6
<i>Ilex</i> 'Rutzan' (Red Beauty®)	1	2.8
<b><i>Evergreen Shrub</i></b>		
<i>Ilex cornuta</i> 'Dwarf Burford'	6	2.5
<i>Ilex crenata</i> 'Green Lustre'	3	3.4
<i>Ilex crenata</i> 'Helleri'	4	2.6
<i>Ilex crenata</i> 'Sky Pencil'	2	2.5
<i>Ilex glabra</i> 'Compacta'	7	2.4
<i>Ilex glabra</i> 'Densa'	13	2.9
<i>Ilex glabra</i> 'Shamrock'	1	2.6
<i>Ilex</i> 'Mesdob' (China Boy®)	3	2.4
<i>Ilex</i> × <i>meserveae</i> 'Blue Girl'	1	1.3
<i>Ilex</i> × <i>meserveae</i> 'Conablu' (Blue Prince®)	1	1.3
<i>Ilex</i> 'Mesog' (China Girl®)	3	2.3
<b><i>Deciduous Shrub</i></b>		
<i>Ilex</i> 'Sparkleberry'	3	2.9
<i>Ilex verticillata</i>	2	2.9
<i>Ilex verticillata</i> 'Afterglow'	3	3.2
<i>Ilex verticillata</i> 'Southern Gentleman'	2	3.2
<i>Ilex verticillata</i> 'Winter Gold'	7	3.3
<i>Ilex verticillata</i> 'Winter Red'	12	2.4

Applying the mean physical condition score recorded for all specimens of each taxon held in the collection presents an overall assessment of educational relevance. These calculations for the existing taxa deemed most prevalent are found in Table 29.

The mean physical rating for the 18 plants classified as prevalent *evergreen tree* taxa was 2.64. Using the physical condition rating scale outlined in the previous section, this category of *Ilex* taxa received a cumulative rating of “FAIR”. The mean physical rating for the 44 plants classified as prevalent *evergreen shrub* taxa was slightly lower at 2.37. This group also received a “FAIR” rating. The mean physical rating for the 29 plants classified as prevalent Deciduous Shrub Taxa was higher at 3.0. This group received a “GOOD” rating.

The target taxa making up the 15% of holly designated as “Newer introductions or less common taxa in need of further evaluation” were not dependent on a high level of industry prominence or popularity. Conversely, this category includes less commercially prevalent taxa having been introduced into the horticultural trade within the previous 15 years. This category also features plants named by instructors as having the potential for future instructional use by instructors. Taxa in this category may have either occasional availability in the Mid-Atlantic and Southeast or wider availability in the Southeast and show promise for more northern adaptability and use. The 14 taxa in this category are listed in Table 30.

Of the 14 taxa deemed “Newer introductions or less common taxa in need of further evaluation, only 2 (12%) are currently held by the UDBG. Both of these (*I.* ‘Dragon Slayer’ and *I. ×meserveae* ‘Hachfee’) exist as young containerized specimens not yet planted out in the collection and received no physical condition rating during this evaluation.

Table 30 Newer introductions or less common *Ilex* taxa in need of further evaluation

TAXON	IN UDBG
<b><i>Evergreen Tree</i></b>	
<i>Ilex aquifolium</i> 'Marijo'	NO
<i>Ilex buergeri</i>	NO
<i>Ilex</i> 'Dapat' (Miss Patricia™)	NO
<i>Ilex</i> 'Dragon Slayer'	*YES
<i>Ilex</i> 'Homefire'	NO
<i>Ilex opaca</i> 'Portia Orton'	NO
<i>Ilex purpurea</i>	NO
<b><i>Evergreen Shrub</i></b>	
<i>Ilex aquifolium</i> 'Sadezam' (Santa's Delight™)	NO
<i>Ilex crenata</i> 'Farrowone' (Sky Pointer™)	NO
<i>Ilex</i> 'H635-13' (Winter Bounty™)	NO
<i>Ilex</i> × <i>meserveae</i> 'Hachfee' (Castle Spire®)	*YES
<b><i>Deciduous Shrub</i></b>	
<i>Ilex verticillata</i> f. <i>chrysocarpa</i>	NO
<i>Ilex verticillata</i> 'FarrowBPop' (Berry Poppins™)	NO
<i>Ilex verticillata</i> 'NCIV1' (Little Goblin™)	NO
<b>*Unplanted container specimen</b>	

The category of *Ilex* accessions labeled “Instructionally or locally important taxa” were targeted for 10% of current UDBG holdings. These taxa are largely comprised of plants presented for further study in UD plant materials courses (PLSC 212 and PLSC 214) that are not represented in other target categories. A list of the 11 taxa in this category is presented in Table 31.

For this category, the interspecific hybrids *I. ×altaclerensis* represented by the cultivars ‘Camelliifolia’, ‘James G. Esson’ and ‘Tatnall School’; the last of which is also locally important, having been found near and named for the Tatnall School, Wilmington, DE, and introduced by the former Millcreek Nursery (Galle, 1997). *I. cornuta* × *I. pernyi* is represented by the cultivars ‘John T. Morris’ and ‘Lydia

Morris’, which are also locally significant. However, only two of four specimens of these taxa are currently planted out in the collection. One plant each of ‘John T. Morris’ and ‘Lydia Morris’ exist as young container plants are were not physically evaluated.

In addition to inclusion of the species-level taxon, *I. serrata* is represented by the cultivar ‘Sundrops’. *I. serrata* × *I. verticillata* is represented by one purported seedling (accession no. 74-7\*1) and by two cultivars not appearing in Table 30 (‘Autumn Glow’ and ‘Harvest Red’). Due to uncertainty regarding the origin of the cultivar ‘Christmas Cheer’ as well as physical incongruity between the two specimens evaluated, it was excluded from consideration.

Table 31 Instructionally or locally important *Ilex* taxa

TAXON	IN UDBG	PLANTS	MEAN PHYS. RATING
<b><i>Evergreen Tree</i></b>			
<i>Ilex</i> × <i>altaclerensis</i>	YES	4	2.3
<i>Ilex</i> × <i>attenuata</i> ‘Longwood Gold’	YES	4	3.4
<i>Ilex cassine</i>	NO	-	-
<i>Ilex latifolia</i>	YES	1	3.4
<i>Ilex cornuta</i> × <i>I. pernyi</i>	YES	2	2.0
<b><i>Evergreen Shrub</i></b>			
<i>Ilex myrtifolia</i>	YES	1	2.7
<i>Ilex pedunculosa</i>	YES	1	1.7
<i>Ilex vomitoria</i>	YES	6	2.5
<b><i>Deciduous Shrub</i></b>			
<i>Ilex decidua</i>	YES	9	3.1
<i>Ilex serrata</i>	YES	15	3.4
<i>Ilex serrata</i> × <i>I. verticillata</i>	YES	7	2.2

Nine of these taxa (82%) are currently held by the UDBG. Of these, the mean physical rating was 2.8 (“FAIR”) for the *evergreen tree* category, 2.3 (“FAIR”) for *evergreen shrubs*, and 2.8 (“FAIR”) for *deciduous shrubs*.

Ten percent of the collection was slated for “Native taxa not commercially common”. These were either rare or not recorded in either survey of industry prevalence. One taxon (*I. mucronata*) was named during the researcher’s survey of instructors and several others have instructional utility in PLSC 212, PLSC 212, or both courses. Due to a lack of *evergreen tree* taxa fitting this description, additional plants categorized as *deciduous shrubs* were chosen for this category. Only one taxon (*I. coriacea*) is held by the UDBG and exists only as a young container specimen not yet planted out in the collection. This taxon did not receive a physical condition rating. The target taxa in this category are presented in Table 32.

Table 32 Native *Ilex* taxa not commercially common

<b>TAXON</b>	<b>IN UDBG</b>
<b><i>Evergreen Tree</i></b>	
<i>None</i>	N/A
<b><i>Evergreen Shrub</i></b>	
<i>Ilex coriacea</i>	*YES
<i>Ilex cumulicola</i>	NO
<b><i>Deciduous Shrub</i></b>	
<i>Ilex ambigua</i>	NO
<i>Ilex laevigata</i>	NO
<i>Ilex longipes</i>	NO
<i>Ilex montana</i>	NO
<b>*Unplanted container specimen</b>	

The final category of target taxa consisted of “Unusual plants of specific ornamental interest” and was proposed to comprise 5% of the collection. Taxa in this

category were selected by the researcher from plants not listed in other categories and having some representation in the nursery trade. Three taxa (*I. opaca* ‘Maryland Dwarf’, *I.* ‘Rock Garden’, and *I. ×meserveae* ‘Honey Maid’) were identified by instructors. Due to a high proportion of *evergreen shrub* taxa in this category, it does not reflect the exact composition proposed in Table 25.

Of the seven taxa belonging to this category, 4 (57%) are currently held by the UDBG. The mean physical rating was 2.6 (“FAIR”) for the *evergreen tree* category and 3.0 (“GOOD”) for the *evergreen shrub* category. No selection was made for the *deciduous shrub* category. This group of taxa is listed in Table 33.

Table 33 Unusual *Ilex* taxa of specific ornamental interest

<b>TAXON</b>	<b>IN UDBG</b>	<b>PLANTS</b>	<b>MEAN PHYS. RATING</b>
<b><i>Evergreen Tree</i></b>			
<i>Ilex opaca</i> ‘Lin’s Gold’	YES	1	2.3
<i>Ilex ×attenuata</i> ‘Sunny Foster’	YES	1	2.8
<b><i>Evergreen Shrub</i></b>			
<i>Ilex opaca</i> ‘Maryland Dwarf’	YES	1	3.0
<i>Ilex</i> ‘Rock Garden’	NO	-	-
<i>Ilex ×meserveae</i> ‘Honey Maid’	NO	-	-
<i>Ilex ×attenuata</i> ‘Pack’s Weeping’	YES	1	3.0
<b><i>Deciduous Shrub</i></b>			
NONE	-	-	-

## Chapter 5

### DISCUSSION

#### Industry Prevalence of *Ilex* Taxa

As expected, the majority of taxa offered by both categories of industry firms are infraspecific taxa, namely interspecific hybrids and cultivars. Of the 114 legitimate taxa recorded by the researcher during the survey of re-wholesale distributors, only 5 taxa (4%) were of specific rank. Similarly, wholesale growers offered 181 legitimate taxa with only 10 (6%) being of specific rank. These findings are even more significant when one considers that many infraspecific taxa, interspecific hybrids, and cultivars bear little physical resemblance to the “main” (species level) taxon or the parental taxa of hybrids introduced in plant materials courses. A concerted effort by university gardens to provide student access the diversity of this (or any) ornamentally important genus is a key step toward enhancing horticultural literacy.

#### Industry Issues with Nomenclature

The five illegitimate taxa recorded at wholesale growers provide an interesting insight into the dichotomy between proper adherence to the rules of nomenclature for cultivated plants as required by botanical collections and the ignorance or misuse of said rules by some commercial entities. These taxa were listed as *I.* ‘Augusta’ (listed as a selection of *I. cornuta* × *I. ciliospinosa* by Tankard Nurseries), *I.* ‘Ellyn Capper’ (Manor View Farm), *I. opaca* ‘Pamela Orton’ (Foxborough Nursery), *I.* ‘Unique’ (Ingleside Plantation Nurseries), and *I.* ×*attenuata* ‘Yellow Foster Holly’ (Wye Nursery).

*I. opaca* ‘Pamela Orton’ (not to be confused with the legitimately named ‘Portia Orton’) was selected and named by Dr. Elwin Orton, Professor Emeritus, Rutgers University, and distributed to a select group of commercial growers circa 2005 for evaluation. However, it has never been registered or intended for sale (Orton, 2014). *I.* ‘Unique’ is an unregistered taxon of unknown origin exhibiting a slow growth rate, shrubby habit and variegated foliage (Resch, 2015a).

Two of these illegitimate taxa, *I.* ‘Augusta’ and *I.* ‘Ellyn Capper’ are potentially the same clone. In addition, one properly registered taxon, *I.* ‘Dragon Slayer’ (named, registered, and introduced by Mobjack Nurseries) and a heretofore un-introduced plant, known as *I.* B51517, may also be synonymous. The latter resulted from crosses of *I. cornuta* × *I. ciliospinosa* by Dr. W.L. Ackerman and Dr. J.L. Creech at the U.S. Plant Introduction Station, Glenn Dale, MD but was not officially released (Galle, 1997). B51517 may also be identical to (or a sister seedling of) *I.* ‘Augusta’, or *I.* ‘Ellyn Capper’ or both.

Attempts to verify the distribution history and current locations for B51517 were largely unsuccessful. Olsen (2014) noted that the “B number” is a reference to the “Bell Station”, which was the previous name for the Glenn Dale Plant Introduction Station before merging with the U.S. National Arboretum. Unfortunately, the catalog of Bell numbers is incomplete as some records were lost in a fire (Olsen, 2014). Further investigation revealed that no plant with this designation is extant at the U.S. National Arboretum (Lura, 2014).

In addition to highly congruent physical characteristics such as growth habit, leaf color, leaf shape and leaf size, these plants may all traceable to material distributed by the U.S. Plant Introduction Station to the Hampton Roads Agricultural

Research and Extension Center (then known as the Virginia Truck and Ornamentals Research Station) in Virginia Beach, VA. This site is identified as the source of *I.* ‘Dragon Slayer’ per Mobjack Nurseries’ cultivar registration description Holly Society of America. However, it is not linked to any other documentation of origin other than conjecture that the plant was received by the site from Glenn Dale “possibly as NA 28321” (Holly Society of America, 2015a).

NA 28231 is documented as the progeny of a controlled cross of *I.* ‘Nellie R. Stevens’ and *I. latifolia* in the collection records of the Ebersole Holly Collection at Sandhills Community College, Pinehurst, NC (Holly Society of America, 2015b) which would be expected to produce progeny of little resemblance to ‘Dragon Slayer’ or any of the associated taxa mentioned here. Unfortunately, the Ebersole Collection’s specimen of NA 28231 is no longer extant (Stoehling, 2015).

Also surfacing in this quandary is a connection to the former Tingle Nursery Company, Pittsville, MD. Personal communication with Mr. Daniel Capper, Stuart FL, proprietor of the former Capper’s Nursery in McLean, VA, revealed the history of an unnamed hybrid holly obtained from Tingle Nursery in the 1980’s. Mr. Capper relates that he was told it was an *I. cornuta* × *I. ciliospinosa* seedling that originated at the “U.S. Department of Agriculture” (likely the U.S. Plant Experiment Station) and was only identified by the letter “B” followed by a number beginning “515” (Capper, 2014). It is possible that this reference is to Galle’s B51517. A review of Tingle Nursery catalog from the late 1960’s and early 1970’s revealed a number of yet unnamed *I. cornuta* selections marketed as “from Glenn Dale” and may establish a connection between Tingle and germplasm distributions from the Plant Experiment

Station. In addition, Galle (1997) notes a plant at the Ebersole Holly Collection, Pinehurst, NC, that came from Tingle Nursery.

Capper states that he was offered the rights to said plant when Tingle determined it had insufficient commercial appeal and successfully propagated and grew the clone for several years. He began referring to the clone as ‘Ellyn Capper’ (after his wife), though it was never properly registered with the Holly Society of America. Capper also related that he distributed the plant widely, including as favors at his daughter's wedding (Capper, 2014). Bob Dieter (now deceased), a former propagator at Manor View Farm, Monkton, MD possibly acquired the plant around this time (Bowman, 2015). Manor View Farm continued to produce and sell the plant under the incorrectly spelled name ‘Ellen Capper’ up to and including 2015.

It is also hypothetical that the plant currently known as ‘Augusta’ was also obtained, under an unknown or coded name, from the Hampton Roads Experiment Station or Tingle Nursery due to the relatively close geographical proximity of Tankard Nurseries (Exmore, VA), Virginia Beach, VA and Pittsville, MD. This scenario would require that the U.S. Plant Introduction Station distributed germplasm of this same clone (or multiple selections of *I. cornuta* × *I. ciliospinosa* crosses) to the Hampton Roads Experiment for evaluation.

Further complicating this situation is the existence of a fifth clone, known as *I.* ‘Washington’ documented by Galle as originating as a hybrid of *I. cornuta* (U.S. P.I. 658860) and *I. ciliospinosa* (U.S. P.I. 78144) in 1952 at the U.S. Plant Introduction Station. It was named and introduced in the Netherlands from material (perhaps B51517) sent from Glenn Dale (Galle, 1997). Photographs of the foliage of *I.* ‘Washington’ obtained by the researcher from German holly collector Yvo Meyling

bear a striking resemblance to all of the taxa listed here (Meyling, 2015). Figures 6 and 7 features images of the foliage of B51517, ‘Dragon Slayer’, ‘Ellyn Capper’, and ‘Washington’. Moreover, a sixth taxon, sold as *I. ‘Mrs. Palmer’* by Diller Nursery, Mechanicsburg, PA may also have *I. cornuta* × *I. ciliospinosa* heritage or be genetically identical to some or all of the previous five clones. Photographs of said plant featured on the firm’s website show foliage and fruit strongly resembling that of *I. B51517* (Resch, 2015b).



Figure 6 Foliage of *Ilex* B51517 (top) and *I. ‘Ellyn Capper’*



Figure 7 Foliage of *Ilex* 'Dragon Slayer' (top) and *I.* 'Washington'

It is clear that further investigation and side-by-side cultivation and evaluation will be required to determine the validity of the scenarios outlined here. These taxa (or a subset of those mentioned above) may be genetically identical or simply constitute sister seedlings of crosses made in 1952, those conducted later by Ackerman and Creech, or some combination of both. Definitive identification may only be possible through molecular analysis. Published examples include the use of DNA amplification fingerprinting to assess cultivar synonymy in kousa dogwood (*Cornus*

*kousa* Hance) by Trigiano, et al. (2004) or amplified fragment length polymorphism (AFLP) as applied to cultivar, hybrid, and parental identification in Japanese barberry (*Berberis thunbergii* DC.) by Lubell, et al. (2008).

### **University Garden Collection Relevance Survey**

The overriding theme arising during the survey of multiple university gardens was the wide diversity of garden attributes that were recorded. These include marked differences in garden age, size, staffing levels, revenue and budgeting, and the annual amount of institutional or departmental financial support. These findings corroborate anecdotal evidence gathered by the researcher during the August, 2014 visits to the cohort of gardens mentioned in Chapter 3.

This stark juxtaposition of academic foci (and curatorial philosophy) is also documented in the results of the University Garden Collection Relevance survey. Also noted in conversation with directors at each garden was a lack of any formal processes for assessing or maximizing the relevance of collections

One key finding of the University Garden Collection Relevance survey was the prevalence of multiple job responsibilities of key staff at these gardens. Twenty-five percent of respondents indicated that they held two or more titles or performed two or more primary duties. This illustrates the challenging funding and staffing environment common to many university gardens (as noted by Looney, 2004). It was common for directorial or curatorial duties to be split with academic or maintenance activities. This obviously decreases the time spent on specific duties and forces garden staff to satisfy multiple responsibilities.

While a majority of gardens claim "education" as a primary mission, it was at this point that a dichotomy of the specific educational foci at various university

collections became evident. The survey revealed an interesting dissonance between respondents citing a primary focus on traditional horticulture (ornamental or commercially useful plant material) and those concerned with biological or ecological instruction and having a loose or nonexistent relationship with a horticulture department or related programs.

This potential problem was anticipated and the primary goal of this survey was clearly stated in the introductory message to all recipients. The following text was included: "My thesis involves developing a method for evaluating and quantifying the relevance of university garden plant collections to student audiences--particularly those studying ornamental horticulture and landscape design." However, several respondents offered comments illustrating a modern schism between traditional ornamental horticulture and a decidedly ecological perspective in the free text section following the final question. Comments of this nature included the following:

The structure of your survey is definitely biased towards horticultural programs. We deal with species, not horticultural selections. We also focus on native plant collections including regionally threatened and endangered taxa. We have very little interaction with the green industry.

Our collection is educational for more than horticulture students...just a friendly reminder that being a public garden doesn't make horticulture automatically a priority. We are in fact part of the natural history collections in the Dept. of biological sciences, and not really connected to our University's Hort department.

This survey does not represent well the situation at the Botanical Gardens at University of California, Riverside...we are heavily used by Biology, botany and plant sciences classes, entomology and plant pathology, etc. We do not have a Horticulture Department as such.

Though pertinent to an overall understanding of how gardens view the concept of collection relevance, the above responses demonstrate an inherent philosophical

conflict between collection curation based wholly on the ecological (i.e. non-ornamental) branch of plant science instruction. In some case, these viewpoints disavow any connection to traditional ornamental horticulture. While information from these individuals would have significant value to the construction of an evaluation method for the conservation or ecological value of academic collections, corresponding survey data from these respondents will not be used to influence the design of the UDBG holly collection's evaluation scheme.

In light of this situation, it is imperative that any collection assessment initiatives at university gardens take the specific mission, instructional objectives and usage of each collection into account. The UDBG holly collection evaluation focused on its cumulative relevance pertinence to students of ornamental horticulture, and to a lesser extent, the indigenous taxa pertinent to students of insect and wildlife ecology. The collection's historical composition and development favors a diverse breadth of native and exotic taxa important to ornamental horticulture and will be honored as the primary standard for evaluation. In this sense, the resulting evaluation template is inherently more applicable to institutions with similar collection attributes, scope and instructional needs. Those exhibiting diverging objectives or usage patterns (i.e. programs in conservation biology or ecology) would be advised to draft individualized standards for collection content and condition.

In a second step for determining which data is not appropriate to this study's construction of an evaluation template for rating the UDBG holly collection's current educational relevance, some data from larger gardens will not influence design. A major challenge to collection management and expansion identified by survey respondents is a limitation of space. This is certainly a barrier to collection

development at the UDBG. In order to maximize the utility of the assessment template to similar small university collections (i.e. those measuring 50 acres or less), data from respondents reporting a cultivated acreage of 51 acres or more ( $n = 10$ ) were excluded from consideration.

The more specific line of questioning regarding collection relevance also produced notable results. Particularly striking was the opinion of ten respondents (31% of all responses) that the most important benefit of an educationally relevant plant collection was not botanical, ecological or horticultural training, but rather a method for demonstrating or quantifying a garden's function (or very existence) to its governing institution or department. It is clear that many gardens feel increasingly pressured to justify and secure institutional support for garden operations. In recent years, a national trend of decreased state support for public universities coupled with the lingering fiscal effects of the Great Recession are primarily to blame (Barr and Turner, 2013).

As expected, the majority of gardens surveyed (81%) reported no current guidelines for measuring or maximizing collection relevance. This supported the researcher's initial hypothesis that the concept has received little to no attention at most university gardens. It is assumed this is due to the lack of funding, professional staff or other resources as outlined by survey respondents. Unfortunately, the anonymous nature of this survey prevented the researcher from identifying all three (8%) of the respondents indicating that written guidelines aimed at assessing collection relevance are currently in place at their gardens. However, two of the three respondents freely entered identifying information in the portion of the survey inviting additional comments. These were the Botanical Gardens at the University of

California, Riverside and the W.J. Beal Botanical Garden and Campus Arboretum of Michigan State University.

Follow-up contact was made with the individuals from these institutions that responded to the "Collection Relevance" survey. First, correspondence with Dr. Giles Waines, Director, Botanical Gardens at the University of California, Riverside led to the determination that no formal process for evaluating collection relevance exists at said institution. This was despite initial survey responses that indicated otherwise. A full transcript of contact with Dr. Waines is found in Appendix N. Clarification from Dr. Waines effectively reduced the number of respondents correctly reporting existing written policies or procedures for collection relevance evaluation to two out of 36 completed surveys (6%). Due to the aforementioned anonymous nature of this survey, only one of these could be confirmed (W.J. Beal Botanical Garden).

Second, correspondence with Dr. Frank Telewski, Professor of Plant Biology and Curator, W.J. Beal Botanical Garden and Campus Arboretum, Michigan State University, (Telewski, 2015) revealed the only documented case of periodic evaluation related to collection relevance. A full transcript of the researcher's correspondence with Dr. Telewski is presented in Appendix O. Dr. Telewski's comments provided a wealth of information pertinent to the design and implementation of the researcher's partial collection evaluation at the UDBG. This information was related to the Beal Garden's purpose for and frequency of assessment, and the garden's evaluation criteria and methodology as dictated by pertinent academic constituents and other stakeholders. Though exhibiting distinct educational missions that dictate which plants are displayed, several analogs were identified among the factors influencing collection relevance promotion at the Beal Garden and the UDBG.

The mission of the W.J. Beal Botanical Garden is the conservation and display of important economic, medicinal, and toxic plants (Telewski, 2015). Thus, input from entities such as the Michigan Regional Poison Control Center and University of Michigan rotation in Emergency Toxicology directly influences collection composition. The garden deals with species, not horticultural selections...and has very little interaction with the green industry (Telewski, 2014). Conversely, the UDBG's purpose of landscape horticulture education requires a distinctly different set of influences. This comparison illustrates the importance of garden mission to the determination of vital collection evaluation and management decisions.

Two respondents indicated that written guidelines for measuring or maximizing collection relevance were currently under development. Only one of these, Reiman Gardens (Iowa State University), could be identified from the optional post-survey comments. Mr. Aaron Steil, Manager of Public Programs (now Assistant Director), indicated the following: "(collection relevance) is a topic we are very interested in and something we have started work on, but have a long way to go". The researcher contacted Mr. Steil via telephone to follow-up on his response.

Mr. Steil related that Reiman Gardens has identified (and intends to continue developing) methods to market itself to multiple university (both science and non-science) departments to achieve greater visibility, visitation, use and support by a wider range of academic (and non-academic) audiences. Mr. Steil equated these goals with increased relevance of the Reiman Gardens to the greater university community. The major obstacles to engaging a diversity of audiences is the prevailing misconception by university stakeholders that the garden offers limited opportunities

for multiple uses, and a lack of direct (i.e. walkable) access from central campus (Steil, 2014).

In this sense, the concept of collection relevance embodies the need for "internal publicity" as addressed by Klatt and Pickering (2003). Three main tenets mark the connection between gardens, audiences and potential audiences: teaching, research and public service. Klatt and Pickering argue that these areas can be used as an organizing principle to examine what it is you do and how it benefits your home institution. The connection between garden activities and the institution's core academic mission (obvious or not) must be unmistakable to administrators, whether academic or professional (Klatt and Pickering, 2003). Steil echoed this approach at Reiman Gardens and recommended addressing these efforts concurrently with more directed curatorial efforts (i.e. the evaluation of a specific portion of the collection) to appeal to the widest range of audiences possible.

An overall positive opinion of the benefits of an evaluation of collection relevance was identified by the 57% of respondents who felt that said assessment would be a valuable future endeavor at their gardens. Only 3 respondents (9%) indicated it would not be valuable and the remaining 31% of respondents who selected "not sure" indicate that the purpose, methodology and benefits of an evaluation would require further investigation.

Respondents' opinion of the main benefit of developing and publishing a quantitative measurement of collection relevance (not simply having a relevant plant collection) could be interpreted as being linked to the previously highlighted interest in justifying or securing institutional funding and other support. The highest ranked benefits were earning institutional recognition or visibility, securing institutional

funding/ support, securing outside funding/ grants and gaining recognition among other institutions/ gardens. These align with the researcher's expectation that this data would provide a tangible illustration of the garden's educational value to both intra-institutional and extra-institutional sources of funding.

Remaining data collected in the "Collection Relevance" survey was directly applicable to the design and implementation of the evaluation scheme for the UDBG holly collection and resulting recommendations (Chapter 5). These include a consensus from garden directors, curators and other horticultural staff regarding the characteristics and composition of an educationally relevant collection, horticultural characteristics detrimental to educational relevance, steps for improving and promoting educational relevance and suitable time intervals for conducting relevance assessments. The relative value placed on each of these by survey respondents was considered during the design of the physical assessment scheme and final interpretation of holly collection relevance.

### **Woody Plant Instruction and the Academic Value of *Ilex* Taxa**

This survey provided useful data regarding two different issues. First, it reflected the demographics, institution attributes, teaching venues and instructional methods of a cross-section of woody plant instructors in the Mid-Atlantic, New England and Southeastern United States. Second, it was useful in gauging the opinion of the academic value of various *Ilex* taxa in these areas.

Survey respondents were nearly equally representative of universities (51%) and community colleges or technical institutes (49%). The majority of instructors at universities reporting an affiliation with a large university likely reflects the traditional hosting of horticulture departments at many land grant institutions. However, during

the respondents' research of potential survey recipients in the geographic areas of interest, a larger number of horticulture-related programs were offered by non-university institutions in areas where *Ilex* is commonly cultivated (USDA Hardiness Zones 5B to 8B).

Surveys were e-mailed to recipients at 43 of these institutions versus only 36 to public or private universities. The wide majority of community college/ technical schools offering horticulture programs are concentrated in the southeast (56%), with twelve (28%) located in North Carolina and six (14%) in Georgia.

Like the survey of university garden leadership and staff (University Garden Collection Relevance), a notable subset (16%) of instructors indicated multiple roles and responsibilities. This may also reflect a similar pressure to combine various professional activities in order to conform to budgetary mandates.

The relative level of taxonomic detail covered by instructors supports the need to promote plant collections that feature popular and useful taxa. Ninety-five percent of instructors related that at least "a few important hybrids and prominent cultivars" are addressed. This is strongly illustrated by both surveys of industry suppliers, which reveal that the majority of taxa offered for sale are below specific rank (e.g. cultivars). The consistency of cultivated varieties in terms of growth rate, habit and ornamental attributes make them highly attractive to both producers and end-users. Thus, they should be a primary component of horticultural education.

The further categorization of prominent taxa into distinct groups reflecting their proportional importance to instruction will be particularly valuable to the UDBG holly collection evaluation. Respondents indicated that regionally popular (native and exotic) taxa should make up 61% of the plant material covered in courses. The

cumulative voting results of all instructors, coupled with the industry prevalence of all *Ilex* taxa will determine which taxa should be included in this category of “regionally popular” taxa.

Second, instructors were relatively consistent in recommendations for the percentage of other taxa to be addressed. These included native taxa not common in commercial horticulture and new or “up and coming” varieties. Finally, the evaluation standards for academic collections must address the goals for a percentage of unusual plants (e.g. dwarf or weeping mutations), taxa or specimens of unique local or historical value, and other taxa of particular instructional importance (i.e. parents of prominent hybrids). It should be stressed that the weight given to each category is unique to a given garden or institution’s mission and highly dependent on local climate and/or other abiotic or biotic factors.

Also supporting the need to curate relevant university collections is the fact that they represent the primary, and in many case, the only academic resource for horticulture instructors and students. Whether officially designated as botanical collections or not, campus-centric gardens are key to undergraduate instruction. Woody plant instructors reported spending 74% of outdoor class time in these venues. Limited class time and costs associated with transportation to off-campus instructional sites underscores the need to maximize the value of collections offering that convenient student access.

Also illustrating the need for relevant collections is the assertion by instructors that, aside from problems due to environmental unsuitability (e.g. heat, cold, soils), a lack of plantings available for outdoor observation would be a primary reason for discontinuing coverage of a particular taxon. One respondent’s comment regarding

the physical and subsequent curricular elimination of *Hamamelis virginiana* (common witch-hazel) is a notable example.

Respondents' characterization of primary instructional venues' strengths and weaknesses illustrates an overall satisfaction with some aspects while others are a matter of concern. Instructors gave a relatively high rating to the more static nature of relevant collections, such the exhibition of current plant usage trends of a given region and overall health and physical condition of the plants displayed. Conversely, those factors receiving a lower relative ranking indicate the need for closer curatorial attention to the dynamics of an academic plant collection. In order of decreasing satisfaction, instructors expressed relative discontent with the proficiency of primary instructional venues' in displaying multiple sizes or ages of important taxa, the incorporation of new or superior woody landscape plants, and the timely removal and replacement of inferior or ornamentally obsolete taxa. Heightened curatorial awareness of the instructional needs of faculty and the horticultural requirements of the collection would result in a more relevant, useful academic tool.

This benefit would also be aided by an increased level of communication between users of the collection and those charged with its care. Over half (55%) of the woody plant instructors surveyed indicated that they either have no input in curatorial decisions or only make suggestions from time to time. A disconnect between a collection's users and managers is detrimental to educational relevance. With the exception of situations in which instructors themselves have direct or semi-direct responsibility for the curation of collections used for teaching, active discourse regarding planting, removal or maintenance priorities should be encouraged. However, comments from some respondents indicated that institutional or

departmental bureaucracy may impede this objective. Plant collection committees were cited by several respondents and can be utilized to bridge the gap between administrators, horticultural staff and instructors.

### **Recommendations for the UDBG *Ilex* Collection**

Recommendations stemming from this project's evaluation of educational relevance deal mainly with necessary changes to the collection's composition to improve educational function and aesthetic appeal. Any taxa listed in Tables 25 through 28 and 30 through 33 not currently held by the UDBG should be considered for acquisition as space (see removals, below) and resources permit. These consist of taxa needed to fulfill the recommended proportion of target taxa categories discussed in Chapter 4. A cumulative desiderata of all recommended taxa is found in Appendix Q.

Recommendations for taxa or plants to be removed are listed in Appendix R. Primary candidates for removal ("HIGH PRIORITY") consist of any plants not found in the tables listed above (i.e. educationally relevant) and that received a rating of "POOR" during the collection's physical evaluation. This removal priority also applies to any instructionally relevant taxa rated "POOR" but having specimen(s) of better physical integrity elsewhere in the collection.

Secondary removal priority ("MEDIUM PRIORITY") includes any plants identified as instructionally relevant, but receiving a "POOR" physical rating and where a suitable replacement has been acquired or propagated. Also included in this category are any taxa not identified as instructionally valuable in Chapter 4 and receiving a physical condition rating of "FAIR".

Third, items designated as “LOW” priority for removal are taxa not identified as having instructional relevance within the parameters of target composition goals and receiving a “GOOD” physical rating. Also in this category are any plants of any taxa deemed relevant but scoring between 2 and 2.5 “(FAIR)” physically and having specimens of higher quality elsewhere in the collection. Removal of these plants is also contingent upon inspection to confirm that no maintenance alternatives exist prior to removal. If the need for removal is determined, a suitable replacement must first be propagated or acquired.

### **Other Implications for the UDBG**

It is intended that the general form of this evaluation can be implemented in assessing the educational value of other plant groups within the UDBG. Similar surveys of industry prevalence would be recommended and require minimal time and effort to collect the pertinent data. However, a large scale survey of instructors at multiple post-secondary institutions was cumbersome, time consuming, and would therefore not be recommended. Though providing detailed insight on the perceived instructional value of holly in many parts of the Eastern United States, the information collected required significant analysis in order to determine its true pertinence to curation of the UDBG.

A notable consideration is the relatively strong positive correlation exhibited by physical evaluation scores in each of the four categories for each holly specimen in the UDBG collection (Table 24). It was clear that these variables, especially Density, Habit, and Health cannot be considered independent. However, the nature of physical plant condition in landscape settings dictates that said factors are typically linked and lead to specific manifestations of a plant’s appearance. For example, increased

instances of crowding can cause most evergreen *Ilex* taxa to become leggy and open, thus reducing the observed Density score. Since the physical assessment utilized in this thesis was intended to judge the individual condition (as compared to acceptable landscape standards) of each taxon, the lack of variable independence was not considered detrimental to the overall physical evaluation grading scheme. Future evaluations could benefit from a careful examination of all pertinent variables to avoid superfluous evaluation criteria.

It would be advisable to keep future inquiries regarding the academic value of plants centered on course requirements at the University of Delaware. Additional feedback could be gleaned from surrounding non-academic institutions offering continuing education or other forms of horticultural training. Also helpful would be the establishment of an informal consortium of plant materials instructors at a limited number of Mid-Atlantic post-secondary institutions (e.g. Delaware State University, University of Maryland, Delaware Valley College, Rutgers University.) This would facilitate a direct, regular exchange of plant information most useful to regional horticultural training.

Other educationally significant plant groups likely to benefit from an evaluation of educational relevance at the UDBG include but are not limited to the genera *Acer*, *Buxus*, *Camellia*, *Cornus*, *Chamaecyparis*, *Deutzia*, *Hydrangea*, *Juniperus*, *Lagerstroemia*, *Magnolia*, *Malus*, *Nandina*, *Prunus*, *Rhododendron*, *Rosa*, *Spiraea*, *Syringa*, and *Viburnum*. With the exceptions of *Acer*, *Magnolia*, and *Rhododendron*, it is unlikely that any of these would approach the diversity of forms and functions of *Ilex*. Additionally, genera of lesser landscape prominence could be

assessed at the family level. Notable examples would be Berberidaceae, Betulaceae, and Hamamelidaceae.

A recommended interval for relevance evaluation was clearly proposed by respondents to this study's University Garden Collection Relevance survey. A majority of garden leadership and staff identified a frequency of 5-10 years as the ideal period of time between evaluations of relevance. Depending on the plant group being assessed and attributes such as growth rate, landscape use and value, mature size, and the rate at which new introductions appear, this time frame appears adequate. Depending on the steps taken to improve the composition and condition of the *Ilex* collection, a goal of re-evaluation in five to seven years would be satisfactory.

Another key lesson illuminated by this research was the decline of traditional taxonomically-grouped collections in favor of those achieving collection and display goals while offering aesthetic beauty. "If it is beautiful, it will be cared for," stated one survey respondent. Indeed the incorporation of future holly accessions should be spread throughout the UDBG in harmony with other types of plants. The draw of a visually pleasing landscape is universal, quickly appreciated, and can help foster interest and vital support from those outside the plant sciences.

### **Recommendations for Similar Academic Collections**

Several recommendations can be extended to the custodians of similar academic collections wishing to maximize instructional value. Important considerations and questions stemming from the conception and completion of this project are summarized in Table 34. These consist of guidelines for planning, execution, and related post-evaluation concerns.

Any concept of relevance and related assessment procedures must focus directly on an institution's specific mission or purpose. This attribute dictates the types of plants to be assembled and displayed, how they are used, cared for, and when and why they are removed. Perhaps more importantly, mission identifies the audience(s) collections are intended to serve. All of these factors culminate in a vision for curation and informs the evaluation criteria that should be employed and the curatorial actions that result. An honest and accurate understanding of what any collection is, where it should be, and how it should get there is the driver of sound evaluation and responsible curation.

Second, the importance of an open and honest dialogue with stakeholders cannot be underestimated. Those vested in the use and care of the collection can provide the most valuable information in terms of how it can be improved. In the context of university gardens, this means speaking with instructors, students, and industry representatives to determine gaps in collection holdings, maintenance needs, and opportunities to expand usefulness and visibility.

In terms of collection evaluation, a clear plan is essential. How can we ensure that our collections are fit for purpose if we are not quite sure what that purpose truly is? This involves designating reasonable goals, methods and criteria at the outset and consistently following all assessment guidelines. Goals for collection improvement can be as simple as identifying pruning needs or as complex as a major overhaul of collection scope or composition. The proper perspective should guide any evaluation.

Table 34 Guidelines for similar evaluations of collection relevance

STEP	IMPORTANT CONSIDERATIONS AND QUESTIONS
<b>Define the scope of the evaluation</b>	<p>What plant group(s) will be assessed?            Do current resources and/or time constraints permit an evaluation of this type or size?</p>
<b>Establish and justify the goal(s) and/or purpose(s) of the evaluation</b>	<p>How will the evaluation's results be used:            To illustrate a collection's current value?            To identify opportunities for improvement? Both?</p>
<b>Identify the appropriate evaluation criteria</b>	<p>What industry firms will be surveyed?            What geographic area will be surveyed?            What instructors (or other users) will be surveyed?            What other factors are important? (research needs, public use)            What are the important physical standards for plant size, habit, health, and siting, etc. that should be used?            What are the preferred, acceptable, and/or unacceptable levels for each criterion?            Are all criteria for evaluation in line with institutional mission or current/ proposed collection usage?</p>
<b>Outline the evaluation process</b>	<p>Who will conduct the evaluation?            When will the evaluation be conducted?            How will data be collected?            How will data be stored and analyzed?</p>
<b>Conduct the evaluation</b>	<p>Employ articulate, reliable evaluator(s)            Ensure that evaluator(s) understand the goals, processes, and expected standards for evaluation            Collect all data accurately and consistently            Be aware that adjustments may be necessary during the evaluation process</p>

Table 34 continued

<p><b>Synthesize the resulting data appropriately</b></p>	<p>What is the appropriate influence of the various inputs from industry and academic sources?          How should the physical condition of plant specimens affect overall educational relevance?          How do these factors support/ influence collection usage goals?</p>
<p><b>Use the evaluation results appropriately</b></p>	<p>How can current collection value be best interpreted?          Who should be made aware of the results?          How should this information be disseminated?          How can the collection be improved based on predetermined goals?          Taxon additions? Taxon or individual plant removal?          What maintenance requirements have been identified?</p>

As important as why and how data is collected is how it is used when the evaluation is complete. Evaluators should be prepared to accept the responsibility to “change what needs to be changed.” This process also entails effectively vocalizing the purpose for collection evaluation, all pertinent results, initiatives for improvement, and their importance to collection objectives. Klatt and Pickering (2003) stress the importance of “internal publicity” but this effort can extend well beyond the university community. A wider base for involvement and support is required in our time of shrinking budgets and scant resources.

The future of the horticultural trade as an attractive, noble vocation and the green industry as an influential market force will continue to rely on engaging, adaptive, and creative post-secondary training. Immersive, beautiful, educationally relevant plant collections are a vital tool for inspiring and teaching those who will uphold horticultural tradition and spur innovation. Ornamental and functional plants will remain a key solution to society’s struggle with increased urbanization, climate

change, and other environmental and social challenges. Public gardens, especially those supporting academic programs, have the responsibility of promoting their appreciation, enjoyment, and use. It is hoped that this thesis has further illuminated the need to consciously build and manage collections for these purposes.

The object of education is to teach us to love what is beautiful.

—Plato, *The Republic*

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## Appendix A

### ILEX TAXA LIST FOR PLSC 212 AT THE UNIVERSITY OF DELAWARE (FALL, 2014)

TAXON	COMMON NAME	CULTIVARS
<i>*Ilex aquifolium</i> × <i>I. cornuta</i>		'Nellie R. Stevens'
<i>Ilex cornuta</i> × <i>I. pernyi</i>		'Dr. Kassab' 'John T. Morris' 'Lydia Morris'
<i>Ilex cornuta</i> × <i>I. rugosa</i>		'Mesdob' (China Boy) 'Mesog' (China Girl) 'Accent'
<i>Ilex integra</i> × <i>I. pernyi</i>		'Tanager'
<i>Ilex myrtifolia</i> × <i>I. opaca</i>		'Autumn Glow'
<i>Ilex serrata</i> × <i>I. verticillata</i>		'Camelliifolia'
<i>*Ilex</i> × <i>altaclerensis</i>	Altaclera Holly	'James G. Esson'
<i>Ilex amelanchier</i>	Swamp Holly	
<i>*Ilex aquifolium</i>	English Holly	'Teufel's' 'Augustifolia' 'Argenteo-Marginata' 'Lewis' 'N.Y. Botanic Garden' 'Tatnall School'
<i>*Ilex</i> × <i>aquipernyi</i>	Aquiperny Holly	'San Jose' 'Meschick' (Dragon Lady Holly)
<i>*Ilex</i> × <i>attenuata</i>	Foster's Holly	'Fosteri' 'Sunny Foster'
<i>Ilex buergeri</i>		
<i>Ilex cassine</i>	Dahoon	
<i>Ilex ciliospinosa</i>		
<i>Ilex chinensis</i>		
<i>*Ilex cornuta</i>	Chinese Holly	'Burfordii' 'Carissa' 'Compacta' 'D'Or' 'Rotunda'

<b>*<i>Ilex crenata</i></b>	Japanese Holly	'Compacta' 'Convexa' 'Firefly' 'Helleri' 'Hetzii' 'Ivory Tower' 'Microphylla' 'Miss Muffet' 'Stokes' 'Yellow Beam'
<i>Ilex cumulicola</i>		'Coy Girl'
<i>Ilex decidua</i>	Possumhaw	'Red Escort'
<i>Ilex glabra</i>	Inkberry	'Compacta' 'Leucocarpa'
<i>Ilex integra</i>	Nepal Holly	
<b>*<i>Ilex ×koehneana</i></b>		'Jade' 'Ruby' 'San Jose'
<b>*<i>Ilex latifolia</i></b>	Lusterleaf Holly	'Mary Nell'
<b>*<i>Ilex ×meserveae</i></b>	Blue Holly	'Blue Angel' 'Blue Boy' 'Blue Girl' 'Mesid' (Blue Maid Holly) 'Blue Prince' 'Blue Princess' 'Mesan' (Blue Stallion Holly) 'Mesolg' (Golden Girl Holly)
<i>Ilex myrtifolia</i>		
<i>Ilex opaca</i>	American Holly	'Arden' 'Delia Bradley' 'Fallow' 'Greenleaf' 'William Hawkins' 'Leatherleaf' 'Maryland Dwarf' 'Miss Helen' 'Silica King' 'Satyr Hill'

<i>Ilex opaca</i> (cont'd)		'Villanova'
<b>*<i>Ilex pedunculosa</i></b>		f. <i>xanthocarpa</i> 'Canary'
<i>Ilex rotunda</i>		Longstalk Holly
<i>Ilex rugosa</i>		Lord's Holly
<i>Ilex serrata</i>		Prostrate Holly
<i>Ilex verticillata</i>	Winterberry	'Sundrops'
		'Fairfax'
		'Jolly Red'
		'Tiasquam'
		'Winter Red'
<i>Ilex sugerokii</i>		
<i>Ilex verticillata</i> × <i>I. serrata</i>	Deciduous Holly	'Apollo'
		'Christmas Cheer'
		'Raritan Chief'
<i>Ilex vomitoria</i>		Yaupon

**\*PRESENTED IN CLASS**

## Appendix B

### **ILEX TAXA LIST FOR PLSC 214 AT THE UNIVERSITY OF DELAWARE (SPRING, 2015)**

#### **TAXON**

*Ilex ambigua*

*Ilex amelanchier*

*Ilex beadlei*

*Ilex cassine*

*Ilex coriacea*

**\**Ilex crenata***

**\**Ilex decidua***

**\**Ilex glabra***

*Ilex laevigata*

*Ilex montana*

*Ilex mucronata* (as *Nemopanthus mucronatus*)

*Ilex myrtifolia*

**\**Ilex opaca***

**\**Ilex verticillata***

**\**Ilex vomitoria***

**\*OUTDOOR IDENTIFICATION REQUIRED**

## Appendix C

### UNIVERSITY OF DELAWARE IRB EXEMPTION NOTICE (UNIVERSITY GARDEN COLLECTION RELEVANCE SURVEY)



RESEARCH OFFICE

210 HULLIHEN HALL  
UNIVERSITY OF DELAWARE  
NEWARK, DELAWARE 19716-1551  
Ph: 302/831-2136  
Fax: 302/831-2828

DATE: July 23, 2014

TO: Jason Veil  
FROM: University of Delaware IRB

STUDY TITLE: [634926-1] University Garden Collection Relevance Survey

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS  
DECISION DATE: July 23, 2014

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 Farnese-McFarlane at (302) 831-1119 or [nicolefm@udel.edu](mailto:nicolefm@udel.edu). Please include your study title and reference number in all correspondence with this office.

## Appendix D

### INVITATION MESSAGE TO UNIVERSITY GARDEN COLLECTION RELEVANCE SURVEY RECIPIENTS

Hello,

I am an M.S. candidate in Dr. John Frett's graduate program in Plant Curation at the University of Delaware. My thesis involves developing a method for evaluating and quantifying the relevance of university garden plant collections to student audiences--particularly those studying ornamental horticulture and landscape design. I would like my findings to be useful in developing and guiding future curatorial initiatives at the University of Delaware Botanic Gardens (UDBG) and similar collections.

I have developed the following survey to better understand how university gardens view and address this issue. I would greatly appreciate if you would answer a few questions about your institution's garden and provide your thoughts on collection relevance. My project will focus specifically on assessing the current relevance of the UDBG's holly collection, so I ask that you think primarily about the woody components of educational collections as you navigate the survey.

If you would be interested in receiving the results of this survey, please feel free to contact me. Thank you very much for your help.

Jason Veil  
[jveil@udel.edu](mailto:jveil@udel.edu)

**Follow this link to the Survey:**

[\\${1://SurveyLink?d=Take the Survey}](#)

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

[\\${1://SurveyURL}](#)

Follow the link to opt out of future emails:

[\\${1://OptOutLink?d=Click here to unsubscribe}](#)

## Appendix E

### UNIVERSITY GARDEN RELEVANCE SURVEY RESULTS

#### 1. Section 1 of 3: BASIC INFORMATION

What is your title or primary responsibility? (select all that apply)

#	Answer	Response	%
1	Director	12	33%
2	Assistant Director	5	14%
3	Curator	12	33%
4	Director of Horticulture/ Garden Manager	6	17%
5	Faculty/ Instructor	7	19%
6	Horticulturist/ Gardener	3	8%
7	Other	3	8%

#### Other

plant breeding and accessions

plant records specialist

Arborist

#### 2. What is the PRIMARY mission/ function of your garden?

#	Answer	Response	%
1	Education	21	58%
2	Display	10	28%
3	University extension	3	8%
4	Research	1	3%
5	Community recreation	0	0%
6	Conservation	0	0%
7	Other	1	3%
	Total	36	100%

#### Other

We have equally important: research, teaching, conservation (natural diversity as well as cultural landscapes) and public outreach

**3. What is the current cultivated area of your garden?**

#	Answer	Response	%
1	Under 2 acres	1	3%
2	2-5 acres	2	6%
3	6-10 acres	9	25%
4	11-20 acres	10	28%
5	21-50 acres	4	11%
6	51-100 acres	9	25%
7	Over 100 acres	1	3%
	Total	36	100%

**4. How many YEAR-ROUND, full-time horticulture staff members do you employ?**

#	Answer	Response	%
1	1-3	22	61%
2	4-6	10	28%
3	7-10	3	8%
4	11-15	0	0%
5	16-20	1	3%
6	21+	0	0%
	Total	36	100%

**5. On average, how many PART-TIME horticulture employees (including students/interns) do you employ per year?**

#	Answer	Response	%
1	1-3	6	17%
2	4-6	10	28%
3	7-10	8	22%
4	11-15	9	25%
5	16-20	2	6%
6	21+	1	3%
	Total	36	100%

**6. Approximately what percentage of your institution's total annual operating budget is allocated to the Horticulture Department or horticulture-related expenditures?**

#	Answer	Response	%
1	Less than 20%	15	43%
2	20-40%	7	20%
3	41-60%	10	29%
4	61-80%	1	3%
5	81-100%	2	6%
	Total	35	100%

**7. The percentage indicated in the previous question represents approximately how many dollars?**

#	Answer		Response	%
1	Less than \$50,000		11	33%
2	\$51,000 - \$100,000		3	9%
3	\$101,000 - \$200,000		7	21%
4	\$201,000 - \$500,000		10	30%
5	\$501,000 - \$1,000,000		1	3%
6	\$1,000,000+		1	3%
	Total		33	100%

**8. Approximately what portion of your annual horticulture budget is provided by your university/ college and/or department?**

#	Answer		Response	%
1	None		5	14%
2	Less than 10%		3	9%
3	10-20%		3	9%
4	21-40%		5	14%
5	41-60%		8	23%
6	61-80%		4	11%
7	81-100%		7	20%
	Total		35	100%

**9. What is the most important source of your annual horticulture budget?**

#	Answer		Response	%
1	University/ college and/or department		19	54%
2	Membership/ admission revenue		6	17%
3	Plant sale or other retail revenue (e.g. gift shop; restaurant)		1	3%
4	Tributes/ memorials		0	0%
5	Industry (firms or associations) contributions of materials/ services/ funds		0	0%
6	Endowment income		6	17%
7	Grants		0	0%
8	Non-grant governmental funding		0	0%
9	Other		3	9%
	Total		35	100%

Other
combination of plant sale, fundraiser event (gala), and membership program - all about the same %
Ours is a dynamic mixture of university funding and self-generated funds. We don't have a "horticulture" budget per se since Natural Areas management is included in the overall budget that includes the Horticulture (in the strict sense). This makes sense because the staff and spaces are shared rather than in un-collected administrative silos. And isn't managing public semi-natural areas and native plant gardens "horticulture" as much as our Conservatory and gardens of exotics or exotics + cultivars of natives?
A combination of plant sale, memberships, donations and endowment - majority is private

#### 10. How long has your garden been established?

#	Answer	Response	%
1	Fewer than 10 years	2	6%
2	11-20 years	5	14%
3	21-30 years	9	25%
4	31-50 years	7	19%
5	51-100 years	8	22%
6	Over 100 years	5	14%
	Total	36	100%

#### 11. Section 2 of 3: COLLECTION CURATION

Who is primarily responsible for curatorial decisions such as plant acquisition, propagation, removal or maintenance?

#	Answer	Response	%
1	Director or Assistant Director	10	28%
2	Curator	8	22%
3	Director of Horticulture/ Garden Manager	9	25%
4	Horticulturist(s) or gardener(s)	2	6%
5	Committee of faculty and/or internal staff	3	8%
6	Outside advisory committee	0	0%
7	Combination of faculty/ staff & outside expertise (e.g. green industry)	1	3%
8	Volunteers	0	0%
9	Students	0	0%
10	Other	3	8%
	Total	36	100%

**Other**  
 team effort - horticulturist, woody plant curator, and director  
 Curator - but in discussion with Director and program managers. Interestingly, the budget isn't the Curator's (curator is faculty-status and administratively such routine items aren't faculty budget lines)  
 It really is a group decision - though Director has final say

**12. Which of the following academic programs or concentrations (including minors) are offered at your institution? (please select all that apply)**

#	Answer	Response	%
1	Horticulture	25	81%
2	Landscape Contracting/ Design/ Management	19	61%
3	Landscape Architecture	26	84%
4	Public Horticulture	13	42%
5	Nursery Production/ Management	15	48%
6	Urban/ Community Forestry	17	55%
7	Ornamental Plant Breeding	8	26%
8	Museum Studies	11	35%

**13. Does your garden have a written collections policy?**

#	Answer	Response	%
1	Yes	22	61%
2	No	11	31%
3	Being developed	2	6%
4	Unsure	1	3%
	Total	36	100%

**14. Do you currently utilize one of the following computerized plant records software systems?**

#	Answer	Response	%
1	BG-BASE	10	29%
2	IrisBG	1	3%
3	General spreadsheet program (e.g. MS Excel, MS Access)	12	35%
4	GIS software (e.g. ESRI)	0	0%
5	Custom records software	1	3%
6	Other	10	29%
	Total	34	100%

Other	
Collection Space	
No	
Microsoft Access	
currently switching from Excel to BG-BASE	
Excel	
about to purchase IrisBG	
FileMaker Pro	
Both custom records software and GIS software	
File Maker Pro Database	
Access and part in GoogleDocs	

**15. Do you utilize plant mapping software?**

#	Answer	Response	%
1	Yes	16	46%
2	No	18	51%
3	Unsure	1	3%
	Total	35	100%

**16. How do you acquire the majority of plant material to be accessioned/ planted?**

#	Answer	Response	%
1	Purchased from commercial growers/ distributors	24	67%
2	In-house propagation/ production	1	3%
3	Industry donations/ plant trial distributions	5	14%
4	Member/ alumni/ public donations	0	0%
5	Wild collection/ index semina	3	8%
6	Other	3	8%
	Total	36	100%

<b>Other</b>
All of abov
All of the above
Depends on were to be used. Native gardens - native genotypes from specialty nurseries or collection (we have DNR permits for all state-listed species but one); for "exotic areas" its purchase or in-house production

**17. Does your garden feature any of the following? (select all that apply)**

#	Answer	Response	%
1	National/ regional plant trial participation	16	48%
2	Internal plant evaluation program	12	36%
3	A North American Plant Collections Consortium (NAPCC) collection	14	42%
4	Plant society reference collection	6	18%
5	A "recommended plants" promotional program	8	24%
6	Industry demonstrations/ field days	7	21%
7	Regular plant sale(s)	27	82%

**18. Section 3 of 3: COLLECTION RELEVANCE**

**In your opinion, what is the most important benefit of an educationally relevant plan collection?**

#	Answer	Response	%
3	Demonstrate/ quantify the value of your garden to your institution or department	11	31%
2	Adequately prepare students for green industry employment or further study	10	28%
1	Ensure high standards for horticultural display and maintenance	6	17%
6	Other	6	17%
5	Cultivate support from members/ alumni/ community stakeholders	2	6%
4	Cultivate mutually beneficial relationships with industry groups/ commercial firms	1	3%
	Total	36	100%

Other
The collection is primarily to teach plant biology, taxonomy, ecology, local plant communities and ornamentals that will grow well in inland Southern California, The department is Botany & Plant Sciences, rather than horticulture.
That is SERVES as an educational tool--that visitors (students, colleagues, community) learn about plants and the relationship between plants, human health and nutrition in both the designed and natural landscape.
Imbue future leaders with a passion for environmental stewardship
What is an educationally relevant plant collection?
Provide an accurately botanically identified and interpreted collection of plants relevant to the courses and research programs that utilize the garden.
Provide plants that are conceptually challenging - from engineering to conservation to the sheer enjoyment factor

**19. Does your garden currently have written guidelines for evaluating and/or maximizing the relevance of your collection to undergraduate/ graduate education?**

#	Answer	Response	%
1	Yes	3	8%
2	No	29	81%
3	Being developed	2	6%
4	Unsure	2	6%
	Total	36	100%

**20. If not, would an evaluation of collection relevance be a valuable future endeavor at your garden?**

#	Answer	Response	%
1	Yes	20	57%
2	No	3	9%
3	Not sure	11	31%
4	We already have evaluation guidelines in place	1	3%
	Total	35	100%

**21. What is/ would be the most important benefit of an evaluation of collection relevance at your garden?**

#	Answer	Response	%
1	Prioritize taxa to be acquired or propagated	19	53%
2	Develop or improve maintenance practices	5	14%
3	Determine more effective/ efficient use of garden space	6	17%
4	Prioritize the removal of poor quality specimens or ornamentally obsolete taxa	4	11%
5	Other	2	6%
	Total	36	100%

**Other**

Assess how applicable our collections are to educational purposes and our mission statement, and use as a tool to evaluate what specimens to add or remove.  
I answered no to the previous question.

Statistic	Value
Min Value	1
Max Value	5
Mean	2.03
Variance	1.68
Standard Deviation	1.30
Total Responses	36

**22. In its current state, how would you rate the relevance of your collection to preparing students for future horticultural study and/or green industry employment?**

#	Answer	Response	%
1	Poor	0	0%
2	Fair	7	19%
3	Good	12	33%
4	Very Good	10	28%
5	Excellent	4	11%
6	Not sure	3	8%
	Total	36	100%

**23. Please drag & drop each of the following actions to rank its importance to improving the educational relevance of your collection (1 = Most Important, 7 = Least Important)**

#	Answer	1	2	3	4	5	6	7	Total Responses
1	Thin/ renovate crowded garden areas/ beds	5	5	9	5	4	5	3	36
2	Add locally adapted/ improved/ popular taxa	13	9	2	5	3	3	1	36
3	Add newer introductions for evaluation	11	10	5	0	3	4	3	36
4	Improve pruning methods/ frequency or other maintenance practices	5	2	10	7	4	7	1	36
5	Remove aged/ diseased/ deceased specimens	1	4	5	10	8	4	4	36
6	Remove taxa deemed obsolete or no longer commercially important	0	3	3	3	8	10	9	36
7	Provide better control of insect pests/ disease	1	3	2	6	6	3	15	36
	Total	36	36	36	36	36	36	36	-

**24. Aside from a lack of funding or staff, what is the primary obstacle to achieving increased collection relevance at your garden?**

#	Answer	Response	%
1	Timely pruning/ maintenance	3	8%
2	Lack of space	4	11%
3	Difficulty keeping up with new introductions	4	11%
4	Lack of communication with the green industry	2	6%
5	Lack of institutional/ departmental interest	13	36%
6	Other	10	28%
	Total	36	100%

Other
Differences of opinion regarding which plants to add or remove
Bring plants on site useful and important to faculty/students and still engage the public w exciting displays
Lack of communication with campus bureaucracy.
I would say "insufficient" interest, not lack. A lot of faculty have a passive interest in our collections for instructional and other purposes, but they are often reticent about advancing their "agendas."
lack of good database/records/mapping system
Lack of upper administrative (Vice President/President) understanding of the academic function of a garden.
Collections policy
budgetary restraints
Dynamic needs of the University faculty. We're not in a department/college but a peer to the University Museum of Art and thus expected to be relevant to art, language, science, technology, health sciences, etc. etc. We're NOT focused on horticulture which is the presumption here. Being freed from departmental agendas has been truly liberating and we're much more dynamic/broadening our collections for it.
Lack of cohesiveness

**25. In developing standards for the physical condition of plants in university gardens, how would you rank the importance of each of the following to evaluating and/or grading educational relevance? (1 = most important, 5 = least important)**

#	Answer	1	2	3	4	5	Total Responses
1	Proper pruning/ form/ branching habit	2	7	15	10	2	36
2	Proper spacing/ lack of crowding	4	14	8	8	2	36
3	Harmonious/ aesthetic design	6	7	5	11	7	36
4	Proper siting (shade/sun, moist/dry, etc.)	23	7	5	0	1	36
5	Control/ prevention of disease or insect pests	1	1	3	7	24	36
	Total	36	36	36	36	36	-

**26. How important would a quantitative measure of collection relevance be to each of the following?**

#	Question	Not Important	Somewhat Important	Moderately Important	Very Important	Total Responses	Mean
5	Earning institutional recognition/visibility	1	4	14	17	36	3.31
4	Securing outside funding/grants	0	6	16	14	36	3.22
3	Securing/justifying institutional funding	2	5	13	16	36	3.19
8	Gaining recognition among other institutions/gardens	1	4	20	11	36	3.14
7	Garnering community/visitor/alumni support	1	8	19	8	36	2.94
6	Fostering industry collaboration/support	3	10	13	10	36	2.83
2	Recruiting faculty or staff	6	12	8	10	36	2.61
1	Recruiting students	11	11	10	4	36	2.19

**27. In promoting an educationally relevant university garden collection, how important are each of the following?**

Question	Not Important	Somewhat Important	Moderately Important	Very Important	Total Responses	Mean
Growing all specimens to mature size	5	8	16	7	36	2.69
Growing/maintaining specimens at the size seen in the majority of local landscapes	9	13	7	7	36	2.33
Displaying multiple ages/sizes of the same taxon	12	16	6	2	36	1.94
Grouping contrasting species/cultivars to aid in identification/evaluation	3	11	16	6	36	2.69
Grouping taxa according to taxonomic/phylogenetic relationships	13	10	11	2	36	2.06
Displaying taxa in well-designed, properly-sited landscape situations	0	3	13	20	36	3.47

**28. In determining which plants are the most prevalent or important to local/ regional horticulture, how important is input from each of the following?**

Question	Not	Somewhat Important	Moderately Important	Very Important	Total Responses	Mean
“Re-wholesale” plant distributors	9	18	8	1	36	2.03
Landscape contractors	9	13	7	5	34	2.24
Landscape architects/ designers	8	13	9	5	35	2.31
Retail garden centers	8	15	5	8	36	2.36
Plant breeders/ marketing firms	7	11	11	6	35	2.46
Wholesale plant producers	6	11	13	6	36	2.53
Plant societies/ cultivar registrars	4	8	19	4	35	2.66
Garden staff/ students/ volunteers	2	8	17	8	35	2.89
Other botanical gardens and arboreta	1	5	21	8	35	3.03
University faculty/ instructors	2	7	14	12	35	3.03

**29. In terms of the percentage of accessions, what would be the ideal composition of an educationally relevant university plant collection?**

#	Answer	Min Value	Max Value	Average Value	Standard Deviation
1	Locally adapted/ recommended or popular taxa (native or exotic)	0.00	75.00	40.81	23.49
2	New introductions or "up and coming" taxa	0.00	50.00	14.94	13.03
3	Rare/ threatened germplasm	0.00	70.00	11.86	12.38
4	Taxa important to past or current breeding work	0.00	20.00	6.94	5.89
5	Historic/ mature specimens	0.00	50.00	13.89	12.66
6	Unusual plants and genetic freaks	0.00	25.00	5.72	6.20
7	Other	0.00	100.00	5.83	19.48

**Other**

Plants used in classwork

I can't answer a question like this.

Plants relevant to courses taught and in support of academic research.

Tropical and non-hardy varieties

**30. In a perfect world, how often would an evaluation of collection relevance be conducted?**

#	Answer	Response	%
1	Every 1-3 years	6	17%
2	Every 4-6 years	16	44%
3	Every 7-10 years	11	31%
4	Every 11-15 years	2	6%
5	Every 16-25 years	0	0%
6	Evaluating collection relevance is not important	1	3%
	Total	36	100%

31. Please add any comments, concerns or questions not addressed in this survey:

Good luck with your survey. Please send a copy of the results to [bmaynard@uri.edu](mailto:bmaynard@uri.edu).

This is a topic we are very interested in and something we have started work on, but have a long way to go - I would love to see what you come up with. My contact information is below. Thanks!

Aaron Steil Reiman Gardens - Iowa State University [ajsteil@iastate.edu](mailto:ajsteil@iastate.edu)

Some questions didn't fit us exactly. We don't completely separate out horticultural staff from others, for instance, so I made the best guesses for your answers. We also don't separate out budgets completely.

It was difficult to answer the mostly vague questions. For many, it would depend on the audience, and we have many audiences.

This survey does not represent well the situation at the Botanical Gardens at University of California, Riverside. We started in 1963 as a Life Sciences research area, later morphed into a Botanic Garden and now serve university education and extension, with a small amount of research. WE are heavily used by Biology, botany and plant sciences classes, entomology and plant pathology, etc. We do not have a Horticulture Department as such.

I am the woody plant curator of the Gardens, thus some questions were left blank since I do not access to needed information. The director of the Gardens will most likely fill out this survey and fill in these gaps. Volunteers are a huge help in sustaining the Gardens.

Your request to rank what should most importantly go into the decision to site plantings seemed something like 'which of your body parts is most important to you?'. Siting for conditions, for space, for aesthetics, etc. are all critical and are brought into play everytime we plant each tree or shrub. You might instead consider such things as 'planted it because someone donated it' or other such public pressures.

So much more could be done if we had more funding. Universities provide very little support for botanical gardens and arboretum. They want us to look great but don't want to provide any significant funds to help us. They even want to control what donors we can contact and solicit.

We are more focused on natural areas and ecosystem restoration. Survey did not ask how many natural areas staff we have or what portion of our budget goes to this. In building new gardens our focus is typically on creating ecosystems not on specific horticultural plants.

The structure of your survey is definitely biased towards horticultural programs, such as the use of horticultural varieties, interactions with the green industry, focus on landscape design and presentation and presentation of garden maintenance practices. We are a botanic garden which focuses on plants of systematic classification and economic uses beyond horticulture (medicinal plants, dye plants, oil plants, food plants, perfume plants etc.) as we are based in the College of Natural Sciences. We deal with species, not horticultural selections. We also focus on native plant collections including regionally threatened and endangered taxa. We have very little interaction with the green industry. We have an entirely separate Horticultural Demonstration Garden housed in the Horticulture Department under the College of Agriculture which I am certain would provide much different responses to the questions provided in this survey than the replies provided here.

Our collection is educational for more than horticulture students. Many of our patrons come to observe ecology, pathology, storm water management, habitat displays, etc. We do also display up and coming as well as proven selections of native plants in more designed displays in our more formal areas. Just a friendly reminder that being a public garden doesn't make horticulture automatically a priority. We are in fact part of the natural history collections in the Dept. of biological sciences, and not really connected to our University's Hort department. Food for thought. Cheers

Collection relevance should also be tied closely to the mission of each Garden.

Thanks for the thought you've put into this. Here are some comments for context on my responses. 1. Gardens (and museums) ultimately rely on societal relevance for survival. A specific department / unit may have its own agendas and (very legitimate) needs that are not long-term congruent with societal relevance, so collections assembled for more-limited needs are ultimately unsustainable across academic generations. Its important to try and sort our these issues when looking for long-term criteria for prioritizing collections/gardens/restored areas. 2. If its not beautiful, it won't be cared for in the long run. That's a simple truth. But the reverse - it its beautiful it will be retained, is not true. A collection/garden can be marginally relevant with time (see #1) so one has to be bold in making judgments. 3. Instructional needs (undergrad and professional schools) are dynamic targets that we have to track. Since mature specimens may take decades, and the curricula will have changed many times before maturity is reached, one doesn't want to tie collection-relevance assessment too tightly to short-term or idiosyncratic demands, however loud those may be. [This is yet another strength of not being in a specific department/college.] 4. Will look forward to seeing the results of your survey! Nice job.

I am the Director of Michigan State University Horticulture Gardens. Note that we also have Beal Garden on campus - and their focus is on rare and endangered and phylogenic relationships. Our campus has wonderful mature trees - so that is also not a particular focus of our horticulture gardens

## Appendix F

### UNIVERSITY OF DELAWARE IRB EXEMPTION NOTICE (WOODY PLANT INSTRUCTION AND THE ACADEMIC VALUE OF *ILEX* TAXA SURVEY)



RESEARCH OFFICE

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

DATE: September 26, 2014

TO: Jason Veil  
FROM: University of Delaware IRB

STUDY TITLE: [662703-1] Academic Value of Ilex Taxa Survey

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS  
DECISION DATE: September 26, 2014

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 Farnese-McFarlane at (302) 831-1119 or [nicolefm@udel.edu](mailto:nicolefm@udel.edu). Please include your study title and reference number in all correspondence with this office.

## Appendix G

### INVITATION MESSAGE TO WOODY PLANT INSTRUCTION AND THE ACADEMIC VALUE OF *ILEX* TAXA SURVEY RECIPIENTS

Hello,

I am an M.S. candidate in Dr. John Frett's graduate program in Plant Curation at the University of Delaware. My thesis involves developing a method for evaluating and quantifying the relevance of university garden plant collections to student audiences--particularly those studying ornamental horticulture and landscape design. The purpose of my thesis is to develop recommendations for curatorial initiatives that promote "horticultural literacy" at university gardens. As an instructor of woody plants, your input is vital to a comprehensive approach to this process.

My project will focus on the University of Delaware Botanic Gardens' (UDBG) holly collection as a template for judging current educational relevance. Therefore, I am very interested in which *Ilex* taxa you consider most important to your students, those you've taught in the past and eliminated, and those you view as "up and coming" plants for future courses. Your feedback, combined with assessments of industry prevalence and the physical condition of each holly accession in the UDBG, will contribute to my evaluation and grading of the collection.

Please take a few minutes to complete my survey on woody plant instruction and the academic value of all things *Ilex*. If you would be interested in receiving the results of this survey, please feel free to contact me. However, if you feel you are not the right person to complete this survey, please let me know or simply forward this message to the appropriate person at your institution.

Your help is greatly appreciated.

Sincerely,

Jason Veil  
[jveil@udel.edu](mailto:jveil@udel.edu)

**Follow this link to the Survey:**

[\\${1://SurveyLink?d=Take the Survey}](#)

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

[\\${1://SurveyURL}](#)

Follow the link to opt out of future emails:

[\\${1://OptOutLink?d=Click here to unsubscribe}](#)

## Appendix H

### WOODY PLANT INSTRUCTION AND THE ACADEMIC VALUE OF *ILEX* TAXA SURVEY RESULTS (Section One)

#### 1. What is your title or current position? (please select all that apply)

#	Answer	Response	%
1	Full-time faculty	31	84%
2	Adjunct or part-time faculty	4	11%
3	Garden Administrator, Curator or Horticulturist	3	8%
4	Green Industry Professional	3	8%
5	Extension Professional	1	3%
6	Other (please indicate)	2	5%

#### Other (please indicate)

Horticulture Department Chairperson  
Horticulture Program Director

#### 2. At what type of institution do you teach woody plants?

#	Answer	Response	%
1	Small University (fewer than 10,000 students)	1	2.7%
2	Mid-sized University (10,000 - 20,000 students)	3	8.1%
3	Large University (more than 20,000 students)	15	40.5%
4	Small Community College or Technical Institute (fewer than 5,000 students)	4	10.8%
5	Mid-sized Community College or Technical Institute (5,000 - 10,000 students)	8	21.6%
6	Large Community College or Technical Institute (more than 10,000 students)	6	16.2%
7	Other (please specify)	0	0.0%

**3. How long have you been teaching woody plants?**

#	Answer		Response	%
1	Less than 5 years		5	14%
2	5-9 years		10	28%
3	10-15 years		8	22%
4	16-20 years		5	14%
5	21-30 years		7	19%
6	Over 30 years		1	3%
	Total		36	100%

**4. What is the USDA Hardiness Zone (2012 edition) of your institution?**

#	Answer		Response	%
1	5B		4	11%
2	6A		8	22%
3	6B		9	24%
4	7A		7	19%
5	7B		3	8%
6	8A		5	14%
7	8B		1	3%
	Total		37	100%

**5. What is the AHS Heat Zone of your institution? (Note: Click [HERE](#) to open the Heat Zone map in a new window)**

#	Answer		Response	%
1	4		6	16%
2	5		6	16%
3	6		7	19%
4	7		10	27%
5	8		7	19%
6	9		1	3%
	Total		37	100%

**6. Students in which of the following disciplines are typically enrolled in your woody plant course(s)? (please select all that apply)**

#	Answer	Response	%
1	Landscape Contracting/ Design/ Management	30	81%
2	Landscape Architecture	14	38%
3	Public Horticulture	20	54%
4	Forestry, Urban Forestry or Arboriculture	14	38%
5	Nursery Production/ Management	23	62%
6	Ecology/ Wildlife Ecology	3	8%
7	Other	11	30%

Other
Mainly horticulture and landscape architecture students with some biology majors
Turfgrass, also get a few business and english (garden writing) majors
20 % general hort
Agribusiness and Turf Management
Environmental Studies
Agricultural Education, Architecture, Turfgrass
turfgrass
Landscape Gardening
Horticulture Technology
Agricultural Education
Biology

**7. When presenting woody landscape plants to students in an outdoor setting, which of the following is most accurate?**

#	Answer	Response	%
1	I cover plants only to the species level	0	0%
2	I cover mostly species, but also cover a few important hybrids or prominent cultivars	24	67%
3	I cover one or more important hybrids or cultivars of many plants	10	28%
4	The majority of plants covered are hybrids or cultivars	0	0%
5	Other (please explain)	2	6%
Total		36	100%

**Other (please explain)**

Native and non-native and cultivars of both - and the importance especially of native cultivars I provide on-line lectures. There is a long version with related plants, hybrids and cultivars and a short version without the related species. The students are responsible to ID only to the species level.

**8. In a perfect world, what would be the ideal proportion of the following woody plant categories you would like to cover in your course(s)?**

#	Answer	Min Value	Max Value	Average Value	Standard Deviation
1	Locally/ regionally popular landscape plants (native and introduced)	0	100	61	19
3	Native taxa not typically seen in the landscape/nursery trade	0	30	12	8
4	Unusual plants and genetic freaks	0	10	4	3
5	Historically important plants now rare or no longer available in the trade	0	10	4	3
6	New introductions or lesser known "up and coming" plants	0	25	11	7
7	Parents of popular hybrid taxa or plants important to current breeding	0	10	3	4
8	Other (please specify)	0	100	5	18

**Other (please specify)**

Important taxa from other regions, we buy them in each year even though they will not survive where we are long term

Exotics (Europe, Asia)

Not sure what a perfect world means. 80% of my students are LA and I therefore primarily cover plants commonly available in the nursery industry. As mentioned before, I provide a long version of the lectures that include additional plants in each family for those students who are truly interested in a more comprehensive woody plant course.

Plants required for Certified Plant Professional exam

What is commonly grown in area  
invasive woodies

**9. How would you allocate the percentage of time spent teaching woody plants at each of the following outdoor venues? (Total must equal 100)**

#	Answer	Min Value	Max Value	Average Value	Standard Deviation
1	Part(s) of campus designated as an arboretum or botanical garden	0	100	40	37
2	Off-campus (requiring transportation) arboretum/ botanical garden affiliated with your institution	0	100	8	23
3	Off-campus neighborhood, park or forest	0	75	8	17
4	Arboretum or botanical garden(s) NOT affiliated with your institution	0	100	8	20
6	Other (please specify)	0	0	0	0
7	Part(s) of campus not designated as an arboretum or botanical garden	0	100	34	32
12	Nursery production facility or retail garden center	0	25	3	6

**Other (please specify)**

Use to spend nearly a 90% of time in the garden until it was lost to budget cuts.  
I offer two off-campus optional field trips.

**10. How would you rate the academic effectiveness of your PRIMARY instructional venue in each of the following categories?**

Question	Very Ineffective	Ineffective	Somewhat Ineffective	Undecided	Somewhat Effective	Effective	Very Effective	Total Responses	Mean
Timely removal/ replacement of inferior or ornamentally obsolete taxa	4	5	5	3	12	6	2	37	4.08
Incorporation of new and/or superior woody landscape plants	3	4	7	1	10	8	4	37	4.38
Display of multiple ages/ sizes of the taxa covered	3	5	6	2	7	10	4	37	4.38
Demonstration of current plant usage trends in your region	2	2	3	1	9	15	5	37	5.11
Overall health/ physical condition of the plants displayed	2	1	4	0	8	18	4	37	5.19
Overall relevance of the plant material to your teaching needs	2	2	0	0	6	18	9	37	5.59

**11. How empowered are you to determine which plants are displayed and/or how they are maintained at your primary instructional venue?**

#	Answer		Response	%
1	I have no input		8	22%
2	I am part of a committee that determines planting/ removal/ maintenance		6	16%
3	I have direct responsibility for which plants are displayed and their care		8	22%
4	I make suggestions from time to time		12	32%
5	Other (please specify)		3	8%
	Total		37	100%

**Other (please specify)**

I am able to make suggestions for new plants and do have a wish list that gets addressed each year. I also sometimes plant sections of plants in the arboretum and on the grounds with my landscape management class or also make suggestions

We have some say in what gets planted. We have major problems with poor maintenance. We have unique challenges in that we share the location with a National Park Historic Site (Springfield Armory). I am currently in the process of setting up and applying for Tree Campus USA designation to try and alleviate some of our challenges. We have a newer head of Facilities Dept. who is very cooperative and we are developing systems and communication improvements with her.

I have direct responsibility for which plants are displayed, but care is shared with others

**12. If ONLY ONE SPECIMEN of each plant covered was available for outdoor instruction, which of the following ages/ sizes would you consider the most educationally pertinent to your students? Please slide the tab to indicate the ideal size (relative to the maximum landscape size typically seen in your area) in each category of hollies:**

#	Answer	Min Value	Max Value	Average Value	Standard Deviation	Responses
1	Evergreen Trees (e.g. Ilex opaca, Ilex Nellie R. Stevens)	0.00	100.00	64.84	20.60	37
2	Evergreen Shrubs (e.g. Ilex glabra, Ilex Blue Princess®)	33.00	100.00	65.38	16.65	37
3	Deciduous Shrubs (e.g. Ilex decidua, Ilex verticillata Winter Red)	33.00	100.00	68.89	16.90	37

**13. How important would each of the following factors be to your decision to DISCONTINUE teaching a particular taxon?**

#	Question	Not Important	Somewhat Important	Moderately Important	Very Important	Total Responses	Mean
2	Decreased popularity with local designers/contractors	3	10	18	5	36	2.83
8	Other (please specify)	1	0	1	1	3	3.00
6	Invasiveness or potential invasiveness	6	8	11	12	37	3.11
1	Unavailability from growers/retailers	2	9	15	11	37	3.24
4	Chronic insect or animal pest problems	3	8	13	13	37	3.32
5	Chronic disease problems (fungal, bacterial, etc.)	4	6	14	13	37	3.32
7	No plantings available for local observation	2	7	11	17	37	3.62
3	Environmental unsuitability (heat, cold, soils, etc.)	1	3	13	19	36	3.92
<b>Other (please specify)</b>							
I try to propagate plants in our collection because we have plants that are not found anywhere else. Historically some of the plants are important to our collections							
Show good and bad to illustrate both what should be planted and what should not, so just as important to show the students undesirable as desirable plants							
I teach an entire week on invasive species hence my rating on invasive species							
I had difficulty answering this question because I consider the lecture and lab to be complementary but not duplicative. For example, we discontinued Hamamelis virginiana as a lab plant because campus construction removed the only existing plant. We still include in the lecture as an important native landscape plant.							
interesting historical place							

## Appendix I

### **ILEX TAXA RECEIVING VOTES IN WOODY PLANT INSTRUCTION AND ACADEMIC VALUE OF HOLLY TAXA SURVEY (Section Two)**

#### **Evergreen Tree Taxa**

TAXON	VOTES	MODIFIED VOTES	TOTAL
<i>Ilex</i> × <i>altaclerensis</i> 'Camelliifolia'	1		1
<i>Ilex</i> × <i>aquipernyi</i>	1		1
<i>Ilex</i> × <i>aquipernyi</i> 'Dragon Slayer'	2		2
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	6	1	7
<i>Ilex</i> × <i>aquipernyi</i> 'San Jose'	1	1	2
<i>Ilex</i> × <i>attenuata</i> 'East Palatka'	1		1
<i>Ilex</i> × <i>attenuata</i> 'Foster No. 2'	21		21
<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	1	1	2
<i>Ilex</i> × <i>attenuata</i> 'Savannah'	10		10
<i>Ilex</i> × <i>attenuata</i> 'Sunny Foster'	2		2
<i>Ilex</i> × <i>koehneana</i>	3		3
<i>Ilex</i> × <i>koehneana</i> 'Wirt L. Winn'	2	3	5
<i>Ilex aquifolium</i>	17		17
<i>Ilex aquifolium</i> 'Argentea Marginata'	1	17	18
<i>Ilex aquifolium</i> Fructu Luteo Group	1	17	18
<i>Ilex cassine</i>	2		2
<i>Ilex</i> 'Conaf' (Oak Leaf™)	2		2
<i>Ilex</i> 'Conive' (Festive™)	1		1
<i>Ilex</i> 'Conty' (Liberty™)	1		1
<i>Ilex cornuta</i> 'Burfordii'	21	10	31
<i>Ilex cornuta</i> 'Needlepoint'	4	9	13
<i>Ilex</i> 'Doctor Kassab'	1		1
<i>Ilex</i> 'Emily Bruner'	10		10
<i>Ilex latifolia</i>	5	1	6
<i>Ilex</i> 'Lydia Morris'	1		1
<i>Ilex</i> 'Mary Nell'	6		6
<i>Ilex</i> 'Nellie R. Stevens'	25		25
<i>Ilex opaca</i>	29		29
<i>Ilex opaca</i> 'Angelica'	1	29	30
<i>Ilex opaca</i> Cave Hill Group	1	29	30

TAXON	VOTES	MODIFIED VOTES	TOTAL
<i>Ilex opaca</i> 'Dan Fenton'	1	29	30
<i>Ilex opaca</i> f. <i>xanthocarpa</i>	4	29	33
<i>Ilex opaca</i> 'Goldie'	1	29	30
<i>Ilex opaca</i> 'Jersey Knight'	4	29	33
<i>Ilex opaca</i> 'Jersey Princess'	4	29	33
<i>Ilex opaca</i> 'Miss Helen'	2	29	31
<i>Ilex opaca</i> 'Old Heavy Berry'	3	29	32
<i>Ilex opaca</i> 'Pamela Orton'	1	29	30
<i>Ilex opaca</i> 'Portia Orton'	3	29	32
<i>Ilex opaca</i> 'Red Velvet'	1	29	30
<i>Ilex opaca</i> 'Satyr Hill'	3	29	32
<i>Ilex pernyi</i>	1		1
<i>Ilex rotunda</i>	3		3
<i>Ilex</i> 'Whoa Nellie'	1		1

### **Evergreen Shrub Taxa**

<i>Ilex aquifolium</i> 'Angustifolia'	2	17	19
<i>Ilex aquifolium</i> 'Sadezam' (Santa's Delight®)	1	17	18
<i>Ilex cornuta</i>	9		9
<i>Ilex cornuta</i> 'Carissa'	11	9	20
<i>Ilex cornuta</i> 'Dwarf Burford'	15	9	24
<i>Ilex cornuta</i> 'O. Spring'	1	9	10
<i>Ilex cornuta</i> 'Rotunda'	12	9	21
<i>Ilex crenata</i>	19		19
<i>Ilex crenata</i> 'Beehive'	1	19	20
<i>Ilex crenata</i> 'Chesapeake'	1	19	20
<i>Ilex crenata</i> 'Compacta'	5	19	24
<i>Ilex crenata</i> 'Convexa'	9	20	29
<i>Ilex crenata</i> 'Dwarf Pagoda'	1	19	20
<i>Ilex crenata</i> 'Golden Heller'	1	19	20
<i>Ilex crenata</i> 'Green Luster'	3	19	22
<i>Ilex crenata</i> 'Helleri'	18	19	37
<i>Ilex crenata</i> 'Hetzii'	3	19	22
<i>Ilex crenata</i> 'Hoogendorn'	3	19	22

TAXON	VOTES	MODIFIED VOTES	TOTAL
<i>Ilex crenata</i> 'Jersey Pinnacle'	3	19	22
<i>Ilex crenata</i> 'Pyramidalis'	1	19	20
<i>Ilex crenata</i> 'Sentinel'	1	19	20
<i>Ilex crenata</i> 'Sky Pencil'	14	19	33
<i>Ilex crenata</i> 'Soft Touch'	5	19	24
<i>Ilex crenata</i> 'Steed's Upright'	1	19	20
<i>Ilex glabra</i>	22		22
<i>Ilex glabra</i> 'Chamzin' (Nordic®)	1	22	23
<i>Ilex glabra</i> 'Compacta'	4	22	26
<i>Ilex glabra</i> 'Densa'	1	22	23
<i>Ilex glabra</i> 'Nigra'	2	22	24
<i>Ilex glabra</i> 'Shamrock'	15	22	37
<i>Ilex</i> 'Mesdob' (China Boy®)	4		4
<i>Ilex</i> × <i>meserveae</i> 'Blue Boy'	6		6
<i>Ilex</i> × <i>meserveae</i> 'Blue Girl'	10		10
<i>Ilex</i> × <i>meserveae</i> 'Conablu' (Blue Prince®)	6		6
<i>Ilex</i> × <i>meserveae</i> 'Conang' (Blue Angel®)	3		3
<i>Ilex</i> × <i>meserveae</i> 'Conapri' (Blue Princess®)	9		9
<i>Ilex</i> × <i>meserveae</i> 'Hachfee' (Castle Spire®)	3		3
<i>Ilex</i> × <i>meserveae</i> 'Honey Maid'	3		3
<i>Ilex</i> × <i>meserveae</i> 'Mesan' (Blue Stallion®)	2		2
<i>Ilex</i> × <i>meserveae</i> 'Mesid' (Blue Maid®)	2		2
<i>Ilex</i> × <i>meserveae</i> 'Willemer' (Emerald Magic®)	1		1
<i>Ilex</i> 'Mesog' (China Girl®)	7		7
<i>Ilex myrtifolia</i>	1		1
<i>Ilex opaca</i> 'Maryland Dwarf'	1	29	30
<i>Ilex pedunculosa</i>	4		4
<i>Ilex</i> 'Rutzan' (Red Beauty®)	2	2	4
<i>Ilex vomitoria</i>	11		11
<i>Ilex vomitoria</i> 'Dwarf'	4	14	18
<i>Ilex vomitoria</i> 'Pendula'	6	11	17
<i>Ilex vomitoria</i> 'Pride of Houston'	1	12	13
<i>Ilex vomitoria</i> 'Stokes Dwarf' ('Schillings')	4	11	15

**Deciduous Shrub Taxa**

<b>TAXON</b>	<b>VOTES</b>	<b>MODIFIED VOTES</b>	<b>TOTAL</b>
<i>Ilex</i> 'Apollo'	3		3
<i>Ilex decidua</i>	11	12	23
<i>Ilex decidua</i> 'Warren's Red'	9	11	20
<i>Ilex mucronata</i>	1		1
<i>Ilex</i> 'Raritan Chief'	2		2
<i>Ilex</i> 'Sparkleberry'	15		15
<i>Ilex verticillata</i>	24		24
<i>Ilex verticillata</i> 'Afterglow'	3	24	27
<i>Ilex verticillata</i> 'Chrysocarpa'	2	24	26
<i>Ilex verticillata</i> 'Hoogendorn'	1	24	25
<i>Ilex verticillata</i> 'Jim Dandy'	4	24	28
<i>Ilex verticillata</i> 'Maryland Beauty'	1	24	25
<i>Ilex verticillata</i> 'Red Sprite'	17	24	41
<i>Ilex verticillata</i> 'Southern Gentleman'	7	24	31
<i>Ilex verticillata</i> 'Spriber' (Berry Nice®)	1	24	25
<i>Ilex verticillata</i> 'Stop Light'	1	24	25
<i>Ilex verticillata</i> 'Tiasquam'		25	25
<i>Ilex verticillata</i> 'Winter Gold'	5	24	29
<i>Ilex verticillata</i> 'Winter Red'	14	24	38

## Appendix J

### ***ILEX* TAXA OFFERED BY RE-WHOLESALE DISTRIBUTORS**

#### **Evergreen Tree Taxa**

<b>TAXON</b>	<b>SITES</b>	<b>SAMPLE DAYS</b>	<b>% OF SAMPLE DAYS</b>
<i>Ilex altaclerensis</i> 'James G. Esson'	1	3	6.7%
<i>Ilex aquifolium</i> 'Argentea Marginata'	11	31	68.9%
<i>Ilex aquifolium</i> 'Aurea Marginata Pendula'	1	3	6.7%
<i>Ilex aquifolium</i> 'Limsi' (Siberia™)	1	3	6.7%
<i>Ilex aquifolium</i> 'Marijo'	1	3	6.7%
<i>Ilex</i> × <i>aquipernyi</i> 'Dragon Slayer'	2	3	6.7%
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	14	42	93.3%
<i>Ilex</i> × <i>attenuata</i> 'Foster No. 2'	6	18	40.0%
<i>Ilex</i> × <i>attenuata</i> 'Greenleaf'	3	8	17.8%
<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	1	3	6.7%
* <i>Ilex</i> × <i>attenuata</i> 'Orange Delight'	1	3	6.7%
<i>Ilex</i> 'Centennial Girl'	7	20	44.4%
<i>Ilex</i> 'Conaf' (Oak Leaf™)	8	22	48.9%
<i>Ilex</i> 'Conal' (Cardinal™)	1	3	6.7%
<i>Ilex</i> 'Coned' (Little Red™)	1	3	6.7%
<i>Ilex</i> 'Conin' (Robin™)	10	27	60.0%
<i>Ilex</i> 'Conot' (Patriot)	1	3	6.7%
<i>Ilex</i> 'Conty' (Liberty™)	3	9	20.0%
<i>Ilex cornuta</i> 'Anicet Delcambre' (sold as 'Needlepoint')	2	6	13.3%
<i>Ilex cornuta</i> 'Burfordii'	4	10	22.2%
<i>Ilex cornuta</i> 'Fine Line'	3	8	17.8%
<i>Ilex</i> 'Dapat' (Miss Patricia™)	1	3	6.7%
<i>Ilex</i> 'Doctor Kassab'	5	15	33.3%
<i>Ilex</i> 'Emily Bruner'	1	3	6.7%
<i>Ilex</i> 'Hefcup' (Buttercup™) err. sold as 'Butterfly'	1	3	6.7%
<i>Ilex</i> 'HL10-90' (Christmas Jewel®)	3	7	15.6%
<i>Ilex</i> 'Homefire'	1	3	6.7%
<i>Ilex koehneana</i>	1	3	6.7%
<i>Ilex koehneana</i> 'Conayule' (Yule Brite™)	1	3	6.7%
<i>Ilex</i> 'Magland' (Oakland™)	7	19	42.2%
<i>Ilex</i> 'Mary Nell'	2	6	13.3%
<i>Ilex</i> 'Nellie R. Stevens'	14	41	91.1%
<i>Ilex opaca</i>	9	24	53.3%

<b>TAXON</b>	<b>SITES</b>	<b>SAMPLE DAYS</b>	<b>% OF SAMPLE DAYS</b>
<i>Ilex opaca</i> 'Betsy'	1	3	6.7%
<i>Ilex opaca</i> Cave Hill Group (sold as 'Cave Hill')	1	3	6.7%
<i>Ilex opaca</i> 'Dan Fenton'	3	8	17.8%
<i>Ilex opaca</i> 'Jersey Knight'	2	6	13.3%
<i>Ilex opaca</i> 'Jersey Princess'	4	12	26.7%
<i>Ilex opaca</i> 'Miss Courtney'	1	3	6.7%
<i>Ilex opaca</i> 'Miss Helen'	3	7	15.6%
<i>Ilex opaca</i> 'Paterson'	1	2	4.4%
<i>Ilex opaca</i> 'Satyr Hill'	8	22	48.9%
<i>Ilex</i> 'Rutzan' (Red Beauty®)	8	24	53.3%
<i>Ilex</i> 'September Gem'	1	3	6.7%
<i>Ilex</i> 'Virginia'	1	3	6.7%
<i>Ilex</i> 'Wyriv' (River Queen™)	1	1	2.2%

**\*DENOTES AN ILLEGITIMATE NAME**

**Evergreen Shrub Taxa**

<b>TAXON</b>	<b>SITES</b>	<b>SAMPLE DAYS</b>	<b>% OF SAMPLE DAYS</b>
<i>Ilex aquifolium</i> 'Ferox Argentea'	2	5	11.1%
<i>Ilex aquifolium</i> 'Monvilla' (Gold Coast™)	2	6	13.3%
<i>Ilex cornuta</i> 'Carissa'	6	16	35.6%
<i>Ilex cornuta</i> 'Dwarf Burford'	6	18	40.0%
<i>Ilex cornuta</i> 'Rotunda'	5	12	26.7%
<i>Ilex crenata</i> 'Bennett's Compact'	3	7	15.6%
<i>Ilex crenata</i> 'Chesapeake'	8	22	48.9%
<i>Ilex crenata</i> 'Compacta'	11	31	68.9%
<i>Ilex crenata</i> 'Dwarf Pagoda'	1	3	6.7%
<i>Ilex crenata</i> 'Green Lustre'	10	28	62.2%
<i>Ilex crenata</i> 'Helleri'	14	41	91.1%
<i>Ilex crenata</i> 'Hetzii'	2	6	13.3%
<i>Ilex crenata</i> 'Hoogendorn'	14	42	93.3%
<i>Ilex crenata</i> 'Mariesii'	1	3	6.7%
<i>Ilex crenata</i> 'Nigra'	1	2	4.4%
<i>Ilex crenata</i> 'Schwoebel's Compact'	1	3	6.7%

TAXON	SITES	SAMPLE DAYS	% OF SAMPLE DAYS
<i>Ilex crenata</i> 'Schwoebel's Upright'	3	6	13.3%
<i>Ilex crenata</i> 'Sky Pencil'	15	44	97.8%
<i>Ilex crenata</i> 'Snowflake' (sold as 'Shiro Fukurin')	1	3	6.7%
<i>Ilex crenata</i> 'Soft Touch'	11	29	64.4%
<i>Ilex crenata</i> 'Steed's Upright' (sold as 'Steeds')	15	44	97.8%
<i>Ilex glabra</i>	1	2	4.4%
<i>Ilex glabra</i> 'Compacta'	7	20	44.4%
<i>Ilex glabra</i> 'Densa'	8	21	46.7%
<i>Ilex glabra</i> 'Nigra'	2	5	11.1%
<i>Ilex glabra</i> 'Shamrock'	15	43	95.6%
<i>Ilex</i> 'H635-13' (Winter Bounty™)	3	7	15.6%
<i>Ilex</i> 'Mesdob' (China Boy®)	10	29	64.4%
* <i>Ilex</i> × <i>meserveae</i> Berri-Magic®	1	3	6.7%
<i>Ilex</i> × <i>meserveae</i> 'Blue Baron'	1	3	6.7%
<i>Ilex</i> × <i>meserveae</i> 'Blue Boy'	2	6	13.3%
<i>Ilex</i> × <i>meserveae</i> 'Blue Girl'	4	12	26.7%
<i>Ilex</i> × <i>meserveae</i> 'Conablu' (Blue Prince®)	12	35	77.8%
<i>Ilex</i> × <i>meserveae</i> 'Conang' (Blue Angel®)	2	6	13.3%
<i>Ilex</i> × <i>meserveae</i> 'Conapri' (Blue Princess®)	15	44	97.8%
<i>Ilex</i> × <i>meserveae</i> 'Hachfee' (Castle Spire®)	2	6	13.3%
<i>Ilex</i> × <i>meserveae</i> 'Heckenstar' (Castle Wall™)	2	4	8.9%
<i>Ilex</i> × <i>meserveae</i> 'Honey Maid'	6	18	40.0%
<i>Ilex</i> × <i>meserveae</i> 'Mesgol' (Golden Girl®)	2	6	13.3%
<i>Ilex</i> × <i>meserveae</i> 'Mesid' (Blue Maid®)	15	45	100.0%
<i>Ilex</i> × <i>meserveae</i> 'Willemer' (Emerald Magic®)	2	6	13.3%
<i>Ilex</i> 'Mesog' (China Girl®)	14	39	86.7%
<i>Ilex</i> 'Mondo' (Little Rascal®)	1	3	6.7%
<i>Ilex myrtifolia</i>	1	3	6.7%
<i>Ilex opaca</i> 'Maryland Dwarf'	4	9	20.0%
<i>Ilex pedunculosa</i>	3	9	20.0%
<i>Ilex vomitoria</i> 'Condeaux' (Bordeaux™)	2	5	11.1%
<i>Ilex vomitoria</i> 'Dwarf'	2	4	8.9%
<i>Ilex vomitoria</i> 'Gremic' (Micron®)	1	3	6.7%
<i>Ilex vomitoria</i> 'Pendula'	2	3	6.7%
<i>Ilex vomitoria</i> 'Shadow's Female' (Hoskin Shadow™)	1	2	4.4%

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**Deciduous Shrub Taxa**

<b>TAXON</b>	<b>SITES</b>	<b>SAMPLE DAYS</b>	<b>% OF SAMPLE DAYS</b>
<i>Ilex</i> 'Apollo'	8	24	53.3%
<i>Ilex</i> 'Sparkleberry'	9	29	64.4%
<i>Ilex verticillata</i>	2	6	13.3%
<i>Ilex verticillata</i> 'Afterglow'	3	9	20.0%
<i>Ilex verticillata</i> 'Chrysocarpa'	1	2	4.4%
<i>Ilex verticillata</i> 'Golden Verboom' (female)	1	1	2.2%
<i>Ilex verticillata</i> 'Golden Verboom' (male)	2	6	13.3%
<i>Ilex verticillata</i> 'Jim Dandy'	13	36	80.0%
<i>Ilex verticillata</i> 'Maryland Beauty'	3	7	15.6%
<i>Ilex verticillata</i> 'Oosterwijk'	1	3	6.7%
<i>Ilex verticillata</i> 'Red Sprite'	14	42	93.3%
<i>Ilex verticillata</i> 'Southern Gentleman'	12	35	77.8%
<i>Ilex verticillata</i> 'Spravy' (Berry Heavy®)	3	9	20.0%
<i>Ilex verticillata</i> 'Spriber' (Berry Nice®)	3	7	15.6%
<i>Ilex verticillata</i> 'Stop Light'	1	3	6.7%
<i>Ilex verticillata</i> 'Sunset'	1	3	6.7%
<i>Ilex verticillata</i> 'Winter Gold'	4	12	26.7%
<i>Ilex verticillata</i> 'Winter Red'	14	42	93.3%
* <i>Ilex</i> "Sweetheart Combo" ('Apollo' & 'Sparkleberry')	1	3	6.7%

**\*DENOTES AN ILLEGITIMATE NAME**

## Appendix K

### ***ILEX* TAXA OFFERED BY WHOLESALE GROWERS**

#### **Evergreen Tree Taxa**

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex</i> × <i>altaclerensis</i> 'James G. Esson'	1	3.7%
<i>Ilex aquifolium</i>	1	3.7%
<i>Ilex aquifolium</i> 'Alice'	1	3.7%
<i>Ilex aquifolium</i> 'Argentea Marginata'	2	7.4%
<i>Ilex aquifolium</i> Fructu Luteo Group (sold as 'Xanthocarpa')	1	3.7%
<i>Ilex aquifolium</i> 'Limsi' (Siberia™)	1	3.7%
<i>Ilex aquifolium</i> 'Marijo' (sold as 'Maryjo')	1	3.7%
<i>Ilex aquifolium</i> 'Satan Leaf'	1	3.7%
<i>Ilex</i> × <i>aquipernyi</i> 'Dragon Slayer'	1	3.7%
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	17	63.0%
<i>Ilex</i> × <i>aquipernyi</i> 'San Jose'	4	14.8%
<i>Ilex</i> × <i>attenuata</i> 'Annie Armstrong'	1	3.7%
<i>Ilex</i> × <i>attenuata</i> 'Eagleson'	1	3.7%
<i>Ilex</i> × <i>attenuata</i> 'East Palatka'	2	7.4%
<i>Ilex</i> × <i>attenuata</i> 'Foster No. 2'	10	37.0%
<i>Ilex</i> × <i>attenuata</i> 'Greenleaf'	6	22.2%
<i>Ilex</i> × <i>attenuata</i> 'Savannah'	2	7.4%
<i>Ilex</i> × <i>attenuata</i> 'Sunny Foster'	1	3.7%
* <i>Ilex</i> × <i>attenuata</i> 'Yellow Foster Holly'	1	3.7%
<i>Ilex</i> 'Auburn'	1	3.7%
* <i>Ilex</i> 'Augusta'	1	3.7%
<i>Ilex</i> 'Carolina Sentinel'	4	14.8%
<i>Ilex</i> 'Centennial Girl'	5	18.5%
<i>Ilex</i> 'Conaf' (Oak Leaf™)	12	44.4%
<i>Ilex</i> 'Conal' (Cardinal™)	2	7.4%
<i>Ilex</i> 'Conin' (Robin™)	8	29.6%
<i>Ilex</i> 'Conot' (Patriot)	1	3.7%

**\*DENOTES AN ILLEGITIMATE NAME**

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex</i> 'Conty' (Liberty™)	2	7.4%
<i>Ilex cornuta</i> 'Anicet Delcambre' (sold as 'Needlepoint')	9	33.3%
<i>Ilex cornuta</i> 'Burfordii'	3	11.1%
<i>Ilex cornuta</i> 'Fine Line'	4	14.8%
<i>Ilex cornuta</i> 'National'	1	3.7%
<i>Ilex</i> 'Coronet'	1	3.7%
<i>Ilex</i> 'Doctor Kassab'	9	33.3%
* <i>Ilex</i> 'Ellyn Capper'	1	3.7%
<i>Ilex</i> 'Emily Bruner'	4	14.8%
<i>Ilex</i> 'HL10-90' (Christmas Jewel®)	5	18.5%
<i>Ilex</i> 'Hohman'	2	7.4%
<i>Ilex</i> 'Homefire'	2	7.4%
<i>Ilex integra</i>	1	3.7%
<i>Ilex</i> 'John T. Morris'	1	3.7%
<i>Ilex</i> × <i>koehneana</i>	3	11.1%
<i>Ilex</i> × <i>koehneana</i> 'Ajax'	1	3.7%
<i>Ilex</i> × <i>koehneana</i> 'Chieftain'	1	3.7%
<i>Ilex</i> × <i>koehneana</i> 'Lassie'	3	11.1%
<i>Ilex</i> × <i>koehneana</i> 'Loch Raven'	1	3.7%
<i>Ilex</i> × <i>koehneana</i> 'San Jose'	1	3.7%
<i>Ilex latifolia</i>	2	7.4%
<i>Ilex</i> 'Magiana' (Acadiana™)	4	14.8%
<i>Ilex</i> 'Magland' (Oakland™)	3	11.1%
<i>Ilex</i> 'Mary Nell'	5	18.5%
<i>Ilex</i> 'Nellie R. Stevens'	20	74.1%
<i>Ilex opaca</i>	5	18.5%
<i>Ilex opaca</i> 'Angelica'	1	3.7%
<i>Ilex opaca</i> 'Arlene Leach'	2	7.4%
<i>Ilex opaca</i> 'Arthur Pride'	1	3.7%
<i>Ilex opaca</i> 'Baltimore Buzz'	1	3.7%
<i>Ilex opaca</i> 'Cardinal'	1	3.7%
<i>Ilex opaca</i> 'Carnival'	3	11.1%
<i>Ilex opaca</i> 'Carolina No. 2'	2	7.4%
<i>Ilex opaca</i> 'Clarissa'	1	3.7%

**\*DENOTES AN ILLEGITIMATE NAME**

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex opaca</i> 'Dan Fenton'	5	18.5%
<i>Ilex opaca</i> 'David Leach'	1	3.7%
<i>Ilex opaca</i> f. <i>xanthocarpa</i> (sold as 'Xanthocarpa')	5	18.5%
<i>Ilex opaca</i> 'Delia Bradley'	2	7.4%
<i>Ilex opaca</i> 'Gable'	1	3.7%
<i>Ilex opaca</i> 'Goldie'	1	3.7%
<i>Ilex opaca</i> 'Grace'	1	3.7%
<i>Ilex opaca</i> 'Hedgeholly'	2	7.4%
<i>Ilex opaca</i> 'Ingleside Big Berry'	1	3.7%
<i>Ilex opaca</i> 'Jersey Knight'	5	18.5%
<i>Ilex opaca</i> 'Jersey Princess'	5	18.5%
<i>Ilex opaca</i> 'Lamp Post'	1	3.7%
<i>Ilex opaca</i> 'Mary Holman'	2	7.4%
<i>Ilex opaca</i> 'Miss Helen'	7	25.9%
<i>Ilex opaca</i> 'Old Heavy Berry'	1	3.7%
* <i>Ilex opaca</i> 'Pamela Orton'	1	3.7%
<i>Ilex opaca</i> 'Parkton'	1	3.7%
<i>Ilex opaca</i> 'Paterson'	3	11.1%
<i>Ilex opaca</i> 'Portia Orton'	2	7.4%
<i>Ilex opaca</i> 'Prancer'	1	3.7%
<i>Ilex opaca</i> 'Prettyboy'	2	7.4%
<i>Ilex opaca</i> 'Pride of Butler'	1	3.7%
<i>Ilex opaca</i> 'Red Velvet'	1	3.7%
<i>Ilex opaca</i> 'Satyr Hill'	10	37.0%
<i>Ilex opaca</i> 'Tinga'	1	3.7%
<i>Ilex opaca</i> 'Virginia West' (sold as 'West Virginia')	1	3.7%
<i>Ilex opaca</i> 'Wyetta'	3	11.1%
<i>Ilex</i> 'Rutzan' (Red Beauty®)	10	37.0%
<i>Ilex</i> 'Scepter'	1	3.7%
<i>Ilex</i> 'STBB' (Aspire™)	1	3.7%
<i>Ilex</i> 'Wybec' (Becky Stevens™)	1	3.7%
<i>Ilex</i> 'Wyriv' (River Queen™)	1	3.7%

**\*DENOTES AN ILLEGETIMATE NAME**

**Evergreen Shrub Taxa**

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex aquifolium</i> 'Sadezam' (Santa's Delight™)	1	3.7%
<i>Ilex</i> 'Cherry Bomb'	1	3.7%
<i>Ilex colchica</i>	1	3.7%
<i>Ilex cornuta</i> 'Carissa'	7	25.9%
<i>Ilex cornuta</i> 'Dwarf Burford'	15	55.6%
<i>Ilex cornuta</i> 'O. Spring'	1	3.7%
<i>Ilex cornuta</i> 'Rotunda'	2	7.4%
<i>Ilex cornuta</i> 'Sunrise' (sold as 'Golden Burfordii')	1	3.7%
<i>Ilex crenata</i> 'Beehive'	1	3.7%
<i>Ilex crenata</i> 'Bennett's Compact'	3	11.1%
<i>Ilex crenata</i> 'Chesapeake'	8	29.6%
<i>Ilex crenata</i> 'Compacta'	17	63.0%
<i>Ilex crenata</i> 'Convexa'	1	3.7%
<i>Ilex crenata</i> 'Drops of Gold'	1	3.7%
<i>Ilex crenata</i> 'Farrowone' (Sky Pointer™)	5	18.5%
<i>Ilex crenata</i> 'FarrowSK6' (Patti O™)	2	7.4%
<i>Ilex crenata</i> 'Golden Heller'	3	11.1%
<i>Ilex crenata</i> 'Green Lustre'	13	48.1%
<i>Ilex crenata</i> 'Helleri'	13	48.1%
<i>Ilex crenata</i> 'Hetzii'	3	11.1%
<i>Ilex crenata</i> 'Hoogendorn'	9	33.3%
<i>Ilex crenata</i> 'Howardi'	1	3.7%
<i>Ilex crenata</i> 'Jersey Pinnacle'	1	3.7%
<i>Ilex crenata</i> 'Microphylla Columnaris' (sold as "micro. Glossy Leaf")	1	3.7%
<i>Ilex crenata</i> 'Nigra'	1	3.7%
<i>Ilex crenata</i> 'Pyramidalis' (sold as 'Pyramid')	1	3.7%
<i>Ilex crenata</i> 'Rocky Creek'	1	3.7%
<i>Ilex crenata</i> 'Schwoebel's Upright'	1	3.7%
<i>Ilex crenata</i> 'Sentinel'	1	3.7%
<i>Ilex crenata</i> 'Sky Pencil'	20	74.1%
<i>Ilex crenata</i> 'Soft Touch'	12	44.4%
<i>Ilex crenata</i> 'Steed's Upright' (sold as 'Steeds')	16	59.3%
<i>Ilex crenata</i> 'Stokes'	1	3.7%
<i>Ilex crenata</i> 'Suspensum'	1	3.7%

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex crenata</i> 'Tee Dee'	1	3.7%
<i>Ilex crenata</i> 'Wayne'	1	3.7%
<i>Ilex glabra</i>	1	3.7%
<i>Ilex glabra</i> 'Chamzin' (Nordic®)	1	3.7%
<i>Ilex glabra</i> 'Compacta'	4	14.8%
<i>Ilex glabra</i> 'Densa'	6	22.2%
<i>Ilex glabra</i> 'Ivory Queen'	2	7.4%
<i>Ilex glabra</i> 'Nigra'	3	11.1%
<i>Ilex glabra</i> 'Nova Scotia'	1	3.7%
<i>Ilex glabra</i> 'Shamrock'	14	51.9%
<i>Ilex</i> 'H635-13' (Winter Bounty™)	2	7.4%
<i>Ilex</i> 'Mesdob' (China Boy®)	1	3.7%
<i>Ilex</i> × <i>meserveae</i> 'Blue Baron'	1	3.7%
<i>Ilex</i> × <i>meserveae</i> 'Conablu' (Blue Prince®)	10	37.0%
<i>Ilex</i> × <i>meserveae</i> 'Conang' (Blue Angel®)	1	3.7%
<i>Ilex</i> × <i>meserveae</i> 'Conapri' (Blue Princess®)	11	40.7%
<i>Ilex</i> × <i>meserveae</i> 'Gold Princess' (Castle Gold™)	1	3.7%
<i>Ilex</i> × <i>meserveae</i> 'Hachfee' (Castle Spire®)	6	22.2%
<i>Ilex</i> × <i>meserveae</i> 'Heckenstar' (Castle Wall™)	3	11.1%
<i>Ilex</i> × <i>meserveae</i> 'Honey Maid'	1	3.7%
<i>Ilex</i> × <i>meserveae</i> 'Mesan' (Blue Stallion®)	2	7.4%
<i>Ilex</i> × <i>meserveae</i> 'Mesgolg' (Golden Girl®)	1	3.7%
<i>Ilex</i> × <i>meserveae</i> 'Mesid' (Blue Maid®)	11	40.7%
<i>Ilex</i> 'Mesog' (China Girl®)	1	3.7%
<i>Ilex myrtifolia</i>	1	3.7%
<i>Ilex opaca</i> 'Maryland Dwarf'	3	11.1%
<i>Ilex pedunculosa</i>	10	37.0%
<i>Ilex</i> 'RutHol1' (Emerald Colonnade®)	1	3.7%
<i>Ilex</i> 'Spartan'	1	3.7%
* <i>Ilex</i> 'Unique'	1	3.7%
<i>Ilex vomitoria</i>	2	7.4%
<i>Ilex vomitoria</i> 'Condeaux' (Bordeaux™)	5	18.5%
<i>Ilex vomitoria</i> 'Dwarf'	4	14.8%
<i>Ilex vomitoria</i> 'HOGY' (Eureka Gold™)	1	3.7%

**\*DENOTES AN ILLEGITIMATE NAME**

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex vomitoria</i> 'Pendula'	3	11.1%
<i>Ilex vomitoria</i> 'Shadow's Female' (Hoskin Shadow™)	1	3.7%
<i>Ilex vomitoria</i> 'Stoke's Dwarf' (sold as 'Schillings')	5	18.5%
<i>Ilex vomitoria</i> 'Taylor's Rudolph'	1	3.7%

**Deciduous Shrub Taxa**

<b>TAXON</b>	<b>NO. SITES</b>	<b>% OF SITES</b>
<i>Ilex</i> 'Apollo'	4	14.8%
<i>Ilex decidua</i> 'Sentry'	1	3.7%
<i>Ilex</i> 'Sparkleberry'	5	18.5%
<i>Ilex verticillata</i>	1	3.7%
<i>Ilex verticillata</i> 'Afterglow'	1	3.7%
<i>Ilex verticillata</i> 'Cacapon'	1	3.7%
<i>Ilex verticillata</i> 'FarrowBPop' (Berry Poppins™)	2	7.4%
<i>Ilex verticillata</i> 'Hoogendorn'	1	3.7%
<i>Ilex verticillata</i> 'Late Male'	2	7.4%
<i>Ilex verticillata</i> 'Maryland Beauty'	3	11.1%
<i>Ilex verticillata</i> 'NCVIV1' (Little Goblin™)	1	3.7%
<i>Ilex verticillata</i> 'Oosterwijk'	1	3.7%
<i>Ilex verticillata</i> 'Raritan Chief'	1	3.7%
<i>Ilex verticillata</i> 'Red Sprite'	13	48.1%
<i>Ilex verticillata</i> 'Southern Gentleman'	13	48.1%
<i>Ilex verticillata</i> 'Spravy' (Berry Heavy®)	4	14.8%
<i>Ilex verticillata</i> 'Spriber' (Berry Nice®)	2	7.4%
<i>Ilex verticillata</i> 'Winter Gold'	6	22.2%
<i>Ilex verticillata</i> 'Winter Red'	16	59.3%

**\*DENOTES AN ILLEGITIMATE NAME**







## Appendix M

### UDBG ILEX COLLECTION PHYSICAL EVALUATION RESULTS

GOOD = Weighted average of 3-4

FAIR = Weighted average of 2-2.9

POOR = Weighted average of 1-1.9

#### Evergreen Tree Taxa

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
95-17*1	<i>Ilex</i> × <i>koehneana</i> 'Wirt L. Winn'	H	16	4	4	4	4	3	3.8	3.9
95-54*1	<i>Ilex</i> × <i>koehneana</i> 'Ajax'	CP	24	4	4	4	4	1	3.4	3.7
07-14*2	<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	GE	12	3	4	4	4	3	3.6	3.6
95-38*1	<i>Ilex integra</i>	A1	18	4	3	4	3	2	3.2	3.5
07-14*1	<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	GE	11	3	3	4	4	3	3.4	3.4
07-14*3	<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	GE	11	3	3	4	4	3	3.4	3.4
92-16*1	<i>Ilex latifolia</i>	CP	12	3	4	4	4	1	3.2	3.4
02-10*1	<i>Ilex</i> × <i>attenuata</i> 'Bienville Gold'	CC	20	4	3	4	3	1	3	3.4
67-4*1	<i>Ilex opaca</i> 'Arden'	FH	22	4	4	3	3	1	3	3.3
67-4*2	<i>Ilex opaca</i> 'Arden'	FH	22	4	4	3	3	1	3	3.3
15-55*1	<i>Ilex</i> 'Centennial Girl'	N2	8	2	4	4	4	3	3.4	3.3
69-44*1	<i>Ilex opaca</i>	FH	30	3	4	3	4	3	3.4	3.3
69-10*1	<i>Ilex opaca</i>	N2	30	3	4	3	3	4	3.4	3.3
69-10*2	<i>Ilex opaca</i>	N2	30	3	4	3	3	4	3.4	3.3
69-45*1	<i>Ilex opaca</i> 'Canary'	FH	30	3	4	3	4	2	3.2	3.2
95-60*1	<i>Ilex</i> 'Ginny Bruner'	A1	15	3	4	3	4	1	3	3.1
93-126*1	<i>Ilex</i> × <i>aquipernyi</i> [Dragon Lady] = 'Meschick'	TE2	14	3	4	3	4	1	3	3.1

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
93-126*3	<i>Ilex</i> × <i>aquipernyi</i> [Dragon Lady] = 'Meschick'	TE2	14	3	4	3	4	1	3	3.1
09-75*1	<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	F3	12	3	3	3	4	3	3.2	3.1
14-153*1	<i>Ilex</i> 'Nellie R. Stevens'	F3	6	2	4	3	4	3	3.2	3
79-5*1	<i>Ilex opaca</i> 'Delia Bradley'	FH	28	4	3	2	3	2	2.8	2.9
09-76*1	<i>Ilex aquifolium</i> 'N.Y.B.G. No. 2'	F3	5	2	4	3	4	2	3	2.9
97-91*1	<i>Ilex</i> 'Carolina Cone'	GH	14	3	4	3	2	1	2.6	2.9
94-134*1	<i>Ilex</i> × <i>attenuata</i> 'Sunny Foster'	FH	18	4	2	3	2	1	2.4	2.8
14-150*1	<i>Ilex</i> [Red Beauty] = 'Rutzan'	FH	2	1	4	3	4	4	3.2	2.8
01-1*1	<i>Ilex opaca</i>	N2	16	3	4	2	4	1	2.8	2.8
N/A	<i>Ilex opaca</i> f. <i>xanthocarpa</i> cv.	A2	9	2	4	2	4	3	3	2.7
09-20*1	<i>Ilex</i> × <i>altaclerensis</i> 'James G. Esson'	F3	8	2	4	2	3	4	3	2.7
95-88*1	<i>Ilex opaca</i> 'Satyr Hill'	W6	25	4	2	2	3	1	2.4	2.6
09-80*1	<i>Ilex integra</i> × <i>aquifolium</i>	F3	8	2	4	2	4	1	2.6	2.5
71-59*1	<i>Ilex</i> × <i>altaclerensis</i> 'Tatnall School'	CH1	18	4	2	2	1	1	2	2.4
95-40*1	<i>Ilex opaca</i> 'Lin's Gold'	F5	10	3	2	2	2	2	2.2	2.3
64-13*1	<i>Ilex</i> × <i>altaclerensis</i> 'James G. Esson'	FH	25	3	2	2	2	2	2.2	2.3
64-14*2	<i>Ilex aquifolium</i> 'N.Y.B.G. No. 2'	CH1	16	4	2	1	1	2	2	2.2
60-3*2	<i>Ilex aquifolium</i> 'Teufel's'	CH1	18	4	2	1	2	1	2	2.2
95-67*1	<i>Ilex aquifolium</i> 'Winter Queen'	NUR28	18	4	2	1	2	1	2	2.2
73-11*1	<i>Ilex</i> 'Doctor Kassab'	CH2	18	4	2	1	2	1	2	2.2
95-63*1	<i>Ilex</i> 'William Cowgill'	NUR28	20	4	2	1	2	1	2	2.2
73-5*1	<i>Ilex</i> × <i>attenuata</i> 'Tanager'	CH2	18	4	2	1	2	1	2	2.2

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
58-12*2	<i>Ilex opaca</i> 'Silica King'	FH	30	3	3	1	2	1	2	2.1
73-2*1	<i>Ilex</i> 'John T. Morris'	CH2	20	4	1	1	2	1	1.8	2
74-6*1	<i>Ilex</i> 'Lydia Morris'	CH2	18	4	1	1	2	1	1.8	2
73-7*1	<i>Ilex</i> × <i>koehneana</i> 'Jade'	CH2	16	4	1	1	2	1	1.8	2
73-6*1	<i>Ilex</i> × <i>koehneana</i> 'Ruby'	CH2	18	4	1	1	2	1	1.8	2
95-32*1	<i>Ilex aquifolium</i> [Siberia] = 'Limsi'	F5	10	2	3	1	3	1	2	1.9
58-10*1	<i>Ilex opaca</i> 'Miss Helen'	FH	35	2	3	1	3	1	2	1.9
95-57*1	<i>Ilex</i> 'Bob Bruner'	NUR23	16	4	1	1	1	1	1.6	1.9
95-60*2	<i>Ilex</i> 'Ginny Bruner'	NUR23	18	4	1	1	1	1	1.6	1.9
73-15*1	<i>Ilex aquifolium</i> 'Argentea Marginata'	CH2	14	3	2	1	2	1	1.8	1.9
95-58*2	<i>Ilex</i> 'Carolina Cone'	NUR5	12	3	1	2	1	1	1.6	1.9
67-3*1	<i>Ilex</i> 'Nellie R. Stevens'	CH1	24	3	2	1	1	2	1.8	1.9
00-70*1	<i>Ilex</i> 'Red Robe'	CH1	14	3	2	1	1	2	1.8	1.9
N/A	<i>Ilex</i> × <i>altaclerensis</i> 'Camelliifolia'	CH1	22	3	2	1	2	1	1.8	1.9
73-4*1	<i>Ilex</i> 'Accent'	CH2	22	3	2	1	1	1	1.6	1.8
94-22*1	<i>Ilex opaca</i> 'Millville'	NUR29	15	3	1	1	2	1	1.6	1.7
93-87*1	<i>Ilex opaca</i> 'William Hawkins'	W6	3	2	1	1	2	3	1.8	1.6
N/A	Unknown hybrid	CH1	18	2	2	1	2	1	1.6	1.6
73-9*1	<i>Ilex</i> × <i>aquipernyi</i>	CH2	14	3	1	1	1	1	1.4	1.6
95-61*1	<i>Ilex</i> 'Patricia Varner'	NUR7	4	1	1	1	1	1	1	1

**Evergreen Shrub Taxa**

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
95-101*1	<i>Ilex crenata</i> 'Convexa'	FH	2	4	4	3	4	4	3.8	3.7
96-31*1	<i>Ilex glabra</i> 'Densa'	TD2	4	4	4	3	4	4	3.8	3.7
96-31*13	<i>Ilex glabra</i> 'Densa'	TD2	4	4	4	3	4	4	3.8	3.7
96-31*7	<i>Ilex glabra</i> 'Densa'	TD2	4	4	4	3	4	4	3.8	3.7
96-31*8	<i>Ilex glabra</i> 'Densa'	TD2	4	4	4	3	4	4	3.8	3.7
96-73*1	<i>Ilex crenata</i> 'Green Lustre'	FE	3.5	4	4	3	1	4	3.2	3.4
96-73*2	<i>Ilex crenata</i> 'Green Lustre'	FE	3.5	4	4	3	1	4	3.2	3.4
96-73*3	<i>Ilex crenata</i> 'Green Lustre'	FE	3.5	4	4	3	1	4	3.2	3.4
70-17*1	<i>Ilex glabra</i> 'Compacta'	C3	6	3	4	3	4	4	3.6	3.4
70-17*2	<i>Ilex glabra</i> 'Compacta'	C3	6	3	4	3	4	4	3.6	3.4
70-17*3	<i>Ilex glabra</i> 'Compacta'	C3	6	3	4	3	4	4	3.6	3.4
96-31*2	<i>Ilex glabra</i> 'Densa'	TD2	6	3	4	3	4	4	3.6	3.4
96-31*3	<i>Ilex glabra</i> 'Densa'	TD2	6	3	4	3	4	4	3.6	3.4
96-31*4	<i>Ilex glabra</i> 'Densa'	TD2	6	3	4	3	4	4	3.6	3.4
96-31*5	<i>Ilex glabra</i> 'Densa'	TD2	6	3	4	3	4	4	3.6	3.4
96-31*6	<i>Ilex glabra</i> 'Densa'	TD2	6	3	4	3	4	4	3.6	3.4
96-31*20	<i>Ilex glabra</i> 'Densa'	TR	6	3	4	3	4	4	3.6	3.4
13-62*1	<i>Ilex vomitoria</i> 'Stokes Dwarf'	FE	1.5	2	4	4	4	4	3.6	3.4
14-62*1	<i>Ilex cornuta</i> 'Rotunda'	FE	1	2	4	4	3	4	3.4	3.3
14-62*2	<i>Ilex cornuta</i> 'Rotunda'	FE	1	2	4	4	3	4	3.4	3.3
14-62*3	<i>Ilex cornuta</i> 'Rotunda'	FE	1	2	4	4	3	4	3.4	3.3

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
95-19*1	<i>Ilex cornuta</i> 'Rotunda'	GH	6	3	4	4	2	1	2.8	3.2
96-31*9	<i>Ilex glabra</i> 'Densa'	TD2	4	4	3	2	3	4	3.2	3.1
98-125*1	<i>Ilex</i> × <i>meserveae</i> [Blue Angel]= 'Conang'	GH	6	3	3	4	3	1	2.8	3.1
09-59*2	<i>Ilex crenata</i> 'Sky Pencil'	H	4	2	4	3	4	3	3.2	3
09-131*1	<i>Ilex glabra</i> 'Nova Scotia'	GP	2	2	4	3	4	3	3.2	3
80-4*2	<i>Ilex crenata</i> 'Helleri'	CC	6	3	4	3	3	1	2.8	3
64-16*1	<i>Ilex crenata</i> 'Helleri'	FH	6	3	4	3	3	1	2.8	3
78-10*1	<i>Ilex opaca</i> 'Maryland Dwarf'	CH2	6	3	4	3	3	1	2.8	3
09-109*1	<i>Ilex</i> × <i>attenuata</i> 'Pack's Weeping'	F3	2	2	4	3	3	4	3.2	3
96-31*15	<i>Ilex glabra</i> 'Densa'	TD2	3	3	3	2	4	4	3.2	2.9
97-32*1	<i>Ilex glabra</i> [Nordic] = 'Chamzin'	W3	5	3	3	2	3	4	3	2.8
58-7*1	<i>Ilex cornuta</i>	C1	18	3	3	2	3	4	3	2.8
90-3*3	<i>Ilex cornuta</i> 'Dwarf Burford'	W8	8	2	4	3	3	2	2.8	2.8
90-3*9	<i>Ilex cornuta</i> 'Dwarf Burford'	W8	7	2	4	3	3	2	2.8	2.8
90-3*1	<i>Ilex cornuta</i> 'Dwarf Burford'	W8	5	3	3	2	3	3	2.8	2.7
96-63*1	<i>Ilex myrtifolia</i>	N1	4	2	3	3	2	4	2.8	2.7
01-109*1	<i>Ilex glabra</i> 'Nigra'	CC	7	2	4	3	3	1	2.6	2.7
90-3*10	<i>Ilex cornuta</i> 'Dwarf Burford'	W8	8	2	3	3	3	2	2.6	2.6
00-62*1	<i>Ilex glabra</i> 'Shamrock'	FE	2	2	3	3	3	2	2.6	2.6
93-25*1	<i>Ilex vomitoria</i>	TP1	3	2	3	3	3	2	2.6	2.6
64-16*2	<i>Ilex crenata</i> 'Helleri'	FH	6	3	4	2	2	1	2.4	2.6
89-73*2	<i>Ilex</i> [China Boy] = 'Mesdob'	C1	6	3	3	2	2	2	2.4	2.5
97-38*1	<i>Ilex vomitoria</i> [Hoskin Shadow]	TP1	6	3	3	2	3	1	2.4	2.5

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
90-3*8	<i>Ilex cornuta</i> 'Dwarf Burford'	W8	12	1	4	3	3	2	2.6	2.5
77-2*3	<i>Ilex crenata</i> 'Ivory Tower'	CH2	3	3	2	2	3	3	2.6	2.5
97-35*1	<i>Ilex crenata</i> 'Jersey Pinnacle'	FE	7	4	2	1	3	2	2.4	2.4
97-35*2	<i>Ilex crenata</i> 'Jersey Pinnacle'	FE	7	4	2	1	3	2	2.4	2.4
89-73*1	<i>Ilex [China Boy]</i> = 'Mesdob'	C1	4	3	2	2	2	2	2.2	2.3
89-73*3	<i>Ilex [China Boy]</i> = 'Mesdob'	C1	4	3	2	2	2	2	2.2	2.3
89-74*1	<i>Ilex [China Girl]</i> = 'Mesog'	C1	5	3	2	2	2	2	2.2	2.3
89-74*2	<i>Ilex [China Girl]</i> = 'Mesog'	C1	4	3	2	2	2	2	2.2	2.3
89-74*3	<i>Ilex [China Girl]</i> = 'Mesog'	C1	4	3	2	2	2	2	2.2	2.3
04-11*1	<i>Ilex glabra</i> 'Compacta'	TP2	5	3	2	2	3	1	2.2	2.3
96-31*16	<i>Ilex glabra</i> 'Densa'	TD2	2	2	2	2	1	4	2.2	2.1
04-12*1	<i>Ilex vomitoria</i> 'Carolina Ruby'	TP2	5	3	2	2	1	1	1.8	2.1
04-12*2	<i>Ilex vomitoria</i> 'Carolina Ruby'	TP2	5	3	2	2	1	1	1.8	2.1
04-12*3	<i>Ilex vomitoria</i> 'Carolina Ruby'	TP2	5	3	2	2	1	1	1.8	2.1
95-33*1	<i>Ilex cornuta</i> 'O. Spring'	NUR 24	8	2	2	2	2	1	1.8	1.9
92-57*1	<i>Ilex crenata</i> 'Sky Pencil'	F5	5	3	2	1	1	2	1.8	1.9
97-35*3	<i>Ilex crenata</i> 'Jersey Pinnacle'	FE	4	2	2	1	3	2	2	1.8
04-11*2	<i>Ilex glabra</i> 'Compacta'	TP2	6	3	1	1	3	1	1.8	1.8
04-11*5	<i>Ilex glabra</i> 'Compacta'	TP2	3	3	1	1	3	1	1.8	1.8
90-3*4	<i>Ilex cornuta</i> 'Dwarf Burford'	W8	6	3	1	1	2	1	1.6	1.7
64-16*4	<i>Ilex crenata</i> 'Helleri'	FH	3	3	1	1	1	2	1.6	1.7
92-13*1	<i>Ilex pedunculosa</i>	CH1	7	3	1	1	1	2	1.6	1.7
04-11*6	<i>Ilex glabra</i> 'Compacta'	TP2	7	2	1	1	3	1	1.6	1.5

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG	W AVG
79-4*1	<i>Ilex x meserveae</i> [Blue Prince] = 'Conablu'	CH1	5	2	1	1	1	1	1.2	1.3
69-40*1	<i>Ilex x meserveae</i> 'Blue Girl'	CH1	4	2	1	1	1	1	1.2	1.3

### Deciduous Shrub Taxa

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG	W. AVG
07-10*2	<i>Ilex serrata</i> 'Sundrops'	GE	4	4	4	4	4	4	4	4
07-10*3	<i>Ilex serrata</i> 'Sundrops'	GE	4	4	4	4	4	4	4	4
07-10*4	<i>Ilex serrata</i> 'Sundrops'	GE	4	4	4	4	4	4	4	4
07-10*6	<i>Ilex serrata</i> 'Sundrops'	GE	4	4	4	4	4	4	4	4
01-33*2	<i>Ilex verticillata</i> 'Oosterwijk'	N1B	8	4	4	4	4	3	3.8	3.9
07-10*1	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
07-10*10	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
07-10*11	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
07-10*5	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
07-10*7	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
07-10*8	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
07-10*9	<i>Ilex serrata</i> 'Sundrops'	GE	5	3	4	4	4	4	3.8	3.7
01-35*1	<i>Ilex verticillata</i> 'Winter Gold'	N1B	8	4	3	4	4	2	3.4	3.6
96-36*2	<i>Ilex verticillata</i> 'Afterglow'	TD1	7	4	4	3	4	3	3.6	3.6
71-28*1	<i>Ilex verticillata</i> 'Christmas Cheer'	C3	6	3	4	4	4	3	3.6	3.6
90-106*1	<i>Ilex verticillata</i>	N1	7	4	4	3	4	2	3.4	3.5
01-31*1	<i>Ilex verticillata</i> f. <i>aurantiaca</i>	N1B	8	4	4	3	4	2	3.4	3.5
01-35*2	<i>Ilex verticillata</i> 'Winter Gold'	N1B	8	4	3	4	3	2	3.2	3.5

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
89-115*1	<i>Ilex</i> 'Sparkleberry'	W3	8	4	3	4	2	2	3	3.4
89-115*2	<i>Ilex</i> 'Sparkleberry'	W3	8	4	3	4	2	2	3	3.4
01-34*1	<i>Ilex verticillata</i> 'Southern Gentleman'	N1	8	4	4	3	3	2	3.2	3.4
90-56*2	<i>Ilex verticillata</i> 'Stop Light'	N1	8	4	3	3	4	3	3.4	3.4
90-73*3	<i>Ilex decidua</i> 'Red Escort'	N1	12	4	4	3	4	1	3.2	3.4
04-10*1	<i>Ilex verticillata</i> 'Winter Gold'	TP2	6	4	4	3	4	1	3.2	3.4
04-10*3	<i>Ilex verticillata</i> 'Winter Gold'	TP2	8	4	4	3	4	1	3.2	3.4
04-21*1	<i>Ilex verticillata</i> 'Invincible'	N1B	5	3	4	3	4	4	3.6	3.4
04-21*2	<i>Ilex verticillata</i> 'Invincible'	N1B	5	3	4	3	4	4	3.6	3.4
91-51*1	<i>Ilex decidua</i> 'Pocahontas'	N1	12	4	3	3	4	2	3.2	3.3
01-32*2	<i>Ilex verticillata</i> 'Cacapon'	N1B	8	4	3	3	3	3	3.2	3.3
96-36*1	<i>Ilex verticillata</i> 'Afterglow'	TD1	5	3	4	3	4	2	3.2	3.2
04-10*4	<i>Ilex verticillata</i> 'Winter Gold'	TP2	8	4	3	2	3	4	3.2	3.1
04-10*5	<i>Ilex verticillata</i> 'Winter Gold'	TP2	8	4	3	2	3	4	3.2	3.1
04-10*6	<i>Ilex verticillata</i> 'Winter Gold'	TP2	8	4	3	2	3	4	3.2	3.1
90-73*1	<i>Ilex decidua</i> 'Red Escort'	N1	16	3	4	3	4	1	3	3.1
90-73*2	<i>Ilex decidua</i> 'Red Escort'	N1	14	3	4	3	4	1	3	3.1
91-1*1	<i>Ilex verticillata</i> 'Fairfax'	N1	6	3	3	3	4	3	3.2	3.1
14-88*1	<i>Ilex verticillata</i> 'Southern Gentleman'	GE	2	2	3	4	4	2	3	3
91-51*2	<i>Ilex decidua</i> 'Pocahontas'	N1	14	3	3	3	4	2	3	3
91-51*3	<i>Ilex decidua</i> 'Pocahontas'	N1	14	3	3	3	4	2	3	3
90-55*2	<i>Ilex decidua</i> 'Warren's Red'	N1	14	3	3	3	4	2	3	3
90-55*3	<i>Ilex decidua</i> 'Warren's Red'	N1	14	3	3	3	4	2	3	3

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
01-32*1	<i>Ilex verticillata</i> 'Cacapon'	N1B	7	4	3	2	3	3	3	3
90-72*1	<i>Ilex verticillata</i> f. <i>aurantiaca</i>	N1	7	4	3	2	4	2	3	3
01-31*2	<i>Ilex verticillata</i> f. <i>aurantiaca</i>	N1B	6	3	3	3	4	1	2.8	2.9
90-55*1	<i>Ilex decidua</i> 'Warren's Red'	N1	14	3	2	3	4	2	2.8	2.8
90-29*2	<i>Ilex</i> 'Harvest Red'	N1	8	4	2	2	3	2	2.6	2.7
90-29*3	<i>Ilex</i> 'Harvest Red'	N1	8	4	2	2	3	2	2.6	2.7
96-36*3	<i>Ilex verticillata</i> 'Afterglow'	TD1	4	2	3	3	4	2	2.8	2.7
90-70*2	<i>Ilex verticillata</i> 'Shaver'	N1	9	3	2	3	3	2	2.6	2.7
90-39*2	<i>Ilex verticillata</i> 'Winter Red'	N1	8	4	2	2	3	2	2.6	2.7
96-35*11	<i>Ilex verticillata</i> 'Winter Red'	TD2	7	4	2	2	3	2	2.6	2.7
71-28*2	<i>Ilex verticillata</i> 'Christmas Cheer'	TP1	6	3	4	2	3	1	2.6	2.7
96-35*3	<i>Ilex verticillata</i> 'Winter Red'	TD2	4	3	3	2	3	2	2.6	2.6
90-70*1	<i>Ilex verticillata</i> 'Shaver'	N1	9	3	2	3	3	1	2.4	2.6
73-27*4	<i>Ilex</i> 'Autumn Glow'	C3	9	3	3	2	2	2	2.25	2.5
69-46*2	<i>Ilex serrata</i>	C3	5	3	3	2	3	1	2.4	2.5
96-35*12	<i>Ilex verticillata</i> 'Winter Red'	TD2	8	4	1	2	3	2	2.4	2.5
90-70*3	<i>Ilex verticillata</i> 'Shaver'	N1	9	3	2	2	3	2	2.4	2.4
96-35*2	<i>Ilex verticillata</i> 'Winter Red'	TD2	4	3	2	2	3	2	2.4	2.4
96-35*4	<i>Ilex verticillata</i> 'Winter Red'	TD2	4	3	2	2	3	2	2.4	2.4
89-114*1	<i>Ilex</i> 'Harvest Red'	W3	10	3	2	2	3	1	2.2	2.3
90-71*2	<i>Ilex verticillata</i> 'Jolly Red'	N1	5	3	3	1	3	2	2.4	2.3
96-35*5	<i>Ilex verticillata</i> 'Winter Red'	TD2	5	3	2	2	3	1	2.2	2.3
96-35*6	<i>Ilex verticillata</i> 'Winter Red'	TD2	6	3	2	2	3	1	2.2	2.3
96-35*7	<i>Ilex verticillata</i> 'Winter Red'	TD2	6	3	2	2	3	1	2.2	2.3

ACC NUM	TAXON	LOC.	SIZE (FT.)	SIZE RTG.	DEN.	HABIT	HEALTH	SPACE	AVG.	W. AVG
96-35*8	<i>Ilex verticillata</i> 'Winter Red'	TD2	5	3	2	2	3	1	2.2	2.3
96-35*9	<i>Ilex verticillata</i> 'Winter Red'	TD2	6	3	2	2	3	1	2.2	2.3
73-27*5	<i>Ilex</i> 'Autumn Glow'	C3	7	4	2	1	2	1	2	2.2
69-46*3	<i>Ilex serrata</i>	C3	7	4	2	1	2	1	2	2.2
69-46*6	<i>Ilex serrata</i>	C3	9	3	2	2	2	1	2	2.2
90-71*3	<i>Ilex verticillata</i> 'Jolly Red'	N1	6	3	2	1	4	2	2.4	2.2
90-39*1	<i>Ilex verticillata</i> 'Winter Red'	N1	5	3	2	1	3	2	2.2	2.1
90-36*1	<i>Ilex</i> 'Sparkleberry'	N1	9	3	1	2	2	2	2	2.1
91-1*3	<i>Ilex verticillata</i> 'Fairfax'	N1	10	3	1	2	3	1	2	2.1
69-46*5	<i>Ilex serrata</i>	C3	11	3	1	2	2	1	1.8	2
91-1*2	<i>Ilex verticillata</i> 'Fairfax'	N1	13	2	1	2	3	1	1.8	1.8
74-7*1	<i>Ilex serrata x</i> <i>verticillata</i>	C3	10	3	1	1	2	1	1.6	1.7
90-107*1	<i>Ilex verticillata</i>	N1	10	3	1	1	2	1	1.6	1.7
89-114*2	<i>Ilex</i> 'Harvest Red'	W3	3	2	1	1	3	2	1.8	1.6

## Appendix N

### CORRESPONDENCE WITH DR. GILES WAINES, DIRECTOR, UC RIVERSIDE BOTANIC GARDENS

**Researcher:** I wanted to follow up to confirm that you saw a previous message regarding my thesis survey and ask again for a brief clarification. In the survey, you indicated that your garden DOES have "*current written guidelines in place to measure/ maximize collection relevance*". I am quite curious to hear a brief description of how this is accomplished. Is it conducted via a periodic inventory and review of the gardens holdings? Or perhaps a clause in your collection policy intended to ensure that all accessions meet certain guidelines for value to student and/or faculty use? Do you categorize accessions as meeting certain requirement(s) (e.g. a specific insect's host) and somehow determine and/or prioritize key taxa that should be represented? Or perhaps some other process dictated by your own interpretation or view of what a "relevant" collection at UC Riverside actually entails? Some combination of the above?

**Dr. Waines:** Firstly, the UC Riverside Botanic Gardens collects native California plants that grow well in Riverside for teaching purposes. We collect indicator species for the coastal sage scrub, chaparral, CA southern oak woodland, low desert, high desert, coastal, and some Yellow Pine forest communities. Many northern California plants are not adapted to growing in southern California. Also native plants from high elevations in SoCal also are not adapted to grow at low elevations, ca. 1000 ft. Secondly, we also collect plants from other Mediterranean climates/floras that grow well in Riverside and which might act as demonstration plants for classes and extension/outreach/gardening. This is especially so for elements of the Baja

Californian, South African, Australian, Mediterranean (herbs and medicinal plants), Chilean plant communities. Thirdly we have a few plants from southern/eastern/southwestern USA states that are able to grow well in Riverside, and contrast with native plants. Essentially from a horticultural point of view, any plant that grows well in Riverside is of interest to us as a teaching plant or as an ornamental horticultural plant. In addition, we have a small *Ficus* Collection, the remnants of a larger *Ficus* collection that was brought together by Dr. Ira J. Condit, who wrote the *Chronica Botanica* book on *Ficus*, 1947. We have a small *Juniperus* collection from the Western States, the remnants of a collection brought together by Dr. Frank Vasek the first director of the Gardens. We have a small collection of low-winter chill *Syringa* (lilac species) that grow well in Riverside. Lilac is native to southeastern Europe (2 species) and China (20 species), many of which grow well in SoCal. We have a small ethnobotanical collection of plants used by Native Americans in SoCal and AZ. Lack of gardeners also dictates what plants we grow.

**Researcher:** Thank you very much for your detailed description of UC Riverside's collections. This information is extremely helpful. I hope you'll have time for one final question: Do you have a formal process for ensuring that all accessions of these collections remain pertinent to and/or fit for teaching/research/extension purposes? This could relate to prioritizing the deaccessioning of non-viable ornamental taxa to add more potentially suitable *Syringa* taxa and/or removal of declining portions of the *Juniperus* collection in favor of plants specifically requested by instructors/extension staff...or perhaps this process is more informal or spontaneous in nature?

**Dr. Waines:** We do not have a written formal process for deaccessioning. Firstly our curator is ill and will retire soon. (There is a “human” part to your question that is not mentioned). Secondly, as we are always pushing the adaptation limit by testing species that may grow in more humid/wetter areas, by having them grow in drier areas, many taxa de-accession themselves. Another part to the “human” aspect is that it is assumed irrigation is always even. Unfortunately in waterline breaks, or in heat waves, that is not always so. At present because of the curator’s illness, while we know what has been planted, we do not have an up-to-date list of what has survived. So the process is more informal or spontaneous. The climate in SoCal is very different from the more even climate in Delaware, especially in this extended drought.

## Appendix O

### CORRESPONDENCE WITH DR. FRANK TELEWSKI, PROFESSOR AND CURATOR, W.J. BEAL BOTANICAL GARDEN AND CAMPUS ARBORETUM

**Researcher:** I wanted to follow up to confirm that you saw the previous message regarding my thesis survey ("University Garden Collection Relevance") and ask again for a brief clarification. In the survey, you indicated that your garden DOES have "*current written guidelines in place to measure/ maximize collection relevance*". I am very curious to hear a brief description of how this is accomplished. Is it conducted via a periodic inventory and review of the gardens holdings?

**Dr. Telewski:** Yes, on an annual basis, sometimes more than once a year to review plant health as well as relevance to the collection. If we cannot maintain a plant horticulturally in the collection, we look for a replacement. We also continuously review and update our interpretive labels for each plant in the garden/collection. This is accomplished every time a label is destroyed and needs replacement. We have also recently completed a complete revision of our economic plant labels. Our systematic collection was updated about 15 years ago, however the recent changes in the APG (Angiosperm Phylogeny Group) has forced us to constantly review our taxonomy and update family relationships and update our interpretive labels as needed to present the most up to date taxonomy to keep pace with what is being taught in the lecture hall.

**Researcher:** Does a clause in your collection policy intended to ensure that all accessions meet certain guidelines for value to student and/or faculty use?

**Dr. Telewski:** Yes, we also query faculty with regard to what their teaching and research needs are so we can maintain both collections flexibility and relevance to a changing academic and research environment.

**Researcher:** Do you categorize accessions (e.g. economic, medicinal) and somehow determine and/or prioritize key taxa that should be represented? Or some other process dictated by your own interpretation or view of what a "relevant" collection at the Beal Gardens actually entails? Some combination of the above?

**Dr. Telewski:** Yes, the accessions reflect the collection categories (systematic, economic which includes medicinal and several other sub categories). An entire collection of non-flowering vascular plants was created to meet the needs of our Plant Form and Function class in Plant Biology. The constant changing face of medicinal plant discovery and creation of new synthetics to retire plant based pharmaceuticals keeps our medicinal sub-collection in flux. With our toxic plant workshops for both on-campus vet med classes and our work with the Michigan Regional Poison Control Center and University of Michigan rotation in Emergency Toxicology we are always looking to keep our toxic plant collection updated and relevant to these programs. Input from participating faculty and medical doctors are most helpful in the acquisition/accessioning process as well as the deaccessioning process.

## Appendix P

### RELEVANCE SCORES FOR ALL RECORDED *ILEX* TAXA

#### Evergreen Tree Taxa

TAXON	GROWERS	DISTRIBUTORS	INSTRUCTORS	UD USE	AWARDS	TOTAL	IN UDBG
<i>Ilex</i> × <i>altaclerensis</i> 'Camelliifolia'	0.0	0.0	1.6	100.00	0.00	<b>101.6</b>	Yes
<i>Ilex</i> × <i>altaclerensis</i> 'James G. Esson'	3.7	6.7	0.0	100.00	0.00	<b>110.4</b>	Yes
<i>Ilex</i> × <i>aquipernyi</i>	0.0	0.0	1.6	100.00	0.00	<b>101.6</b>	Yes
<i>Ilex</i> × <i>aquipernyi</i> 'Meschick' (Dragon Lady®)	63.0	93.3	10.9	100.00	0.00	<b>267.2</b>	Yes
<i>Ilex</i> × <i>aquipernyi</i> 'San Jose'	14.8	0.0	3.1	100.00	0.00	<b>117.9</b>	No
<i>Ilex</i> × <i>attenuata</i> 'Annie Armstrong'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> × <i>attenuata</i> 'Eagleson'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> × <i>attenuata</i> 'East Palatka'	7.4	0.0	1.6	100.00	0.00	<b>109.0</b>	No
<i>Ilex</i> × <i>attenuata</i> 'Foster No. 2'	37.0	40.0	32.7	100.00	0.00	<b>209.7</b>	No
<i>Ilex</i> × <i>attenuata</i> 'Greenleaf'	22.2	17.8	0.0	100.00	0.00	<b>140.0</b>	No
<i>Ilex</i> × <i>attenuata</i> 'Longwood Gold'	0.0	6.7	3.1	100.00	0.00	<b>109.8</b>	Yes
<i>Ilex</i> × <i>attenuata</i> 'Savannah'	7.4	0.0	15.6	100.00	0.00	<b>123.0</b>	No
<i>Ilex</i> × <i>attenuata</i> 'Sunny Foster'	3.7	0.0	3.1	100.00	50.00	<b>156.8</b>	Yes
<i>Ilex</i> × <i>koehneana</i>	11.1	6.7	4.7	100.00	0.00	<b>122.4</b>	Yes
<i>Ilex</i> × <i>koehneana</i> 'Ajax'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	Yes
<i>Ilex</i> × <i>koehneana</i> 'Chieftain'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> × <i>koehneana</i> 'Conayule' (Yule Brite™)	0.0	6.7	0.0	100.00	0.00	<b>106.7</b>	No
<i>Ilex</i> × <i>koehneana</i> 'Lassie'	11.1	0.0	0.0	100.00	50.00	<b>161.1</b>	No
<i>Ilex</i> × <i>koehneana</i> 'Loch Raven'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> × <i>koehneana</i> 'San Jose'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> × <i>koehneana</i> 'Wirt L. Winn'	0.0	0.0	7.8	100.00	0.00	<b>107.8</b>	Yes
<i>Ilex aquifolium</i>	3.7	0.0	26.4	100.00	0.00	<b>130.1</b>	Yes
<i>Ilex aquifolium</i> 'Alice'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex aquifolium</i> 'Argentea Marginata'	7.4	68.9	28.0	100.00	0.00	<b>204.3</b>	Yes
<i>Ilex aquifolium</i> 'Aurea Marginata Pendula'	0.0	6.7	0.0	100.00	0.00	<b>106.7</b>	No
<i>Ilex aquifolium</i> Fructu Luteo Group	3.7	0.0	28.0	100.00	0.00	<b>131.7</b>	No
<i>Ilex aquifolium</i> 'Lewis'	0.0	0.0	0.0	100.00	50.00	<b>150.0</b>	No
<i>Ilex aquifolium</i> 'Limsi' (Siberia™)	3.7	6.7	0.0	100.00	0.00	<b>110.4</b>	Yes
<i>Ilex aquifolium</i> 'Marijo'	3.7	6.7	0.0	100.00	0.00	<b>110.4</b>	No
<i>Ilex aquifolium</i> 'Proud Mary'	0.0	0.0	0.0	100.00	50.00	<b>150.0</b>	No

<b>TAXON</b>	<b>GROWERS</b>	<b>DISTRIBUTORS</b>	<b>INSTRUCTORS</b>	<b>UD USE</b>	<b>AWARDS</b>	<b>TOTAL</b>	<b>IN UDBG</b>
<i>Ilex aquifolium</i> 'Satan Leaf'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> 'Auburn'	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	No
<i>Ilex</i> 'Carolina Sentinel'	14.8	0.0	0.0	0.00	0.00	<b>14.8</b>	No
<i>Ilex cassine</i>	0.0	0.0	3.1	0.00	0.00	<b>3.1</b>	No
<i>Ilex</i> 'Centennial Girl'	18.5	44.4	0.0	0.00	0.00	<b>63.0</b>	Yes
<i>Ilex</i> 'Conaf' (Oak Leaf™)	44.4	48.9	3.1	0.00	0.00	<b>96.4</b>	No
<i>Ilex</i> 'Conal' (Cardinal™)	7.4	6.7	0.0	0.00	0.00	<b>14.1</b>	No
<i>Ilex</i> 'Coned' (Little Red™)	0.0	6.7	0.0	0.00	0.00	<b>6.7</b>	No
<i>Ilex</i> 'Conin' (Robin™)	29.6	60.0	0.0	0.00	0.00	<b>89.6</b>	No
<i>Ilex</i> 'Conive' (Festive™)	0.0	0.0	1.6	0.00	0.00	<b>1.6</b>	No
<i>Ilex</i> 'Conot' (Patriot)	3.7	6.7	0.0	0.00	0.00	<b>10.4</b>	No
<i>Ilex</i> 'Conty' (Liberty™)	7.4	20.0	1.6	0.00	0.00	<b>29.0</b>	No
<i>Ilex cornuta</i> 'Anicet Delcambre' (Needlepoint')	33.3	13.3	20.2	100.00	0.00	<b>166.9</b>	No
<i>Ilex cornuta</i> 'Burfordii'	11.1	22.2	48.2	100.00	0.00	<b>181.5</b>	No
<i>Ilex cornuta</i> 'Fine Line'	14.8	17.8	0.0	100.00	0.00	<b>132.6</b>	No
<i>Ilex cornuta</i> 'National'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex</i> 'Coronet'	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	No
<i>Ilex</i> 'Dapat' (Miss Patricia™)	0.0	6.7	0.0	0.00	0.00	<b>6.7</b>	No
<i>Ilex</i> 'Doctor Kassab'	33.3	33.3	1.6	0.00	0.00	<b>68.2</b>	Yes
<i>Ilex</i> 'Dragon Slayer'	3.7	6.7	3.1	0.00	0.00	<b>13.5</b>	*Yes
<i>Ilex</i> 'Emily Bruner'	14.8	6.7	15.6	0.00	0.00	<b>37.0</b>	No
<i>Ilex</i> 'Hefcup' (Buttercup™)	0.0	6.7	0.0	0.00	0.00	<b>6.7</b>	No
<i>Ilex</i> 'HL10-90' (Christmas Jewel®)	18.5	15.6	0.0	0.00	0.00	<b>34.1</b>	No
<i>Ilex</i> 'Hohman'	7.4	0.0	0.0	0.00	0.00	<b>7.4</b>	No
<i>Ilex</i> 'Homefire'	7.4	6.7	0.0	0.00	0.00	<b>14.1</b>	No
<i>Ilex integra</i>	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	Yes
<i>Ilex</i> 'John T. Morris'	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	Yes
<i>Ilex latifolia</i>	7.4	0.0	9.3	100.00	0.00	<b>116.7</b>	Yes
<i>Ilex</i> 'Lydia Morris'	0.0	1.6	0.0	0.00	0.00	<b>1.6</b>	Yes
<i>Ilex</i> 'Magiana' (Acadiana™)	14.8	0.0	0.0	0.00	0.00	<b>14.8</b>	No
<i>Ilex</i> 'Magland' (Oakland™)	11.1	42.2	0.0	0.00	0.00	<b>53.3</b>	No
<i>Ilex</i> 'Mary Nell'	18.5	13.3	9.3	0.00	0.00	<b>41.2</b>	No
<i>Ilex</i> 'Nellie R. Stevens'	74.1	91.1	38.9	100.00	50.00	<b>354.1</b>	Yes
<i>Ilex opaca</i>	18.5	53.3	45.1	100.00	25.00	<b>242.0</b>	Yes
<i>Ilex opaca</i> 'Angelica'	3.7	0.0	46.7	100.00	0.00	<b>150.4</b>	No
<i>Ilex opaca</i> 'Arlene Leach'	7.4	0.0	46.7	100.00	0.00	<b>154.1</b>	No
<i>Ilex opaca</i> 'Arthur Pride'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No

<b>TAXON</b>	<b>GROWERS</b>	<b>DISTRIBUTORS</b>	<b>INSTRUCTORS</b>	<b>UD USE</b>	<b>AWARDS</b>	<b>TOTAL</b>	<b>IN UDBG</b>
<i>Ilex opaca</i> 'Betsy'	0.0	6.7	0.0	100.00	0.00	<b>106.7</b>	No
<i>Ilex opaca</i> 'Cardinal'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Carnival'	11.1	0.0	0.0	100.00	0.00	<b>111.1</b>	No
<i>Ilex opaca</i> 'Carolina No. 2'	7.4	0.0	0.0	100.00	0.00	<b>107.4</b>	No
<i>Ilex opaca</i> Cave Hill Group	0.0	6.7	0.0	100.00	0.00	<b>106.7</b>	No
<i>Ilex opaca</i> 'Clarissa'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Dan Fenton'	18.5	17.8	46.7	100.00	0.00	<b>183.0</b>	No
<i>Ilex opaca</i> 'David Leach'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Delia Bradley'	7.4	0.0	0.0	100.00	0.00	<b>107.4</b>	Yes
<i>Ilex opaca</i> f. <i>xanthocarpa</i>	18.5	0.0	51.3	100.00	0.00	<b>169.8</b>	Yes
<i>Ilex opaca</i> 'Gable'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Goldie'	3.7	0.0	46.7	100.00	0.00	<b>150.4</b>	No
<i>Ilex opaca</i> 'Grace'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Hedgeholly'	7.4	0.0	0.0	100.00	0.00	<b>107.4</b>	No
<i>Ilex opaca</i> 'Ingleside Big Berry'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Jersey Knight'	18.5	13.3	51.3	100.00	0.00	<b>183.2</b>	No
<i>Ilex opaca</i> 'Jersey Princess'	18.5	26.7	51.3	100.00	0.00	<b>196.5</b>	No
<i>Ilex opaca</i> 'Lamp Post'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Mary Holman'	7.4	0.0	0.0	100.00	0.00	<b>107.4</b>	No
<i>Ilex opaca</i> 'Miss Courtney'	0.0	6.7	0.0	100.00	0.00	<b>106.7</b>	No
<i>Ilex opaca</i> 'Miss Helen'	25.9	15.6	48.2	100.00	0.00	<b>189.7</b>	Yes
<i>Ilex opaca</i> 'Old Heavy Berry'	3.7	0.0	49.8	100.00	0.00	<b>153.5</b>	No
<i>Ilex opaca</i> 'Parkton'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Paterson'	11.1	4.4	0.0	100.00	0.00	<b>115.6</b>	No
<i>Ilex opaca</i> 'Portia Orton'	7.4	0.0	49.8	100.00	0.00	<b>157.2</b>	Yes
<i>Ilex opaca</i> 'Prancer'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Prettyboy'	7.4	0.0	0.0	100.00	0.00	<b>107.4</b>	No
<i>Ilex opaca</i> 'Pride of Butler'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Red Velvet'	3.7	0.0	46.7	100.00	0.00	<b>150.4</b>	No
<i>Ilex opaca</i> 'Satyr Hill'	37.0	48.9	49.8	100.00	50.00	<b>285.7</b>	Yes
<i>Ilex opaca</i> 'Tinga'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Virginia West'	3.7	0.0	0.0	100.00	0.00	<b>103.7</b>	No
<i>Ilex opaca</i> 'Wyetta'	11.1	0.0	0.0	100.00	0.00	<b>111.1</b>	No
<i>Ilex pernyi</i>	0.0	0.0	1.6	0.00	0.00	<b>1.6</b>	No
<i>Ilex rotunda</i>	0.0	0.0	4.7	0.00	0.00	<b>4.7</b>	No
<i>Ilex</i> 'Rutzan' (Red Beauty®)	37.0	53.3	4.8	0.00	25.00	<b>120.1</b>	Yes
<i>Ilex</i> 'Scepter'	3.7	0.0	0.0	0.00	50.00	<b>53.7</b>	No
<i>Ilex</i> 'September Gem'	0.0	6.7	0.0	0.00	0.00	<b>6.7</b>	No

TAXON	GROWERS	DISTRIBUTORS	INSTRUCTORS	UD USE	AWARDS	TOTAL	IN UDBG
<i>Ilex</i> 'STBB' (Aspire™)	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	No
<i>Ilex</i> 'Virginia'	0.0	6.7	0.0	0.00	0.00	<b>6.7</b>	No
<i>Ilex</i> 'Whoa Nellie'	0.0	2.2	1.6	0.00	0.00	<b>3.8</b>	No
<i>Ilex</i> 'Wybec' (Becky Stevens™)	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	No
<i>Ilex</i> 'Wyriv' (River Queen™)	3.7	0.0	0.0	0.00	0.00	<b>3.7</b>	No

### Evergreen Shrub Taxa

TAXON	GROWERS	DISTRIBUTORS	INSTRUCTORS	UD USE	AWARDS	TOTAL	IN UDBG
<i>Ilex aquifolium</i> 'Angustifolia'	0.0	0.0	22.6	100.0	0.00	<b>122.6</b>	No
<i>Ilex aquifolium</i> 'Ferox Argentea'	0.0	11.1	0.0	100.0	0.00	<b>111.1</b>	No
<i>Ilex aquifolium</i> 'Monvilla' (Gold Coast™)	0.0	13.3	0.0	100.0	0.00	<b>113.3</b>	No
<i>Ilex aquifolium</i> 'Sadezam' (Santa's Delight™)	3.7	0.0	21.5	100.0	0.00	<b>125.2</b>	No
<i>Ilex</i> 'Cherry Bomb'	3.7	0.0	0.0	0.0	0.00	<b>3.7</b>	No
<i>Ilex colchica</i>	3.7	0.0	0.0	0.0	0.00	<b>3.7</b>	No
<i>Ilex cornuta</i>	0.0	0.0	10.7	100.0	0.00	<b>110.7</b>	Yes
<i>Ilex cornuta</i> 'Carissa'	25.9	35.6	23.8	100.0	0.00	<b>185.3</b>	No
<i>Ilex cornuta</i> 'Dwarf Burford'	55.6	40.0	28.6	100.0	0.00	<b>224.2</b>	Yes
<i>Ilex cornuta</i> 'O. Spring'	3.7	0.0	11.9	100.0	0.00	<b>115.6</b>	Yes
<i>Ilex cornuta</i> 'Rotunda'	7.4	26.7	25.0	100.0	0.00	<b>159.1</b>	Yes
<i>Ilex cornuta</i> 'Sunrise' (sold as 'Golden Burfordii')	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i>	3.7	0.0	22.6	100.0	0.00	<b>126.3</b>	Yes
<i>Ilex crenata</i> 'Beehive'	11.1	0.0	23.8	100.0	0.00	<b>134.9</b>	No
<i>Ilex crenata</i> 'Bennett's Compact'	29.6	15.6	0.0	100.0	0.00	<b>145.2</b>	No
<i>Ilex crenata</i> 'Chesapeake'	63.0	48.9	23.8	100.0	0.00	<b>235.7</b>	No
<i>Ilex crenata</i> 'Compacta'	0.0	68.9	28.6	100.0	0.00	<b>197.5</b>	No
<i>Ilex crenata</i> 'Convexa'	3.7	0.0	34.6	100.0	0.00	<b>138.3</b>	Yes
<i>Ilex crenata</i> 'Drops of Gold'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i> 'Dwarf Pagoda'	0.0	6.7	23.8	100.0	0.00	<b>130.5</b>	No
<i>Ilex crenata</i> 'Farrowone' (Sky Pointer™)	18.5	0.0	0.0	100.0	0.00	<b>118.5</b>	No
<i>Ilex crenata</i> 'FarrowSK6' (Patti O™)	7.4	0.0	0.0	100.0	0.00	<b>107.4</b>	No
<i>Ilex crenata</i> 'Golden Heller'	11.1	0.0	23.8	100.0	0.00	<b>134.9</b>	No
<i>Ilex crenata</i> 'Green Lustre'	48.1	62.2	26.2	100.0	0.00	<b>236.6</b>	Yes
<i>Ilex crenata</i> 'Helleri'	48.1	91.1	44.1	100.0	50.00	<b>333.4</b>	Yes
<i>Ilex crenata</i> 'Hetzii'	11.1	13.3	26.2	100.0	0.00	<b>150.7</b>	No
<i>Ilex crenata</i> 'Hoogendorn'	33.3	93.3	26.2	100.0	0.00	<b>252.9</b>	No
<i>Ilex crenata</i> 'Howardi'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No

TAXON	GROWERS	DISTRIBUTORS	INSTRUCTORS	UD USE	AWARDS	TOTAL	IN UDBG
<i>Ilex crenata</i> 'Jersey Pinnacle'	3.7	0.0	26.2	100.0	0.00	<b>129.9</b>	Yes
<i>Ilex crenata</i> 'Mariesii'	0.0	6.7	0.0	100.0	0.00	<b>106.7</b>	No
<i>Ilex crenata</i> 'Microphylla Columnaris'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i> 'Nigra'	3.7	4.4	0.0	100.0	0.00	<b>108.1</b>	No
<i>Ilex crenata</i> 'Pyramidalis' (sold as 'Pyramid')	3.7	0.0	23.8	100.0	0.00	<b>127.5</b>	No
<i>Ilex crenata</i> 'Rocky Creek'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i> 'Schwoebel's Compact'	0.0	6.7	0.0	100.0	0.00	<b>106.7</b>	No
<i>Ilex crenata</i> 'Schwoebel's Upright'	3.7	13.3	0.0	100.0	0.00	<b>117.0</b>	No
<i>Ilex crenata</i> 'Sentinel'	3.7	0.0	23.8	100.0	0.00	<b>127.5</b>	No
<i>Ilex crenata</i> 'Sky Pencil'	74.1	97.8	39.3	100.0	50.00	<b>361.2</b>	Yes
<i>Ilex crenata</i> 'Snowflake' (sold as 'Shiro Fukurin')	0.0	6.7	0.0	100.0	0.00	<b>106.7</b>	No
<i>Ilex crenata</i> 'Soft Touch'	44.4	64.4	28.6	100.0	0.00	<b>237.5</b>	No
<i>Ilex crenata</i> 'Steed's Upright' (sold as 'Steeds')	59.3	97.8	23.8	100.0	0.00	<b>280.9</b>	No
<i>Ilex crenata</i> 'Stokes'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i> 'Suspensum'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i> 'Tee Dee'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex crenata</i> 'Wayne'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex glabra</i>	3.7	4.4	26.2	100.0	0.00	<b>134.4</b>	Yes
<i>Ilex glabra</i> 'Chamzin' (Nordic®)	3.7	0.0	27.4	100.0	0.00	<b>131.1</b>	Yes
<i>Ilex glabra</i> 'Compacta'	14.8	44.4	31.0	100.0	0.00	<b>190.2</b>	Yes
<i>Ilex glabra</i> 'Densa'	22.2	46.7	27.4	100.0	25.00	<b>221.3</b>	Yes
<i>Ilex glabra</i> 'Ivory Queen'	7.4	0.0	0.0	100.0	0.00	<b>107.4</b>	No
<i>Ilex glabra</i> 'Nigra'	11.1	11.1	28.6	100.0	0.00	<b>150.8</b>	Yes
<i>Ilex glabra</i> 'Nova Scotia'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	Yes
<i>Ilex glabra</i> 'Shamrock'	51.9	95.6	44.1	100.0	0.00	<b>291.5</b>	Yes
<i>Ilex</i> 'H635-13' (Winter Bounty™)	7.4	15.6	0.0	0.0	0.00	<b>23.0</b>	No
<i>Ilex</i> 'Mesdob' (China Boy®)	3.7	64.4	4.8	0.0	0.00	<b>72.9</b>	Yes
<i>Ilex</i> × <i>meserveae</i> 'Blue Baron'	0.0	6.7	0.0	100.0	0.00	<b>106.7</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Blue Boy'	0.0	13.3	7.2	100.0	0.00	<b>120.5</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Blue Girl'	37.0	26.7	11.9	100.0	0.00	<b>175.6</b>	Yes
<i>Ilex</i> × <i>meserveae</i> 'Conablu' (Blue Prince®)	3.7	77.8	7.2	100.0	0.00	<b>188.6</b>	Yes
<i>Ilex</i> × <i>meserveae</i> 'Conang' (Blue Angel®)	40.7	13.3	3.6	100.0	0.00	<b>157.6</b>	Yes
<i>Ilex</i> × <i>meserveae</i> 'Conapri' (Blue Princess®)	3.7	97.8	10.7	100.0	0.00	<b>212.2</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Gold Princess' (Castle Gold™)	22.2	0.0	0.0	100.0	0.00	<b>122.2</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Hachfee' (Castle Spire®)	11.1	13.3	3.6	100.0	0.00	<b>128.0</b>	*Yes

<b>TAXON</b>	<b>GROWERS</b>	<b>DISTRIBUTORS</b>	<b>INSTRUCTORS</b>	<b>UD USE</b>	<b>AWARDS</b>	<b>TOTAL</b>	<b>IN UDBG</b>
<i>Ilex</i> × <i>meserveae</i> 'Heckenstar' (Castle Wall™)	3.7	8.9	0.0	100.0	0.00	<b>112.6</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Honey Maid'	7.4	40.0	3.6	100.0	0.00	<b>151.0</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Mesan' (Blue Stallion®)	0.0	0.0	2.4	100.0	0.00	<b>102.4</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Mesgolg' (Golden Girl®)	0.0	13.3	0.0	100.0	50.00	<b>163.3</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Mesid' (Blue Maid®)	0.0	100.0	2.4	100.0	25.00	<b>227.4</b>	No
<i>Ilex</i> × <i>meserveae</i> 'Willemer' (Emerald Magic®)	0.0	13.3	1.2	100.0	0.00	<b>114.5</b>	No
<i>Ilex</i> 'Mesog' (China Girl®)	3.7	86.7	8.3	0.0	0.00	<b>98.7</b>	Yes
<i>Ilex</i> 'Mondo' (Little Rascal®)	0.0	6.7	0.0	0.0	0.00	<b>6.7</b>	No
<i>Ilex myrtifolia</i>	3.7	6.7	1.2	0.0	0.00	<b>11.6</b>	Yes
<i>Ilex opaca</i> 'Maryland Dwarf'	11.1	20.0	35.8	100.0	0.00	<b>166.9</b>	Yes
<i>Ilex pedunculosa</i>	37.0	20.0	4.8	100.0	50.00	<b>211.8</b>	Yes
<i>Ilex</i> 'RutHol1' (Emerald Colonnade®)	3.7	0.0	0.0	0.0	0.00	<b>3.7</b>	No
<i>Ilex</i> 'Spartan'	3.7	0.0	0.0	0.0	0.00	<b>3.7</b>	No
<i>Ilex vomitoria</i>	7.4	0.0	13.1	100.0	0.00	<b>120.5</b>	Yes
<i>Ilex vomitoria</i> 'Condeaux' (Bordeaux™)	18.5	11.1	0.0	100.0	0.00	<b>129.6</b>	No
<i>Ilex vomitoria</i> 'Dwarf'	14.8	8.9	21.5	100.0	0.00	<b>145.2</b>	No
<i>Ilex vomitoria</i> 'Gremic' (Micron®)	0.0	6.7	0.0	100.0	0.00	<b>106.7</b>	No
<i>Ilex vomitoria</i> 'Kathy Ann'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No
<i>Ilex vomitoria</i> 'Pendula'	11.1	6.7	20.3	100.0	0.00	<b>138.0</b>	No
<i>Ilex vomitoria</i> 'Pride of Houston'	3.7	0.0	15.5	100.0	0.00	<b>119.2</b>	No
<i>Ilex vomitoria</i> 'Shadow's Female' (Hoskin Shadow™)	3.7	4.4	0.0	100.0	0.00	<b>108.1</b>	Yes
<i>Ilex vomitoria</i> 'Stoke's Dwarf' (sold as 'Schillings')	3.7	0.0	17.9	100.0	0.00	<b>121.6</b>	Yes
<i>Ilex vomitoria</i> 'Taylor's Rudolph'	3.7	0.0	0.0	100.0	0.00	<b>103.7</b>	No

### **Deciduous Shrub Taxa**

<b>TAXON</b>	<b>GROWERS</b>	<b>DISTRIBUTORS</b>	<b>INSTRUCTORS</b>	<b>UD USE</b>	<b>AWARDS</b>	<b>TOTAL</b>	<b>IN UDBG</b>
<i>Ilex</i> 'Apollo'	53.3	14.8	6.9	0.0	0.0	<b>75.1</b>	No
<i>Ilex decidua</i>	0.0	0.0	53.1	100.0	0.0	<b>153.1</b>	Yes
<i>Ilex decidua</i> 'Sentry'	0.0	3.7	0.0	100.0	0.0	<b>103.7</b>	Yes
<i>Ilex decidua</i> 'Warren's Red'	0.0	0.0	46.2	100.0	0.0	<b>146.2</b>	Yes
<i>Ilex</i> 'Harvest Red'	0.0	0.0	0.0	0.0	25.0	<b>25.0</b>	No
<i>Ilex mucronata</i>	0.0	0.0	2.3	0.0	0.0	<b>2.3</b>	No
<i>Ilex</i> 'Raritan Chief'	0.0	0.0	4.6	0.0	0.0	<b>4.6</b>	Yes
<i>Ilex</i> 'Sparkleberry'	64.4	18.5	34.6	0.0	50.0	<b>167.6</b>	No
<i>Ilex verticillata</i>	13.3	3.7	55.4	100.0	0.0	<b>172.5</b>	No

<b>TAXON</b>	<b>GROWERS</b>	<b>DISTRIBUTORS</b>	<b>INSTRUCTORS</b>	<b>UD USE</b>	<b>AWARDS</b>	<b>TOTAL</b>	<b>IN UDBG</b>
<i>Ilex verticillata</i> 'Afterglow'	20.0	3.7	62.4	100.0	0.0	<b>186.1</b>	No
<i>Ilex verticillata</i> 'Cacapon'	0.0	3.7	0.0	100.0	0.0	<b>103.7</b>	No
<i>Ilex verticillata</i> f. <i>chrysocarpa</i>	4.4	0.0	60.0	100.0	0.0	<b>164.5</b>	No
<i>Ilex verticillata</i> 'FarrowBPop' (Berry Poppins™)	0.0	7.4	0.0	100.0	0.0	<b>107.4</b>	No
<i>Ilex verticillata</i> 'Golden Verboom' (female)	2.2	0.0	0.0	100.0	0.0	<b>102.2</b>	Yes
<i>Ilex verticillata</i> 'Golden Verboom' (male)	13.3	0.0	0.0	100.0	0.0	<b>113.3</b>	Yes
<i>Ilex verticillata</i> 'Hoogendorn'	0.0	3.7	57.7	100.0	0.0	<b>161.4</b>	No
<i>Ilex verticillata</i> 'Jim Dandy'	80.0	37.0	64.7	100.0	0.0	<b>281.7</b>	No
<i>Ilex verticillata</i> 'Late Male'	0.0	7.4	0.0	100.0	0.0	<b>107.4</b>	No
<i>Ilex verticillata</i> 'Maryland Beauty'	15.6	11.1	57.7	100.0	50.0	<b>234.4</b>	No
<i>Ilex verticillata</i> 'NCIV1' (Little Goblin™)	0.0	3.7	0.0	100.0	0.0	<b>103.7</b>	No
<i>Ilex verticillata</i> 'Oosterwijk'	6.7	3.7	0.0	100.0	0.0	<b>110.4</b>	Yes
<i>Ilex verticillata</i> 'Raritan Chief'	0.0	3.7	0.0	100.0	0.0	<b>103.7</b>	No
<i>Ilex verticillata</i> 'Red Sprite'	93.3	48.1	94.7	100.0	50.0	<b>386.2</b>	No
<i>Ilex verticillata</i> 'Scarlett O'Hara'	0.0	0.0	0.0	0.0	25.0	<b>25.0</b>	No
<i>Ilex verticillata</i> 'Southern Gentleman'	77.8	48.1	71.6	100.0	0.0	<b>297.5</b>	Yes
<i>Ilex verticillata</i> 'Spravy' (Berry Heavy®)	20.0	14.8	0.0	100.0	0.0	<b>134.8</b>	No
<i>Ilex verticillata</i> 'Spriber' (Berry Nice®)	15.6	7.4	57.7	100.0	0.0	<b>180.7</b>	No
<i>Ilex verticillata</i> 'Stop Light'	6.7	0.0	57.7	100.0	0	<b>164.4</b>	Yes
<i>Ilex verticillata</i> 'Sunset'	6.7	0.0	0.0	100.0	0.0	<b>106.7</b>	No
<i>Ilex verticillata</i> 'Tiasquam'	0.0	0.0	57.7	100.0	0.0	<b>157.7</b>	No
<i>Ilex verticillata</i> 'Winter Gold'	26.7	22.2	67.0	100.0	25.0	<b>240.9</b>	Yes
<i>Ilex verticillata</i> 'Winter Red'	93.3	59.3	87.8	100.0	25.0	<b>365.4</b>	Yes

**\*UNPLANTED CONTAINER SPECIMEN**

## Appendix Q

### RECOMMENDED DESIDERATA OF *ILEX* TAXA FOR ACQUISITION BY THE UDBG

TAXON	*COMPOSITION CATEGORY				
	A	B	C	D	E
<i>Ilex ambigua</i>				X	
<i>Ilex</i> 'Apollo'	X				
<i>Ilex aquifolium</i> 'Marijo'		X			
<i>Ilex aquifolium</i> 'Sadezam' (Santa's Delight™)		X			
<i>Ilex</i> × <i>aquipernyi</i> 'San Jose'	X				
<i>Ilex</i> × <i>attenuata</i> 'Foster No. 2'	X				
<i>Ilex</i> × <i>attenuata</i> 'Greenleaf'	X				
<i>Ilex</i> × <i>attenuata</i> 'Savannah'	X				
<i>Ilex buergeri</i>		X			
<i>Ilex</i> 'Carolina Sentinel'	X				
<i>Ilex cassine</i>					
<i>Ilex</i> 'Conaf' (Oak Leaf™)	X				
<i>Ilex</i> 'Conal' (Cardinal™)	X				
<i>Ilex</i> 'Conin' (Robin™)	X				
<i>Ilex</i> 'Conty' (Liberty™)	X				
<i>Ilex cornuta</i> 'Anicet Delcambre'	X				
<i>Ilex cornuta</i> 'Burfordii'	X				
<i>Ilex cornuta</i> 'Carissa'	X				
<i>Ilex cornuta</i> 'Fine Line'	X				
<i>Ilex crenata</i> 'Chesapeake'	X				
<i>Ilex crenata</i> 'Compacta'	X				
<i>Ilex crenata</i> 'Farrowone' (Sky Pointer™)		X			
<i>Ilex crenata</i> 'Hoogendorn'	X				
<i>Ilex crenata</i> 'Soft Touch'	X				
<i>Ilex crenata</i> 'Steed's Upright'	X				
<i>Ilex cumulicola</i>				X	
<i>Ilex</i> 'Dapat' (Miss Patricia™)		X			
<i>Ilex</i> 'Emily Bruner'	X				
<i>Ilex</i> 'H635-13' (Winter Bounty™)		X			
<i>Ilex</i> 'HL10-90' (Christmas Jewel®)	X				
<i>Ilex</i> 'Homefire'		X			

TAXON	*COMPOSITION CATEGORY				
	A	B	C	D	E
<i>Ilex laevigata</i>				X	
<i>Ilex longipes</i>				X	
<i>Ilex</i> 'Magiana' (Acadiana™)	X				
<i>Ilex</i> 'Magland' (Oakland™)	X				
<i>Ilex</i> 'Mary Nell'	X				
<i>Ilex</i> × <i>meserveae</i> 'Honey Maid'					X
<i>Ilex</i> × <i>meserveae</i> 'Conapri' (Blue Princess®)	X				
<i>Ilex</i> × <i>meserveae</i> 'Hachfee' (Castle Spire®)		X			
<i>Ilex</i> × <i>meserveae</i> 'Mesid' (Blue Maid®)	X				
<i>Ilex montana</i>				X	
<i>Ilex opaca</i> 'Dan Fenton'	X				
<i>Ilex opaca</i> 'Jersey Knight'	X				
<i>Ilex opaca</i> 'Jersey Princess'	X				
<i>Ilex opaca</i> 'Paterson'	X				
<i>Ilex purpurea</i>		X			
<i>Ilex</i> 'Rock Garden'					X
<i>Ilex rugosa</i>			X		
<i>Ilex verticillata</i> 'Afterglow'	X				
<i>Ilex verticillata</i> f. <i>chrysocarpa</i>		X			
<i>Ilex verticillata</i> 'FarrowBPop' (Berry Poppins™)		X			
<i>Ilex verticillata</i> 'Golden Verboom'	X				
<i>Ilex verticillata</i> 'Jim Dandy'	X				
<i>Ilex verticillata</i> 'Maryland Beauty'	X				
<i>Ilex verticillata</i> 'NCIV1' (Little Goblin™)		X			
<i>Ilex verticillata</i> 'Red Sprite'	X				
<i>Ilex verticillata</i> 'Spravy' (Berry Heavy®)	X				
<i>Ilex verticillata</i> 'Spriber' (Berry Nice®)	X				

**\*COMPOSITION CATEGORIES:**

A = Prevalent taxa

B = New introductions or less common taxa in need of further evaluation

C = Instructionally or locally important taxa

D = Native taxa not commercially common

E = Unusual hollies of specific ornamental interest

## Appendix R

### UDBG ILEX RECOMMENDED FOR REMOVAL

PLANT	ACC. NUM.	LOCATION
<b>HIGH PRIORITY</b>		
<i>Ilex</i> × <i>altaclerensis</i> 'Camelliifolia'	N/A	CH1
<i>Ilex</i> × <i>aquipernyi</i>	73-9*1	CH2
<i>Ilex</i> 'Accent'	73-4*1	CH2
<i>Ilex aquifolium</i> [Siberia] = 'Limsi'	95-32*1	F5
<i>Ilex</i> 'Bob Bruner'	95-57*1	NUR23
<i>Ilex</i> 'Carolina Cone'	95-58*2	NUR5
<i>Ilex cornuta</i> 'Dwarf Burford'	90-3	W8
<i>Ilex cornuta</i> 'O. Spring'	95-33*1	NUR24
<i>Ilex crenata</i> 'Helleri'	64-16*4	FH
<i>Ilex crenata</i> 'Jersey Pinnacle'	97-35*3	FE
<i>Ilex crenata</i> 'Sky Pencil'	92-57*1	F5
<i>Ilex</i> 'Ginny Bruner'	95-60*2	NUR23
<i>Ilex glabra</i> 'Compacta'	04-11*2	TP2
<i>Ilex glabra</i> 'Compacta'	04-11*5	TP2
<i>Ilex glabra</i> 'Compacta'	04-11*6	TP2
<i>Ilex</i> 'Harvest Red'	89-114*2	W3
<i>Ilex</i> 'Nellie R. Stevens'	67-3*1	CH1
<i>Ilex opaca</i> 'Millville'	94-22*1	NUR29
<i>Ilex opaca</i> 'William Hawkins'	93-87*1	W6
<i>Ilex</i> 'Patricia Varner'	95-61*1	NUR7
<i>Ilex pedunculosa</i>	92-13*1	CH1
Unknown hybrid	N/A	CH1
<i>Ilex</i> 'Red Robe'	00-70*1	CH1
<i>Ilex serrata</i> × <i>I. verticillata</i>	74-7*1	C3
<i>Ilex verticillata</i>	90-107*1	N1
<i>Ilex verticillata</i> 'Fairfax'	91-1*2	N1
<b>MEDIUM PRIORITY</b>		
<i>Ilex</i> × <i>attenuata</i> 'Tanager'	73-5*1	CH2
<i>Ilex</i> × <i>koehneana</i> 'Jade'	73-7*1	CH2
<i>Ilex</i> × <i>koehneana</i> 'Ruby'	73-6*1	CH2
<i>Ilex</i> × <i>meserveae</i> 'Blue Girl'	69-40*1	CH1

PLANT	ACC. NUM.	LOCATION
<i>Ilex aquifolium</i> 'Argentea Marginata'	73-15*1	CH2
<i>Ilex aquifolium</i> 'N.Y.B.G. No. 2'	09-76*1	F3
<i>Ilex aquifolium</i> 'N.Y.B.G. No. 2'	64-14*2	CH1
<i>Ilex aquifolium</i> 'Teufel's'	60-3*2	CH1
<i>Ilex aquifolium</i> 'Winter Queen'	95-67*1	NUR28
<i>Ilex</i> 'Autumn Glow'	73-27*4	C3
<i>Ilex</i> 'Autumn Glow'	73-27*5	C3
<i>Ilex</i> 'Carolina Cone'	97-91*1	GH
<i>Ilex crenata</i> 'Ivory Tower'	77-2*3	CH2
<i>Ilex crenata</i> 'Jersey Pinnacle'	97-35*1	FE
<i>Ilex crenata</i> 'Jersey Pinnacle'	97-35*2	FE
<i>Ilex glabra</i> [Nordic] = 'Chamzin'	97-32*1	W3
<i>Ilex</i> 'Harvest Red'	90-29*2	N1
<i>Ilex</i> 'Harvest Red'	90-29*3	N1
<i>Ilex opaca</i> 'Delia Bradley'	79-5*1	FH
<i>Ilex opaca</i> 'Miss Helen'	58-10*1	FH
<i>Ilex opaca</i> 'Silica King'	58-12*2	FH
<i>Ilex verticillata</i> 'Christmas Cheer'	71-28*2	C3
<i>Ilex verticillata</i> 'Shaver'	90-70*2	N1
<i>Ilex verticillata</i> 'Shaver'	90-70*1	N1
<i>Ilex</i> 'William Cowgill'	95-63*1	NUR28
<i>Ilex x meserveae</i> [Blue Prince] = 'Conablu'	79-4*1	CH1
<b>LOW PRIORITY</b>		
<i>Ilex</i> [China Boy] = 'Mesdob'	89-73*1	C1
<i>Ilex</i> [China Boy] = 'Mesdob'	89-73*3	C1
<i>Ilex</i> [China Boy] = 'Mesdob'	89-73*2	C1
<i>Ilex</i> [China Girl] = 'Mesog'	89-74*1	C1
<i>Ilex</i> [China Girl] = 'Mesog'	89-74*2	C1
<i>Ilex</i> [China Girl] = 'Mesog'	89-74*3	C1
<i>Ilex</i> × <i>altaclerensis</i> 'James G. Esson'	64-13*1	FH
<i>Ilex</i> × <i>altaclerensis</i> 'Tatnall School'	71-59*1	CH1
<i>Ilex</i> × <i>attenuata</i> 'Bienville Gold'	02-10*1	CC
<i>Ilex</i> × <i>koehneana</i> 'Ajax'	95-54*1	CP
<i>Ilex</i> × <i>meserveae</i> [Blue Angel]= 'Conang'	98-125*1	GH
<i>Ilex</i> 'Autumn Glow'	73-27*4	C3
<i>Ilex cornuta</i> 'Dwarf Burford'	90-3*8	W8
<i>Ilex crenata</i> 'Convexa'	95-101*1	FH

PLANT	ACC. NUM.	LOCATION
<i>Ilex</i> 'Doctor Kassab'	73-11*1	CH2
<i>Ilex</i> 'Ginny Bruner'	95-60*1	A1
<i>Ilex</i> 'Ginny Bruner'	95-60*1	A1
<i>Ilex glabra</i> 'Compacta'	04-11*1	TP2
<i>Ilex glabra</i> 'Densa'	96-31*16	TD2
<i>Ilex</i> 'Harvest Red'	89-114*1	W3
<i>Ilex</i> 'John T. Morris'	73-2*1	CH2
<i>Ilex</i> 'Lydia Morris'	74-6*1	CH2
<i>Ilex opaca</i> 'Arden'	67-4*1	FH
<i>Ilex opaca</i> 'Arden'	67-4*2	FH
<i>Ilex opaca</i> 'Lin's Gold'	95-40*1	F5
<i>Ilex serrata</i>	69-46*2	C3
<i>Ilex serrata</i>	69-46*3	C3
<i>Ilex serrata</i>	69-46*6	C3
<i>Ilex serrata</i>	69-46*5	C3
<i>Ilex</i> 'Sparkleberry'	90-36*1	N1
<i>Ilex verticillata</i> 'Cacapon'	01-32*1	N1B
<i>Ilex verticillata</i> 'Fairfax'	91-1*1	N1
<i>Ilex verticillata</i> 'Fairfax'	91-1*3	N1
<i>Ilex verticillata</i> 'Jolly Red'	90-71*2	N1
<i>Ilex verticillata</i> 'Jolly Red'	90-71*3	N1
<i>Ilex verticillata</i> 'Shaver'	90-70*3	N1
<i>Ilex verticillata</i> 'Stop Light'	90-56*2	N1
<i>Ilex verticillata</i> 'Winter Red'	96-35*12	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*2	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*4	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*5	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*6	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*7	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*8	TD2
<i>Ilex verticillata</i> 'Winter Red'	96-35*9	TD2
<i>Ilex verticillata</i> 'Winter Red'	90-39*1	N1
<i>Ilex vomitoria</i> [Hoskin Shadow] = 'Shadow's Female'	97-38*1	TP1
<i>Ilex vomitoria</i> 'Carolina Ruby'	04-12*1	TP2
<i>Ilex vomitoria</i> 'Carolina Ruby'	04-12*2	TP2
<i>Ilex vomitoria</i> 'Carolina Ruby'	04-12*3	TP2