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# Assessment and Review of the Morris Arboretum Magnolia Collection

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An independent study project report by The Martha J. Wallace Endowed Plant Propagation Intern (2016-2017)

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# Assessment and Review of the Morris Arboretum Magnolia Collection

## **Abstract**

The magnolia collection at the Morris Arboretum is comprised of an enticing blend of attractive horticultural specimens, historically significant plants and cultivars, and species of importance to conservation. This project aims to assess the magnolia collection and produce a well-informed review of future improvements to the collection. The comprehensive assessment includes three objectives: to evaluate plant condition, to appraise age and species richness, and to compare our collection with other major magnolia collections. This assessment, combined with information from relevant literature, allows us to predict the expected longevity of the collection, to forecast future re-propagation, to locate gaps within the collection, to assign value to our trees that are unusual, special, or rarely present in other collections, and to recommend additions to the collection over the next several years. Due to the challenges of limited planting space, improvement recommendations are made with the goal of shaping a collection that is representative, rather than all-inclusive, of major groups of wild-collected species and cultivars.

## **Disciplines**

Botany | Horticulture | Plant Breeding and Genetics

## **Comments**

An independent study project report by The Martha J. Wallace Endowed Plant Propagation Intern (2016-2017)

**TITLE:** Assessment and Review of the Morris Arboretum Magnolia Collection

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*The Martha J. Wallace Endowed Plant Propagation Intern*

**DATE:** April 2017

**ABSTRACT:**

The magnolia collection at the Morris Arboretum is comprised of an enticing blend of attractive horticultural specimens, historically significant plants and cultivars, and species of importance to conservation. This project aims to assess the magnolia collection and produce a well-informed review of future improvements to the collection. The comprehensive assessment includes three objectives: to evaluate plant condition, to appraise age and species richness, and to compare our collection with other major magnolia collections. This assessment, combined with information from relevant literature, allows us to predict the expected longevity of the collection, to forecast future re-propagation, to locate gaps within the collection, to assign value to our trees that are unusual, special, or rarely present in other collections, and to recommend additions to the collection over the next several years. Due to the challenges of limited planting space, improvement recommendations are made with the goal of shaping a collection that is representative, rather than all-inclusive, of major groups of wild-collected species and cultivars.

## INTRODUCTION

Magnolias are flowering trees that exhibit “phenomenal diversity in habit, flower, foliage and adaptability” (Dirr, pg 675). There is a great range of flower color, from white and cream to pink and purple to yellow. With the large flowers of many species emerging before leaf-out in the springtime, these trees put on a fantastic colorful show.

There are approximately 210 species in the genus *Magnolia* and countless cultivars and hybrids. Magnolias are widely distributed across the globe, with different species having more or less hardiness. “Long thought to be the earliest angiosperms (flowering plants), magnolias have been bumped out of that position by recent research discoveries, but they are still among the more ancient plant lineages” (Rose and Dosmann, pg 2). The fossil record for *Magnolia*, which extends back to the Mesozoic times (or the age of the dinosaurs), shows a much broader historic distribution of the genus, spanning across the Americas, Europe, Greenland, and Asia in a continuous band across the globe. Today, the *Magnoliaceae* exhibits a disjunct distribution (Figure 1), with species in the Americas (with ranges from Canada to Brazil) and throughout much of Asia. The modern disjunct distribution may be explained by competition: since magnolias are relatively small and slow growing trees and shrubs, they were outcompeted in many areas over the ages of climate variability (Cox et. al, pg 49).

**Figure 1:** Global distribution of *Magnoliaceae* (Missouri Botanical Garden).



Since the Morris Arboretum works to collect and conserve species across eastern North America and eastern Asia, it makes sense for the Arboretum to have a strong magnolia collection from those regions. The Morris Arboretum’s Living Collections Policy states:

Plant collecting efforts focus on eastern Asia, the Caucasus, Pennsylvania, and eastern North America. Through its collection, the Arboretum is active in the conservation of important collections of rare and threatened plants... Significant plant collection groups include maples, magnolia species, native azaleas, the witch hazel family, roses, hollies, and conifers.

*Living Collections Policy, 2007*

The Morris Arboretum's magnolia collection should include both plants of conservation value and of ornamental value. Many *Magnolia* species are both beautiful and rare or threatened. Many threatened magnolias occur in the tropics, and would not be hardy at the Morris Arboretum. However, there are several threatened Asian temperate species that are candidates for ex-situ conservation in our growing zone. The diversity of magnolias in Asia is also much greater than in North America. For example, while the USA boasts 7 (or 8) species of *Magnolia*, none of which are threatened, China has 108 *Magnolia* species. Of those 108 species, 6 are critically endangered, 19 are endangered, and 8 are threatened (Rivers et. al, pg 53). Further details on these species will be provided in the "Recommendations" section of this report.

Though many species of *Magnolia* are not hardy at the Morris Arboretum, due to climate change and the corresponding shift in USDA climate zones, some marginally hardy species may be possible to grow in Philadelphia in the coming years and decades. Planning for climate change is a new challenge for modern management of living collections. In the case of magnolias, more species may be available to plant under climate change, however warm winters and increased springtime temperature variability can cause magnolias to flower early and then suffer frost damage. This occurred to an extreme extent in the spring of 2016, and to a moderate extent in the spring of 2017, dampening the overall visual effect of the collection's springtime flower display.

The largest grouping of the magnolia collection is planted on the front slope of the Morris Arboretum, or the "magnolia slope"—as visitors enter via the front driveway, they wind through the collection. A long view is preserved from the top of the hill, as no magnolias are planted in the center of the slope. Director John M. Fogg, Jr. chose the front slope as the major area for magnolias. This may seem an odd choice, since the slope is subject to harsh winter winds, and magnolia flowers are tender. However, he intentionally chose the harsh and windy hill side, in hope that the magnolias would wait to bloom later in the spring and thereby receive less frost damage. Fogg wrote, "Turning now to the north-facing slope of our quartzite ridge, we find that the soil changes rather abruptly from acid to prevailingly alkaline. On the declivity just below the summit we have established our major concentration of *Magnolia*. Although this may appear suicidal, it has already proved highly satisfactory. The mere fact of their northerly exposure tends sufficiently to retard the opening of the buds so that they usually escape the blasting effects of a belated cold spell in April." The long-term effectiveness of this choice, especially as springtime becomes increasingly variable, is unclear. In 1962, there was a major planting of 40 trees on the magnolia slope. A secondary grouping of magnolias was planted on Hillcrest Avenue. In 1993 and 1995, the construction of the handicap-accessible loop path caused the removal of many

magnolias along Hillcrest Avenue. Currently, the oldest magnolia at the Arboretum is *M. stellata* ‘Rubra’, 32-3183\*A that was sent to Lydia Morris in 1930 and planted in 1932 after her death. Overall, the story of the collection has more to do with the visual impact of the whole magnolia slope, rather than the specific history of any one tree. Indeed, the magnolia collection has a disproportionate impact on the experience of visitors. When I taught a course for the public on the magnolia collection, I asked participants to guess what percentage of the plants at the Morris are magnolias; their estimates ranged from 5% to 25%. In reality, magnolias make up 1.8% of the Morris Arboretum living collection (210 of 11,494 accessioned plants planted on the grounds).

Given the value of this collection to the experience of visitors and to the Arboretum as a whole, it is crucial to plan for the longevity of the collection. Propagating by taking cuttings is an important tool; by creating young clones of aging trees, the genetics of a collection can be kept alive across centuries. I’m particularly interested in the ways that living collections at arboreta are developed, and then how those collections are maintained and perpetuated over the long lifetime of an arboretum—especially since this exceeds the lifetime of any particular tree.

## **METHODS**

I collected data for this project by visiting each magnolia tree planted on the grounds of the Morris Arboretum and performing field checks. During my field checks, I evaluated plant condition on a four level scale: Excellent, Good, Fair, or Poor (Box 1). Additionally, I took notes on any remarkable issues with each tree, with the goal of providing the Arboretum horticulturalists with a detailed report on the trees in their respective section. During my field checks, I additionally measured the diameter at breast height (DBH) of the major stems of each tree. For small single-stem saplings I measured the stem regardless of its size, though for large trees I ignored minor stems. For multi-stem trees, I calculated a single DBH value using the formula  $DBH = (\text{dbh}_1^2 + \text{dbh}_2^2 + \dots + \text{dbh}_n^2)^{0.5}$ , in order to simplify the data analysis.

I entered my data into Excel spreadsheets and used R statistical software to manipulate the data and generate figures and tables. I additionally utilized collection data exported from BG-Base by the wonderful Plant Recorder, Elinor Goff. Finally, I obtained lists of magnolia collections from several gardens via the Magnolia Society, the APGA Plant Collections Network (PCN) and the websites of individual institutions.

I presented two springtime tours of the magnolia collection: one tour titled “Magnificent Magnolias” for the public on April 5<sup>th</sup>, and one tour for the horticulture volunteers on April 12<sup>th</sup>. I taught about the botany and evolutionary history of magnolias and discussed the blooming trees on the magnolia slope.

## **PLANT CONDITION**

Plant condition was assessed in the autumn through the winter of 2016-2017. Assessing the deciduous magnolias without foliage present ended up being useful; I was able to focus on the

structural aspects of the plant’s health and note wounds and similar concerns more easily. Two extremely common notes were the damage caused by sap-suckers (leaving small round holes up the trunk of the tree) and the presence of water sprouts or root suckers (which could indicate rejuvenation in response to some decline of the tree). These issues are unlikely to indicate poor health in and of themselves, but when combined with other problems, sapsucker damage and suckering tended to lower the condition score of a tree. Some accessions of *Magnolia* that were recently added and are currently in the greenhouse were not evaluated. Overall, the health of the magnolia collection at the Morris Arboretum is quite good, with 66% of trees in “Excellent” or “Good” condition, 25% in “Fair” condition, and only 8% in “Poor” condition (Table 1, Figure 2).

**Table 1:** Magnolia Conditions.

Condition	Number of Trees	Percentage
Excellent	61	30
Good	73	36
Fair	51	25
Poor	17	8

**Figure 2:** Pie Chart of Magnolia Conditions



I compiled condition reports for the trees in each horticultural section, and shared these reports with the section leaders in early February 2017. These reports contained the condition

**Box 1: Plant Evaluation Criteria**

Excellent –

- An outstanding and/or exemplary plant, not just in good health but thriving (vigorous).
- No recent structural damage or defects; no pest(s) or disease(s)
- Past damage has fully compartmentalized

Good –

- A plant in good health, actively growing, no evidence of decline.
- Minor structural damage or disease that is not significantly harming the plant (e.g., powdery mildew can still grow on a “good” Syringa).
- Compartmentalization proceeding well

Fair –

- A plant in minor decline (minimal vigor), but not life-threatening.
- Notable pathological, structural, or physical damage
- Some form of stress or pressure is evident (or at least the symptoms are); may have some active growth or is in stasis.
- Compartmentalization not proceeding well

Poor –

- A plant in major decline, the problem is life-threatening, and the expectation is that the plant will be dead within 1 to 2 years unless remedial action is taken.
- Major pathological, structural, or physical damage
- No evidence of active growth
- No compartmentalization

score and notes for each tree and specifically mentioned instances where attention such as pruning, fencing, or remediation of girdling roots was recommended.

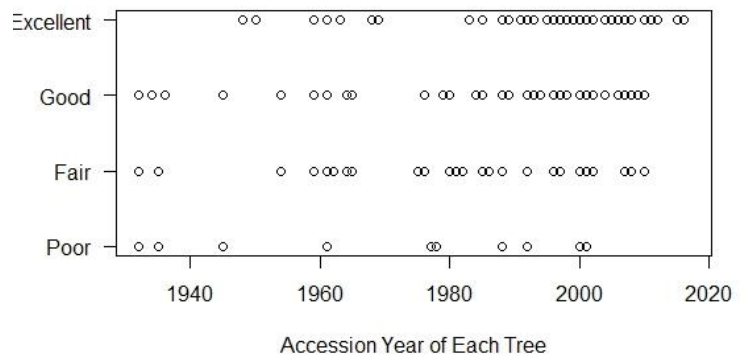
Beyond producing these recommendations for short-term management and care, this evaluation of magnolia condition also helps to reveal which trees should be re-propagated soon in order to maintain their place in the collection.

Trees in poor condition were, on average, older (Table 2). However, age did not directly determine the condition of the tree: there is a large range of tree ages for each of the four condition categories (Figure 3). Therefore, re-propagation efforts cannot focus solely on the oldest trees.

**Table 2:** Mean accession year of trees in each condition category.

Condition	Mean Accession Year
Excellent	1993.6
Good	1986.2
Fair	1984.5
Poor	1974.8

**Figure 3:** Magnolia Condition by Accession Year.



Since trees in “Poor” condition are likely to fail in coming years, re-propagation efforts should start with these trees (Table 3). Table 3 compiles the magnolias in “Poor” condition that are likely to have sufficient material for re-propagation. Unfortunately, older trees with low vigor are much harder to propagate than their more juvenile counterparts. When water sprouts are available, it may be preferable to attempt to root these. Some trees in “Poor” condition are in fact on the path to successful self-rejuvenation by producing new, juvenile suckers. For example, the oldest magnolia at the Morris, 1932-3183\*A *Magnolia stellata* ‘Rubra’, has new vigorous suckers which may eventually replace the decaying old trunks. However, re-propagation of this tree is still recommended.

**Table 3:** Trees recommended for imminent re-propagation.

Accession #:	Location	Scientific Name	Condition	Check Notes
1961-673*A	J16	<i>Magnolia</i> × <i>soulangeana</i> 'Alexandrina'	Poor	Major dieback. Trunks split at bottom- hazard?
1945-056*A	K24	<i>Magnolia kobus</i>	Poor	Sapsucker damage. Water sprouts. Rubbing limbs. Dangerous dead

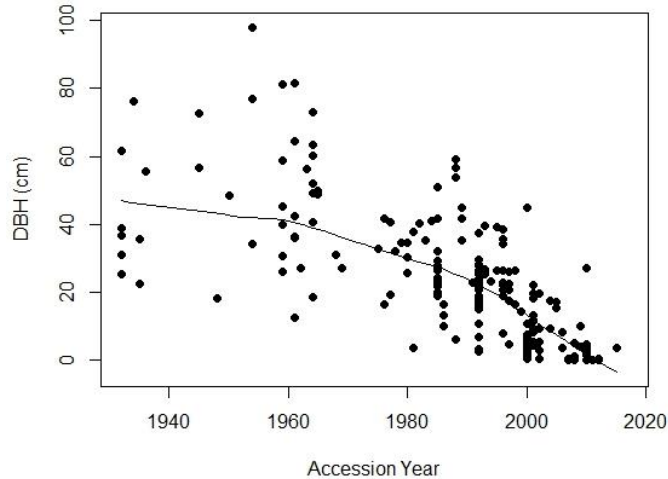


				wood. Growing onto fence, over power lines.
1961-546*A	L16	<i>Magnolia kobus</i> var. <i>borealis</i>	Poor	Major decay of original trunk. Some new large suckers. Supports already in place.
1932-0073*A	H22	<i>Magnolia macrophylla</i>	Poor	Trunk mostly rotted out. Dimensions at breast height are actually elliptical, 15cm by 55 cm.
1935-5471*A	H15	<i>Magnolia macrophylla</i>	Poor	Major crack and decay up trunk
1978-012*A	J16	<i>Magnolia</i> 'Orchid'	Poor	Major dieback, suckers, terrible compartmentalization
1992-002*B	J20-BED-H	<i>Magnolia sieboldii</i>	Poor	Major wounds not compartmentalizing. Low vigor. Many small stems.
1992-004*B	J20-BED-H	<i>Magnolia sieboldii</i>	Poor	Poorly compartmentalized decay. Main trunks gone. New trunks wounded, not vigorous.
1932-3183*A	K16	<i>Magnolia stellata</i> 'Rubra'	Poor	Major decay of main trunks. Rejuvenation proceeding well.
1977-065*A	F20	<i>Magnolia tripetala</i>	Poor	Trunk hollow and decaying.
1977-066*A	F20	<i>Magnolia tripetala</i>	Poor	Many wounds. Poorly compartmentalized decay.
1988-114*A	G17	<i>Magnolia tripetala</i>	Poor	Rotting at base, leaning.

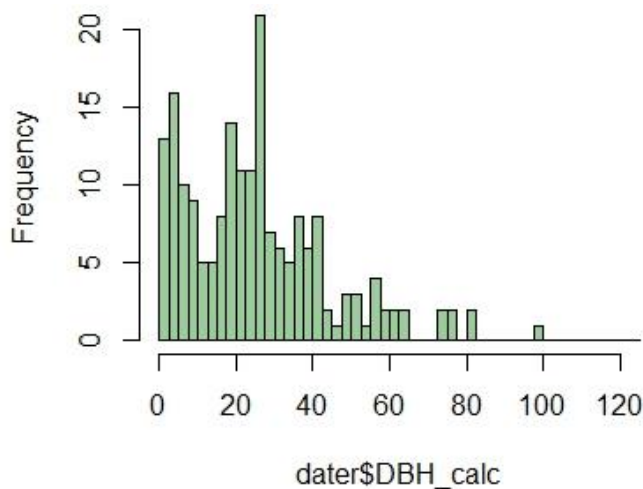
### **AGE AND SPECIES RICHNESS**

To understand the overall picture of the health of the collection, and to gain some insight on how diverse and interesting the collection is, it is interesting to consider the age and size class distribution of the trees, as well as the relative proportions of different magnolia groups within the collection. Based on the large number of dead tree records on file for magnolias, this seems to be a collection that is frequently changing. A healthy collection should have a variety of sizes and ages of trees for each important group, so that as older trees die, younger trees are already present to fill their places.

**Figure 4:** The diameter at breast height (DBH), in centimeters, of the trees in the magnolia collection, plotted by their accession year. Recently accessioned trees tend to be smaller. Older trees tend to be larger overall, and exhibit greater variation in size.

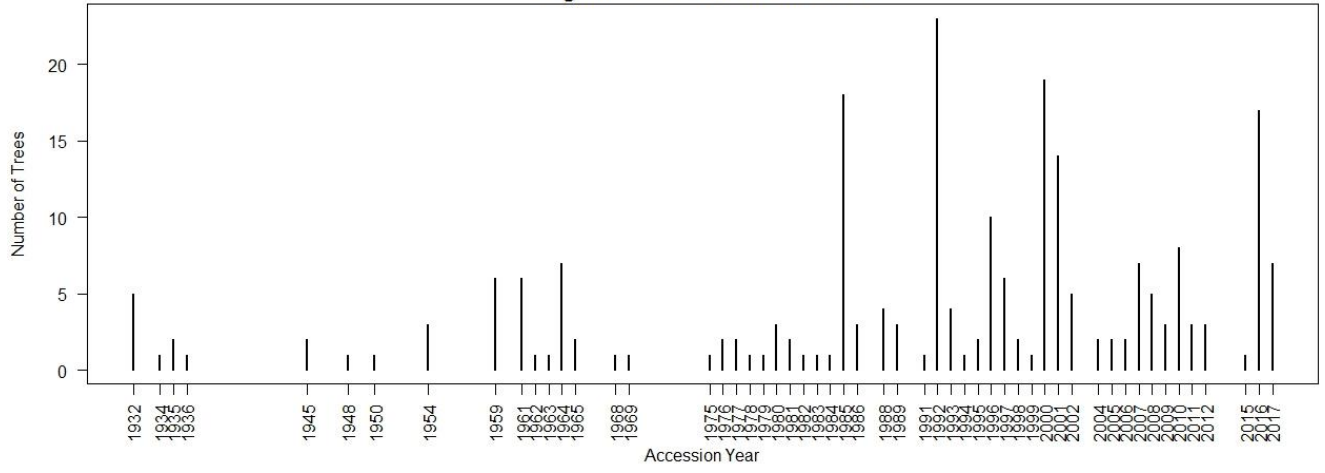


**Figure 5:** Number of magnolia trees in each diameter class. There are many more trees with a DBH under 50 cm than over 50 cm, and there is good representation of trees with a DBH under 10 cm. These smaller trees will hopefully survive in adequate enough numbers to replace the larger trees in the collection.



**Figure 6:** Number of currently alive magnolias accessioned each year from 1932-2017. This graph gives a good picture of the overall age distribution of the collection, as it stands today. Interestingly, despite a large planting of magnolias in the 1960s, enough of them must have died so as to obscure any higher rate of additions to the collection during that era.

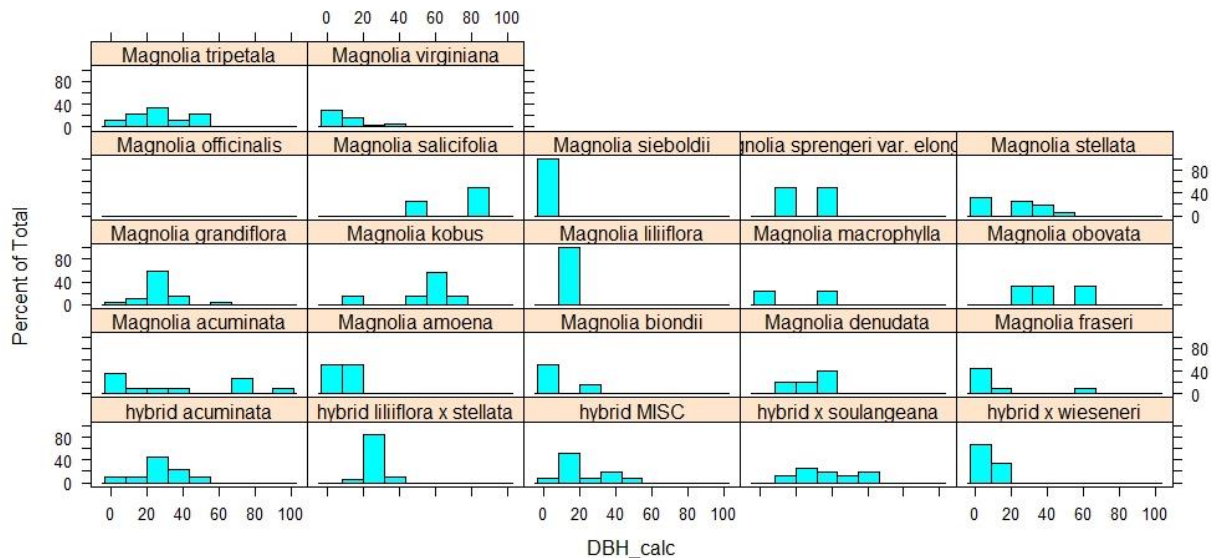
Magnolias Accessioned Each Year



**Table 4:** The number of trees in each “group” of magnolias. I defined these groups by lumping together all the cultivars of a species with that species, and by examining the parentage of the hybrid magnolias for useful patterns.

GROUP	trees	GROUP	trees
hybrid <i>acuminata</i>	9	<i>Magnolia kobus</i>	7
hybrid <i>liliiflora</i> x <i>stellata</i>	19	<i>Magnolia liliiflora</i>	1
hybrid MISC	27	<i>Magnolia macrophylla</i>	8
hybrid x <i>soulangeana</i>	16	<i>Magnolia obovata</i>	3
hybrid x <i>wieseneri</i>	3	<i>Magnolia officinalis</i>	3
<i>Magnolia acuminata</i>	11	<i>Magnolia salicifolia</i>	4
<i>Magnolia amoena</i>	2	<i>Magnolia sieboldii</i>	5
<i>Magnolia biondii</i>	6	<i>Magnolia sprengeri</i> var. <i>elongata</i>	2
<i>Magnolia denudata</i>	5	<i>Magnolia stellata</i>	16
<i>Magnolia fraseri</i>	11	<i>Magnolia tripetala</i>	9
<i>Magnolia grandiflora</i>	27	<i>Magnolia virginiana</i>	39

**Figure 7:** Histogram of magnolia trees in each diameter class, broken down by “group” as defined above. This figure demonstrates that some groups have a healthy distribution of DBH classes, exhibited by a bell-curve shape or a shape weighted to the left (see *M. grandiflora* and hybrid *acuminata*). However, some of these groups are in need of collections development, evidenced by a distribution of DBH classes that is heavily weighted to the right, with too few small trees to replace large trees (see *M. salicifolia* in particular and *M. amoena*).



## COMPARISON WITH OTHER MAJOR COLLECTIONS

I chose to compare the Morris Arboretum with gardens that were:

- 1) Included in the 2016 Magnolia Society tour of Philadelphia area gardens, or
- 2) Included in the multi-site National Collection of *Magnolia* by the American Public Garden Association Plant Collections Network (APGA PCN), or
- 3) The Arnold Arboretum, and
- 4) Not in a USDA zone warmer than 7b.

The numbers in the last column were computed by dividing the number of taxa for each garden by the total number of individual magnolia trees for each garden. Gardens with lower numbers, for example Longwood at 0.19, have a larger amount of repetition in their collections; Longwood has 209 magnolia trees, a number comparable to the Morris, but far fewer taxa are represented in their collection. Gardens with higher numbers, for example Scott Arboretum at 0.57, have collections that are less redundant and more diverse for their size. Taxonomic redundancy in a collection could make a collection more resilient to the loss of any given tree, as well as provide space in a collection for trees of the same species from multiple provenances. Meanwhile, a large amount of redundancy in a collection also means that a greater proportion of the collection is repetitive rather than diverse.

The Morris Arboretum, with a medium garden acreage, houses a respectably sized collection with a seemingly healthy balance between redundancy and diversity.

**Table 5:** A comparison of general information for the magnolia collections of 10 public gardens.

<b>Garden</b>	<b>USDA Zone</b>	<b>Acreage</b>	<b>Number of Magnolia Trees</b>	<b>Number of Taxa (Richness)</b>	<b>Number of Taxa/ Number of Trees</b>
Longwood Gardens	6b	1077	209	39	0.19
Mt. Cuba	6b	7	94	20	0.21
The Morton Arboretum	5a	500	231	58	0.25
Chanticleer	6b	27	143	48	0.34
The Arnold Arboretum	5b	281	175	63	0.36
South Carolina Botanical Garden	7b	295	161	62	0.39
Powell Gardens	5b	970	682	263	0.39
Morris Arboretum	6b	175	207	86	0.42
Bartlett	6b	93	706	385	0.55
Scott Arboretum	7a	357	265	152	0.57

## SPECIES ADDITION RECOMMENDATIONS

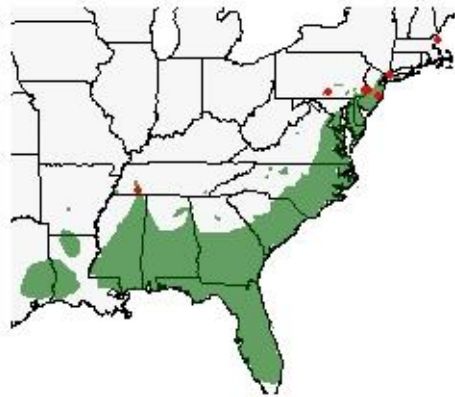
### Native *Magnolia* Species:

There are 8 *Magnolia* species native to the United States: *M. acuminata*, *M. ashei*, *M. fraseri*, *M. grandiflora*, *M. macrophylla*, *M. pyramidata*, *M. tripetala*, and *M. virginiana*.

I mapped our collection location data for our desired species onto USGS range maps that were compiled by Elbert L. Little in the 1970s. The red dots on the map indicate a collection location for one or more of our *Magnolia* accessions. The green areas indicate the range where that species may occur. Since these ranges are over 40 years old, it is entirely possible that shifts have occurred, especially in the northward direction as the warming effects of climate change are felt. It is also possible that isolated population fragments may no longer exist, due to human development or other pressures.

The Morris Arboretum is located at or beyond the northern range limit for many of the native *Magnolia* species. With this in mind, it is interesting to collect germplasm from the northernmost parts of a species' range—plants at the northern edge of a range are more likely to exhibit greater cold hardiness. Many of the ranges for these native magnolias overlap in western North Carolina; an area of high biodiversity with mountainous topography, creating a somewhat cooler climate at a southern latitude. A collection trip in that region may be very interesting and useful.

### **Magnolia virginiana Range**

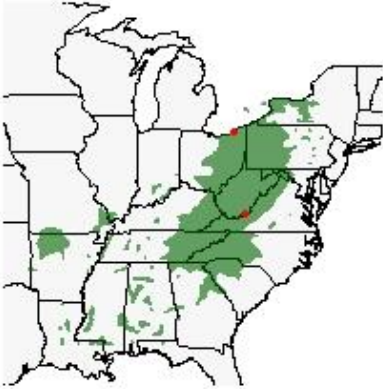


*Magnolia virginiana* and its cultivars are well represented in the Morris magnolia collection, with 39 trees planted out in the garden. This tree is semi-evergreen, with some cultivars exhibiting more reliable evergreen behavior.

Our *M. virginiana* trees with source location records (sources represented by red dots) provide good coverage of the northern range edge, as well as of the interesting spike northward spike in the range in Tennessee.

Recommendation: Continue to pursue cold hardy cultivars. Wild collect from the population islands in western North Carolina.

### Magnolia acuminata Range



*Magnolia acuminata* is one of the tallest magnolias, which ultimately limits the visibility of its blooms, yet it is still a valuable native tree to have represented in our collection. There are 9 trees planted out in the garden, currently.

There are significant areas of the range left unrepresented in our collection.

Recommendation: Wild collect from northern range edge in NY State, populations in PA, and western NC additionally if desired.

### Magnolia fraseri Range

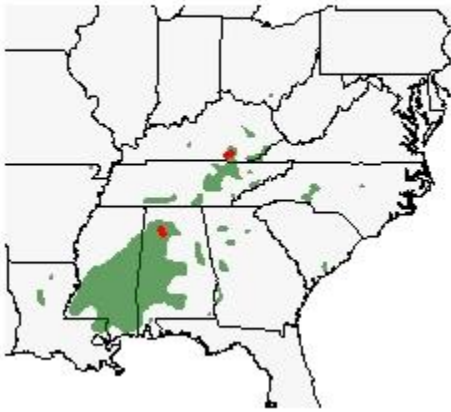


*Magnolia fraseri* is a small tree with an Appalachian distribution.

We have 8 trees planted out in the garden, (and 2 in the greenhouse). Those with collection location information are mostly from the 2000 SE US Plant Expedition. Additionally, plants have been received from the Dawes Arboretum in OH and from the US National Arboretum. *Magnolia fraseri* x *pyramidata* has been received from the North Carolina Arboretum in Asheville NC.

Recommendation: Wild collect from northern range edge.

## Magnolia macrophylla Range



*Magnolia macrophylla* is represented in our collection by 5 trees planted out in the garden (including accessions in the 1930s and in 2000). We recently received new seed accessions. Including these seed accessions, we have material from 4 collection locations.

Recommendation: Wild collect in western North Carolina on a combined collecting trip.

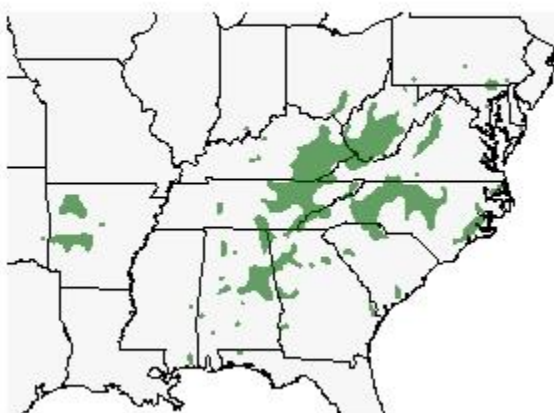
## Magnolia ashei Range



*Magnolia ashei* has a native distribution in the panhandle of Florida. This species is not currently represented in our collection. However, it is present in gardens in similar or colder growing zones. For example, Chanticleer has 3, Mt. Cuba has 6, the Morton Arboretum has 5.

Recommendation: Wild collect in northernmost populations, if possible. More likely, since it is in cultivation at Chanticleer and Mt. Cuba, obtain cuttings.

## Magnolia tripetala Range



*Magnolia tripetala* is present at the Morris, with 8 trees currently planted out on the grounds. The accession years of those 8 trees are evenly distributed over the years from 1930s to 2010. However, there is no collection location information available.

Recommendation: Wild collect from the population on the PA-MD border. Collect in western North Carolina.



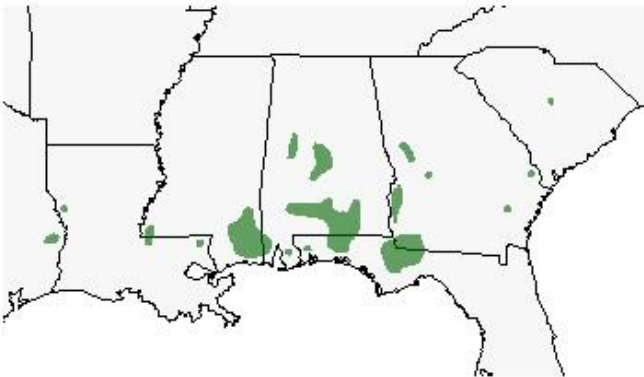
## Magnolia grandiflora Range



*Magnolia grandiflora* and its cultivars are well represented in the collection, with 27 trees planted out. No collection location information exists for those trees. Many cultivars of *M. grandiflora* were planted at the Morris to trial their cold hardiness.

Recommendation: It is not a priority to add more *M. grandiflora* to the collection. If in the future wild collected material is desired, collect from the northern edge of the range.

## Magnolia pyramidata Range



*Magnolia pyramidata* is not represented in the Morris magnolia collection, though *M. fraseri* x *pyramidata* is.

It is present in gardens in similar or colder growing zones, for example Mt. Cuba has 5, Powell Gardens has 1, and the Morton Arboretum has 1.

Recommendation: Wild collect in northernmost populations, if possible. Since it is in cultivation at Mt. Cuba, obtain cuttings there.

### Temperate Asian *Magnolia* Species:

Of the 108 *Magnolia* species in China, 6 are Critically Endangered, 19 are Endangered, and 8 are Threatened (Rivers et. al, pg 53). A much more limited list may plausibly be grown in our temperate climate.

*Magnolia amoena* is listed as Vulnerable by the IUCN. We currently have two plants at the Morris Arboretum of this species. It is “sporadically distributed in the montane sparse forests at alt. 200~1000 m in Zhejiang, Jiangsu, Anhui and Jiangxi” (Liu Yu-Hu). It “is found only in China but is scattered across many provinces. The population is highly fragmented and collection of flower buds for medicinal purposes is believed to be reducing its ability to regenerate. It occurs in small scattered stands in hilly lowland mixed forest” (Rivers et. al, pg 21).

*Magnolia officinalis* is listed as Endangered by the IUCN. We currently have three plants at the Morris Arboretum. It is “sporadically distributed in the forests at alt. 300~2000m in Gansu, Shaanxi, Hubei, Sichuan, Guizhou and Guangxi” (Liu Yu-Hu). It “is a very important medicinal species. Although it has an overall wide distribution in China, the wild population is thought to mainly exist in protected areas. The decline in native forest habitat and the impacts of bark stripping of wild trees has caused a severe decline in the number of individuals of *Magnolia officinalis* of at least 50% in the last three generations. Today the species is widely cultivated in order to supply bark to the commercial market” (Rivers et. al, pg 34).

*Magnolia dawsoniana* is listed as Endangered by the IUCN. It is likely possible in our growing zone, since one is growing at Bartlett in zone 6b. It is “distributed in the forests at alt. 1400~2500m in C Sichuan (Kangding, Luding, Shimian, Tianquan and Lushan)” (Liu Yu-Hu). According to Rivers et. al (pg 25), “the subpopulations of this species are scattered and severely fragmented over two (or possibly three) provinces in China within a forest area of c. 200 km<sup>2</sup>. The area of occupancy is thought to be above 10 km<sup>2</sup> (but less than 200 km<sup>2</sup>) and there is a continuing decline in the extent of forest cover and the habitat quality.”

*Magnolia sargentiana* is listed as Vulnerable by the IUCN. It should be possible to grow at the Morris. A previous attempt to grow *M. sargentiana* var. *robusta* (accession 85-029) failed due to girdling roots. It grows in the colder climate of the Arnold Arboretum. It is “distributed in the broad-leaved forests at alt. 1400-3000m in C & S Sichuan and NE & N Yunnan” (Liu Yu-Hu). It “was previously classified as Endangered. However, further survey work has revealed extensive and protected populations in southern Sichuan of at least 20,000 individuals. It is exploited for medicinal use and threatened by habitat clearance, although the areas where the extensive populations occur are protected within reserves. Its area of occupancy is 860 km<sup>2</sup>.” (Rivers et. al, pg 37).

*Magnolia wilsonii* is listed by the IUCN as Near Threatened. It should be possible to grow at the Morris, though likely in a warmer area of the garden. Accessions of this species in 1962, 1966, and 1980 all appear to have died within three years, however there are currently plants growing at Bartlett and at Scott Arboretum. It is “distributed in the forests at alt. 1900~3300m in C & W Sichuan and N Yunnan” (Liu Yu-Hu).

*Magnolia zenii* is listed by the IUCN as Critically Endangered. Wild collected seeds were sent to the Arnold Arboretum and the US National Arboretum, and the plant is now also grown at Bartlett, Powell Gardens, Scott Arboretum, and the SC Botanical Garden. It was grown at the Morris Arboretum from cuttings (accession number 89-128), but the plants all died by 2013. Since it is so rare, it would be interesting to try again. It “is only found in Jiangsu (Mount Baohua), growing on the north slopes at alt. c. 220 m” (Liu Yu-Hu). In fact, “only a single population exists containing 18 individuals at the type locality on the north slopes of Mount Baohua. This location is a provincial reserve, but no specific protection is given to these trees. No natural regeneration has been observed. It exists in *ex situ* collections so has the potential to be propagated.” (Rivers et. al, pg 41).

Other Chinese species that are possible to grow in our climate, but are not listed as concerns for conservation, include *M. liliiflora*, *M. sieboldii*, and *M. sprengeri*. I think it would be especially interesting to add another *M. liliiflora* to the collection, since we have only one, and this species is a parent of many cultivated hybrids. Finally, *M. campbellii* is unlikely to be hardy currently, however it should be kept on the wish-list as our climate continues to warm.

## **BIBLIOGRAPHY**

- Callaway, Dorothy J. (2010). *The World of Magnolias*. Timber Press, Inc.
- Cox, C.B., Moore P.D., & Ladle, R. (2016). *Biogeography: An Ecological and Evolutionary Approach*. Retrieved from <https://books.google.com>
- Damery, J., Dosmann, M., Hird, A., Pfeiffer, S., Port, K., Richardson, K. (2011). *Plant Inventory Operations Manual*. Boston: Arnold Arboretum.
- Dirr, Michael A. (1990). *Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses*. Stipes Pub Llc.
- Fogg, John M. (1965). Landscaping an Arboretum. In *Morris Arboretum Bulletin*. The Morris Arboretum.
- Gardiner, Jim. (2000). *Magnolias: A Gardener's Guide*. Timber Press, Inc.
- Hunt, David R. (1996). *Magnolias and Their Allies: Proceedings of an International Symposium*. International Dendrology Society and the Magnolia Society.
- Missouri Botanical Garden. Magnoliaceae. Retrieved from <http://www.mobot.org/mobot/research/apweb/orders/magnolialesweb.htm>
- Morris Arboretum of the University of Pennsylvania. (2007). *Living Collections Policy*.
- Rivers, M., Beech, E., Murphy, L., & Oldfield, S. (2016). *The Red List of Magnoliaceae*. Richmond, Surrey: Botanic Gardens Conservation International.
- Rose, Nancy, & Dosmann, Michael. (2014). *Early to Evolve, Early to Flower: Collections Up Close Spotlights the Magnolia Collection*. Boston: Arnold Arboretum.

Yu-Hu, Liu. (2004). *Magnolias of China*. Beijing Science and Technology Press.